Assessment of Member States' performance regarding the implementation of the Extractive Waste Directive; appraisal of implementation gaps and their root causes; identification of proposals to improve the implementation of the Directive

Final Report

Written by Amec Foster Wheeler Environment & Infrastructure UK Ltd, BiPRO and Milieu
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Directorate-General for Environment

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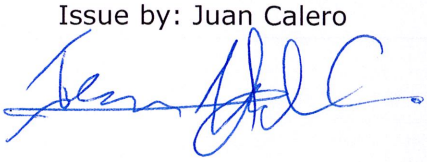

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Abstract

Directive 2006/21/EC on the management of waste from extractive industries provides for measures, procedures and guidance to prevent or minimise the adverse effects on the environment and risks to health resulting from the management of waste from the extractive industries. The study examines implementation of the Directive indicating possible difficulties in implementation and where possible, the causes. Specific provisions are examined relating to the management of Category A facilities, the use of cyanide technologies, the stability of tailing dams and ponds and the reprocessing of extractive waste. A framework was developed to provide a structured basis for the assessment of the performance of Member States in relation to the implementation the Directive and the specific provisions. The framework defined areas of intervention and associated measurable parameters and indicators. A range of information sources was used encompassing results of the reporting on the implementation of the Directive for the second reporting period (2011-2014), engagement with stakeholders, review of Member States' competent authority information, an information request to Member States and literature review. Implications are set out together with possible approaches to improving information collection, the focus of future guidance and areas where compliance promotion may support consistent implementation across Member States.

Résumé

La Directive 2006/21/CE relative à la gestion des déchets de l'industrie extractive prévoit des mesures, procédures et orientations visant à prévenir ou minimiser les effets néfastes sur l'environnement et les risques pour la santé résultant de la gestion des déchets des industries extractives. Cette étude propose une analyse des difficultés liées à la mise en œuvre de la directive et de leurs causes, ainsi qu'un examen de thèmes spécifiques tels que la gestion des installations de catégorie A, l'application de technologies liées à l'utilisation du cyanure, la stabilité des bassins de résidu et des digues ou des terrils et le retraitement des déchets d'extraction. Un cadre d'évaluation a été élaboré afin de fournir une base structurée pour l'analyse de la performance des États membres en ce qui concerne la mise en œuvre de la directive et de ses dispositions spécifiques. Ce cadre définit les domaines d'intervention, les paramètres et les indicateurs associés à cette directive. Différentes sources d'information ont été utilisées, telles que les résultats des rapports sur la mise en œuvre de la directive pour la période 2011-2014, une réunion de travail avec les parties prenantes, l'examen des informations fournies par les autorités compétentes des États membres et une analyse bibliographique. Les enjeux liés aux problèmes de mise en œuvre seront présentés, ainsi que les solutions possibles pour améliorer la collecte d'informations et la mise en œuvre de la directive.

Executive summary

This report

This report is the final report for the 'Service Contract on Assessment of Member States' performance regarding the implementation of the Extractive Waste Directive (2006/21/EC); Appraisal of implementation gaps and their root causes; Identification of proposals to improve the implementation of the Directive' (Contract No 07.0201/2015/723491/ETU/ENV.A.2 implementing Framework Contract No ENV.A.2/2015/0008 held by BiPRO GmbH). The study was performed by Amec Foster Wheeler E&I UK Ltd, BiPRO GmbH and Milieu. This report presents an analysis of the implementation of the Extractive Waste Directive (EWD) and the assessment of the status of implementation for selected thematic areas.

Approach

The approach taken comprised:

- Development of an assessment framework to provide a structured basis for the assessment of the performance of Member States in relation to the implementation of the Directive;
- Information and data collection (including results of the reporting from Member States on the implementation of the Directive for the second reporting period[1]; engagement with stakeholders from industry, academia and non-governmental organisations (NGOs); review of Member States' competent authority websites; direct engagement with Member States (a data request on permit information and a questionnaire on reprocessing of waste and specific aspects); and literature review;
- A stakeholder workshop on the implementation of the EWD; and
- Analysis of information in line with the areas of intervention and parameters set out in the assessment framework.

Information availability and quality

A variety of sources were used to gather information. Overall, the availability and quality of information varied across the themes examined and between the sources used. For observations and conclusions on information availability and quality, refer to sections 3 and 6.1.

Summary of main findings and potential solutions

Member State enforcement and control

The information available under the selected indicators was not complete and detailed enough to enable full assessment of how Member States are enforcing and controlling the application of the EWD however, the following can be concluded:

- **Inspectors (expertise and number):** according to the mining industry, inspectors are well qualified in countries with a 'mining history', but this is not always the case in other Member States. A potential solution to increase consistency of inspections may be to provide guidance. Some Member States called for a checklist setting out the principal questions/issues for inspections. The guidance would need to account for different requirements regarding Category A and non-Category A facilities and also inert and non-inert facilities;
- **Inventories of closed and abandoned sites:** almost all of the Member States concerned have set up inventories. From the 21 Member States where the inventory of closed and abandoned sites is applicable, 17 online inventories were

[1] http://ec.europa.eu/environment/waste/mining/pdf/report_mining_waste.pdf

available and one that is temporarily offline[2]. It was not possible to confirm for three Member States whether they have an inventory. Based on the 18 Member States for which there is data available, 3,462 closed and abandoned waste facilities have been registered at national level by competent authorities. 1,027 of the facilities (30%) were in mines extracting metallic minerals, 3% non-metallic minerals, 2% fuels, 2% coal, 1% precious metals, 5% combinations with the remaining 47% unspecified. It was not possible to identify whether inventories were updated periodically[3]. However, the date when they were last updated was available in most cases (ranging from 2011 to 2017). There is limited information on how Member States select the closed facilities although some Member States stated that they had used the available Technical Advisory Committee guidance to inform development of the inventory; and

- **Cases of non-compliance:** to ensure that the reporting on non-compliance cases is more accurate and detailed, it may be relevant to gather more specific information (e.g. type of non-compliance, category of the facility, type of sanctions). This information could be considered in updated implementation reporting**.**

Accident prevention

The number of events notified to the Commission is low. It is not clear whether this is due to the effectiveness of the safety measures or that not all events of this kind are reported in accordance with the Directive:

- **Guidance for reporting events:** it is possible that, to improve effectiveness and consistency of implementation of Directive requirements in this area, the planned guidelines on the implementation of the EWD could feature a specific section on recommendations for the annual reporting of events; and
- **External emergency plans at Category A facilities:** according to the available data, only two thirds of the Category A facilities in the EU have an external emergency plan. This appears to be a gap in implementation. There are examples of Member States which have not prepared external emergency plans for some of the Category A facilities located in their territory.

Waste management plans

Although it is integrated in the national legislation of EU Member States, there is not sufficient data to verify that waste management plans (WMPs) have the minimum content as in Article 5 of the Directive. Moreover, very few examples are available at national level of guidance documents for the preparation of WMPs. The following solutions and measures may help assure effective and consistent implementation:

- **Guidelines for operators and competent authorities:** guidance on the content of WMPs was identified in the UK and Ireland suggesting that guidance on this subject would be beneficial to promote consistency. The issue of guidance regarding WMPs was discussed at the stakeholder workshop in March 2017 at which it was noted that the scope of any guidance should be determined following further engagement with Member States and if developed, guidance should be at a generic level and not attempt to address detailed (i.e. site or process specific) aspects. Furthermore, if good practice examples of WMPs are developed, such examples should include WMPs for both Category A and non-Category A facilities and the varying degrees of risk and size of facilities should also be considered to enable appropriate examples to be demonstrated; in addition, consideration of guidance for facilities in or nearing closure phase may also be important. Finally, some

[2] The Member State is updating its website and the link to the inventory is temporarily unavailable. This Member State has provided the Commission with their inventory by email.

[3] This information was only available for one Member State but the inventory has not been updated at the stated frequency of three years.

stakeholders would find it useful to implement clear and measurable criteria to evaluate the quality of waste management plans submitted by operators.

Application and permitting procedures

Based on information returns from Member States, 3,754 extractive waste permits were recorded across the EU as of July 2017. 3,228 (86%) were recorded as being operational, 460 (12%) in the closure / post closure phases and 66 (2%) were reported as not operational or unknown. Regarding products, of the 2,013 permits for which information was available, the majority (79%) related to non-metallic minerals and 10% to metallic minerals. The remaining permits related to coal, oil and gas, geothermal energy and 'exploration'. 1,739 (46%) permits concern inert waste, 518 (14%) permits concern non-inert waste and no information was provided for 1,497 (40%) permits. 90 permits (2%) related to Category A facilities with 95% confirming that they are not Category A and 2% with no data. Whilst more than one reason was sometimes noted for Category A classification, the majority (66%) were classified based on the Directive's Annex III first indent regarding the potential for a failure or incorrect operation potentially giving rise to a major accident.

Information for this parameter was of mixed coverage and detail hence only indicative conclusions can be made.

- **Clarification of the interlinkages between permitting regimes:** at the stakeholder workshop there was a call for clarification of the interlinkages between EWD permits and other regimes (such as the Industrial Emissions Directive (IED) and Seveso) which could be addressed in guidance. In particular, it should be clarified that a Category A extractive waste facility which also falls under the Seveso Directive is not entirely exempted from a permit under the EWD. Furthermore the result of a comparison made between data on extractive waste facility permits collected from Member States and data from public Seveso database tends to demonstrate that Member States may not have understood that several Directives can apply to the same site. A compliance promotion exercise may be beneficial to clarifying this aspect; and
- **Use of Best Available Techniques (BAT):** Whereas the EWD requires Member States to ensure that competent authorities follow or are informed of developments in BAT, one weakness is that BAT may not necessarily always be followed during permitting and thus no uniform standards applied and enforced, although impacts from extractive waste facilities may be comparable with those from other industrial installations. In this respect, an ambitious option would be proposing an amendment to the Directive, introducing a mechanism of making BAT conclusions part of each permit comparable to the approach of the IED.

  Based on information collected from Member States on permits, 2,595 note or make reference to BAT. Information collected differed from one site to another (e.g. where recorded, some permits recorded a single BAT and others 40) and a great amount of information was missing. Overall, it was not possible to derive clear findings from the information collected from Member States on application of BAT in permits other than that information from Member States on this subject was often poor and inconsistent in the control measures reported as BAT.

  More specifically, available literature and Member States responses to a questionnaire provided generic information on the application of BAT in relation to the use of cyanide and on the stability of dams and heaps in permitting procedures in relevant Member States. More detailed information could, however, be requested in the Member State reporting questionnaire (e.g. detailed description of the application of BAT and justification on the use of cyanide). The next questionnaire could request information on the application of the best available techniques reference document (BREF) on the management of waste from extractive industries (currently under revision).

Financial guarantee

Overall, there was good information regarding financial guarantees but little information on practical steps undertaken for setting the level of financial guarantees at Member State level. There were examples of general guidance on setting up financial guarantees and a specific European Commission guidance document however, examples of specific guidance at Member State level were scarce:

- **Enhancing implementation of the Directive with regard to financial guarantees:** information indicates that whereas there are no major implementation issues related to this provision, Member States would benefit from having examples of good practice which could be referred to. It would be beneficial to examine the best approaches to financial guarantees involving financial institutions and insurance companies, as such organisations may need to be involved in setting up or underwriting the guarantees. The issue of financial guarantees could be a theme of further collaboration with the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL).

Waste facility classification

Based on the (incomplete) information received from Member States, there is a very high density of non-Category A facilities in Spain, part of the UK (England), Ireland and Hungary. The density of non-Category A facilities is lower in other countries such as Sweden, Austria or Poland. It is to be noted that not all Member States replied to the official request from the Commission. Also, some Member States did not provide sufficient information to assess the density of facilities.

In the Member States with a high density of facilities, regions can be visible where clusters of facilities can be identified, which is natural given that in such regions, the mineral reserves are favourable.

Most Category A facilities that were permitted are linked to the extraction of metallic minerals, including precious metals (80% of the reported Category A facilities that are currently operational).

There was limited information on specific guidance/guidelines for the classification of extractive waste facilities at national level (two sources contained dedicated guidance for the classification of these sites). At the workshop, some stakeholders argued that the discrepancies identified in waste facility classification were mainly due to reporting inconsistencies. Some Member States stressed the importance of a common understanding of Annex III of the Directive (first indent):

- **Consistency of interpretation of Annex III[4]:** whilst some stakeholders at the March 2017 workshop considered that guidance may not be necessary as definitions were viewed as being clear, a compliance promotion exercise could address the discrepancies in waste facility classification (particularly in respect of a common understanding of Annex III of the Directive (first indent)).

Closure and post closure phase

Information was very limited for the indicators used to assess this area of intervention which prevented the drawing of firm conclusions.

According to the information submitted by Member States as part of the information collection exercise undertaken for this project, there are 460 extractive waste facilities that are in their closure/post closure phase (12% of all the facilities reported as part of the data request). Of these, 27 are classified as Category A facilities.

With regard to closed and abandoned sites, as of 30th June 2017, out of the 3,462 facilities which have been included in the online national inventories, 52% were heaps,

[4] Annex III: Criteria for determining the classification of waste facilities

2% dams, 3% ponds and 1% other (in 42% of the cases, the type of facility was not included in the inventory).

It is to be noted that there has been a call from the European Parliament for increased transparency on closed and abandoned extractive waste facilities[5].

- **Review of the inventories of closed and abandoned sites:** a possible solution to transparency issues would be the development of an EU-wide inventory (integrating Member State information) that would reflect the requirements on Member States of Article 20 of the Directive. Stakeholders at the March 2017 workshop had mixed opinions regarding the usefulness of an EU-wide inventory however. A possible advantage of such an approach would be the increase of awareness and transparency with regard to the transboundary effects of extractive waste facilities located close to the borders with other Member States. A disclaimer would be needed to account for possible differences in the site selection approach chosen by Member States.

Transboundary effects

Based on the (incomplete) information provided by Member States that responded to the request for information made as part of this study, it appears that at least some 40 waste facilities are located near borders of other Member States, mainly between Portugal and Spain and between Ireland and the UK (Northern Ireland). From information reviewed, it can be concluded that Member States have established the appropriate procedures and defined the relevant authorities involved in this process. From this perspective, implementation of the requirements of the EWD in terms of transboundary effects is good. However, findings on how well these procedures are applied in practice are scarce due to lack of cases:

- **Guidance for transboundary communication:** no interest was expressed for guidance by stakeholders or Member States. However rapid communication and cooperation between Member States in the event of an incident was considered of most importance to avoid possible environmental damage. Although there is no evidence that performance in this respect is low, it may be appropriate to present possible approaches for transboundary communication as part of the planned general guidance on implementation of the Directive (while respecting Member State autonomy for designing competent authorities and appropriate procedures).

Thematic areas

Category A facilities

From the analysis, it would appear that application of the criteria for classification of waste facilities as Category A by Member States authorities and economic operators is inconsistent; an indication of this is the deviation for a number of Member States in data provided for Category A facilities in the context of the request for statistical information as part of this study compared to those indicated for the implementation report 2011-2014 (although deviations may partly be due to the fact that some new facilities may have been permitted and others may have closed in the meantime).

Although during the workshop, a number of stakeholders were of the opinion that legislation is sufficiently clear, the provision of guidance on interpretation of the criteria for classification of facilities as Category A as part of the planned guidelines on the implementation of the EWD would be useful to facilitate consistent interpretation. Several Member States stressed in particular the importance of a proper consideration of the first indent of Annex III of the Directive (regarding "incorrect operation").

5 Implementation of the Mining Waste Directive, European Parliament resolution of 27th April 2017 on implementation of the Mining, Waste Directive (2006/21/EC) (2015/2117(INI))

Cyanide processes

Regarding cyanide-based gold extraction techniques, it was concluded that cyanide-based techniques remain the dominant technology used for gold production in the EU. Whilst alternative reagents have been tested and some of them have been developed to commercial scale outside the EU, the appropriateness and applicability of alternative reagents and processes is governed by ore types and alternative reagents are not without their own technical, environmental and economic issues.

In reviewing the availability and the status of commercial application of alternatives to cyanide-based technologies, there does not appear to be a clear alternative that can replace cyanide-based technologies as BAT at the present time. There has not been a material change in the application and use of alternatives to cyanide-based technologies since 2010, hence the introduction of an EU-wide ban would still imply the closure of existing mines.

Whilst monitoring of developments in alternative technologies should continue, a focus on the full application of the Directive by the Member States should be a priority to ensure that mines using cyanide technologies continue to operate in a safe condition.

Stability of waste management facilities

In terms of stability of waste management facilities, it can be concluded that since these aspects are relevant foremost regarding the operation of the facility and the conditions stipulated in the permit, the current revision of the existing BREF on the management of extractive waste is crucial. (See also the above section on use of BAT).

Reprocessing of extractive waste

Member States competent authorities were approached to gather information on policies and practices regarding the reprocessing of extractive waste. Only four indicated they have dedicated strategies / statements regarding extractives waste and a further nine indicated that extractive waste is covered in wider waste management or resource efficiency strategies. Overall it can be concluded that Member State policies on reprocessing of extractive waste are limited.

From analysis of information returned by Member States regarding permitting as part of this study, a narrow range of waste reprocessing was observed with a focus on the reuse of waste rock and overburden for construction related purposes. Only a limited number of examples indicated reprocessing waste and tailings to extract minerals indicating that at the current time, reprocessing activities are typically the productive utilisation of inert waste materials rather than innovative reprocessing activities to extract greater value associated with recovery of substances and minerals.

In addition to policies, case studies were also examined. This included projects aimed at increasing reuse/recyclability of bauxite residue (red mud), producing zinc concentrates from flotation waste, and extracting tin and tantalum minerals from flotation tailings.

Synthèse

Ce rapport

Ce rapport est le rapport final du 'Contrat de service sur l'évaluation des performances des États membres concernant la mise en œuvre de la directive relative à la gestion des déchets extractifs (2006/21/CE)'; Évaluation des lacunes en matière de mise en œuvre et de leurs causes profondes; identification des propositions visant à améliorer la mise en œuvre de la directive » (Contrat n ° 07.0201 / 2015/723491 / ETU / ENV.A.2, contrat de mise en œuvre n ° ENV.A.2 / 2015/0008 détenu par BiPRO GmbH). L'étude a été réalisée par Amec Foster Wheeler E & I UK Ltd, BiPRO GmbH et Milieu. Ce rapport présente une analyse de la mise en œuvre de la directive sur les déchets extractifs et l'évaluation de la mise en œuvre pour certains domaines thématiques.

Méthodologie

La méthodologie adoptée comprend les phases suivantes :

- L'élaboration d'un cadre d'évaluation afin de fournir une base structurée pour l'analyse de la performance des États membres en ce qui concerne la mise en œuvre de la directive ;
- La collecte d'informations et de données, y compris les résultats des rapports des États membres sur la mise en œuvre de la directive pendant la seconde période sous revue (2011-2014)[6] ; la consultation des parties prenantes telles que l'industrie, le milieu universitaire et les organisations non-gouvernementales (ONG) ; l'examen des sites internet des autorités compétentes des États membres ; la consultation des États membres (une demande de données sur les informations sur les permis et un questionnaire sur le retraitement des déchets et des aspects spécifiques) et une analyse bibliographique.
- Une réunion de travail avec des parties prenantes sur la mise en œuvre de la directive ;
- Une analyse de l'information en fonction des domaines d'intervention et des paramètres définis dans le cadre d'évaluation.

Disponibilité et qualité de l'information

Diverses sources ont été mobilisées pour recueillir des informations. Dans l'ensemble, la disponibilité et la qualité de l'information varient selon les thèmes examinés et les sources utilisées. Les observations et les conclusions concernant la disponibilité et la qualité de l'information sont détaillées aux sections 3 et 6.1.

Résumé des principaux résultats et solutions possibles

Application et contrôle des États Membres
Les informations disponibles sous les indicateurs sélectionnés n'étaient pas complètes ni suffisamment détaillées pour permettre une évaluation complète de la manière dont les États membres appliquent et contrôlent l'application de la directive. Il est toutefois possible d'en tirer les conclusions suivantes :

- **Inspecteurs (expertise et nombre) :** selon l'industrie minière, les inspecteurs sont suffisamment qualifiés dans les pays ayant une « histoire minière », mais ce n'est pas toujours le cas dans d'autres États membres. Fournir des lignes directrices pourrait constituer une solution permettant d'augmenter la cohérence des inspections. Certains États membres ont demandé l'élaboration d'une liste de contrôle indiquant les principaux points devant être couverts lors des inspections. Les lignes directrices devront tenir compte des différentes exigences concernant les

[6] http://ec.europa.eu/environment/waste/mining/pdf/report_mining_waste.pdf

installations de catégorie A ou hors catégorie A, ainsi que les installations inertes et non-inertes ;

- **Inventaires de sites fermés ou abandonnés :** des inventaires ont été mis en place dans presque tous les Etats membres. Sur les 21 Etats membres où un inventaire des sites fermés ou abandonnés est applicable, 17 inventaires sont disponibles en ligne et un autre était temporairement indisponible[7]. Il n'a pas été possible, pour trois Etats membres, de confirmer s'ils disposaient d'un inventaire. Sur base des 18 Etats membres pour lesquels des données sont disponibles, 3 462 installations fermées et abandonnées ont été répertoriées au niveau national par les autorités compétentes. 1 027 de ces 3 462 installations (30%) étaient des mines d'extraction de minerais métalliques, 3% d'extraction de minerais non-métalliques, 2% d'extraction de combustibles, 2% d'extraction de charbon, 1% d'extraction de métaux précieux et 5% d'extraction de combinaisons d'autres matériaux non-précisés. Il n'a pas été possible de vérifier si les inventaires étaient mis à jour périodiquement[8]. Néanmoins, la date de dernière mise à jour (allant de 2011 à 2017) est la plupart du temps disponible. Peu d'informations sont disponibles quant à la manière dont les Etats membres identifient les installations fermées, bien que certains aient déclaré utiliser les lignes directrices de la Commission Consultative Technique pour le développement de leurs inventaires ;
- **Cas de non-respect :** il pourrait être pertinent de recueillir des informations plus spécifiques (comme par exemple le type de non-respect, la catégorie de l'installation ou le type de sanctions) afin de s'assurer que les notifications de cas de non-respect soient plus précises et plus détaillées. Ces informations pourraient être prises en compte dans la mise à jour des rapports de mise en œuvre.

Prévention des accidents

Peu d'événements ont été notifiés à la Commission. Il n'est cependant pas évident de déduire si ce nombre est bas du fait de l'efficacité des mesures de sécurité, ou si tous les événements de cette sorte n'ont pas été notifiés à la Commission conformément à la directive :

- **Guide pour la notification d'événements :** afin d'améliorer l'efficacité et la cohérence de la mise en œuvre des provisions de la directive dans ce domaine, une section spécifique comportant des recommandations concernant la notification annuelle des événements pourrait être ajoutée aux lignes directrices pour la mise en œuvre de la directive sur la gestion des déchets de l'industrie extractive.
- **Plans d'urgence externe pour les installations de catégorie A :** les informations disponibles indiquent que seuls deux tiers de installations de catégorie A au sein de l'UE disposent de plans d'urgence externe, dénotant un manquement dans la mise en œuvre de la directive. Il existe des exemples d'Etats membres n'ayant pas préparé de plans d'urgence externe pour certaines installations de catégorie A implantées sur leur territoire.

Plans de gestion des déchets

Bien qu'ils soient intégrés dans la législation nationale des Etats membres de l'UE, les informations disponibles ne sont pas suffisantes pour vérifier que les plans de gestion des déchets couvrent les dispositions minimales telles qu'indiquées dans l'article 5 de la directive. En outre, très peu d'exemples de documents d'orientation pour la préparation de plans de gestion des déchets sont disponibles au niveau national. Les solutions et mesures suivantes pourraient favoriser la garantie d'une mise en œuvre efficace et cohérente :

[7] L'Etat membre en question est en train de mettre à jour son site internet et l'inventaire est temporairement indisponible. Cet Etat membre a fourni son inventaire à la Commission par courriel.

[8] Cette information n'était disponible que pour un Etat membre. Toutefois, cet inventaire n'a pas été mis à jour selon la fréquence indiquée de trois ans.

- **Lignes directrices pour les exploitants et autorités compétentes :** des lignes directrices concernant le contenu des plans de gestion des déchets ont été identifiées au Royaume-Uni et en Irlande, suggérant que des orientations sur ce sujet favoriseraient la cohérence de ces plans. Cette question a été abordée lors de la réunion de travail avec des parties prenantes en mars 2017. Il a été noté à cette occasion que le champ d'application de tout document d'orientation devra être élaboré en coopération plus avancée avec les Etats membres et, dans le cas où ils seraient effectivement introduits, ces documents d'orientation devraient demeurer généraux et ne pas tenter d'entrer dans les détails spécifiques aux sites et aux procédés. En outre, si des exemples de bonnes pratiques en matière de plans de gestion des déchets venaient à être élaborés, ceux-ci devraient inclure à la fois des exemples relatifs aux installations de catégorie A et hors catégorie A. Les divers degrés de risque et la taille des installations devraient également être pris en compte afin de présenter des exemples adéquats. Il pourrait de plus être important de tenir compte des orientations spécifiques aux installations proches de la fermeture. Enfin, certaines parties prenantes estimeraient utile de mettre en place des critères clairs et mesurables afin d'évaluer la qualité des plans de gestion des déchets présentés par les exploitants.

Procédures de demande et d'octroi d'autorisation

Selon les informations fournies par les Etats membres 3 754 permis de déchets extractifs ont été enregistrés au sein de l'UE jusqu'en juillet 2017. 3 228 (86%) de ces permis ont été enregistrés comme permis d'exploitation, 460 (12%) ont été enregistrés dans le cadre de phases de fermeture ou de post-fermeture, et 66 (2%) ont été enregistrés hors exploitation ou sans information. Concernant les produits, sur les 2 013 autorisations au sujet desquels des informations étaient disponibles, la majorité (79%) concerne des minerais non-métalliques et 10%, des minerais métalliques. Les autres autorisations concernent le charbon, le pétrole et le gaz, ainsi que l'énergie géothermique et l'« exploration ». 1 739 (46%) autorisations concernent des déchets inertes, 518 (14%), des déchets non-inertes. Aucune information n'a été communiquée au sujet de 1 497 (40%) des autorisations. 90 autorisations (2%) sont liées aux installations de catégorie A, bien que 95% d'entre elles affirment qu'elles sont hors catégorie A, et 2% restent sans informations. Si plusieurs raisons peuvent parfois être invoquées pour classifier une installation sous la catégorie A, la majorité de ces installations (66%) l'a été sur base du premier alinéa de l'annexe III de la directive portant sur une potentielle défaillance ou mauvaise exploitation pouvant donner lieu à un accident majeur.

Les informations réunies au sujet de ce paramètre sont variées en termes de champ et de niveau de détail. De fait, seules des conclusions indicatives sont présentées ici.

- **Eclaircissement des interconnexions entre les régimes d'autorisation :** un appel à davantage de clarté, qui pourrait être apportée dans le document d'orientation, quant à la coordination entre les autorisations émises dans le cadre de la directive sur la gestion des déchets de l'industrie extractive et celles émises dans le cadre d'autres régimes (comme la directive relative aux émissions industrielles et la directive Seveso) a été lancé lors de la réunion de travail avec les parties prenantes. En particulier, le fait qu'une installation de gestion des déchets d'extraction de catégorie A entrant également dans le champ de la directive Seveso n'est pas totalement dispensée d'autorisation selon la directive relative à la gestion des déchets de l'industrie extractive devrait être clarifié. D'autre part, les résultats d'une comparaison entre les données relatives aux autorisations octroyées aux installations de gestion des déchets d'extraction fournies par les Etats membres et les données issues de la base de données publique Seveso tendent à indiquer que les Etats membres pourraient ne pas avoir compris que certains sites peuvent entrer dans le champ d'application de plusieurs directives. Un exercice de promotion de la conformité pourrait favoriser une meilleure compréhension de cet aspect.

- **Utilisation des Meilleures Techniques Disponibles (MTD) :** Si la directive relative à la gestion des déchets de l'industrie extractive nécessite un suivi des développements des MTD de la part des Etats membres, le fait que ces dernières ne soient pas toujours utilisées lors de l'octroi d'autorisations et, de fait, qu'il n'y ait pas de normes uniformes appliquées et mises en œuvre, constitue un point faible, bien que l'impact des installations de gestion des déchets d'extraction soit comparable à celui des autres installations industrielles. Une solution ambitieuse pourrait être de proposer un amendement à la directive consistant en un mécanisme introduisant les conclusions des MTD comme parties intégrantes de chaque autorisation, de manière comparable à l'approche de la directive relative aux émissions industrielles.

  Selon les informations collectées auprès des Etats membres, 2 595 autorisations font référence aux MTD. Ces informations varient d'un site à l'autre (certaines autorisations font référence à une seule MTD, d'autres, à quarante) et beaucoup d'informations sont manquantes. Dans l'ensemble, il n'a pas été possible de tirer de conclusions claires des informations fournies par les Etats membres sur l'applications des MTD dans le cadre de l'octroi d'autorisations, à l'exception du fait que les informations disponibles sur le sujet auprès des Etats membres sont souvent assez pauvres et s'avèrent manquer de cohérence dans l'interprétation des mesures signalées comme MTD.

  Plus précisément, la littérature disponible ainsi que les réponses des Etats membres à un questionnaire ont permis d'obtenir des informations sur l'application des MTD en lien avec l'utilisation de cyanure et la stabilité des digues et des terrils dans les procédures d'octroi d'autorisations dans les Etats membres concernés. De plus amples informations pourraient néanmoins être demandées dans le questionnaire de notification des Etats membres, telles que la description détaillée de l'application de MTD et des explications justifiant l'usage de cyanure. Le prochain questionnaire pourrait porter notamment sur l'application du Document de référence sur les meilleures techniques disponibles (BREF) relatif à la gestion des déchets de l'industrie extractive (actuellement en cours de réforme).

Garantie financière

Dans l'ensemble, une quantité satisfaisante d'informations concernant les garanties financières est disponible, mais peu d'informations ont pu être réunies concernant les étapes mises en place pour établir le niveau de ces garanties au niveau des Etats membres. Des exemples d'orientations générales sur la mise en place de garanties financières ainsi qu'un document d'orientation de la Commission européenne existent, mais peu d'exemples d'orientations spécifiques au niveau des Etats membres ont été trouvés :

- **Renforcer la mise en œuvre de la directive en ce qui concerne les garanties financières :** les informations recueillies indiquent que bien qu'il n'y ait aucun problème majeur relatif à la mise en œuvre de cette disposition, les Etats membres pourraient tirer profit d'une mise à disposition d'exemples de bonnes pratiques auxquelles ils pourraient se référer. Il serait bénéfique d'examiner quelles sont les meilleures approches envers les garanties financières impliquant les institutions financières et les compagnies d'assurance, ces organisations devant potentiellement être mobilisées dans la mise en place ou la souscription à de telles garanties. La question des garanties financières pourrait constituer l'un des thèmes d'une coopération renforcée avec le réseau IMPEL (Réseau de l'Union européenne pour l'application et le respect du droit de l'environnement).

Classification des installations de gestion des déchets

Selon les informations (incomplètes) fournies par les Etats membres, on note une importante densité d'installations hors catégorie A en Espagne, dans une partie du Royaume-Uni (en Angleterre), en Irlande et en Hongrie. La densité d'installations hors catégorie A est plus faible dans d'autres Etats tels que la Suède, l'Autriche ou la Pologne. Il est également à noter qu'une partie des Etats membres n'ont pas répondu aux

demandes officielles de la Commission. En outre, certains Etats membres n'ont pas fourni assez d'informations pour permettre l'évaluation de la densité des installations.

Dans les Etats membres présentant une haute densité d'installations, des groupements d'installations peuvent être identifiés dans certaines régions, ce qui s'explique naturellement par la présence de minerais.

La plupart des installations de catégorie A ayant reçu une autorisation concernent le secteur de l'extraction de minerais métalliques, y compris de métaux précieux (80% des installations de catégorie A notifiées actuellement opérationnelles).

Peu d'informations ont pu être recueillies concernant les orientations/lignes directrices relatives à la classification des installations de gestion des déchets d'extraction au niveau national (seules deux sources comprenaient des orientations dédiées à la classification de ces sites). Lors de la réunion de travail, certaines parties prenantes ont souligné que les divergences dans la classification des installations de gestion des déchets découlent principalement d'incohérences dans les rapports. Certains Etats membres ont insisté sur l'importance d'une même compréhension de l'annexe III de la directive (premier alinéa) :

- **Cohérence dans l'interprétation de l'annexe III[9] :** bien que certaines parties prenantes présentes à la réunion de travail de mars 2017 considèrent qu'un document d'orientation ne soit pas nécessaire car les définitions paraissent suffisamment claires, un exercice de promotion de la conformité à la directive pourrait permettre de résoudre les divergences notées dans la classification des installations de gestion des déchets (particulièrement concernant une compréhension commune de l'annexe III de la directive (premier alinéa)).

Phases de fermeture et de post-fermeture

Une quantité limitée d'informations a pu être réunie au sujet des indicateurs utilisés afin d'évaluer ce domaine d'intervention, empêchant ainsi toute conclusion solide.

Selon les informations fournies par les Etats membres dans le cadre de l'exercice de collecte d'informations entrepris pour ce projet, il apparaît que 460 installations de gestion des déchets issus de l'industrie extractive sont en phase de fermeture / post-fermeture (12% de l'ensemble des installations répertoriées dans le cadre de la demande de données). 27 de ces installations sont des installations de catégorie A.

Pour ce qui est des sites fermés ou abandonnés, au 30 juin 2017, sur les 3 462 installations inclues dans les inventaires nationaux en ligne, 52% sont des terrils, 2%, des digues, 3%, des bassins, et 1% couvre d'autres types d'installations (dans 42% des cas, le type d'installation n'était pas précisé dans l'inventaire).

Il est à noter que le Parlement européen a lancé un appel à davantage de transparence concernant les installations de gestion des déchets de l'industrie extractive fermées ou abandonnées[10] .

- **Revue des inventaires des sites fermés ou abandonnés :** l'élaboration d'un inventaire à l'échelle de l'UE (intégrant les informations provenant des Etats membres), reflétant les exigences de l'article 20 de la directive envers les Etats membres, pourrait représenter une solution possible aux problèmes de transparence. Lors de la réunion de travail de mars 2017, les parties prenantes ont toutefois exprimé des opinions divergentes au sujet de l'utilité d'un inventaire à l'échelle de l'UE. Une telle démarche pourrait avoir l'avantage d'améliorer la prise de conscience et la transparence des effets transfrontière des installations de gestion des déchets de l'industrie extractive situées à proximité des frontières avec d'autres

[9] Annexe III: Critères de classification des installations de gestion de déchets

[10] Mise en œuvre de la directive sur les déchets de l'industrie extractive, résolution du Parlement européen du 27 avril 2017 sur la mise en œuvre de la directive sur les déchets de l'industrie extractive (2006/21/CE) (2015/2117(INI)).

Etats membres. Une notice légale devrait être prévue afin de tenir compte des différentes approches possibles adoptées par les Etats membres.

Effets transfrontaliers

Selon les informations (incomplètes) fournies par les Etats membres ayant répondu à la demande d'information émise dans le cadre de cette étude, il apparaît qu'au moins 40 installations de gestion des déchets sont situées proche des frontières entre Etats membres, principalement entre l'Espagne et le Portugal et entre l'Irlande et le Royaume-Uni (Irlande du Nord). Les informations analysées ont permis de conclure que les Etats membres avaient mis en place les procédures appropriées et identifié les autorités pertinentes impliquées dans ce processus. De ce point de vue, la mise en œuvre des exigences de la directive relative à la gestion des déchets issus de l'industrie extractive en matière d'effets transfrontaliers est bonne. Néanmoins, peu de conclusions ont pu être tirées au sujet de la qualité de la mise en application de ces pratiques, en raison d'un manque de cas à analyser :

- **Orientations pour la communication transfrontalière :** les parties prenantes des Etats membres n'ont pas exprimé d'intérêt pour de telles orientations. Cependant, une grande importance a été accordée à une communication rapide et à la coopération entre Etats membres en cas d'incident, afin d'éviter au maximum tout dégât environnemental possible. Bien qu'aucune preuve ne permette de percevoir de faibles performances en la matière, il pourrait être bénéfique de présenter quelques possibilités d'approches en matière de communication transfrontalière dans le cadre du futur document d'orientation générale sur la mise en œuvre de la directive (tout en respectant l'autonomie des Etats membres quant à la création d'autorités compétentes et des procédures appropriées).

Domaines thématiques

Installations de catégorie A

L'analyse révèle que l'application des critères de classification des installations de gestion des déchets sous la catégorie A par les autorités des Etats membres et les opérateurs économiques est incohérente. Les divergences dans les données fournies par un certain nombre d'états membres concernant les installation de catégorie A dans le cadre de la demande d'informations statistiques formulée par ce projet, par comparaison avec les données indiquées dans le rapport de mise en œuvre 2011-2014, constituent une indication de cette application incohérente (bien que ces divergences puissent être en partie dues au fait que certaines nouvelles installations aient pu se voir octroyer une autorisation et que d'autres aient fermé dans l'intervalle de temps entre les deux collectes d'informations).

La préparation de lignes directrices portant sur l'interprétation des critères de classification des installations en tant que catégorie A dans le cadre des lignes directrices sur la mise en œuvre de la directive relative à la gestion des déchets de l'industrie extractive prévues permettrait de faciliter une interprétation cohérente, bien que de nombreuses parties prenantes à la réunion de travail estiment que la législation soit suffisamment claire. Plusieurs Etats membres ont particulièrement souligné l'importance d'une considération appropriée du premier alinéa de l'annexe III de la directive (relatif à la "mauvaise exploitation").

Procédés cyanurés

Il s'avère que les techniques basées sur la technologie du cyanure pour l'extraction d'or demeurent les plus utilisées pour la production d'or dans l'UE. Malgré les tests réalisés sur des réactifs alternatifs et le fait que certains d'entre eux aient été développés à l'échelle commerciale en-dehors de l'UE, l'adéquation et l'applicabilité de l'utilisation de réactifs alternatifs dépend des types de minerais. En outre, ces réactifs alternatifs sont également à l'origine de problèmes techniques, environnementaux et économiques spécifiques.

L'examen de la disponibilité et du statut de l'utilisation commerciale des alternatives aux technologies basées sur le cyanure n'a pour l'heure révélé aucune alternative claire faisant office de MTD. Depuis 2010, il n'a été procédé à aucun changement matériel dans l'application et l'utilisation de technologies basées sur le cyanure. De fait, l'introduction d'une interdiction à l'échelle de l'UE impliquerait toujours la fermeture de mines existantes.

Tandis que le suivi des développements en matière de technologies alternatives doit être poursuivi, la priorité doit être accordée à la mise en œuvre intégrale de la directive par les Etats membres afin de garantir que les mines ayant recours aux technologies basées sur l'utilisation du cyanure continuent d'opérer de manière sécurisée.

Stabilité des installations de gestion des déchets

En ce qui concerne la stabilité des installations de gestion des déchets, il peut être conclu que, ces aspects étant avant tout pertinents pour les opérations de l'installation et les conditions stipulées dans l'autorisation, la réforme en cours du BREF existant portant sur la gestion des déchets issus de l'industrie extractive est cruciale. (Voir également la partie dédiée à l'utilisation des MTD ci-dessus)

Retraitement des déchets de l'industrie extractive

Les autorités compétentes des Etats membres ont été contactées, afin de réunir des informations concernant les politiques et pratiques relatives au retraitement des déchets de l'industrie extractive. Seules quatre autorités ont indiqué avoir mis en place des stratégies / déclarations relatives aux déchets de l'industrie extractive. Neuf autres ont indiqué que ces déchets sont couverts par le système de gestion des déchets général ou des stratégies d'efficacité des ressources. Dans l'ensemble, les politiques des Etats membres en matière de retraitement des déchets de l'industrie extractive sont limitées.

L'analyse des informations fournies par les Etats membres concernant les autorisations dans le cadre de cette étude a permis d'examiner une étroite gamme de déchets retraités, portant une attention particulière à la réutilisation des roches stériles et des roches de recouvrement dans des activités de construction. Seul un nombre limité d'exemples indique un retraitement des déchets et résidus miniers. De fait, il semble que, pour l'heure, les activités de retraitement consistent principalement en l'utilisation productive de roches déchets inertes plutôt qu'en des opérations innovantes de retraitement permettant d'extraire davantage de valeur de la réutilisation des substances et minerais.

Plusieurs études de cas ont également été examinées, comprenant des projets visant à accroître la réutilisation/le recyclage des résidus de bauxite (boue rouge), la production de concentrés de zinc à partir de déchets issus de techniques de flottation et l'extraction de minerais d'étain et de tantale des résidus de flottation.

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1. Introduction

1.1 This report

This report is the draft final report for the 'Service Contract on Assessment of Member States' performance regarding the implementation of the Extractive Waste Directive (2006/21/EC); Appraisal of implementation gaps and their root causes; Identification of proposals to improve the implementation of the Directive' (Contract No 07.0201/2015/723491/ETU/ENV.A.2 implementing Framework Contract No ENV.A.2/2015/0008 held by BiPRO GmbH). The study is being performed by Amec Foster Wheeler E&I UK Ltd, BiPRO GmbH and Milieu.

This report presents an analysis of the implementation of the Extractive Waste Directive (EWD) and the assessment of the status of implementation for selected thematic areas.

1.2 Limitations of the report

The analysis conducted in this report is based on the information collected under different information collection strands. These include in particular a literature review, consultation of stakeholders and the review of implementation reporting. For several indicators, it has proven difficult to identify relevant information, particularly at Member State level. This is to be understood as the information as not being identified, rather than a gap *per se* in the implementation by Member States.

Due to the nature of permitting under the EWD, it is likely that some of the required information is held at a very local level or within permits themselves. The review of such information was not within the scope of this project.

1.3 Structure of the report

The report is structured as follows:

- Section 2 presents the assessment framework developed for the purpose of assessing the implementation of the EWD;
- Section 3 presents the results of the information and data collection;
- Section 4 presents the analysis of the gaps in the implementation for specific areas of intervention of the Directive;
- Section 5 presents the assessment of the implementation of specific thematic areas related to the Directive; and
- Section 6 presents conclusions.

2. Assessment framework for the review of the implementation

2.1 Overview of the assessment framework

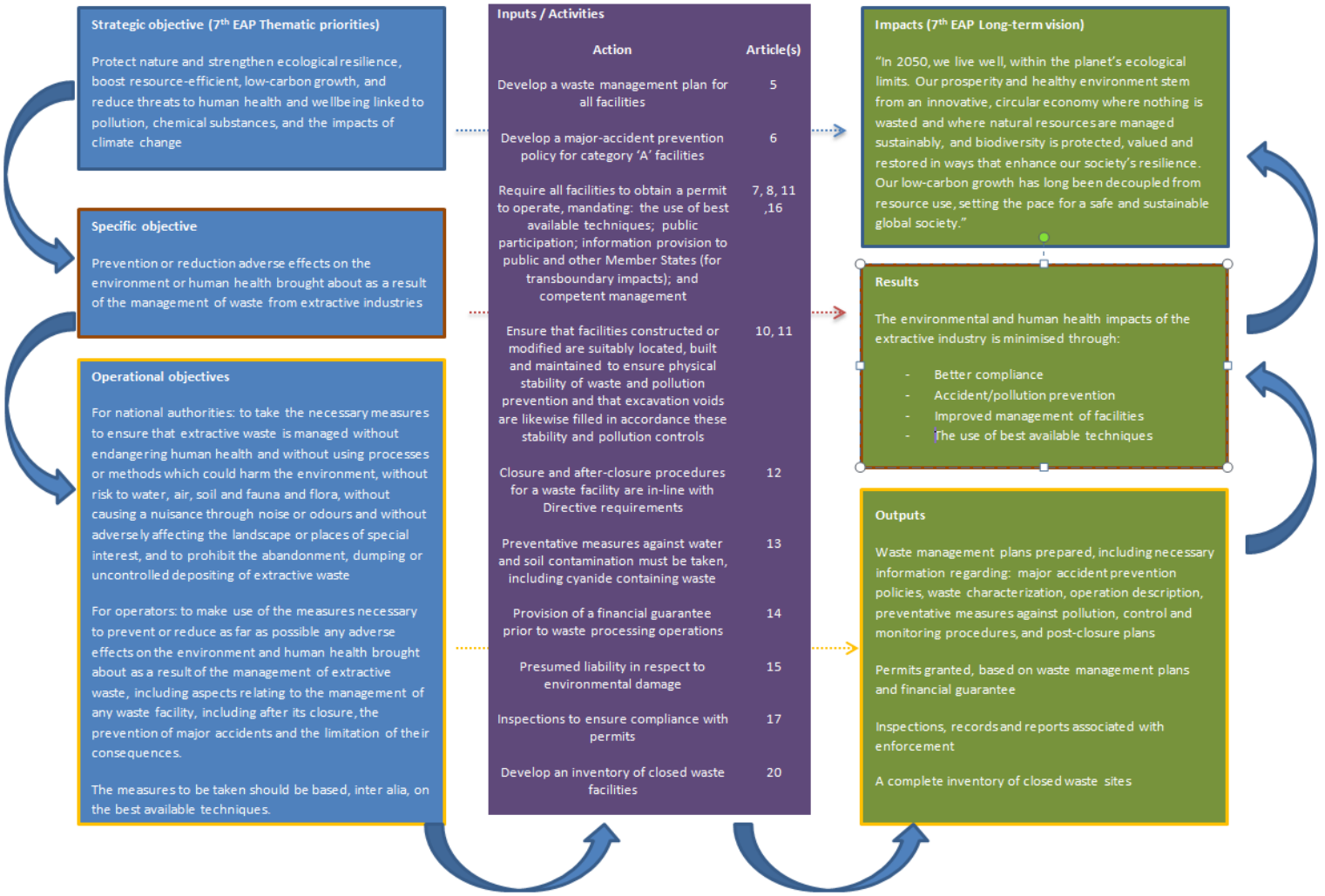
The objective of the assessment framework is to provide a structured basis for the assessment of the performance of Member States in relation to the implementation the Directive. The framework aims to bring together, in a logical manner, both the overarching objectives as defined in the 7th Environmental Action Programme (EAP) together with specific aspects of the Directive.

The Directive's links with other policies, relevant to the mining sector, were considered, for instance, the links between the overall objective of the Directive and the EU Action Plan for the Circular Economy[11].

The following intervention logic identifies the relationship between the high-level objectives set by the 7th EAP, the general and operational objectives of the Directive, the activities (inputs) required by the Directive and the outputs and results (outcomes) expected from these.

[11] The Commission published in December 2015 the Communication on the Circular Economy Package adopted to "boost competitiveness, create jobs and generate sustainable growth". The Annex to the Communication ' 'mentions the following measures relevant for mining waste: guidance and promotion of best practices in the mining waste management plans by 2016; and sharing of best practice for the recovery of critical raw materials from mining waste and landfills by 2017.

Figure 2.1 Intervention logic



2.2 Development of the assessment framework

The assessment framework was developed with reference to the Better Regulation guidelines[12]. The expected outputs and results presented in Figure 2.1 were used as the basis for the development of the parameters and their corresponding indicators. The assessment framework was developed following the steps described below.

2.2.1 Definition of areas of intervention

Key areas of intervention were defined as per key elements of the EWD. The areas of interventions selected were:

- Member State enforcement and control[13];
- Major accident prevention;
- Waste Management Plan;
- Application and permitting procedures[14] ;
- Financial guarantee;
- Waste facility classification;
- Closure and post closure phase; and
- Transboundary effects.

2.2.2 Definition of parameters

Parameters refer to quantitatively or qualitatively measurable facts or aspects that can be used to evaluate implementation of areas of intervention.

2.2.3 Development of indicators

Following the development of parameters, output and result (outcome) indicators were developed for each parameter. The distinction is as follows:

- Output indicators (OI) are identifiable products of implementation such as risk assessments and programmes of inspections; and
- Result indicators (RI) are the end effects such as the number of major accidents or number of facilities using cyanide-free processes.

The indicators were used to assess the status of implementation and also identify potential best practices in Member States.

2.3 Final assessment framework

Based on the review of the information available, an initial assessment framework that comprised a long list of possible indicators submitted in the interim report, was revised. The revision identified two categories of indicators:

- Those indicators for which the information was most complete. While there was not a perfect level of information for all of these indicators, these were considered the most promising for analysing the gaps in implementation of the Directive due to the availability of reasonable information on which to base an assessment; and
- Those indicators for which there was little/no information available but that were retained due to their importance (i.e. key indicators). Table 2.1 presents a simplified version of the final assessment framework. A complete version of the assessment framework is presented in Appendix A.
- The final assessment framework includes 26 indicators with at least two per area of intervention. The assessment framework covers all of the eight areas of intervention.

[12] Better Regulation Guidelines, http://ec.europa.eu/smart-regulation/guidelines/toc_guide_en.htm
[13] Including inspection and enforcement measures, external emergency plans, inventory of closed facilities.
[14] Including public participation in public procedures, application of Best Available Techniques, construction and management of waste facilities

Table 2.1 Final assessment framework

Area of intervention	Parameter to assess implementation	Indicator name
Member State enforcement and control	Effectiveness of enforcement, in relation to: a) enforcement authorities' powers and competencies	Cases of non-compliance identified over the two reporting periods
		Expertise of inspectors (diploma, technical training, etc.), how many inspectors per site
	b) Inspection programmes with clear priorities	Evidence of Competent Authority carrying out sampling of extractive waste, laboratory tests and / or stress tests*
	c) Assessment of implementation of inventory of closed waste facilities	Frequency of the update of the inventory**
		Availability of an inventory*
Major accident prevention	Assessment of major accident policies, in relation to: a) Existence and adequacy of safety management system, including appointment of a safety manager	Number of major accidents*
		Changes in the number of major accidents in two reporting periods
	b) Adequacy of coverage of the external (Competent Authority) emergency plan	Number of Category A facilities with an external emergency plan
Waste management plans	Assessment of the Waste Management Plans (WMP) in relation to: Appropriateness of pollution prevention measures in the WMP	Existence of guidelines for operators to prepare WMP**
		Verification that the WMP includes the elements listed in Article 5(3) of the Directive**
Application and permitting procedures	Assessment of the permitting procedure in relation to compliance with permit requirements (including requirements on construction and management of waste facilities)	Timeframe of the permitting procedure (in months)
	Assessment of public participation in the permitting procedure	Public complaints against public participation procedure
	Assessment of the implementation of Best Available Techniques in the permitting procedure	Application of BAT in gold extractive facilities*
		Application of BAT in relation to dam and heap stability*
Financial guarantee	Assessment of implementation of financial guarantee	Existence of guidelines or method to implement the Commission's guidelines on the establishment

Area of intervention	Parameter to assess implementation	Indicator name
		of the financial guarantee (Decision 2009/335/EC)**
Waste facility classification	Assessment of classification of extractive waste facilities	Existence of guidelines and / or specific binding requirements to classify extractive waste facilities (e.g. definition of a 'certain threshold') according to Annex III*
Closure and post closure phase	Assessment of closure and after closure procedures for waste facility	Risk-based assessment to identify the sites (including the methodology developed by the ad-hoc group)**
Transboundary effects	Assessment of the procedure in case of transboundary effects	Existence of coordination mechanisms to ensure information is forwarded to other Member States**

Note: * indicates a 'key' indicator / ** indicates 'key' indicator for which little information was identified.

3. Information and data collection

3.1 Overview of information collection

The analysis presented in this report relies on a range of information sources collected for the purpose of this project. The sources of information used were:

- Results of the reporting from Member States on the implementation of the Directive for the second reporting period[15];
- Engagement with stakeholders from industry, academia and non-governmental organisations (NGOs); and
- Review of Member States' competent authority websites;
- Direct engagement with Member States encompassing:
  - Data request on permit information;
  - Questionnaire on reprocessing of waste; and
  - Specific aspects of the assessment framework.
- Literature review.

3.2 Review of the information collected and gaps identified

The table below presents the use of the information collected by source.

Table 3.1 Use of information sources, gaps and availability

Information source	Information available	Gaps observed
Member State implementation report information	22 Member State reports were assessed as part of the previous implementation project. An additional six reports from Bulgaria, Greece, Ireland, Italy, Luxembourg and Sweden were made available to the project team. The implementation reports cover: administrative arrangements, waste management plans and major-accident prevention and information, permit and financial guarantee, closure and after closure procedures including inventory, inspections and other relevant information	The level of information and details provided vary greatly between the reports provided and doubts remain on many occasions regarding the robustness and reliability of data provided by Member States. Often very little data are provided and for many Member States the responses are very succinct.

[15] http://ec.europa.eu/environment/waste/mining/pdf/report_mining_waste.pdf

Information source	Information available	Gaps observed
Consultation of NGOs	A total of five NGOs were contacted in June with a follow-up in July 2016. ▪ EEB provided a response on 13th September indicating very little responses from its members; and ▪ Mining Watch Romania provided a response on 9th August focusing on Romania's situation. Pertti Sundqvist provided a response focusing the situation in Finland.	The responses received are limited in two ways: ▪ Mining Watch Romania's focus is mostly on Romania and presents possible amendments to the Directive; and ▪ The EEB response is from two members only from the Netherlands and Germany. While limited it identifies some shortcomings in the implementation that will be useful for the analysis of gaps.
Consultation of trade associations	Euracoal, Euromines, Euroroc, IMA Europe, UEPG were contacted several times. Euromines was the only trade association that agreed to participate and provide feedback. The questionnaire was circulated to the Euromines members and responses were gathered and summarised by a representative of Euromines. A follow-up face to face interview was carried out in September 2016.	Information received from one EU trade association only however, Euromines is the most relevant trade association when considering the EWD. Responses were sometimes quite generic and covered only specific Member States.
Engagement with mining experts	Engagement with mining experts and academics was held throughout the project ▪ Prof. Madai from University of Miskolc and MINPOL study; ▪ The Strategic Dialogue on Sustainable Raw Materials for Europe" (STRADE) project; and ▪ Ciaran Molloy, Eugenio Spadafora and other specialist colleagues within Amec Foster Wheeler involved exclusively on mining projects.	The responses gathered were very useful in assessing the performance for specific thematic areas in particular Category A installations, cyanide, stability of waste management facilities and technology development. The information collected was of limited use for identifying gaps in implementation.

Information source	Information available	Gaps observed
Direct engagement with Member States – data request on permits	Issued in July 2016, the deadline for responding to the request was 12th September 2016. Information was received until July 2017. 26 Member States responded. Generally, the information reported is complete. ▪ **Croatia, Luxembourg, Netherlands, Lithuania, Latvia and Slovenia** indicated that there are no relevant sites in their countries. ▪ **Cyprus** indicated that its only installation is in the process of being closed; ▪ **Austria** and **Estonia** listed five and four permits each and provided a mostly complete response; ▪ **Belgium** listed five permits and provided a mostly complete response but with no information on BAT; ▪ **Bulgaria** listed three permits and provided a complete response; ▪ **Czech Republic** listed 57 permits and provided a partially complete response, indicating that some fields could not be filled at this stage; ▪ **Denmark** listed one permit and provided a complete response; ▪ **Finland** listed 116 permits and provided a complete response; ▪ **France** listed 34 permits and provided a complete response, in addition a document was provided to give further explanation on the permits; ▪ **Germany** listed 209 permits and provided a mostly complete response; ▪ **Ireland** listed 1,489 facilities, this was later clarified to also include quarry sites not relevant to EWD facilities. No detailed information provided; ▪ **Italy** provided a response in which 19 permits were listed corresponding to four regions of the Member	It was expected that the information reported by Member States as part of the data request would provide information on: ▪ Application of BAT and inclusion of BAT in permits; ▪ Average length of validity of permits; ▪ Average renewal period for permits; ▪ Application of control measures in permit; ▪ Current reprocessing practices at permit level; and ▪ Wider general statistics on number of permits, status of the mines and materials being mined. While the responses received do not cover all Member States, for those Member States where information was received, a good level of information was provided which allows an analysis for some of the points highlighted above, with varying degree of completeness. The least well responded parts are in relation to control measures and reprocessing practices. The main limitation is on EU wide comparability of the information reported

Information source	Information available	Gaps observed
	State. The information provide on these permits has significant gaps; ▪ **Hungary** listed 28 permits and provided a complete response; ▪ **Malta** listed 27 permits and provided a complete response; ▪ **Poland** listed 15 permits and provided a complete response; ▪ **Portugal** listed 10 permits and provided a complete response; ▪ **Slovakia** listed 111 permits and provided a complete response; ▪ **Spain** listed 1,217 permits, many of which are for sites in closure phase. The completeness of information varied from permit to permit, overall little information was included on BAT and reprocessing measures; ▪ **Sweden** listed 20 permits and provided a complete response; and ▪ **The UK** listed 401 permits located as follows: 236 in England, 146 in Scotland, 19 in Wales and 0 in Northern Ireland. The response provided was only partially complete and no information on products, issues, BAT and reprocessing was provided. No responses were received from **Greece** and **Romania**.	
Direct engagement with Member States – questionnaire on reprocessing	The request was issued on 11th May 2016 with a deadline for responding of 13th July 2016. 22 Member States provided responses. All of the responses were complete, there was variation between those Member States where policy related to reprocessing of waste from extractive industry is available (i.e. 4 out of 22 with dedicated guidance and a further 9 out	It was expected that this information would be useful to perform the assessment of performance for the specific corresponding thematic area. While sufficient information was available for the purpose of our analysis, not all Member States are represented and those that are, are with varying level of details.

Information source	Information available	Gaps observed
	of 22 where these activities are covered in wider national policy) and others where no policy is in place (9). The responses have provided a range of examples and possible case studies. No responses were received from Finland, France, Greece, the Netherlands, Portugal and Slovakia.	
Literature review	The literature reviewed included: ▪ Member States websites regarding Extractive Waste and its regulation / permitting (see Appendix F); ▪ Member State closed sites inventories as per Article 20 (see weblinks in Appendix E; ▪ Member State guidance, where available; and ▪ Scientific and academic literature identified using targeted search terms (SCOPUS). The availability of data on the Member State websites is variable. Some have a single site with reference to all the legislation, guidance and further information, whereas others use multiple websites (per Region or Competent Authority). The scientific literature review identified a high number of resources (more than 200 academic and scientific articles reviewed). A reference list is presented at the end of this report in Appendix B.	Varies according to source reviewed. Regarding Member State webpage information on implementation, note that the level of detail of the webpage information varied between Member States. The more developed webpages include information on guidance documents and other relevant background material. Where no dedicated webpage is available, information may be contained within other webpages dedicated to either waste or mining. Furthermore, the majority of Member States do not include complete information on permits directly online, rather information can be provided on request.
National legislation (including national guidance / national guidelines)	The national legislation of a large selection of Member States has been reviewed. This included Austria, Bulgaria, Germany, Greece, Spain, France, Ireland, Italy, Portugal, Romania, Slovakia, Sweden and United Kingdom.	The depth of information included in the legislation varied according to Member State; some have detailed provisions, others rely on other guidance or other regimes. In several Member States the information was held at

Information source	Information available	Gaps observed
	The legislation was available online, and normally referenced the same text as in the Directive without much development. Information on sanctions and penalties was available in 5 out of 13 reviewed, and some Member States made reference to other legislative systems (e.g. Greece, Portugal). The availability of guidance to the public was scarce (only identified in Germany (some Lander), Ireland, Sweden, and the UK (among the 14 countries reviewed)).	regional or local level making it difficult to identify and access.
Statistical information from Eurostat	EUROSTAT waste data for 2014 was assessed to identify useful information on the implementation of the Directive. There was waste generation information on 27 categories, however 99.65% (over about 700 million tonnes) of waste generated in the sector is classified as 'Mineral and solidified wastes' of which 99% is generated by 10 Member States: Romania 21.7% Bulgaria 22.6% Sweden 19.7% Poland 10.7% Finland 8.9% Greece 6.7% UK 3.7% Spain 2.6% Estonia 1.1% Germany 1.1% The data can be further disaggregated into hazardous and non-hazardous waste.	Data are available on waste generation (not on treatment). Sub-data sets exist for hazardous waste.
Information provided by Member States on events (Article 11(3) and 12(6) of EWD)	Over the period 2008-2016, the Commission was informed of at least seven events either via notifications by Member States or further desk research.	Low number of events compared to the number of extractive waste facilities and the length of the period examined

3.3 Stakeholder workshop

A stakeholder workshop on the implementation of the EWD was held in Brussels on 14th March 2017. The workshop summary report is presented in Appendix D and

incorporates analysis of the discussions (not repeated here), main points recorded during the workshop, agenda, list of attendees, and the background paper provided to delegates prior to the meeting. The comments, observations and clarifications made at the workshop were considered in developing the analysis for the project in addition to the information sources described above.

3.4 Mining sector context

3.4.1 Technological development

Regarding techniques and technologies, the 2009 BAT Reference Document (BREF) provides an overview for extractive techniques, mineral processing, tailings management, and closure and aftercare (for a summary see Appendix G).

Discussions with specialists indicated that, regarding technology development since the 2009 BREF, whilst there have been improvements (driven by a continual need for efficiency) there has not been fundamental change in mining technologies deployed. However, the following are examples of technologies that are becoming more commonplace, primarily to increase operational and economic efficiency:

- Autonomous (driverless) haulage, including mine haul trucks, trains and drill rigs;
- Satellite survey for measurement and monitoring;
- 3D LIDAR[16] and radar scanning (for slope monitoring and measurement);
- Onsite mineralogical analysis;
- Ore sorting; and
- Remote monitoring and control of process plant.

In terms of risk reduction from these technologies, technological development has focussed on economic risk reduction (although reduction of environmental risk may also result and developments that increased environmental risk would not be looked on favourably). Any new technology that would introduce greater safety, environment or economic risk would be unlikely to succeed. Reducing risk (primarily economic but also safety and environmental) is the main driver for implementing new techniques. Three of the technologies noted above (autonomous haulage, satellite survey, and 3D LIDAR and radar scanning) achieve risk reduction by removing people from the hazard. 3D LIDAR and radar scanning could also have a consequential environmental risk reduction where it is used to monitor waste dumps and tailings ponds. Specialists indicated that while these technologies are becoming more common, they are not widely used at present. No data was available to ascertain with precision uptake in the EU. Specialists were also of the view that the 2006 Directive has assisted in reducing risk by providing clarity to the regulatory framework.

3.4.2 Waste management costs

Allocating Capex and Opex associated with waste management in the extractive sector is complex as there is a very wide range of minerals and extraction processes together with a correspondingly wide range of physical locations and settings to be considered. Obtaining reliable cost data can raise issues of commercial sensitivity (e.g. where there are limited companies or sites engaged in extraction of a particular mineral) and are hard to establish for a facility or sector where an operator is, or used to be, state owned and/or the costs are historic. A further consideration is that many metal mines produce several metals hence it can be difficult to assign common costs to the different metals. These difficulties have been acknowledged by Symonds Group (2001) and confirmed through discussion with other industry experts.

Symonds Group (2001) notes that the following variable activities give rise to waste management costs:

[16] Light Detection and Ranging. LIDAR is a remote sensing technique that uses pulsed laser light to measure variable distances.

- Requirements to reuse material; diversion of overburden or waste rock for use as aggregate and fill; restoration requiring back-filling and re-profiling: such activities are likely to involve the handling and management of waste materials and will entail costs, though actions such as sorting, screening, crushing, storing and placement of materials are relatively minor costs;
- Tailings management (where required): tailings are typically not inert, particularly where chemicals have been used in processing. Costs associated with tailings management (prior to their long-term storage or disposal) include tailings pumping, de-watering, neutralisation and the treatment of chemical residues to render the tailings less hazardous, and the design, installation and closure of the facilities (including any wastewater treatment plant). A tailings management facility is typically developed in phases (the height of the containment dam is likely to be raised in stages over a period many years, thus capex investment will extend over the life of the facility) and will include:
  - containment dam construction and bunding
  - geological or synthetic liner installation to prevent contamination
  - provision of accompanying infrastructure (e.g. pumps and filter presses) needed to operate the tailings facility
- Backfilling is an option for some facilities whereby material is replaced in the mined-out void space. This incurs costs to achieve proper separation of materials, expenditure on cementation type materials and handling costs; and
- Management costs such as monitoring equipment, and access to appropriate analytical facilities.

Extractive facilities develop around an approach that includes waste management as an integral part of ore concentration and processing hence allocating costs to waste management is not straightforward. Furthermore, together with initial Capex investment, ongoing Capex is required at extractive facilities. This may be referred to as 'semi-capital costs' or 'sustaining Capex' and is associated with items of a capital nature which are scheduled to occur regularly throughout the life cycle of a project. Examples are the extension of tailings dams and the replacement of large capital items (e.g. pumps). Such semi-capital costs may be significant. Alongside Capex and semi-capital costs is Opex associated with pumping, treatment of hazardous residues, wastewater treatment, materials handling, monitoring and management oversight.

In investigating waste management costs Symonds Group reviewed responses to an information request from 22 organisations and concluded that for both zinc and copper facilities, waste management typically accounts for about 1.5-2.0% of total cash costs[17] and that for coal mining the proportion of mining costs accounted for by the same waste management practices ranges from 1.0% in France to 3.5% in the UK. Discussion with industry experts has indicated agreement with 1.5 to 2.0% of cash costs assuming that the proportion is for tailings waste management only and does not include costs associated with waste rock dumps. For initial Capex, a range for tailings facility could be in the region of 5-10% however this is highly dependent on the significant variables noted above and excludes further semi-capital costs that would be required through the life cycle of the facility and which are incurred at varying rates and degrees dependent on the particular facility. Further costs associated with the management of waste rock will vary depending on the stripping ratio[18]. For opencast mining stripping ratios may vary from 1:1 to 8:1 but can be greater if the ore grade is high and economically, can support a high stripping ratio.

[17] Total cash cost = cash operating costs (i.e. direct mining expenses + smelting, refining and transport costs + by-product credits + other costs) + royalties (not-profit based) + production taxes. In broad terms, total cash cost is Opex.

[18] The ratio of the volume of overburden (or waste material) requiring management to the volume of ore extracted.

4. Analysis of the gaps in the implementation

This section presents the initial analysis of the information gathered on specific indicators for the areas of intervention relevant to the EWD. The analysis has attempted to identify gaps in implementation at Member State level and draw conclusions on performance and possible solution to address instances of low performance.

4.1 Member State enforcement and control

4.1.1 Parameter: Effectiveness of enforcement, in relation to enforcement authorities' powers and competencies in relation to: a) enforcement authorities' powers and competencies

Table 4.1 Indicator summary – Member State enforcement and control: a) enforcement authorities'

Indicator 1: Cases of non-compliance identified over the two reporting periods	
Description	The indicator aims at describing cases of non-compliance with the permit conditions, identified over the two reporting periods (description of the cases and classification of types of non-compliance), to identify specific trends within and across Member States.
Sources of information	Review of Member State implementation reports Information provided by Member States on incidents and events
Geographic scope of information	MS coverage and EU-wide information
Completeness of information	Under the first reporting period (May 2008- April 2011), there was no information from six Member States (CZ, ES, LT, LU, SE, UK). 12 Member States mentioned that they had not identified any non-compliance (AT, BE, CY, DE, DK, EE, FR, HU, LV, MT, PT, RO). Some countries mentioned that they had identified non-compliance, without providing any specific instances (BG, EL and PL). Ireland stated that non-compliance instances cannot be reported, since the Directive only entered into force in May 2012. Finland, Italy and Slovakia identified specific non-compliance cases with the permit conditions. Under the second reporting period (May 2011-April 2014), there was information on non-compliance cases in 13 out of 21 Member State implementation reports (seven Member States did not have any facilities falling under the scope of the EWD). There was no information from six Member States (BG, GR, IE, IT, LU, SE). Spain and France provided limited information.
Information gathered	Under the first reporting period, only three countries indicated that they identified cases of non-compliance. Ireland mentioned that this question was not relevant, since the Directive entered into force only in May 2012. Under the second reporting period, only five countries indicated that they had identified cases of non-compliance (54 cases in total). Usually the failure to comply with the conditions set in permits is among the main reasons identified[19].

[19] Further details on the non-compliance cases under the second reporting period are available under BiPRO and Oakdene report 'Provision and elaboration of information for the preparation of the '*Implementation*

Indicator 2: Expertise of inspectors (diploma, technical training, etc.), how many inspectors per site (Article 17 of the EWD)	
Description	This indicator aims at describing the level of inspector expertise in Member States, how they are trained and what qualifications they require. It also examines the number of inspectors per site in Member States.
Sources of information	Consultation of trade association Engagement with mining experts
Geographic scope of information	Generic information on EU trends in general together with limited information on Member States.
Completeness of information	Very limited information
Information gathered	According to Euromines, inspectors are not sufficiently trained and do not have the right expertise in some Member States. This is especially the case in Member States in which there are few mines. However, in countries with a long 'mining history', such as Germany, inspectors are well trained and have the right expertise. Euromines suggests the use of external auditors that should assess whether the extractive waste sites are compliant with the Directive, also by taking BAT and voluntary codes (e.g. GruvRIDAS in Sweden or the Cyanide Code internationally) into account to address the lack of expertise of inspectors. This approach is implemented in the UK and Ireland where, according to the 2012 Guidelines on inspection of extractive waste facilities, an independent expert is appointed as the "Competent Engineer" for a facility and must fulfil an expert role during design and permitting, operation and post closure to provide advice and recommendations to the operator, and by assessing and reporting any compliance issues to the competent authorities[20].

b) Inspection programmes with clear priorities

Table 4.2 Indicator summary – Member State enforcement and control: Parameter b) inspections

Indicator 3: Evidence of Competent Authority carrying out sampling of extractive waste, laboratory tests and / or stress tests*	
Description	This indicator aims at identifying the expertise of Competent Authorities in carrying out their own tests to control whether the facilities comply with the obligations of the Directive and do not entail any risk to the environment
Sources of information	Consultation of trade association
Geographic scope of information	Generic information on the practice in the EU in general.

Report of Directive 2006/21/EC on the Management of waste from Extractive Industries.' April 2016 (Section 3.3.3) available at: http://ec.europa.eu/environment/waste/studies/mining/waste_extractive_industries.pdf

[20] See page 46-47 of the Guidelines for the inspection of mining waste facilities prepared by DHI for the European Commission. April 2012 available at: http://ec.europa.eu/environment/waste/mining/pdf/Annex2_guidelines_inspection.pdf

Completeness of information	Limited information based on a consultation of Euromines members
Information gathered	According to Euromines members, inspectors do not carry out their own sampling of extractive waste or laboratory tests or stress tests, but instead rely on their company's own testing. They consider that mining companies are better placed to carry out these tests (technical and financial capacity). Inspectors should, however, have the relevant competences to assess the quality of the tests and to identify potential risks and issues.

c) Assessment of implementation of inventory of closed waste facilities

Table 4.3 Indicator summary – Member State enforcement and control: Parameter c) inventories (Art 20)

Indicators 4 and 5: Availability of an inventory (Article 20 of the EWD) and frequency of update of the inventory	
Description:	These indicators aim to provide information about whether or not Member States have set up inventories of closed sites online and whether these inventories are frequently updated
Sources of information	Literature review including competent authorities' websites Review of Member State implementation reports (first period only[21]) Consultation with Member States authorities (clarifications)
Geographic scope of information	MS coverage for all EU
Completeness of information	Quite complete information on whether or not Member States have set up an inventory online. Whilst there is no information on whether or not these inventories are frequently updated, for those inventories that are publicly available, there is a date of last update in most cases.
Information gathered	The MS implementation reports and consultation with MS (for clarifications) were used to determine whether the inventories were available. 17 are available online and 1 is temporarily offline (the website is being renovated). Appendix E contains the links to the 17 inventories that are available online. There was not information on the frequency of updates of the inventory (except one Member State but it has not updated the inventory as frequent as stated). However, there was information in most cases on the last time that they were updated. See Table 4.4 for details.

[21] No specific questions on inventory under the second reporting period.

4.1.2 Analysis

Under these four indicators, the information available was not complete and detailed enough, to fully assess how Member States are enforcing and controlling the application of the EWD.

With regard to the reporting of non-compliance cases, few countries with extractive waste facilities have identified compliance issues. Furthermore, the information provided on the non-compliance cases is often incomplete and/or unclear. Some countries do not mention the number of cases, the type of cases, the related sanctions or administrative measures or the category of facility involved. It is not possible to assess whether the limited number of cases of non-compliance is due to a high compliance rate from extractive waste companies or to the insufficient enforcement and control measures set in place by Member States. Overall, no detailed comparison between Member States can be achieved based on the data available.

Concerning the expertise of inspectors and their number per site, the information collected is very generic and mainly based on one source (Euromines) which underlines that inspectors are well qualified in countries with a 'mining history', but that this is not always the case in other Member States. Euromines suggests the use of private independent certification/audit systems to replace inspectors from competent authorities. According to the 2012 Guidelines on inspection of mining waste facilities[22] such certification/audit systems are implemented in the UK and Ireland whereby an independent expert "Competent Engineer" which must fulfil certain professional requirements set by law, is appointed and remunerated by the operator to carry out inspections and report to the competent authorities. No data was found within the available sources of information relating to the number of inspectors per site.

There is limited data available, based on one source of information (i.e. Euromines), on whether or not Competent Authorities carry out sampling of extractive waste, laboratory tests and/or stress tests. Euromines' members consider that inspectors do not carry out their own sampling of extractive waste or laboratory tests or stress tests, but instead rely on operators' tests since the inspectors lack the technical and human resources to perform such tests. They suggest that inspectors should, however, have the relevant expertise to assess the quality of the tests and to identify potential risks and issues.

On the availability of inventories[23], information on whether or not Member States had set-up an online inventory is overall complete[24], however from the information available a number of observations can be made. From the 28 EU Member States, seven did not consider establishing an inventory due to the absence of closed or abandoned sites. From the remaining 21 Member States, 17 (Austria, Cyprus, Czech Republic, Estonia, Greece, Spain, Finland, France, Hungary, Ireland, Italy, Portugal, Romania, Sweden, Slovenia, Slovakia and United Kingdom) have an inventory that is available online. Another (Poland) has developed an inventory but it is temporarily unavailable online because the website is being renovated. No information was found on the frequency that the inventories are updated, apart from Greece (every three years, although the inventory has not been updated since 2012). It could be verified when the inventories had been last updated in 13 out of the 17 cases where they were available online (Cyprus, Estonia, Greece, Spain, Finland, France, Hungary, Ireland, Italy, Portugal,

[22] Establishment of guidelines for the inspection of mining waste facilities, inventory and rehabilitation of abandoned facilities and review of the BREF document, April 2012, report for DG Environment

[23] Note that to assess implementation, the existence of inventories was the focus of the evaluation indicator. Information in the inventories is variable in content and date and did not facilitate useful analysis. However, it has been possible to compile information on facility name, location, type of facility (heap, dam, pond, other), type of resource exploited when the mine was active. This list contains over 3,000 entries and has been provided to the Commission in Excel format.

[24] See Appendix E. Note that a lack of an online inventory does not confirm that an inventory has not been developed (e.g. BE, DE, PL). This is actually the case in Austria, where the inventory is available offline. The competent authorities of BE, BG, DE and PL have been contacted to confirm whether an inventory exists, without success. HR, LT, LU, LV, MT, and NL, stated that it was not applicable as either there were no facilitates in the Member State or that there were no abandoned sites. Although SI stated the same in its implementation report, an inventory does exist and is available online.

Romania, Slovenia and the UK). The dates are quite variable and range from 2011 to 2017. Table 4.4 presents a summary of this information. Also, Appendix E presents a list of the links to those inventories that are available online.

In the cases of Germany, Bulgaria, and Belgium, it was not possible to confirm whether inventories are available. The inventories do not appear to be available online. The competent authorities of these Member States were consulted but no response was received as of 12th July 2017.

Table 4.4 Information on availability of the inventories of closed and abandoned extractive waste facilities (Article 20) in the EU-28

Member State	Is there an inventory?	Is the date of last update available?	If so, date
AT	Yes. Available online (PDF). The inventory is not a list or table as there is a single facility. The document states that there is one facility to which the criteria of Article 20 applied.	No	-
BE	Clarification sought from Member State but not available at time of writing. It is only applicable to Walloon.	-	-
BG	Clarification sought from Member State but not available at time of writing.	-	-
CY	Yes. Available online (HTML).	Yes	June 2017
CZ	Yes. Available online. (List in website and map tool with detailed information which requires Microsoft Silverlight™ to work).	It is stated to be "continuously updated". No date available	NA
DE	Clarification sought from Member State but not available at time of writing. No link or information found.	-	-
DK	The Member State stated that there are no sites for which Article 20 is applicable (no inventory required).	NA	NA
EE	Yes. Available online (PDF).	Yes	2011 (first stage) 2012 (second stage)
EL	Yes. Available online (PDF).	Yes	October 2012
ES	Yes. Available online (Excel).	Yes	November 2015
FI	Yes. Available online (PDF).	Yes	November 2012
FR	Yes. Available online (PDF).	Yes	-
HR	The Member State stated that there are no sites to which Article 20 is applicable (no inventory required).	NA	NA
HU	Yes. Available online (PDF).	Yes	December 2012

Member State	Is there an inventory?	Is the date of last update available?	If so, date
IE	Yes. Available online (IT tool with a list of all extractive waste facilities, including those active. There are 86 closed mining waste facilities in Ireland, but only one is stated to meet the Article 20 criteria).	Yes	2015
IT	Yes. Available online (One Excel file for each region).	Yes	May 2017
LT	The Member State stated that there are no sites for which Article 20 is applicable (no inventory required).	NA	NA
LU	The Member State stated that there are no sites for which Article 20 is applicable (no inventory required).	NA	NA
LV	The Member State stated that there are no sites for which Article 20 is applicable (no inventory required).	NA	NA
MT	The Member State stated that there are no sites for which Article 20 is applicable (no inventory required).	NA	NA
NL	The Member State stated that there are no sites for which Article 20 is applicable (no inventory required).	NA	NA
PL	An inventory exists but the website is currently under reconstruction.	-	-
PT	Yes. Available online (Excel).	Yes	February 2013
RO	Yes. Available online (PDF of photocopied material).	Yes	July 2012
SE	Yes. Available online (PDF).	No	-
SI	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required). However, the Slovenian Geological Office published an inventory in 2014, which is available online (PDF)	Yes	February 2014
SK	Yes. Available online (PDF).	No	-
UK	Yes. Available online (Three PDF).	Yes	England and Wales: January 2014 Scotland: January 2015 Northern Ireland: 2011

Note: Information valid as of 30th June 2017

Finally, there is limited information on how Member States select the closed facilities to be included in the inventory and how they define sites causing serious negative environmental impacts or which have the potential of becoming in the medium or short

term a serious threat to human health or the environment[25]. Some Member States mentioned at the workshop organised by the Commission in March 2017 that they used guidance[26] developed by the TAC for the pre-selection of sites. See section 4.7 for details on the inventories of closed and abandoned sites that are available online.

4.1.3 Implications

- Expertise of inspectors and test carried out by Competent Authorities.

Almost no information was available on the level of expertise of inspectors (e.g. qualifications, years of experience, training). It should be relevant to cover this question under the Member State reporting questionnaire. At the stakeholder workshop (see section 3.3), there was recognition that there should be a minimum level of competence for inspectors carrying out facility inspections. Related topics could also be considered such as the outsourcing of inspection to independent experts (e.g. type of expertise outsourced, role of independent experts and efficiency of outsourcing).

Tests carried out by the competent authorities, do not seem a viable indicator since, in general, the competent authorities do not carry out their own tests/sampling, but rely instead on the tests performed by companies due to a lack of financial and technical resources. However, whether there are obligations on the operator of the extractive waste facilities to carry out tests and samples and to record them in view of inspections or to send them to the Competent Authorities is an issue that could also be investigated as part of the triannual reporting.

- Checklist of issues for inspections and proportionality.

At the stakeholder workshop, some Member States and stakeholders called for a 'checklist' of principal questions/issues for inspections. Such a list should concentrate on the main aspects and not extend to detail. In addition, a need for proportionality of inspections was identified (e.g. Category A, non-Category A, inert and non-inert to be differentiated). Some industry stakeholders stressed that checklists should not be a substitute for competence and that requirements on competence are needed in the guidelines. Overall stakeholders saw the 2012 report on inspections[27] as a good basis for further work on the approach to facility inspections.

- Selection of sites to be included in Article 20 inventory.

It may be relevant to further research how Member States select the extractive waste facilities to be included in the inventories, according to Article 20 of the EWD and whether they take into account for these selections the guidance note on pre-selection of closed facilities developed by Member States with the support of the Commission in 2011[28]. At the workshop organised by the Commission, several Member States mentioned that they used this guidance. See section 4.7 for details on the inventories of closed and abandoned sites that are available online.

- Non-compliance cases.

To ensure that the reporting on non-compliance cases is more accurate and detailed, it may be relevant to attempt to gather more specific information in particular on:

- The type of non-compliance based on the different obligations of the Directive;
- The category of the extractive waste facilities;

[25] According to Article 20 of the Directive, the inventory must include closed waste facilities located on their territory which cause serious negative environmental impacts or have the potential of becoming, in the medium or short term, a serious threat to human health or to the environment

[26] Guidance document for a risk based pre-selection protocol for the inventory of closed waste facilities, prepared by the Inventory of closed waste facilities ad-hoc group (as sub-committee of the technical adaptation committee for Directive 2006/21/EC)

[27] http://ec.europa.eu/environment/waste/mining/pdf/Annex2_guidelines_inspection.pdf

[28] Guidance document for a risk based pre-selection protocol for the inventory of closed waste facilities as required by Article 20 of Directive 2006/21/EC, prepared by the Inventory of closed waste facilities ad-hoc group (as sub-committee of the technical adaptation committee for Directive 2006/21/EC)

- The sanctions or administrative measures imposed, as a result of the non-compliance;
- Whether or not the non-compliance resulted in an incident or accident; and
- How the non-compliance case was identified (e.g. through inspections, complaints, incidents).

This information could be considered in updated implementation reporting, however it is important to note that there is currently consideration on whether the triannual reporting format is best suited to gather information on implementation and a recent Commission Communication[29] noted that conclusions of the Fitness Check on Environmental Monitoring and Reporting will be taken into account when updating the reporting questionnaires.

4.2 Major accident prevention

4.2.1 Parameter: Assessment of major accident policies in relation to: a) Existence and adequacy of safety management system, including appointment of a safety manager and b) Adequacy of coverage in the external emergency plan

Table 4.5 Indicator summary

Indicator 1: Number of major accidents	
Description	Aim to assess the major accident policies, in particular the existence and adequacy of safety management system.
Sources of information	Literature review Consultation of NGOs Consultation of trade associations Information provided by Member States
Geographic scope of information	EU wide
Completeness of information	While no literature was identified for this indicator, information was gathered through direct consultation with trade associations and the review of previously reported information by Member States.
Information gathered	▪ A thorough study undertaken in 2001 by the International Commission on Large Dams and the United Nations Environment Programme that found that on average one major incident per year occurs at extractive waste facilities dams and that this figure has doubled between 1995-2001; ▪ Trade associations were not aware of any major accidents since Article 6 came into force (1 May 2008 for new facilities, 1 May 2012 for existing facilities in the sense of Article 24(1), (4) of EWD); and Information provided by Member States on incidents and events (Article 11(3) and 12(6) of EWD).

[29] European Commission, COM (2016)535

Indicator 2: Changes in the number of major accidents in two reporting periods	
Description	This indicator aims to identify possible changes in the number of accidents that occurred between different reporting periods.
Sources of information	Based on Member State reports. In addition, most Member States (those reporting having Category A facilities; excluding Bulgaria, Greece, Ireland, Italy, Luxembourg, and Sweden) were asked to confirm the absence of accidents during the two reporting periods. All Member States except Hungary and Finland, on request via e-mail, confirmed that no accidents took place.
Geographic scope of information	The information obtained covers only the Member States of Finland and Hungary.
Completeness of information	The data reported within the first (1 May 2008-30 April 2011) and the second (1 May 2011-30 April 2014) reporting periods was complete.
Information gathered	Information on events notified to the Commission (Article 18, 11(3) and 12(6) of EWD[30].
Indicator 3: Number of Category A installations with an external emergency plan	
Description	Given that the existence of external emergency plans is compulsory for Category A facilities (except if they are covered under the Seveso Directive), the proportion of those with/without it has been assessed
Sources of information	Review of implementation reports
Geographic scope of information	Reports of 23 Member States assessed The question is relevant for 18 Member States. 12 of them provided an answer.
Completeness of information	It should be taken into account that from all EU Member States, seven declared in their reports for the period 2011-2014 not having any facilities covered by the Directive (Denmark, Croatia, Lithuania, Latvia, Malta, the Netherlands and Slovenia) and a further three declared not having any category A facilities (Austria, Belgium and Czech Republic[31]). The implementation reports cover 13 of the 18 Member States for which the question was relevant, and 12 of them responded (a completeness of 66%).
Information gathered	The implementation reports include information of the missing external emergency plans in each country, where available. In most cases, it also explains the reasons for having a higher or lower proportion of missing external emergency plans, as well as some differences in the

[30] Implementation report: "Assessment of information safety measures taken and on the action required in the event of accidents or events, as requested by Articles 11§3 and 12§6" of the Directive on the management of wastes from the extractive industries (EWD)". April 2016.

[31] Information is from Member State implementation reports covering 2011-2014. The information request undertaken for this study in 2016 contains further information that differs in some cases from information in implementation reports (e.g. Belgium reports one and the Czech Republic two Category A facilities in the 2016 information provided for this study). This report states whether the information has been extracted from implementation reports or the recent additional request.

	interpretation of the circumstances at which these should be drafted (e.g. Category A facilities in closure phase are required to have an external emergency plan in Germany but not in Estonia. According to the Estonian implementation report, a site not in operation but to be closed had no external emergency plan prepared. The site was due to close at the end of 2014. The information collected for this study in 2016 confirmed that the site is now closed and is no longer classified as a Category A facility). A summary has been included in Table 4.6.

4.2.2 Analysis

Article 6 of the EWD requires Member States to ensure that major accident hazards from Category A waste facilities (except for those covered by the Seveso regime) are identified and that the necessary features are incorporated into the design, construction, operation and maintenance, closure and after-closure of the waste facility to prevent such accidents and to limit their adverse consequences for human health and/or the environment, including any transboundary impacts. To this end, *inter alia*:

- The operator shall draw up a major accident prevention policy for the management of extractive waste and put into effect a safety management system implementing it, and shall also put into effect an internal emergency plan specifying the measures to be taken on site in the event of an accident; and
- The competent authority shall draw up an external emergency plan specifying the measures to be taken off-site in the event of an accident.

The results of the analysis of the implementation reports suggest that Member States have put in place legislative and administrative measures in compliance with Article 6.

To assess major accident prevention, our main indicators used were:

- Number of major accidents;
- Changes in the number of major accidents in two reporting periods; and
- Number of Category A installations with an external emergency plan.
- Further indicators have been discussed but not used since robust and comparable data was not reliably retrieved with our main sources of information. These were:
- Recording and reporting of near missed events;
- Number of near miss events;
- Changes in the number of near miss events between the reporting periods;
- Legal requirements to appoint a safety manager applicable to safety manager e.g. minimum professional qualifications;
- Number of Category A facilities with complete safety management policy and systems in place;
- Number of Annex 1 elements covered by safety management system;
- Verification that external emergency plans meet the objectives described in Article 6(3); and
- Verification that the internal emergency plans meet the objectives described in Article 6(4)).

Member States must report to the Commission on events that may affect the stability of waste management facilities or that, in general, might increase the risk of damage, and accidents every year (Article 18(2) EWD). Over the period 2008-2016, the Commission was informed of seven events either via Member States notifications or further desk research. Additional information on events was also identified following consultation with NGOs.

Overall, the number of identified events appears to be low. One may claim that this is due to the effectiveness of the safety measures and thorough accident prevention planning both by operators and competent authorities under the terms of the Directive. However, another explanation is that not all events are reported in accordance with the Directive. For instance, no formal notification of five events, as required under Article 18(2) of the Directive, was submitted in a timely manner (i.e. on an annual basis) to the Commission. Further, events may not be reported in time because the facilities in question may not be properly classified as a facility in the scope of the EWD.

In response to the events observed in Finland, the Finnish Ministry of Environment conducted a risk analysis (i.e. a stress test) of its mines. As part of the assessment, companies were consulted on their safety management. One of the weakest aspect identified was the low preparedness for flooding, for example many mines have emergency pumps but no capacity for emergency power to power these pumps[32].

Although the information about external emergency plans from six Member States is missing (Bulgaria, France, Ireland, Italy, Luxembourg and Sweden), it should be noted that there were other 10 Member States for which this is not relevant (see table above with the description of the indicator). The majority of the Category A facilities of the Member States assessed have an external emergency plan (69%). As can be observed in Table 4.6 there are some gaps, with four Member States reporting that all plans were missing. However most of them have provided an explanation, indicating that they were being developed or that they were to be developed before the start of operation of the facilities (the plans had not been finalised as the facilities had not started operating when the implementation report was drafted) or following reclassification of the facilities.

Table 4.6 Missing external emergency plans

MS	Missing external emergency plans	Comment
Cyprus	0 (no plans missing)	
Germany	5 (all missing)	One to be finalised at the end of 2016, four are already in place but they are being assessed to ensure compliance with the Directive. One of these facilities is in the final phase of closure but Germany requires an external emergency plan for these.
Estonia	0 (no plans missing)	The only Category A facility is in the closure phase and Estonia does not require it to have an external emergency plan. Estonia classified that facility as an abandoned site in its first phases of closure. In its implementation report (2011-2014), Estonian authorities argue that the site was abandoned and therefore had no external emergency plan. In the recent data submission requested for this study, Estonia no longer classifies the facility as category A
Spain	0 (no plans missing)	This was assumed in light of the information provided by Spain. Data on the enforcement of national inspection laws at regional level was not provided.
Finland	5 (out of 9)	One was due to be finalised during 2015. No information has been identified to confirm whether this has been completed.

[32] Stress tests of the mines https://helda.helsinki.fi/handle/10138/42780 and report on the environmental safety of the mines: https://helda.helsinki.fi/handle/10138/42781

MS	Missing external emergency plans	Comment
Greece	0 (no plans missing)	
Hungary	3 (out of 6)	This is due to the reclassification of some facilities to Category A. The implementation report does not contain information on the reason for reclassification.
Poland	0 (no plans missing)	
Portugal	3 (all missing)	Portugal stated that they are "in progress"
Romania	0 (no plans missing)	
Slovakia	1 (out of 3)	Slovakian mining authorities are not the same authorities that prepare the external emergency plans in their country. They could only state that the missing external emergency plan corresponds to a facility which operator is in insolvency proceedings and has not complied with its obligations. No further information from the competent authorities responsible for preparing the plan (which are not the same authorities) was located.
United Kingdom	2 (out of 4)	This refers to two sites that have been classified as Category A but have not started operation yet. One is due to be constructed and the other one was granted a permit provided that they submit information to the competent authorities before the facility starts operating.
Total	**19 out of 61 missing (31%)**	

Source: BiPRO (2016)

4.2.3 Implications

- Guidance for reporting events.

The planned general guidelines announced by the Commission on the implementation of the EWD could feature a specific section on recommendations for the timely reporting of events.

- Updated definition of Category A (alternatively guidance).

One repeated issue which is also relevant for major accident prevention is that Member States' authorities and economic operators are struggling with correctly applying the criteria for classification of waste facilities as Category A (see further information in Section 4.6), in this respect, one possible solution would be proposing an adjusted concept either as part of a review of the Directive, or by means of proposing to amend/modify Decision 2009/337. Another option would be providing guidance on the interpretation of Annex III of the Directive regarding Category A waste facilities.

- External emergency plans at Category A facilities.

According to the available data, the majority (two thirds) of the Category A facilities in the EU have an external emergency plan. Member States which have not yet finalised these plans should aim at finalising these plans as soon as possible since it is a requirement of the EWD (article 6) unless these facilities are covered by Seveso legislation, in which case article 6 would not apply.

4.3 Waste Management Plan

4.3.1 Parameter: Assessment of the Waste Management Plans (WMP) in relation to: appropriateness of pollution prevention measures in the WMP.

Table 4.7 Indicator summary

Indicator 1: Existence of guidelines for operators to prepare waste management plans	
Description	The indicator aims at identifying guidelines for operators to prepare waste management plans to assess whether the appropriate pollution prevention measures are reflected in them.
Sources of information	National legislation of the EU Member States
Geographic scope of information	A review of the national legislation of a large number of EU Member States (Austria, Bulgaria, Germany, Greece, Spain, France, Ireland, Italy, Portugal, Romania, Slovakia, Sweden and United Kingdom) was undertaken, looking for specific keywords and provisions regarding waste management plans. In most cases, the minimum content was specified. Guidelines were found for Germany (some Lander), Ireland and the UK (which includes separate guidelines for England and Wales, Wales, Scotland and Northern Ireland). For Sweden, it was found that guidelines are under development.
Completeness of information	The information is relatively complete in the case of two Member States but these were the only nationwide guidelines available. As a result, it was not possible to provide a horizontal analysis at EU level
Information gathered	Given the low amount of information found, this indicator will take Ireland and the UK as examples of good practice. Ireland: The guidance on the Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 published by the Irish EPA (2012) has a section on waste management plans. This includes six sub-sections, a summary of key points and summary of actions to be taken by local authorities and operators. UK: There are guidelines for England and Wales (Defra, 2010; Environment Agency, 2011), Wales (Natural Resources Wales, 2014), Scotland (SEPA, 2010) and Northern Ireland (NI Department of Environment, 2010): ▪ England and Wales (general): Brief explanation of the requirement, objectives, content, review, monitoring and approval with a high level description of the actions to be taken by the operator and authority; ▪ England and Wales (additional guidance): focuses on the objectives, content and the requirements of waste management plans (classification of the facility, reassessment of the facility status, waste characterisation, description of operation and treatment of waste, description of risks to the environment and human health, construction and management of facilities, control and monitoring procedures, proposed closure and post-closure plans, pollution prevention measures, land survey) and their review. It contains case studies and hypothetical examples that help to interpret the Regulations;

	▪ Wales: is almost the same document as the additional guidance for England and Wales above. The text is the same in the majority of the document; ▪ Scotland: detailed description of waste management plan objectives, waste characterisation, collection and evaluation of information, technical requirements for waste characterisation, waste management plans for extractive waste areas, waste management plans for excavation voids, basic waste management plan requirements for other areas, waste management plans for waste facilities handling inert waste), waste management plans for facilities handling non-inert / non-hazardous extractive waste, waste management plans for facilities handling hazardous waste, construction and management, prevention of water status deterioration, air and soil pollution, existing regulatory controls, and existing aspects of the planning system. It also provides advice to authorities when considering waste management plans. Finally, there is a questionnaire-type guidance with questions that help operators with the requirements; and ▪ Northern Ireland: A transcription of Defra (2010) guidance very similar to the Scottish guidance followed by a questionnaire-type guidance explaining the waste management plan objectives and how the process is different for extractive waste areas, extractive waste placed in void for rehabilitation or construction, inert facilities and non-inert facilities.
Indicator 2: Verification that the waste management plan includes the elements listed in Article 5(3) of the Directive	
Description	A literature review was undertaken to assess whether it was possible to identify how Member States verify that waste management plans include the elements listed in the Directive
Sources of information	Literature review
Geographic scope of information	A review of the websites of a large number of EU Member States (Austria, Bulgaria, Germany, Estonia, Greece, Spain, France, Ireland, Italy, Portugal, Romania, Slovakia, Sweden and United Kingdom) was undertaken, looking for specific keywords and provisions with regard to the minimum content of waste management plans. This has been identified for nine Member States.
Completeness of information	Given that the guidance documents available were very limited (see indicator 1 above) and that the method used by Member States to verify that this minimum content was complied with is not available, it has been concluded that the information is incomplete.
Information gathered	As stated above, the minimum content of waste management plans has been identified for nine Member States (Austria, Bulgaria, Estonia, Greece, Spain, Finland, Ireland, Romania and the UK). The analysis of the minimum content is provided in Table C.2 below. The guidance documents of Ireland and the UK contain information on how to prepare waste management plans as stated in the table above (indicator 1). However, the method to verify that waste management plans are compliant with this minimum content could not be found for any Member State. Only the UK guidance mentions that it is likely that most operators comply with this provision, since competent authorities have to review and approve these plans and will check whether they comply with Article 5(3) thoroughly.

4.3.2 Analysis

Article 5 of the Directive indicates that Member States have to request operators to develop a waste management plan, for the minimisation, treatment, recovery and disposal of extractive waste, taking account of the principle of sustainable development. The objectives are:

- To prevent or reduce waste production and its harmfulness;
- To encourage the recovery of extractive waste by means of recycling, reusing or reclaiming such waste, where this is environmentally sound in accordance with existing environmental standards at Community level and with the requirements of this Directive where relevant; and
- To ensure short and long-term safe disposal of the extractive waste, in particular by considering, during the design phase, management during the operation and after-closure of a waste facility and by choosing a design which requires minimal or no monitoring, control and management of the closed waste facility, prevents or at least minimises any long-term negative effects and ensures the long-term geotechnical stability of any dams or heaps rising above the pre-existing ground surface.

The parameters to assess the implementation of waste management plans are:

- Appropriateness of pollution prevention measures in the WMP (indicators 1 and 2); and
- Existence and adequacy of measures for minimisation, treatment, recovery and disposal of extractive waste (indicators 3 and 4).

The available information for indicators 1 and 2 is limited, with restricted geographical coverage and without the necessary completeness. Although it seems that the national legislation is readily available in several cases, it was difficult to locate guidance for interpretation. As a result, the analysis focuses on best practice found in the two Member States for which guidance was found: Ireland and the UK. The approaches of both countries are similar, although the guidance published by the Ireland competent authorities has clearer explanations of the role and requirements of operators and competent authorities. In the case of the UK, there are general and additional guidelines for England and Wales and then separate guidance documents for Wales, Scotland and Northern Ireland.

As can be seen in Table 4.8, the Ireland guidance has a clear summary of what operators and local authorities must do to comply with this provision. Along with that summary, the guidance includes detailed explanations of each element of the plan. However, the Ireland guidance does not contain case studies or hypothetical examples for potential sources of discrepancies such as the categorisation of facilities or the classification of waste.

Table 4.8 Highlights and requirements for operators and competent authorities as set out in the guidance to the legislation implementing the Extractive Waste Directive in Ireland

MS	Highlights	Operators' requirements (summary)	Competent authorities' requirements (summary)
Ireland	All operators must draw up an extractive waste management plan. This requirement applies to all quarries, sand and gravel extraction sites, locations where peat extraction takes place and other similar facilities operated by the extractive industries. The only exceptions relate to sites that are about to close, as well as peat workings and sites that are handling only unpolluted soil where both such activities are on a small-scale. ▪ Due date: 31 December 2011. All extractive waste management plans need to be submitted by 31 December 2011. ▪ The guidance explains that that the document does not need to be complicated. For existing sites, the Ireland authorities recommend focusing on how the environment is to be protected from deposited extractive waste, as well as how restoration is to be carried out on any remaining deposits; and ▪ Once produced, the plan needs to be revised only in the event of a substantial change (with explanation of what this means).	▪ Operators are legally obliged to produce a waste management plan; ▪ All extractive sites are involved in the management of extractive waste, even those that do not produce any waste on a regular basis or have deployed a successful preventative approach. Accordingly, all operators must produce an extractive waste management plan; ▪ The submission of this plan was due on 31st December 2011; ▪ It only needs to be updated when there is a substantial change (where a change of significant magnitude takes place and relates to site waste management arrangements); ▪ Review of the plans every five years or earlier if there is a substantial change; and ▪ Operators shall expect that the competent authority will need to verify that the sites comply with the waste management plans' contents.	Authorities must: ▪ Actively require and verify that all operators submit a waste management plan by 31st December 2011; ▪ Develop procedures for the recording, receipt and processing of the plans; ▪ Take into account during their review that these plans have the focus only on issues affecting extractive waste management. This means that the legislation does not require the plan to extend to wider issues relating to site closure that are not relevant to extractive waste management; ▪ Verify that the content of the plan complies with the requirements of the Regulation and if so approve it in accordance with it; and ▪ Aim at approving plans within two or three months of their receipt unless there is a good reason for not doing so. In particular, local authorities should not hold unprocessed or semi-processed plans for prolonged periods without issuing a decision on them: ▪ Monitor compliance as part of the competent authorities' inspection duties on an ongoing basis; and ▪ Require that existing plans are amended and re-submitted only when the nature of waste management operations has changed sufficiently for

MS	Highlights	Operators' requirements (summary)	Competent authorities' requirements (summary)
			it to constitute a "substantial change". Such a change is one that has the potential to have "significant negative effects on human health or the environment".

Source: Irish EPA (2012)

The guidance available in the UK is also comprehensive although the text is not as readable and "user friendly" as in the case for Ireland.

The document for England and Wales (Defra, 2010) gives a general overview of what is required. The most relevant parts are in bold. However there is no precise explanation, probably due to the individual countries of the UK producing their own guidance. This is developed in the additional guidance produced by the Environment Agency for England and Wales a year later. This second guidance has very detailed explanations with examples and hypothetical cases. As seen in section 4.6, these hypothetical case studies may show particularly clear examples to highlight the spirit of the law and the competent authorities' 'thinking processes' but without establishing definite thresholds.

As for the guidance documents produced by the three UK devolved administrations, the Welsh guidance is almost identical to the additional guidance produced by the Environment Agency for England and Wales.

The two guidance documents available for Scotland and Northern Ireland are almost identical to each other, with many sections being exactly the same. These two documents develop the text in Defra (2010) slightly further and provide various annexes at the end of the document with a questionnaire that can be used as checklist and logical flowchart. However, this may provide insufficient guidance in certain aspects that are ambiguous or open to interpretation such as the classification of facilities (see section 4.6). Table C.1 in Appendix C illustrates an example of how one sections of the waste management plan is covered in each guidance document of the UK.

The fact that guidance was not found for many EU Member States where the national legislation was relatively easy to find is a finding in itself. This has prevented the comparison with other Member States and a horizontal analysis of how different elements have been interpreted.

The second indicator for assessing the appropriateness of pollution prevention measures was the verification that waste management plans include all the elements listed in Article 5(3). For this, the legislation of a large number of Member States was assessed. For nine EU Member States (Austria, Bulgaria, Estonia, Greece, Spain, Finland, Ireland, Romania and the UK) the provision of the implementing Regulation describing the minimum content of waste management plans was identified (Table C.2 in Appendix C). As can be observed, the content of these provisions is almost identical in all the Member States assessed apart from Romania, where only a general statement was found. However, this only indicates that the provision has been transposed to the national legislation of these nine countries, but does not provide information of how this is actually verified. According to EA (2011), it is likely that most plans will comply with the minimum content because authorities are willing to collaborate with operators and have the ultimate responsibility to approve and review the plans. The latter (i.e., approval and review of plans by authorities) is the case in all Member States. Therefore, the real issue is whether operators and authorities interpret the rules correctly. For instance, if a facility has erroneously been classified as non-category A and one of the wastes produced therein has been erroneously been classified as inert, there could be

risks to the environment and human health arising from the extractive waste of the facility and the plan will not contain relevant information on this, simply because there were interpretation errors in the process. As a result of this, the need of guidance is imperative. As highlighted above, examples of guidance were only found in two Member States. The analysis would benefit from examples of other relevant Member States.

4.3.3 Implications

There were significant gaps in information used to assess the implementation of the Directive with regard to waste management plans. The following can be highlighted:

- Guidance for operators (and competent authorities).

Development of consistent and available guidance is critical given that the content and quality of waste management plans depend on the interpretation and data provided by the operator but also on the review and interpretation of the law of competent authorities. That guidance was difficult to locate is a finding in itself. The guidance documents that were found were deemed relevant and detailed, although they only correspond to two Member States. As a result, a possible solution would be the adoption of guidance at EU level to assist operators with this aspect of the implementation of the Directive. Member State authorities were in favour of this at the stakeholder workshop held in Brussels in March 2017 (see section 3.3). It was also highlighted that guidance should be generic, with description of overall aspects that would help clarify the key aspects of waste management plans, rather than detailed.

A further solution suggested at the workshop was the sharing of examples of good practice among Member States authorities. The stakeholders attending the workshop suggested that it would be helpful to have examples from a variety of waste facility types (category A and non-category A, different sizes and risks). Finally, some stakeholders would find it useful to implement clear and measurable criteria to evaluate the quality of waste management plans submitted by operators.

- Verification that plans have the minimum content as in Article 5(3).

The national legislation of a large number of Member States was available online and it contained provisions with regard to the minimum content of waste management plans. However, it could not be found how it is actually verified that plans contain these minimum contents. It could be assumed that this will be the case since competent authorities have to approve them (i.e. they will ensure the plans have the minimum content). If that assumption is taken as valid, the issue will be to assess whether authorities have the same interpretation of the law when approving the plans, which influences their content. Given the little national guidance found, this could not be assessed. The fact that little national guidance could highlight a gap that could be addressed by an EU wide guidance on ensuring that waste management plans have the correct minimum content. Training or workshop on waste management plans drafting could also be considered. This would need to involve both operators and competent authorities in charge of verifying these plans.

4.4 Application and permitting procedures

4.4.1 Parameter: Assessment of the permitting procedure in relation to compliance with permit requirements (including requirements on construction and management of waste facilities)

Indicator 1: Timeframe of the permitting procedure (in months)	
Description	This indicator aims to provide information on the permitting procedure timeframe across Member States to assess potential differences and similarities.

Sources of information	Consultation of trade associations Study on the legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU (Draft Final Report)
Geographic scope of information	Information on Germany, Greece and Sweden for specific timeframe related to extractive waste facilities. Information on mining permitting procedures in general covering all Member States
Completeness of information	Very incomplete information gathered from Euromines' Members. Comprehensive information on mining permitting procedures and related timeframes in Member States under the study '*on the legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU'* but no information under this study on the specific extractive waste facility permitting procedures in Member States.
Information gathered	According to Euromines' members, the timeframe for obtaining permits depends on the conditions of each individual case. They consider that the timeframe is 'appropriate' in Germany (timeframe not specified), but is too long in Greece (three months). They highlight that, in Sweden, appeals have become a rule rather than an exception. Overall, they stress that extractive waste facilities are usually part of the permitting process of the mine as such and the operations connected thereto. Issues associated with extractive waste facilities differ from one to another and it is not possible to provide meaningful information here. Note that the Study on the legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU contains information on the (legal and in practice) timeframe of the overall mining facility permitting procedure. According to this study, the legal timeframe varies widely across Member States. Denmark, Greece, the Italy/E-Romagna region and Slovakia all require short timeframes for Competent Authorities to issue permits. In contrast, France, Ireland (only for mining permits), Lithuania, Romania and Spain have very long legal timeframes for both metals and industrial and construction minerals. Many Member States have no legal provisions on deadlines, yet, their real timeframes are short, and the authorities, for example, work well without legally established timeframes (e.g. Finland, Sweden, Ireland for exploration permits, Portugal). Sweden does not have statutory or legal timeframes to regulate the work of the authorities to grant mining permits. It is, however, unclear whether these findings can be replicated for the permits only applying to extractive waste facilities. Examples of differences of legal and 'real' timeframes of permitting procedure for mining extraction across Member States[33]:

[33] Study on the legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU [Minlex] (Draft Final Report, unpublished)

Country	Legal timeframe to grant extraction permit	Real timeframe to grant extraction permit
Austria	6 months	6 months
Croatia	Not available	2 to 5 years
Finland	Not defined by law	90 consecutive days (no EIA), 180 days with EIA
France	1 to 2 years depending on the type of mineral	2-3 years depending on the type of minerals
Greece	2 to 7 months depending on the type of mineral.	4 months to 12 months depending on the type of minerals
Slovakia	2 months	2 months
Sweden	Not defined by law	31 months

4.4.2 Analysis

Under this indicator, the information available was not complete and often not detailed enough thereby impeding the assessment of the extractive waste facilities procedures in Member States.

Based on information returns from Member States, 3,754 extractive waste permits were recorded across the EU as of July 2017. 3,228 (86%) were recorded as being operational, 248 (7%) in the closure phase and 212 (6%) as being in a post closure phase. 31 and 35 (totalling 2%) were reported as not operational or unknown respectively.

Regarding products, of the 2,013 permits for which information was available, the majority (79%) related to non-metallic minerals and 10% to metallic minerals. The remaining permits related to coal, oil and gas, geothermal energy and 'exploration'. 1,739 (46%) permits concern inert waste, 518 (14%) permits concern non-inert waste and no information was provided for 1,497 (40%) permits.

90 permits (2%) related to Category A facilities with 95% confirming that they are not Category A and 2% with no data. Whilst more than one reason was sometimes noted for Category A classification, the majority (66%) included classification based on the Directive's Annex III first indent regarding the potential for a failure or incorrect operation, potentially giving rise to a major accident. The second Indent of Annex III regarding waste classified as hazardous under Directive 91/689/EEC above a certain threshold was included in reasons for 24% and 10% noted the third indent regarding containing substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold. 9% did not record a reason for Category A classification.

In terms of the period of validity of the permits, there is no data for 76% however, 8% of the permits are indicated to be unlimited (297), 10% have a validity period of less or equal to five years (365), 3% have a validity period between 5 and 10 years (123), 1% have a validity period between 10 and 25 years (47), 2% have a validity period of more than 25 years (61). Some Member States issue unlimited permits, this is the case for Austria, Germany, Denmark, Finland, Hungary and Sweden. Others specify durations, up to 32 years in Bulgaria, up to 30 years in France and Spain with variations according to the sites' activities, up to 24 years in the UK, 20 years in Czech Republic, 16 years in Belgium with some granted for seven years only, up to seven years in Slovakia, five years in Estonia and either four or one year in Malta. Italy has a combination of unlimited and defined period permits. The latter range between eight and 72 years[34].

Based on the limited information collected from Member States, it appears that out of a total of 3,228 extractive waste facilities in operation, 234 (6%) had their permits

[34] It is to be noted that Italy submitted a response with information from four of its regions only.

renewed in the last 5 years (359) and 10% since the entry into force of the Directive. There are also 534 facilities (14%) that have not had their permits renewed, but which obtained a permit after the entry into force of the Directive (i.e. between May 2008 and 2016). For a small number of facilities (6) a future date was indicated (between December 2017 and 2035), suggesting that the permit has a limited duration and may be renewed after a specific date.

It is to be noted that from the 3,228 facilities in operation 773 (24%) were granted a permit before the entry into force of the Directive. 103 of those granted before the Directive came into force have already renewed their permits. Information was not available, or not applicable for around half of the facilities in operation.

Out of the 248 facilities in the closure phase (but still holding a permit), 149 had their permits granted between 1970 and 2016 (72 between 2016 and 2008; 25 between 2007-2000; 32 during the 1990s; 17 in the 1980s and one in the 1970s). The remaining facilities in the closure phase were as follows: no information on when the first permit was granted (97 facilities), not applicable[35] (2 facilities), not required[36] (1 facility) and possible errors[37] (2 facilities).

Further (very incomplete) information was gathered from Euromines' Members on the situations in Germany, Greece and Sweden. This information highlighted that the permitting procedure for extractive waste facilities is linked to the overall mining permitting procedure and that the timeframe varies from one case to another. A draft study on the legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU contains detailed information on the legal and 'real' timeframes of the mining permitting procedures highlighting differences and similarities across Member States. However, this report does not contain any specific information on the permitting procedure of extractive waste facilities.

Regarding the main issues highlighted in these permits, in the great majority of permits (75%) issues were not recorded. For the remaining permits the main issues concern in majority the environmental impacts and the reduction of environmental pollution (e.g. the management of water and reactants, control of emissions, rehabilitation of the site) but also stability. Whilst indicating some broad themes, overall, it is difficult to derive findings from the information collected from Member States on permits. Information collected differs from one site to another and a great amount of information is missing.

This information shows that permitting for extractive waste management varies between Member States, and is often linked to the integrated permitting structure of the Member State which would typically include the whole mining installation rather than a specific extractive waste permitting.

4.4.3 Parameter: Assessment of public participation in the permitting procedure

Indicator 2: Public complaints against public participation procedure	
Description	This indicator aims to allow for the identification of whether or not the public participation procedure is correctly applied by the operators of extractive waste facilities and by the relevant competent authorities. It may also provide a description on the public's level of involvement in the permitting procedure of extractive waste facilities.

[35] In one case "Not applicable" was stated. In the other case, it was explained that the facility has been in the closure phase since 1995. No specific permit was issued at the time and the facility is currently covered by a dedicated authorisation

[36] Waived

[37] In these two cases, competent authorities indicated 1905 and 1913, respectively. This may refer to when the mine was first in operation and may be errors.

Sources of information	Consultation of NGOs (i.e. Mining Watch Romania, EEB and independent expert)
Geographic scope of information	Opinion on the need to enhance the role of the public in the extractive waste permitting procedure in the EU.
Completeness of information	Very generic information from one source. No concrete data on complaints against public participation procedures, but rather opinions on the limited public participation in the extractive waste permitting procedure. Some information but limited to specific Member States.
Information gathered	According to the Romanian NGO, all communities affected by mining projects should be able to participate in the negotiation and the decision-making process in all of its stages, as early as possible, while all development options are still open - and when they say "no" to a project, this should be taken into account. The process of obtaining the consent should be carried out earlier than an EIA for a mine proposal, because at that stage the mine operator has already invested too much money and will not stop the project. Regarding Article 8 on public participation, they request that the community's consent be compulsory in the case of Category A waste management facilities. A Finnish environment expert highlighted that while the Directive's requirements are respected in Finland, there is no extra efforts undertaken in order to inform and engage with the public. In addition, most permitting procedure make use of confidentiality claims.

4.4.4 Analysis

Under this indicator, the information available was not complete and often not detailed enough thereby impeding the assessment of the extractive waste facilities procedures in Member States.

There is no information available on public complaints against public participation procedures within the permitting process in Member States. This lack of information impedes the analysis of the public's level of involvement in the permitting procedure and whether or not the public participation is correctly applied by the competent authorities and by the extractive waste facility operators. On this topic, Mining Watch Romania has provided an opinion requiring a closer involvement of the public in the permitting procedure of mining activities. Regarding to Article 8 of the EWD on public participation, they request that the community's consent should be compulsory for Category A waste management facilities.

4.4.5 Parameter: Assessment of the implementation of Best Available Techniques in the permitting procedure

Based on information collected from Member States on permits, 2,595 noted or made reference to BAT. There were over 200 explicit references to BAT relating to monitoring of stability in a limited number of Member States (CZ, FI, SK, PT, PL, HG, ES and UK) and 46 references to BAT relating to gold leaching using cyanide among the 3,735 extractive waste permits reported. Information collected was not uniform across permits in Member States (e.g. where recorded, some permits recorded a single BAT and others 40 from the list available) and a great amount of information was missing. Overall, it was not possible to derive clear findings from the information collected from Member States on application of BAT in permits other than that information from Member States on this subject was often poor and inconsistent in the control measures reported as BAT.

Indicator 3: Application of BAT in gold extractive facilities	
Description	This indicator should allow the identification of whether extractive waste facilities using cyanide for gold extraction apply BAT in relation to this use.
Sources of information	Engagement with mining experts Information requested to Member States
Geographic scope of information	Worldwide/EU/selected Member State
Completeness of information	Generic information on BAT was submitted by the extractive waste facilities' operators of gold and silver mines of EU Member States. This was an additional information request specific to this project. The literature selected by mining experts contains information on processes and technologies to remove cyanide from extractive waste. It also contains information on measures and techniques applied or planned to be applied on cyanide in two projects in Romania and one in the UK.
Information gathered	Several articles stress that if properly managed and treated by complying with BAT and the International Cyanide Code, the use of cyanide is a safe method for gold extraction. The available literature includes limited information on the application of BAT in relation to the use of cyanide in the permitting procedures in relevant Member States. A total of 46 BAT were reported by the main gold producers in the EU (Finland, Bulgaria, Sweden Spain, and Slovakia). The BAT reported by the highest number of facilities were water erosion prevention, monitoring of stability, groundwater monitoring, and use of safety manual and independent audits (See table 4.9 above). It however contains more detailed information on measures and/or extractive techniques applied or planned to be applied in three projects (two in Romania one in the UK): According to a 2015 study of Mining Watch Romania[38], the [planned] Certej project covers an area of 456 hectares, involves processing 45 million tonnes of ore - with a concentration of 1.6 grams of gold per tonne of ore – and the use of a sodium cyanide quantity of 1653 tonnes per year for a period of 16 years. As with the Rosia Montana project, the study provides that the post-processing residues, including the cyanide and heavy metals, would be stored in an outdoor, unlined, tailing pond with a total area of 63 hectares. The ore grade at Certej is extremely low. Eldorado estimates it at 1.63 grams per tonne for gold. The ore would be processed using the cyanide-leaching method. Note that the Rosia Montana project was not authorised by permitting authorities and that on 4 January 2017, Romania's Ministry for Culture filed with UNESCO a proposal to place Roşia Montană on the list of World Heritage sites. The operator Gabriel Resources has launched a complaint to the ICSID[39] Arbitration in June 2015. The case is still pending at the time of writing this report[40].

[38]Mining Watch Romania, 'Anticipating Surprise – Assessing Risk Investors guide to the Eldorado Gold Certej mine proposal in Romania' available at: http://miningwatch.ro/wp-content/uploads/2015/04/Investors-guide-to-the-Eldorado-Gold-Certej-mine-proposal-in-Romania-Final.pdf

[39] World Bank's International Centre for Settlement of Investment Disputes

[40] Information available at: https://icsid.worldbank.org/en/Pages/cases/casedetail.aspx?CaseNo=ARB/15/31

	According to the Dalradan gold project pre-application community consultation[41], the project will ensure that the concentration of cyanide at the end of the process will be below the EU limits. Material that has come into contact with cyanide will not be left on surface, and will be detoxified and returned underground. Focusing on the application of BAT, Table C.3 in Appendix C below includes information submitted by the main gold producers in the EU. Selected examples of the application of BAT in the cyanide process have been included in Appendix C on application and permitting procedures.
Indicator 4: Application of BAT in relation to dam and heap stability (Article 5(c)(iii) of the EWD)	
Description	This indicator should allow identifying whether extractive waste facilities apply BAT concerning dam and heap stability or not.
Sources of information	Engagement with mining experts. Member State replies on permitting procedures.
Geographic scope of information	Site specific/ Member State level.
Completeness of information	BE, CZ, DE, FR did not provide any responses. Some Member States (BG, HU, ES, PT, SK) provided generic information on elements to take into account in the permits related to dam and heap stability, but do not mention that they apply in the permit's BAT in relation to dams and heap stability. Estonia mentions that BAT are always required by law and are taken into consideration. The literature selected by mining experts contains some information on techniques to ensure dam and heap stability (e.g. use of paste/thickened tailings) and examples of techniques or approach used at specific sites in the EU (e.g. Somincor Portugal, Zelazny Most, Poland) and outside the EU (e.g. Canada/US/Australia), but no comprehensive information on the use of BAT in relation to dam and heap stability is available in EU Member States.

4.4.6 Analysis

Generic information on BAT was submitted by the extractive waste facilities' operators of gold and silver mines of EU Member States. This was an additional information request specific to this project.

On the stability of dams and heaps, a limited number of Member States have provided information on monitoring and risk management measures to be applied by extractive waste facilities operators. The available literature highlights that there are new alternatives to conventional tailing management that ensure better stability of the dam and the heap (e.g. high density thickened tailings or dry stack filtered tailings)[42] and provides examples of the use of these alternatives in specific sites in the EU (e.g. Neves-Corvo site in Portugal[43]). It also contains examples of measures or recommendations to

[41] Available at: http://dalradianni.com/wp-content/uploads/2016/10/Pre-Application-Community-Consultation.pdf

[42] For instance, see the 2011 study on 'Filtered Dry Stacked Tailings – The Fundamentals Proceedings' by Michael Davies Tailings and Mine Waste 2011 available at: http://www.infomine.com/library/publications/docs/davies2011.pdf

[43] Paste deposition over an existing subaqueous slurry deposit of high sulphide content tailings – the Neves Corvo experience Roy Lopes, Ricardo Bahia, Mike Jefferies, and Mafalda Oliveira 2013 Aug 16, 2013

control the stability of the dam and heap implemented at specific sites in Member States (e.g. Zelazny Most copper tailings facilities in Poland[44]).

Table C.3 presented in Appendix C includes the information on BAT submitted by the extractive waste facilities' operators of gold and silver mines of EU Member States. This was an additional information request specific to this project. This information provides an indication of BAT related to cyanide processes in the EU, given that it covers its main gold producers. A total of 46 BAT were reported by these Member States (Finland, Bulgaria, Sweden Spain, and Slovakia). The BAT reported by the highest number of facilities were water erosion prevention, monitoring of stability, groundwater monitoring, and use of safety manual and independent audits.

Analysis of Seveso and extractive waste permitting procedures

According to Article 7 of the EWD, any permits produced pursuant to other national or EU legislation may be combined to form a single permit where such a format obviates the unnecessary duplication of information and the repetition of work by the operator and competent authorities. Based on information from Member States on the permits granted for extractive waste facilities and on permits granted for Seveso sites falling under "Mining activities (tailings & physicochemical processes)"[45], an analysis was carried out on whether installations classified as Seveso under "Mining activities (tailings & physicochemical processes)" were also permitted as extractive waste facilities, and if so, whether or not they were categorised as Category A or whether no permit under the EWD was granted. The table below summarises this analysis.

Note that due to inconsistencies in the reporting of information on Seveso installations and on extractive waste permits granted by Member States (e.g. lack of coherence between names of companies and operators) potential ranges in the findings are noted. A similar data quality issue was identified in the Member State responses to the triannual questionnaire, where only nine Category A extractive waste facilities in operation (seven in Finland, one in Romania, one in the UK) were also subject to the Seveso regime[46]. Overall, data on the application of the EU permitting regimes is unclear and does not allow a clear picture on the application of these permitting regimes to the extractive waste sites to be concluded.

Table 4.9 Facilities classification under Seveso "Mining activities" and/or EWD

Countries	Installations with both Seveso and extractive waste permits	Installations with both Seveso and Cat A extractive waste permits	Seveso installations without extractive waste permits
Bulgaria	1	1	2
Finland	2 (possibly up to 5)	0 (possibly up to 2)	9 (possibly 6)
Germany	0	0	1
Italy	N/a	N/a	8 [1]
Poland	0	0	1

[44] Za Chieh-Moh Distinguished Lecture: The Geotechnical Problems of the Second World Largest Copper Tailings Pond at Zelazny Most, Poland (2010)

[45] Note that the list of Seveso facilities examined is only the list of installations that can be disclosed publically, so it may not be fully comprehensive as Member States can ask that certain data remain confidential

[46] See Table 5 of the 2016 Commission final report 'Provision and elaboration of information for the preparation of the "Implementation Report of Directive 2006/21/EC on the management of waste from extractive industries' available at: http://ec.europa.eu/environment/waste/studies/mining/waste_extractive_industries.pdf

Countries	Installations with both Seveso and extractive waste permits	Installations with both Seveso and Cat A extractive waste permits	Seveso installations without extractive waste permits
Sweden	7(may be up to 11) [2]	4(may be up to 6)	4(may be down to 0)

Notes:

1. Italy did not reply to the information request of the Commission on extractive waste facilities, therefore there is no available information on such facilities
2. Due to the differences in the description of facilities (indication either by name or location) in the information provided by Member States on the permits granted for extractive waste facilities and in the information on permits granted for Seveso sites falling under "Mining activities, figures in the table can evolve.

4.4.7 Implications

- Interlinkages between permitting regimes

At the stakeholder workshop (see section 3.3), there was a call for clarification of the interlinkages between EWD permits and other regimes (such as the Industrial Emissions Directive (IED) and Seveso) which could be addressed in guidance. The data collected on permitting procedures also suggests that there is not a clear understanding in Member States on how the different EU permitting regimes should be applied to extractive waste facilities. In particular, it is necessary to clarify that a Category A extractive waste facility which also falls under the Seveso Directive is not exempted from a permit under the EWD (only article 6 of the EWD on major accident prevention would not apply if a facility is covered under Seveso).

- Implementation of Best Available Techniques in the permitting procedure.

Information on the application of BAT in relation to the use of cyanide and in relation to dam and heap stability in permits in Member States is quite generic. More detailed information could, however, be requested in the Member State's reporting questionnaire (e.g. detailed description of the application of BAT and justification on the use of cyanide). Note that the next questionnaire could request information on the application of the BREF on the management of waste from extractive industries which covers the use of cyanide and the stability of heaps and dams among others.

- Timeframe of extractive waste facilities permitting procedures and public participation.

It might be relevant to seek further information on the practices for extractive waste facilities permitting procedures in Member States to among others identify their (legal and in practice) timeframe and to also gather information on the public participation involvement in these procedures (e.g. information on Member State public participation requirements, on the number of public complaints, on number of comments received). For the latter, it would be important to distinguish between public participation comprising information provision only (i.e. procedural) and those processes whereby consultation and the opportunity to influence the decision-making process (i.e. participatory processes).

4.5 Financial guarantee

4.5.1 Parameter: Assessment of implementation of financial guarantee

Table 4.10 Indicator summary – Financial guarantee

Indicator 1: Existence of guidelines or method to implement the Commission's guidelines on the establishment of the financial guarantee (Decision 2009/335/EC)	
Description	This indicator aims at assessing whether guidelines have been adopted to support Member States when implementing the requirement for financial guarantee.
Sources of information	Information reported by Member States to the second reporting period of the EWD Literature review
Geographic scope of information	MS coverage and EU wide information
Completeness of information	Overall there is a good level of information available in general terms, but little information available on practical steps undertaken for setting financial guarantee.
Information gathered	MonTec, Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities MINPOL - Study on the legal framework for mineral extraction and permitting procedures for exploration and exploitation in the EU UK (Environment Agency, Guidance On Financial Guarantees For Mining Waste Facilities 5 (U.K. 2010)) International Council On Mining And Metals, Guidance Paper: Financial Assurance For Mine Closure And Reclamation (March 2006)[47] International Council On Mining And Metals, Financial Assurance for mine closure and reclamation (February 2005)[48] The World Bank Group, Guidance notes for the implementation of financial surety for mine closure[49] Irish EPA's general guidance on establishing financial guarantees for environmental liabilities (but not necessarily related to extractive waste)[50] Report published by the Swedish National Audit Office in 2015 on the adequacy of financial guarantees related to mining waste.[51] 2008 guidance on financial guarantees agreed between the Commission and Member States and based on MonTec (2008) Swedish updated guidance for the review of mining operations. (Sveriges Geologiska Undersökning, 2017)

4.5.2 Analysis

Article 14 of the EWD foresees that the operator of a waste facility servicing the extractive industry should be required to lodge a financial guarantee or equivalent following the procedures of the Member State. The Directive requires that the financial guarantee is sufficient to cover the cost of rehabilitation of the land affected by the waste facility and is provided prior to the commencement of the deposition operations in the waste facility and be periodically adjusted. Article 14 (2) details the factors which

[47] http://www.icmm.com/website/publications/pdfs/23.pdf
[48] http://www.icmm.com/website/publications/pdfs/282.pdf
[49] http://siteresources.worldbank.org/INTOGMC/Resources/financial_surety_mine.pdf
[50] http://www.epa.ie/enforcement/financialprovisionforenvironmentalliabilities/
[51] http://www.riksrevisionen.se/PageFiles/23135/RiR_2015_20_Gruvavfall_anpassad.pdf

shall be considered for the calculation of the rehabilitation costs: the likely environmental impact of the waste facility, taking into account in particular the category of the waste facility, the characteristics of the waste and the future use of the rehabilitated land; the assumption that independent and suitably qualified third parties will assess and perform any rehabilitation work needed.

There is no uniform approach to financial guarantees which can lead to uneven burden on operators based on the Member States' application of the legislation[52]. A report was published in 2008 highlighting technical information that could be used to prepare technical guidelines on financial guarantees and inspections[53]. The report gathered views from competent authorities, extractive industry and wider general public. The report concluded that it is important that the scope of the financial guarantee is clearly established, in particular whether it includes third-party costs, long-term liabilities and after-care commitments. Industry feedback was that more support from competent authorities was needed, in particular more detailed information on how to calculate accurate estimates for financial guarantees.

The report formed the basis of a guidance document prepared in 2008 with the support of the ad-hoc Mining Waste Committee. This guidance document gave an overall description and explanation of the various forms of financial guarantee, their minimum coverage, the calculation of the guarantee and periodic adjustments.

In 2009, the European Commission adopted Decision 2009/335/EC providing information on setting financial guarantees[54]. The aim was to provide a common minimum basis for the calculation of the guarantee amount and it lists elements to be taken into account when setting the amount of the guarantee. These are the likely impacts on the environmental and on human health of the waste facility, the definition of the rehabilitation including the after use of the waste facility, applicable environmental standards and objectives, technical measures needed to achieve environmental objectives, measures required to achieve objectives during and after closure, including land rehabilitation, after closure treatment and monitoring, the estimated time scale of impacts and mitigation measures and costs necessary to ensure land rehabilitation. It requires that the assessment of costs is conducted by an independent third party.

While useful, the Decision remains general and does not provide a clear methodology for assessing the amount of guarantees. A review of the information available at Member State level was conducted to understand how the provisions of Article 14 are implemented, and whether specific guidance has been adopted by Member States to supplement the EC technical guidelines.

A review of the responses provided by Member States to the questionnaire on implementation of the Directive during the second reporting period identified little specific guidance at Member State level. The information reported, in particular the legislative provisions reference and their contents are presented in the table below.

[52] The Regulation of Mining and Mining Waste in the European Union , Yvonne Scannell

[53] MonTec, 2008, Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities, http://ec.europa.eu/environment/waste/mining/pdf/EU_Final_Report_30.04.08.pdf

[54] Decision 2009/335/EC on technical guidelines for the establishment of the financial guarantee in accordance with Directive 2006/21/EC of the European Parliament and of the Council concerning the management of waste from extractive industries http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009D0335&from=EN

Table 4.11 Overview of the implementation of Article 14 provisions in Member States

Member State	National provision reference	Detail of the national provision
Belgium	Article 5.2.6.8 of VLAREM II Specific procedures: article 5.2.6.8, referring to article 5.2.4.7.1 of VLAREM II. allowed by Article 65 of Decree on Article 13 of the order dated on 28 May 2009 on the mining waste management	The financial guarantee is fixed by the local authorities in the permit they issue. Its adjustment is made through the permit modification procedure
Bulgaria	Article 22h of the Underground Natural Resources Act (ZPB) last updated on 7 November 2014	Amount of the security is set taking into account the likely environmental impact of the facility, the category of the facility, the characteristics of the extractive waste and the intended use of the land after rehabilitation. It can be provided either as an unconditional and irrevocable bank guarantee in favour of the Ministry, an account with a bank proposed by the operator, an insurance policy with the Ministry as beneficiary, a documentary letter of credit available only for the execution of the activities or other lawful guarantees subject to prior approval by the Minister. Upon the closure of the facility, the Minister releases the security, but retains part of the security sufficient to cover the operator's post-closure obligations regarding maintenance, monitoring and control as well as the costs of any rehabilitation measures provided for in the management plan
Denmark	Section 4(2)(3) of the Extractive Waste Order	Permits can only be issued if the competent authority has evidence that a guarantee will be provided.
Finland	Environmental Protection Act (527/2014), Sections 59-61, and Government Decree on Extractive Wastes (379/200190/2013), Section 10	Operators are required to provide a financial guarantee to secure the appropriate waste management, supervision and measures required for terminating operations, or thereafter. Exemptions are possible for operators other than those engaged in landfill activities, if the costs to be covered by the guarantee upon the termination of operations are minor in scale, considering the amount and quality of waste and other aspects. The environmental permit contains provisions to ensure that the operator's financial guarantee for long-term operations accrues over time to correspond, as well as possible, to the cost of terminating the operations at the time of assessment. The amount is determined taking into account the likely environmental and health effects of the waste facility, the need of restoration and the further use of the waste facility, applicable environmental standards and goals, and technical measures necessary for their

Member State	National provision reference	Detail of the national provision
		achievement during the use of the facility and its after-care.
Croatia	Art. 26 of Ordinance OG No. 128/2008.	Prior to the start of operations, operators are required to name a central administrative institution responsible for providing a financial guarantee to comply with all requirements of category A facilities and for guaranteeing enough funds for the rehabilitation of contaminated land as per the waste management plans of the facilities. The financial security is calculated by estimating the probability of influence on the facility on the environment taking into account the characteristics of the site, the waste and future use of the area after its rehabilitation, assuming that independent and qualified third parties evaluate and execute work required for recovery. The amount of the financial guarantee must be adjusted in accordance with the work necessary for rehabilitation of the potential contamination of the land and in accordance with the Waste Management Plan. Competent authorities shall withdraw operators from this obligation once the facility is closed.
Lithuania	Procedure for preparing, coordinating and implementing the plan for the cessation of waste management activities, approved by Order No 469 of the Minister for the Environment of 25 September 2003.	Not applied to any installations yet and no further information provided
Malta	Provision not applicable	The provision of article 14(1) has been waivered for waste facilities designated for the accumulation or deposit of non-hazardous waste from prospecting.
Romania	Articles 3 and 4 of Joint Order No 202/2881/2348 of 04.12.2013	The amount must cover all the environmental rehabilitation, greening and after-closure monitoring works in development phase of the project. When determined, it must take into account the potential environmental impact of the mining activities, including the extractive waste management installation, the waste generated and the future of the rehabilitated land. It must be readily available, and take into account the costs of the closure, greening, environmental rehabilitation and post-closure works. The financial guarantee may be established in the form of a bank deposit, letter of bank guarantee and/or an insurance policy concluded in the holder's behalf at a recognised insurer.

Member State	National provision reference	Detail of the national provision
Portugal	Article 31 on the National Law-Decree No. 10/2010 of February 4.	No installations covered yet and the competent authority is reviewing procedure for installations to be covered by financial guarantee.
Spain	Articles 41, 42 and 43 of Royal Decree 975/2009 set out the requirements with which the financial guarantees or equivalents must comply	The Spanish Decree includes provisions for two financial guarantees; one for the rehabilitation of the natural space affected by the mining activity itself and another specifically targeted at extractive waste facilities. The latter requires operators to constitute a financial guarantee prior to the commencement of activities. This financial guarantee must be enough to cover the rehabilitation plan as set out in the permit. Such a guarantee shall be calculated taking into account the potential environmental impact of the extractive waste facilities in question, the facility and waste classification and the future use of the rehabilitated land. It will also cover, where necessary, enough to allow third parties with an adequate qualification to undertake any evaluation or rehabilitation work as required. Financial guarantees will be revised periodically as required and as described in the waste management plans. Once the closure of the facilities is authorised, the operator may request authorities to release it from that obligation. There are exemptions for the following waste types: -Inert waste, non-inert non-hazardous waste and non-contaminated soil from research and prospecting of mineral resources, -Extractive waste from research and use of peat. -Non-hazardous extractive waste from research related to mineral resources, except when this research is related to evaporites different to gypsum and anhydrite. The exemptions above apply **unless** the facilities in question are classified as category A.
UK	Regulation 8 of the Planning (Management of Waste from Extractive Industries) Regulations (NI) 2010 Management of Extractive Waste (Scotland) Regulations 2010 Environmental Permitting (England and Wales) Regulations 2010	In England details of the financial guarantee is required as part of the permit application. The provision has to be sufficient, secure and available and include a contingency sum that will remain available in case additional expenditure is required. The amount is set based on third party costs and a contingency element. In Scotland, there are default bonds that must be set up prior to the start of operations. These are the decommissioning and restoration bond for £950k and the minerals waste regulations bond of £160k.

Ireland published general guidance related to establishing financial guarantees for environmental liabilities[55]. The guidance establishes key characteristics of financial guarantees in Ireland such as principles, how the process works (submission of financial security proposal and supporting documents by operator, review by authorities, final document submitted by operator, confirmation and periodical update), different types of financial guarantee (insurance, secured fund, etc.), and a description of how each type works.

Specific guidance was also identified for the UK[56]. The guidance highlights some key requirements on setting financial guarantees. These are broadly similar to those included in the European Decision technical guidance. The additions are that financial guarantees must be adopted by May 2014 and that the Environment Agency (EA) will issue further guidance on calculating the value of the guarantee. The EA published a draft version of this further guidance (available online[57]) as part of a consultation. This draft document proposed a detailed estimate of aftercare costs for a period of 60 years. It also foresaw that the operator could be released from the requirement to provide a financial guarantee once the competent authority had approved the closure of the Category A facility. However, the EA has not produced the final guidance due to the small number of sites for which a financial guarantee is required. The UK is currently reviewing its position on financial guarantees with a view to publishing new guidance in the near future.

The Swedish National Audit published a report in 2015[58] on the adequacy of financial guarantees related to extractive waste. The audit conducted for the report shows that Sweden has difficulties both in determining the financial guarantees, in monitoring allocated guarantees and in environmental supervision of mining activities. According to the Swedish National Audit Office, the current system of financial guarantees for mining activities in Sweden does not sufficiently minimise the risk that Swedish taxpayers will have to pay for necessary post-treatment of closed extractive waste facilities. The audit found that the Swedish Inspectorate does not balance out the costs of waste treatment and after-treatment when assessing the profitability of a mineral deposit. These issues are only considered when establishing the financial guarantees of the projects. The source considers this to be behind the significant increase of the quantity of extractive waste in the country.

According to the report, amendments to legislation and case law have improved the system of determining financial guarantees for mining activities, but practical problems remain. The proposals for financial guarantees submitted by mining companies are often based on after-treatment and follow-up inspections for 30 years after the closure of the facilities. However, there is a risk that this period is insufficient to cover the cost of inspection and remediation for the whole period in which there are environmental consequences related to these facilities. Another issue is that operators have been allowed to operate for a certain amount of time (1-6 months) without a financial guarantee. The source indicates that the total amount of guarantees for mining activities in Sweden is around €280 million. Of this, 90% has been established as a bank guarantee. Bank guarantees require a high level of effort from competent authorities to ensure that the guarantee is sufficient to cover all potential costs. Also, the various terms and conditions imposed by banks may pose difficulties to guarantee the payment, according to the Swedish National Audit Office. The report indicates that sometimes the financial guarantee ceased to apply due to the change of circumstances, and this was not noticed by competent authorities given the high level of resources required to

[55] http://www.epa.ie/enforcement/financialprovisionforenvironmentalliabilities/

[56] DEFRA, the mining waste directive, for the environmental permitting (England and Wales) Regulations 2010, updated May 2010 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69323/pb13636-ep2010miningwaste.pdf

[57] Environment Agency (2009). Guidance on financial guarantees for mining waste facilities.

[58] Published by the Swedish National Audit Office, available at: http://www.riksrevisionen.se/PageFiles/23135/RiR_2015_20_Gruvavfall_anpassad.pdf

monitor the financial guarantee of all facilities. As a result, some facilities did not have financial guarantees for over two years.

A further issue identified in the report published by Sweden is that the significant amount of resources that need to be dedicated to inspection and supervision is not fully covered by the fees charged by the Administration. Furthermore, if the sites have no operator, there is no funding (i.e. no one is paying administrative fees) to cover the inspection of these facilities. There is evidence that Sweden has spent more in post-treatment of closed facilities than what was covered by the financial guarantees. This includes facilities where operators declared bankruptcy a short time after commencing operations.

In Estonia, the setting of the financial guarantee is set to be at least 115% of the provisional amount of the restoration expense of the area affective by the waste facility[59].

In addition to setting a financial guarantee, the Directive requires that Member States review the appropriateness of the financial guarantee periodically. This provision is being implemented differently in Member States. In Greece it is undertaken every five years, while in Finland the review is conducted when the permit for the installation is revised which is after nine years. In Poland, the review is done whenever it is requested by the State Mining Authority[60].

A SWOT analysis of Member States legal framework was undertaken in the MINPOL project[61] which considers that financial guarantees for extractive waste were established and clearly defined in most Member States. Based on information collected in a review of Member State legislation collected by country experts (academics, MINPOL staff or Member State authorities), it noted that there were variations on the amount of the guarantees varying from €1,000 to several million euros depending on estimated site remediation costs, size of the operation and risks involved. The form that the guarantee can take is varied, with bank guarantee, cash deposit or liability insurance policy being the most frequently used. The payment can be distributed over the whole lifetime of the mine in annual increments[61].

This is correlated by the information reported by Member States during the last reporting period with a total of 304 sites covered by financial guarantees. Note that only Bulgaria, Estonia, Finland, Romania and the UK[62] confirmed explicitly the number of sites covered by financial guarantees. Furthermore, 2,342 sites were reported as covered by a permit in conformity with the EWD in the EU[63]. As a result, some of these sites may also be covered by financial guarantees.

Article 14(4) of the EWD foresees that the competent authority releases the operator from the guarantee upon approval of the closure of the waste facility. The 2008 review of Member States practices regarding release of the financial guarantee highlighted differences between Member States. In Poland and Greece, the guarantee is released only after an inspection is held to verify that the closure plan for the facility takes into account all its obligations. In Germany, an external auditor is requested to provide assessment that all closure and rehabilitation measures have been finalised according to best practice and to the closure plan for the guarantee to be released.

Finally, Article 14(2) requires Member States to assume that independent and suitably qualified third parties will assess and perform any rehabilitation work needed when calculating the financial guarantee. The guidance published by MonTec (2008[60]) indicates that the use of a third-party cost basis as a calculation principle is widely

[59] Art 35, Waste Act. https://www.riigiteataja.ee/en/eli/ee/520012015021/consolide/current

[60] MonTec, 2008, http://ec.europa.eu/environment/waste/mining/pdf/EU_Final_Report_30.04.08.pdf

[61] MINPOL 2016

[62] Note that the UK is not fully accounted in the 304 as Scotland indicated that all its sites are covered by financial guarantees but the response does not indicate how many sites are located in Scotland.

[63] Including 5 in Czech Republic, 99 in Germany, 181 in Greece, 1583 in Spain, 21 in Ireland, 49 in Italy, 6 in Hungary, 9 in Poland, 271 in Romania and 118 in Slovakia.

accepted among legislators because it is usually a third party contracted by the government that carries out closure and rehabilitation if the operator cannot meet its obligations. However, MonTec (2008) highlights that many mining companies feel that they can carry out the work at lower cost and that including third-parties in the calculation overstates the costs. Although the provision is included in the national legislation of the majority of the Member States assessed, very little evidence has been found on whether Member States are considering the involvement of third-parties in the performance of rehabilitation work. Only in the Swedish updated guidance on mining activities assessment (2017) was evidence of such involvement found where the guidance states that the size of the security shall also be calculated on the basis of the assumption that someone other than the operator will carry out the required recovery.

Overall, while there is general information available, little comments were made from Member States on the national provisions and experience related to the setting of financial guarantee. The information gathered during the stakeholder workshop (Brussels, March 2017. See section 3.3) indicated that stakeholders find value in discussing the best approaches to financial guarantees, and that these would need to involve all stakeholders (i.e. not only those related to the mining industry or governments), including insurance companies and financial institutions.

From the information reviewed, it does not appear that the setting of financial guarantee is a major implementation issue. However, to further improve and facilitate the use of financial guarantee, referring to what has been done is other countries can be useful and also provide example of good practices in that respect.

Gathering information from mining and metals companies as well as commodities associations, the International Council of Mining and Metals conducted research published in 2005 on financial assurance for mine closure and reclamation[64, 65]. It reviewed the range of instruments available and concluded that the same financial assurance requirements may not suit all companies, for example a large, diversified company could be asked less demanding requirements than a smaller, less financially robust company. It also highlights that requiring to return the land to its pre-disturbance condition is often 'unrealistic or even undesirable' and encouraged policy-makers to develop criteria for determining that the land has been restored to a 'satisfactory' state (as specified in the Directive) rather than a pre-disturbance condition. On the basis of this report, a guidance paper was issued by the ICMM in 2006[66]. It describes options available (i.e. third party guarantee, cash deposit, letter of credit, trust fund, insurance policy and other soft options) their advantages and their inconvenient. It also lists five recommendations:

- Provide adequate financial assurance for mine closure and reclamation, which must be based on a clearly defined process for the development of a closure plan with provision for review and update;
- Provide flexibility in financial assurance, taking into account the financial strength and track record of the specific company being considered;
- Consider existing operations;
- Allow for an exit strategy to relieve explicitly companies of their liabilities at some point after closure; and
- Take into account taxation arrangements.

[64] Although the efforts of the member companies of ICMM shall be observed, it should be noted that it is not an independent institution. It is an association formed by 23 of the world's leading mining companies and 34 national and regional extractive industry associations. Although ICMM has stated the aim of improving the safety and sustainability of the mining industry, its members have a commercial interest on extractive resources

[65] ICMM, 2005, Financial assurance for mine closure and reclamation, http://www.icmm.com/website/publications/pdfs/282.pdf

[66] ICMM, 2006, Financial assurance for mine closure and reclamation, http://www.icmm.com/website/publications/pdfs/23.pdf

Furthermore, in 2008, the World Bank published a guidance document[67] based on the review of current regimes throughout the world. The guidance makes a series of recommendations on the setting of financial guarantees, for example that a financial guarantee is in place before work starts on the site (a provision that is already reflected in the Directive), and that guidelines are produced at national level to guide the identification of which forms of financial surety are acceptable and how they should be implemented.

Finally, the information gathered at the stakeholder workshop highlighted that financial institutions and insurance companies should be involved in the discussions to agree on the best approaches to financial guarantees. The authorities of some Member States suggested the inclusion of aspects such as company financial stability and facility risk in determining the level of guarantee. It was suggested that the issue of financial guarantees could be a potential theme of further collaboration with the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL).

4.6 Waste facility classification

Based on official information received from Member States, there is a very high density of non-Category A facilities in Spain, part of the UK (England), Ireland and Hungary. The density of non-Category A facilities is lower in other countries such as Sweden, Austria and Poland. It is to be noted that not all Member States replied to the official request from the Commission. Also, some Member States did not provide sufficient information to assess the density of facilities. In the Member States with high density of facilities, regions can be visible where "clusters" of facilities can be identified, which is natural given that in such regions, the mineral reserves are favourable.

Of the information returned from Member States to the information request, 90 permits (2%) were confirmed to relate to Category A facilities the majority of which (66%) due to the Directive's Annex III first indent regarding the potential for a failure or incorrect operation, potentially giving rise to a major accident. Most Category A facilities that were permitted are linked to the extraction of metallic minerals, including precious metals (80% of the reported Category A facilities that are currently operational).

4.6.1 Parameter: Assessment of classification of extractive waste facilities

Table 4.12 Indicator summary

Indicator 1: Existence of guidelines and / or specific binding requirements to classify extractive waste facilities (e.g. definition of a 'certain threshold') according to Annex III	
Description	The indicator aims at identifying guidelines or requirements that are used for the classification of Category A installations, according to Annex III of the Directive and as defined in Commission Decision 2009/337/EC.
Sources of information	Review of Member State implementation report Literature review (including Competent Authority websites) Engagement with mining experts
Geographic scope of information	The information obtained covers the following Member States: Austria, Bulgaria, Czech Republic, Finland, Ireland, Italy, Slovakia, Sweden and the UK.
Completeness of information	The level of completeness varied among the sources of information.

[67] http://siteresources.worldbank.org/INTOGMC/Resources/financial_surety_mine.pdf

	No information was identified as part of the review of the Member States implementation reports or consultation with trade associations. The literature review generated incomplete information which only covered Austria[68]. Conversely, the information provided by mining experts was from reliable sources (based on publicly available guidance, scientific research or information published by companies) although it did not cover all EU Member States.
Information gathered	▪ General information on the Directive (Scannel, 2012; Rizo, 2014); ▪ The UK guidance (UK Environment Agency, 2011) gives an overview of how operators can determine whether an installation shall be classified as Category A providing examples based on the type of operation and on the danger presented to the environment. The first part of this Guidance, alongside a position statement published in 2010 indicates the Regulatory framework, requirements and guidance for compliance with the environmental permit once the installation has been classified as Category A. Wales Scotland and Northern Ireland use specific guidance documents, which emanate from the national guidance developed by the Environment Agency for England and either repeat or complete the information. In the case of Scotland and Northern Ireland, the guidance (Annex B, SEPA, 2010) contains a questionnaire for the operator to assess whether his installation falls under Category A; ▪ The Irish guidance describes the key duties of operators and local authorities and contains an explanation of the approach that they have to take with regard to identifying Category A installations; ▪ The Geological Survey of Ireland (GSI) issued a guidance on the criteria in Annex III of the Directive. In Ireland, it is understood that Annex III indent 1 refers to physical (indent 1) and chemical (indents 2 and 3) stability (Stanley, 2013). This criteria is used mainly for including facilities in mining waste facility inventory according to which of them represent a priority. The source indicates that the definition of category A should influence the selection of these sites. A series of criteria for determining the risk taking the definition of category A into account is available in Stanley (2013): – Presence of sulphide ore; – Presence of individual substances (Ag, As, Ba, Be, Cd, Cr, Co, Cu, Hg, Ni, Pb, Sb, Se, Sn, Te, Tl, U, V, Zn or asbestos); – Chemicals used in processing; – Known failures at the site; – Heaps: Height (>20m), Area (>10,000m^2), slope of base (>1:12 or ~5°); – Distance to receptors: Population centres (<1km), Natura 2000 sited (<1km), water course/body (<1km), agricultural land or livestock (<1km); and

[68] This does not mean that the information does not exist, but that it probably required extensive searches in each of the 24 official languages of the EU and/or potentially a significant amount of resources.

	– Pathways: Water course/body within 1km, groundwater protection (e.g. high permeability layer), exposure to wind, uncovered sites. ▪ Petterson et al. (2015) explain the differences in the Finnish and Swedish permitting procedure, without providing specific insight on the categorisation of facilities; ▪ Various sources (Dobbs, 2009; Wells, 2010) explain the Avesta Polarit test, which emanates from a European Court of Justice case in Finland. According to this, residues to be used to fill galleries and voids may be classified as non-waste by-product if demonstrated to Competent Authorities; ▪ A case study from the UK (SLR, 2011) follows the steps undertaken by a company to classify their installation; and A case study from Bulgaria (The CEE Bankwatch Network's, 2009) where it seems that an installation was not classified as 'A' despite clear evidence that it met the criteria. Some sources also described the development of this case after 2009, although the exact outcome could not be identified (novinite.com, 2010; Barradas, 2012; DPM, 2017).

4.6.2 Analysis

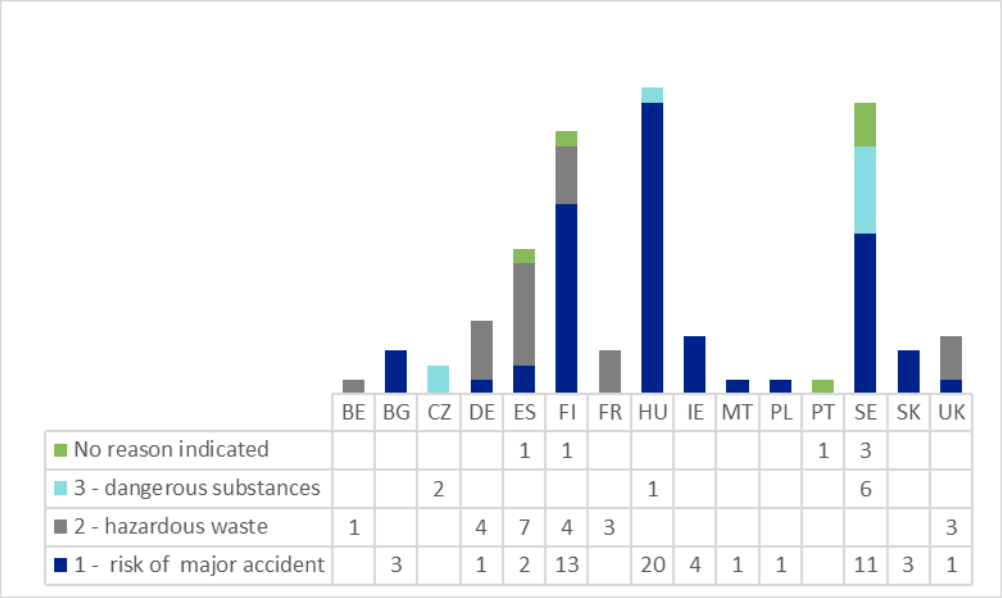
Annex III states that extractive waste facilities can be classified as Category A if:

- "1. A failure or incorrect operation, e.g. the collapse of a heap or the bursting of a dam, could give rise to a major accident, on the basis of a risk assessment taking into account factors such as the present or future size, the location and the environmental impact of the waste facility;
- 2. It contains waste classified as hazardous under Directive 91/689/EEC above a certain threshold [5%]; or
- 3. It contains substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold [as included in national law]".

Decision 2009/337/EC indicates that waste mining facilities shall be classified under Category A "if the predicted consequences in the short or the long term of a failure due to loss of structural integrity, or due to incorrect operation of a waste facility could lead to: (a) non-negligible potential for loss of life; (b) serious danger to human health; (c) serious danger to the environment". As such, Annex III of Directive 2006/21/EC (especially indent 1) and Decision 2009/337/EC leave the criteria for classification of extractive waste facilities subject to interpretation by Member States and it can be expected that the interpretation might differ slightly from one Member State to another. Given the preventive approach of the categorisation system described in Annex III of the Directive, Member States have to establish how they are going to assess what constitutes a 'major accident', and irreversible or significant environmental impact.

The 2016 data request directed to Member States required information on the reason why their Category A installations were classified as such, the results are presented in the figure below.

Figure 4.1 Reasons for classifying sites as Category A as reported by Member States



	BE	BG	CZ	DE	ES	FI	FR	HU	IE	MT	PL	PT	SE	SK	UK
No reason indicated					1	1						1	3		
3 - dangerous substances			2					1					6		
2 - hazardous waste	1			4	7	4	3								3
1 - risk of major accident		3		1	2	13		20	4	1	1		11	3	1

Source: Member State returns to information request under this study
Notes: Information includes Category A sites reported as in the following phases: Operational, Closure and Post closure and also Not yet operational or no phase indicated. Nine facilities were classified as Category A for two reasons (and therefore reported twice in the table above). IT submitted a response that did not cover the entire country and did not report reasons for classifying its sites as Category A and has therefore not been included in the figure. CY and EL reported Category A facilities in the triennial implementation report (2011-2014) but did not submit data as part of this request.

As can be observed, the first criteria under Annex III is the one the most invoked as justification for Category A installations and it is also the one which leaves the most space for interpretation. It is therefore important to review and assess the examples of classification systems and guidance in place in EU Member States to classify extractive waste facilities to identify potential differences and inconsistencies in the interpretation of Annex III of the Directive and Decision 2009/337/EC.

Two sources contained dedicated guidance for classifying extractive waste facilities (Ireland, the UK). From those two sources, the UK guidance provides the most comprehensive and complete description of the criteria and rationale in place to deem whether an installation falls under Category A. The Ireland guidance also describe the steps to be followed by operators and Competent Authorities, but are not as complete in terms of how it should be interpreted.

As indicated above, indent 2 and 3 of Annex III of the Directive are less prone to be problematic because they contain more defined criteria (amount of specific substances). According to both the Ireland and UK guidance, the presence of hazardous substances means that those facilities will need a licence and will already be regulated by Competent Authorities (in the scope of the IED, Seveso or other waste legislation). However, indent 1 (the occurrence of a failure) does not necessarily require the presence of hazardous substances and the existence of pathways and receptors and whether the potential damage is significant have to be interpreted.

The UK guidance contains various examples of how to classify an installation to assist the Competent Authorities in interpret the information provided by the operator. Less support is included in the questionnaire that is part of the Scotland and Northern Ireland guidance. These examples highlight 'the spirit of the law' and provide numerical examples but do not establish specific thresholds, appearing as if the criteria is analysed on a case-by-case basis. For instance, an example is given whereby a solid tip of 35 metres high and a maximum slope gradient of 1:3 containing inert waste and located next to a river is not considered to fall under category A. In this example, a failure would

release between 200 and 250 tonnes of extractive waste into the river blocking the river course and causing water to flow over adjacent land. The blockage is considered temporary and the failure is not deemed to cause permanent or long-lasting damage but the example does not state the point at which a damage is considered long-lasting or the quantity required to consider the release serious.

As a result of the above, inspections are of high relevance, as they will monitor whether the criteria followed by the operator for the classification of the site is compliant with Annex III and whether the situation described in the permit application actually applies (i.e. if the conclusion reached by the operator is realistic and it is true that the environmental damage is not significant nor permanent or long-lasting).

An example can be found in Bulgaria (The CEE Bankwatch Network, 2009) where the tailings dam of Chelopech gold and copper mine seems to have been used at almost its maximum capacity, increasing the risk of overflow, according to a NGO. Also, there was high arsenic concentration in the ore and a new facility was expected to be developed to treat extracted gold with cyanide. However, both the existing site and the expected additional facility were not classified as Category A. The source mentions that the environmental impact assessment gave data of the capacity and use of the dam that did not reflect how the dam is used in reality. The source does not provide enough information to identify whether a guidance such as the one present in the UK or Ireland would have changed the decision of Competent Authorities but it is clear that without defined criteria, the NGO's request of classifying the site as Category A may be more difficult to justify as Competent Authorities will always have to base their decision on their interpretation. Although it is not completely clear, it seems that a court ruling against the operator in 2010 forced it to change the way the mine was operated (novinite.com, 2010). The information available online indicates that the operator no longer uses the dam and acquired a smelter to treat the concentrate in Namibia (novinite.com, 2010; Barradas, 2012). The operator indicates that it has invested 90% of the mine profits to transform the mine and adapt it to the latest environmental standards (DPM, 2017).

Overall not enough information has been identified to allow a judgment on EU-wide performance with regard to classifying the installations due to the limited geographical coverage. However the following can be concluded:

- The analysis identified specific guidance for the classification of facilities in two Member States (Ireland and the UK);
- Given their characteristics, many Category A installations are expected to be covered by an integrated permit issued under the IED (or then IPPC) and may be covered by a Seveso permit (see Table 4.9) It does not exempt them from the provisions under the EWD (except from art 6 of EWD for Seveso installations);
- However, for those facilities not covered by Seveso, competent authorities need to interpret what is a 'major accident' (indent 1, annex III of the Directive) and what "non-negligible potential for loss of life"; "serious danger to human health" and "serious danger to the environment" is. There is insufficient evidence to assure that competent authorities of EU Member States have a very consistent understanding of these concepts. In fact, it seems that those Member States for which a risk system has been found, have followed similar criteria to identify Category A facilities;
- The UK guidance provides clear examples to support the decision making process of the Competent Authorities. However, the examples are based on qualitative and quantitative data and do not provide a limit above/below which the decision reached in the example would change;
- As seen in one example above, that the provisions in Annex III of the Directive need to be interpreted means that certain Authorities may fail to be completely consistent. Whereas the stakeholders' opinions gathered at the workshop (Brussels, March 2017. See section 3.3) indicate that definitions are generally clear, it was argued by some stakeholders that the discrepancies in waste facility

classification were mainly due to inconsistent reporting rather than to unclear definitions. Several Member States stressed the importance of a proper consideration of the first indent of Annex III of the Directive ("incorrect operation");

- The assessment of the classification of extractive waste facilities across the EU has been undertaken using one parameter (Assessment of classification of extractive waste facilities) composed by one indicator (Existence of guidelines and / or specific binding requirements to classify extractive waste facilities (e.g. definition of a 'certain threshold') according to Annex III); and
- The available information does not have a wide enough geographical coverage to identify examples of low performance.

4.6.3 Implications

- Consistency of interpretation of Annex III criteria:

Members of the industry considered in the stakeholder workshop that definitions were clear and that the issue of discrepancies in waste facility classification across Member States may rather be one of ensuring accurate and consistent reporting. Several Member States stressed however the importance of proper understanding of the first indent of Annex III. A compliance promotion exercise could address such issues.

4.7 Closure and post closure phase

According to the information submitted by Member States as part of the information collection exercise undertaken for this project, there are 460 extractive waste facilities that are in their closure/post closure phase (12% of all the facilities reported as part of the data request). From these, 27 are classified as Category A facilities. Out of the 248 facilities in the closure phase, 149 had their permits granted between 1970 and 2016 (72 between 2016 and 2008; 25 between 2007-2000; 32 during the 1990s; 17 in the 1980s and one in the 1970s).The inventories of closed and abandoned sites were also assessed and, from those that are publicly available (see section 4.1), information was extracted on the number of sites that form part of them. From the 3,462 facilities included in the 18 available inventories (17 online and one temporarily offline, see section 4.1), 52% were heaps, 2% dams, 3% ponds and 1% other (in 42% of the cases, the type of facility was not included in the inventory).

4.7.1 Parameter: Assessment of closure and after closure procedures for waste facility

Table 4.13 Indicator summary

Indicator 1: Risk-based assessment to identify the sites (including the methodology developed by the ad-hoc group)	
Description	The indicator aims at identifying risk-based assessments to identify sites for the inventory of closed/abandoned sites
Sources of information	Review of Member State implementation reports Literature review (including CA websites) Engagement with mining experts
Geographic scope of information	EU-wide information. Some detailed examples from Hungary and the UK. The information on scoring systems covers: Austria, Czech Republic, Finland, Ireland, Italy, Slovakia and Sweden.
Completeness of information	The completeness of information is weak. The information found is tangentially relevant as the risk-based systems and studies focus primarily on the inventory of closed and abandoned sites as set out Article 20

Information gathered	The implementation reports do not contain relevant information in this regard. Question A.6(a) was deemed as the one with the highest relevance to this indicator but it did not contain information on the risk-based assessment. Member States have reported the operators' obligations with regard to closure and post-closure but not on their system to ensure this happens. Annex 3 of the study undertaken by DHI et al. (2012) includes an overview of closure methodologies with special focus on the requirements of Article 20 (inventory of closed mining sites). The report includes information on risk assessment and prioritisation that can be used for this section. The information contained in the Guidance document for the risk-based pre-selection protocol for developing the inventory of closed abandoned sites (Stanley et al., 2011) was also assessed. Also, there is some information on risk-based assessments and scoring in Stanley (2013): ▪ Information on examples of extractive waste facility inventories (Austria, Czech Republic, Ireland, Italy, Slovakia, and Sweden) in Stanley (2013); ▪ Historic Mining Site scoring system: A risk model developed in Ireland. It assesses the sources (extractive waste), pathways and receptors according to criteria established in the model. For each pathway, there is a score for each site. According to the score, the sites are classified in four classes which require further risk assessment or different monitoring levels (Stanley, 2013); ▪ Risk classification system in Italy: Similar approach (source, pathway, receptors). The parameters studied include: type of pollutants, concentration of pollutants, extent of potential pollution, climatic, geological and hydrological parameters, presence of particular species and population near the site. (Stanley, 2013); ▪ Criteria for classification system in Slovakia: 14 criteria which classifies sites in 3 categories (I, II, III). Category I is for sites for which remediation is required; category III is for sites with low or minor impact and category II is transitional between I and III. (Stanley, 2013); ▪ Risk classification in Austria: Four risk categories (0, 1, 2 and 3). Categories 2 and 3 contain 3 sub-categories each. (Stanley, 2013); ▪ Method for inventories and risk classification of contaminated sites in Sweden: Based on several criteria, Sweden classifies sites in 4 risk categories. (Stanley, 2013); and ▪ Method for pre-selection of sites for the closed facilities inventory in Hungary: It is based on the same criteria as those of GSI above. Finally, Abdaal et al. (2013) provide an example where the protocol developed by the EU for assessing risk when conducting inventory of mine waste sites is used for 145 mines in Hungary. Again, this study was done in the scope of the inventory of closed and abandoned sites (Article 20) but a similar approach can be used for fulfilling article 12. The inventories of closed and abandoned sites that were available were assessed to compile information on: name of the facilities, location, type (heap, dam, pond or other, where available) and resource exploited when the mine was active.

4.7.2 Analysis

To assess the closure/post closure phase, four indicators were initially included in the assessment framework:

- Frequency of reporting of monitoring results by operators [removed due to the lack of information];
- Risk-based assessment to identify the sites (including the methodology developed by the ad-hoc group) [key indicator];
- Number of post-closure accidents (including number reported to the EC) [removed due to the lack of information]; and
- Number of rehabilitated closed waste facilities [removed due to the lack of information].

Three of the four indicators were removed due to the lack of information found. Therefore, only one indicator was kept for the analysis.

The risk-based assessment to identify sites is relevant to Article 12 of the EWD. Article 12(3) states that:

"A waste facility may be considered as finally closed only after the competent authority has, without undue delay, carried out a final on-site inspection, assessed all the reports submitted by the operator, certified that the land affected by a waste facility has been rehabilitated and communicated to the operator its approval of the closure. That approval shall not in any way reduce the operator's obligations under the conditions of the permit or otherwise in law."

No information specifically covering this has been found in the sources investigated. However, literature sources[69] have been identified for description of risk-based approaches and scoring systems that have been primarily developed to prioritise sites for the inventory of closed and abandoned sites as set out in Article 20.

The most relevant guidance related to this is the TAC guidance developed by Stanley et al. (2011) which includes the basis of pre-selection requirements. They are as follows:

- Be risked-based;
- Address source, pathway and receptor;
- Be simple and office-based;
- Use readily available data;
- Address data and information uncertainty;
- Address serious damage to both human health and the environment (ecosystem) receptors;
- Assess whether the closed waste facility contains either hazardous waste or dangerous substances;
- Assess the physical stability of the closed waste facility;
- Address serious damage occurring at the present and the potential for such damage to occur into the future (medium term, i.e., 1 to 10 years);
- Provide a selection of waste facilities for further assessment;
- Produce a selection of waste facilities that would be reasonably certain of capturing all relevant facilities, i.e., precautionary; and
- Be reasonable and proportionate for the task.

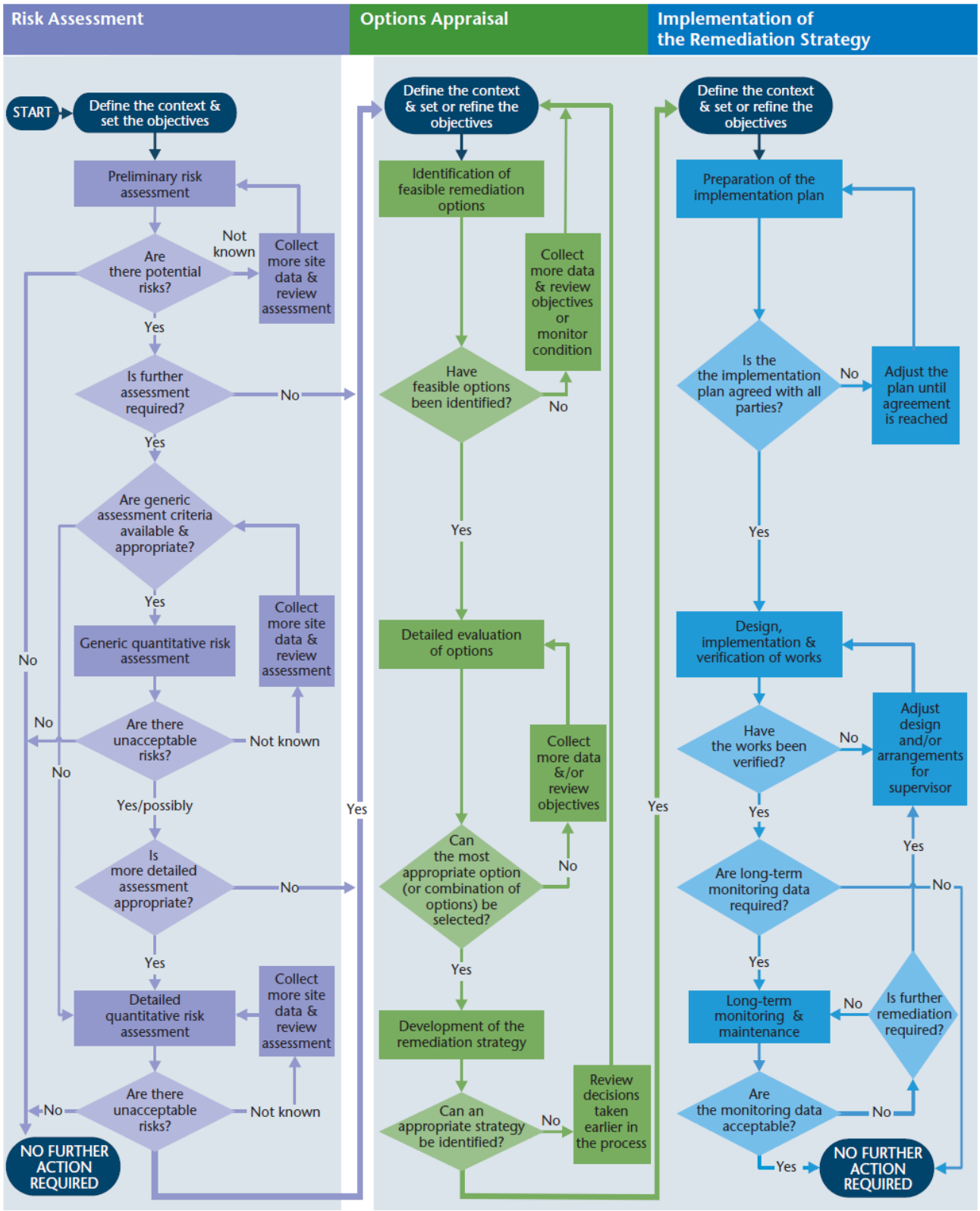
[69] Stanley (2013), Stanley et al. (2011) and DHI et al. (2012)

According to the information gathered at the stakeholder workshop (Brussels, March 2017. See section 3.3), the TAC guidance has been used in several Member States as a risk-based system to prioritise facilities for the inventory of closed and abandoned sites.

Furthermore, the 2012 study from DHI describe best practice and a series of steps to develop the priority list:

- **Establishing a site inventory and performing a first risk assessment:** DHI et al. (2012) establish a prioritisation process that can be used to make sure the requirements of Article 12 are fulfilled. The prioritisation relies on the national inspection plan and gathering existing information, which in many cases will be missing. However, the first risk assessment aspect should be basic and its main aim is determining whether the facility could cause serious environmental impacts. The study gives the example of the NoCAM project in the UK, where a large-scale strategic prioritisation exercise was undertaken. The project identified the highest priority sites for water receptors using historical data;
- **Prioritising sites based on risk and listing the sites based on the priority:** DHI et al. (2012) state that prioritisation should be based on safety hazards and then other environmental hazards. There are various scoring systems in the literature that can be used (e.g. Da Silva, 2003);
- **Detailed site investigation and quantification of problems:** This section explains that if remedial action is deemed necessary after an initial assessment, priority sites need to be investigated thoroughly to quantity the problem and estimate which options are available and at what price. This may change the priority ranking of sites as more is discovered. Although this is envisaged in the scope of the inventory of closed and abandoned sites and to prioritise remediation, the approach could also been applicable to Article 12, where Member States have to ensure they have undertaken a final on-site inspection before closing the site; and
- **Investigation of remedial options and risk evaluation:** During the investigation of potential remedial options it is evaluated which of all potential remedial measure (or combination of measures) is the most appropriate for the specific facility. The investigations will be in the risk evaluation by which the chosen or recommended remedial option is selected. The potential risk reduction with each remedial alternative is assessed. Defra and UK EA (2004) is mentioned as a good example of a comprehensive framework that can be applied to mine sites. The approach was thought to be used at UK level but the approach is generic and could be used for the rest of the EU. The flow diagram of the approach taken by Defra and UK EA (2004) is presented in Figure 4.2.

Figure 4.2 The process of managing contaminated land



Source: Defra and UK EA (2004)

In addition, consultation of stakeholders allowed us to identify some examples of sites rehabilitation. The box below presents these examples.

Rehabilitation of extractive waste sites in Hungary

Mátra Mountains:
A project started in 2010/2011 for a waste facility closed at the end of the 1980s. This site had problem of drainage of acid substances, several waste heaps and one large flotation tailing pond. The site was treated and recovered.

Recsk (Mátra Mountains):
A site with deposits that were never extracted but the company that had the rights to exploit the site did works in the scope of the exploration stage of the mine. After not finding enough evidence to continue, activities were suspended but a significant amount of waste arose from the exploration phase of the project. This site was also close to an active site and was connected to Recsk Lahóca which raised further waste. The rehabilitation is ongoing.

Pécs:
A uranium mine operational from late 1950s until around the 1990s (1997). There were issued related to a pond with tailings and the fact that there was a significant amount of underground areas which had not been filled back with water. In addition to this, water was contaminated with radioactive elements. The mine was rehabilitated and is not a danger anymore.

Stanley[70] (2013) and Abdaal[71] (2013) describe risk-based methods for prioritising facilities with a scoring system based on analysing the sources, pathways and receptors. These were envisaged for prioritising facilities to be included in the inventory of closed and abandoned sites and cover the following countries: Austria, Czech Republic, Finland, Ireland, Italy, Slovakia and Sweden. These Member States use a risk assessment approach to determine priority sites to be part of an extractive waste facility inventory or to comply with Article 20 of the Directive. These approaches are based on analysing the sources (waste), pathways (soil, water, air) and receptors (humans and nature) and apply various thresholds and areas of influence that aim at establishing scores or other methods to be used by the operator and/or Competent Authorities. Although the classification systems and the description of the risk categories vary slightly, the approach and principle are the same. The thresholds are available for Hungary and Ireland and are essentially the same. The information is summarised in Table C.4 of Appendix C. These examples would be suitable and comprehensive for prioritising sites in the scope of Article 12 as well, but it is unknown whether this is actually done.

In summary, the information on this indicator is scarce and no conclusions can be drawn in terms of the implementation of this provision at EU level. While examples of best practice can be found this does not clarify the level of implementation of the provisions of Article 12 in the EU. There is not enough information to provide judgment on whether performance is low in one or more Member States.

As stated in section 4.1, there are 17 online inventories of closed and abandoned sites in the EU. One more (Poland) is temporarily unavailable online. In seven cases (Croatia, Denmark, Lithuania, Latvia, Luxembourg, the Netherlands, and Malta) Member States stated that an inventory was not necessary due to the absence of any closed or abandoned extractive was facility within their boundaries. Finally, the 2011-2014 implementation report submitted by Slovenia also indicates that there is not an inventory because there is not a facility for which Article 20 applies, yet an inventory was found online. Moreover, a scientific abstract published by Slovenian Geological

[70] Stanley, G., 2013 Waste management in the extractive industry, examples from Ireland, and other Member States. Geological Survey of Ireland
[71] Abdaal, A., Jordan, G., Szilassi, P., 2013. Testing Contamination Risk Assessment Methods for Mine Waste Sites. Water, Air and Soil Pollution 224:1416

office states that the inventory had been developed "in accordance with Article 20 of Directive 2006/21/EC[72]".

An Excel-based database with information on facility name, location, type (heap, dam, pond, other) and type of resource exploited when the mine was active was developed using the information of the inventories that are available online (see Appendix C). Information on the type of facility can be found in Table 4.14.

Table 4.14 Information in the available inventories of closed and abandoned extractive waste facilities – type of facility

Member State	Heap	Dam	Pond	ND	Other	Total
AT	1	0	0	0	0	1
CY	38	0	0	0	0	38
CZ	19	0	0	0	0	19
EE	37	0	0	0	0	37
EL	4	n/a	n/a	15	n/a	19
ES	20	53	0	0	0	73
FI	n/a	n/a	n/a	53	n/a	53
FR	n/a	n/a	n/a	28	n/a	28
HU	61	3	15	430	2	511
IE	n/a	n/a	n/a	1	n/a	1
IT	616	n/a	15	5	29	665
PL	6	n/a	n/a	11	n/a	17
PT	64	n/a	n/a	111	1	176
RO	627	0	68	0	0	695
SE	n/a	n/a	2	309	n/a	311
SI	n/a	n/a	n/a	78	n/a	78
SK	314	0	24	0	0	338
UK	n/a	n/a	n/a	402	n/a	402
Total	**1,807**	**56**	**124**	**1,443**	**32**	**3,462**

Note: Information valid as of 30th June 2017
ND: not determined
n/a= information not available

[72] Gosar, M., Sajn, R., Miler, M, 2015. Inventory of closed facilities for treatment of wastes from mining and other activities of mineral resource extraction. GZO 2015

It has not been possible to identify the type of waste present in these facilities, but in some cases it has been possible to identify the type of resource that was extracted when the mine was active (Table 4.15). According to the information available, 30% of these facilities were in mines where metallic minerals were extracted. 3% were in non-metallic minerals mines and 1% in mines extracting precious metals. 5% were a combination of various types of resources were extracted. In a large number of cases (47%), this information was not present in the inventories.

*Table 4.15 Information in the available inventories of closed and abandoned extractive waste facilities – type of resource**

Member State	Metallic minerals	Non-metallic minerals	Precious metals	Fuels	Coal	Combinations of the previous	Other	ND	Total
AT	1	0	0	0	0	0	-	0	1
CY	5	n/a	2	n/a	n/a	n/a	-	31	38
CZ	n/a	n/a	n/a	n/a	n/a	n/a	-	19	19
EE	0	5	0	32	0	0	-	0	37
EL	n/q	5	n/a	n/a	n/a	6	1	7	19
ES	62	2	0	0	9	0	-	0	73
FI	29	6	0	0	0	18	-	0	53
FR	21	1	2	0	3	1	-	0	28
HU	1	n/a	n/a	n/a	n/a	n/a	-	510	511
IE	n/a	n/a	n/a	n/a	n/a	n/a	-	1	1
IT	348	89	12	33	0	151	-	32	665
PL	n/a	n/a	n/a	n/a	n/a	n/a	-	17	17
PT	156	7	10	0	3	0	-	0	176
RO	n/a	n/a	n/a	n/a	n/a	n/a	-	695	695
SE	n/a	n/a	n/a	n/a	n/a	n/a	-	311	311
SI	61	0	0	0	17	0	-	-	78
SK	0	0	0	0	0	0	338	0	338
UK	343	5	0	0	49	5	-	0	402
TOTAL	**1,027**	**120**	**26**	**65**	**81**	**181**	**339**	**1,623**	**3,462**

Note: Information valid as of 30th June 2017
(*)= when the mines were active
ND: not determined
n/a= information not available

4.7.3 Implications

The information assessed for this study and the outcomes of the stakeholder workshop do not have enough evidence to conclude on the implementation of Article 12 at EU level on closure and after closure procedures.

However, there was enough information on the use of a risk-based system to identify sites to include in the inventory of closed and abandoned sites. There is sufficient guidance for the prioritisation of sites and various Member States use a risk-based system, which is typically based on the TAC guidance. 17 inventories of closed and abandoned sites are available online, and some information of an eighteenth inventory is also available although the frequency[73] at which they are updated is not clear. As stated in section 4.1, there is variability in the last updates made in the national inventories. The year of the last update ranges from 2011 to 2017 (see Table 4.4). Taking into account the information available, there are 3,462 closed and abandoned sites facilities in the 18 inventories.

An EU-wide inventory of closed and abandoned sites was proposed at the stakeholder workshop as a possible solution to improve transparency on these sites. There were mixed views about the usefulness of such an-EU-wide approach. A possible advantage of such an approach raised by some stakeholders would be the increase of awareness and transparency with regard to the transboundary effects of extractive waste facilities located close to the borders with other Member States. On the other hand, if such EU inventory is made, there should be a disclaimer explaining that the development of national inventories may have followed different approaches, which may reduce the comparability of the data.

The experts gathered at the Meeting of the Commission Expert group on Waste held on 15th March 2017 highlighted the financial challenge posed by the remediation of closed and abandoned facilities.

4.8 Transboundary effects

Based on information provided by Member States that responded to the request for information made as part of this study, it appears that at least some 40 waste facilities are located near borders of other Member States, mainly between Portugal and Spain and between Ireland and the UK (Northern Ireland).

4.8.1 Parameter: Assessment of the procedure in case of transboundary effects

Table 4.16 Indicator summary

Indicator 1: Existence of coordination mechanisms to ensure information is forwarded to other Member states	
Description	Aims to assess the existence of procedures or coordination mechanisms in case of transboundary effects
Sources of information	Review of Member State implementation reports
Geographic scope of information	28 Member States
Completeness of information	The reports from 28 Member States were assessed. Information varied.

[73] Only available for Greece, but the inventory has not been updated as frequently as intended

Information gathered	Information was based on Member State reports, as regards the Part A of the Questionnaire on the implementation of Directive 2006/21/EC. Detailed review of Part A Questionnaire by Member States Level of detail provided in Member State responses varies. Certain Member States refer to national law only, others include more detailed description.

4.8.2 Analysis

Article 16(3) of EWD requires Member States to ensure inter alia that: in the event of an accident involving a Category A waste facility likely to have significant adverse effects on the environment of, and any resultant risks to human health in, another Member State, information provided by the operator to the competent authority is immediately forwarded to the other Member State to help minimise the consequences of the accident for human health and to assess and minimise the extent of the actual or potential environmental damage.

To assess the state of transboundary effects, as an indicator the existence of coordination mechanisms to ensure information is forwarded to other Member States was used, the information being taken from the Member States' implementation reports. Two further indicators have been discussed but not used in the end: The timeframe to inform public concerned, and tools in place to inform public concerned. For both indicators, information with our direct available sources could not be easily identified, and the effort for reviewing national legislation was deemed out of proportion given that a benchmark for this indicator is very difficult to define.

From the 28 Member States assessed, the following 19 Member States have reported having Category A facilities in their territories: BE, BG, CY, CZ, DE, EE, ES, FI, FR, EL, HU, IE, IT, PL, PT, RO, SE, SK and the UK[74]. Of these Member States, only four reported for the period 2011-2014 that Category A facilities under their jurisdiction may have an impact to another Member State (in brackets the number of facilities in question): Spain (2), Ireland (4), Italy (2), and Sweden (2).

However, this does not necessarily mean that one can disregard the Member States which reported not having any Category A facility, or those Member States reporting that the Category A facilities on their territory would not affect other Member States in the sense addressed by Article 16 EWD. First, different practice and uncertainties are observed when applying the criteria for classifying installations as Category A (see section 4.6). Further, the criteria for identifying whether a facility may have a significant impact on another Member State are not defined in detail in the EWD, leading to further uncertainty in possible interpretation. For instance, in the case of the mining accident at Ajkai Timfoldgyar alumina plant, red mud entered the Danube and may have entered into Member States downstream of the accident site. The site had not been identified as a Category A facility, thus a possible impact on another Member State had not been assessed.

Within their triannual reports, Member States are to describe the mechanisms of information transmission in case of a transboundary constellation. Since this pertains to administrative procedures, the approaches of the Member States vary significantly depending on their national constitutional and administrative practice. Usually the procedure is governed by national law (or Decrees etc.), however some Member States, such as Germany, have concluded (tailored) bilateral agreements with each neighbouring country on mutual assistance in case of certain disasters with transboundary effects.

[74] Figures on Category A are taken from the Member States' answers to the request for statistical information on permits during 2016. Regarding the issue of transboundary impact, and regarding those Member States that did not reply to that request, the information included in the report on implementation for the period 2011-2014 was taken as a basis.

The communication may involve many actors depending on the relevant administrative arrangements yet a frequent pattern is that the operator has in case of an accident to notify the Competent Authority which in turn needs to inform a central institution at national/federal level, which then is responsible for forwarding the information to the other Member State.

Overall, Member States have established the relevant procedures and defined the relevant authorities involved in this process. From this perspective, implementation of the requirements of the EWD in terms of transboundary effects is good. However, findings on how well these procedures are applied in practice are scarce due to lack of cases.

4.8.3 Implications

- Guidance on appropriate transboundary communication.

Although there is no evidence that performance in this respect is low, it may be an option presenting appropriate approaches for transboundary communication as part of the planned general guidance on implementation of the Directive announced by the Commission in 2016 (while respecting Member State autonomy for designing competent authorities and appropriate procedures). Such a chapter could also take into account of the work in the framework of guidelines developed by the United Nations Economic Commission for Europe (UNECE) member countries under two UNECE Conventions — the Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention) and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention). These include safety guidelines and good practices for Tailings Management Facilities. Further, in such framework guidance could be developed regarding what a "significant impact" on another Member State is, aiming to lead at a more consistent and ambitious understanding of this concept in the Member States.

However, at the stakeholder workshop (see section 3.3) the general view was that there is no need for specific guidance on transboundary aspects for extractive waste facility accidents and that of most importance is the rapid communication and cooperation between Member States in the event of an incident. To facilitate this, a web-based list of key contact points, kept up-to-date could ensure quick and effective communications.

5. Thematic areas

This section presents our analysis of the four thematic areas identified in the terms of reference as key areas of interest for the Commission. Each sub-section is focusing on presenting information gathered and our analysis of the state of play for each of the following topic: Category A facilities, cyanide processes in Europe, stability of waste management facilities and the reprocessing of extractive waste.

The analysis builds on information gathered for the purpose of this project, in particular literature review and consultation with Member States competent authorities (i.e. for the reprocessing of extractive waste).

5.1 Category A facilities

Category A is a legal concept established by the EWD, with no preceding legal terms. As presented in section 4.6, there are three criteria used to determine whether or not a facility is Category A.

From the different categories of facilities that the EWD recognises, Category A are the facilities of most concern. Consequently, all substantial basic measures and requirements of the Directive that relate to waste facilities, irrespective whether they introduce supervising obligations for competent authorities, or whether they are addressed to the operator who has (within Member State legislation) to be held responsible for key obligations, are always applicable to Category A facilities. Further, some obligations apply only to Category A facilities. The table below presents the range of obligations from the Directive and in particular those applicable to Category A facilities.

Table 5.1 Substantial requirements of the EWD, its legal basis and concerned facilities

EWD substantial basic requirement	Article	Applies to ...
Develop a waste management **plan for the minimisation, treatment, recovery and disposal of extractive waste**	5	All facilities
Develop a major-accident prevention **policy, including a safety management system and internal emergency plan**	6	Category A facilities
Allow no extractive industry waste facility to operate without a permit **issued by the competent authority**	7	In principle all facilities, but see (1)
Ensure public participation **by providing information and allowing the public to prepare and participate effectively**	8	In principle all facilities, but see (1)
Requirements for placing extractive waste back into the excavation voids **for rehabilitation and construction purposes**	10	All facilities
Member States have to ensure that waste facilities are managed by a competent person **and that technical development and training of staff are provided**	11	In principle all facilities, but see (1) and (2)
Closure and after-closure procedures **of a waste facility and monitoring are to be organised by Member States pursuant to the requirements of the Directive**	12	In principle all facilities, but see (1) and (2)

EWD substantial basic requirement	Article	Applies to …
Preventive measures **must be taken against water and soil contamination, including from cyanide-containing waste tailings**	13	In principle all facilities, but see (1) and (2)
Waste facility operators must provide a financial guarantee before the beginning of waste processing operations	14	In principle all facilities, but see (1) and (2)
In accordance with Directive 2004/35/EC, operators of waste facilities are subject to a presumed liability **in respect of environmental damage caused by their operation**	15	All facilities
Provision of information to other Member States and the public in the case of transboundary effects	16	Category A facilities

Notes:
1. Cf Article 2(3) first para: "Inert waste and unpolluted soil resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries and waste resulting from the extraction, treatment and storage of peat shall not be subject to Articles 7, 8, 11(1) and (3), 12, 13(6), 14 and 16, unless deposited in a Category A waste facility"
2. Cf Article 2(3) third para: "MS may reduce or waive the requirements of Articles 11(3), 12(5) and (6), 13(6), 14 and 16 for non-hazardous non-inert waste, unless deposited in a Category A waste facility"

In May 2016, Member States were requested by the Commission to provide additional statistical data to support the analysis of the implementation but also to provide wider data for the Commission. These data were collected until July 2017, analysed and are summarised below.

- The following Member States provided answers to this inquiry for statistical data: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Germany, Denmark, Estonia, Finland, France, Hungary, Ireland, Italy (incomplete), Malta, Poland, Portugal, Sweden, Slovakia, Slovenia and the UK; and
- No information on extractive waste facilities was received by the deadline from the following Member States: Greece and Romania.

Several Member States (Spain and Slovakia) provided corrections after the deadline, which could not be taken into account in this study.

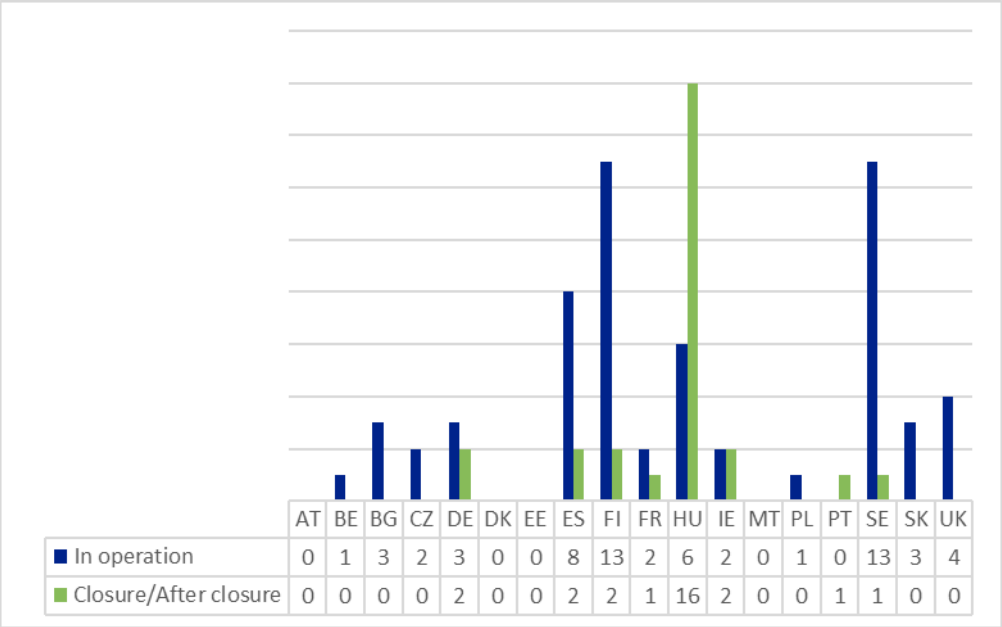
5.1.1 Inert waste

As part of the inquiry to the Member States regarding permits of facilities under the EWD, Member States were also requested to indicate whether the waste managed within the facility was inert, under the terms of the Directive. Significant variations in the share of sites within a single Member State that manage inert wastes were found across Member States. Some Member States reported exclusively inert waste facilities (e.g. Malta and Austria) and others reporting no inert waste facilities (e.g. Hungary, France and Bulgaria). It would be interesting understand whether the inert characteristic of the waste influenced the site classification and consideration under the EWD.

5.1.2 Category A sites

The number of Category A facilities was identified as being uncertain following the review of the implementation report. As part of the data request to Member States under this study, Member States were asked to provide information on all installations falling under the scope of the EWD and to indicate the number of Category A sites. The figure below presents the data reported between May 2016 and July 2017.

Figure 5.1 Number of Category A sites reported



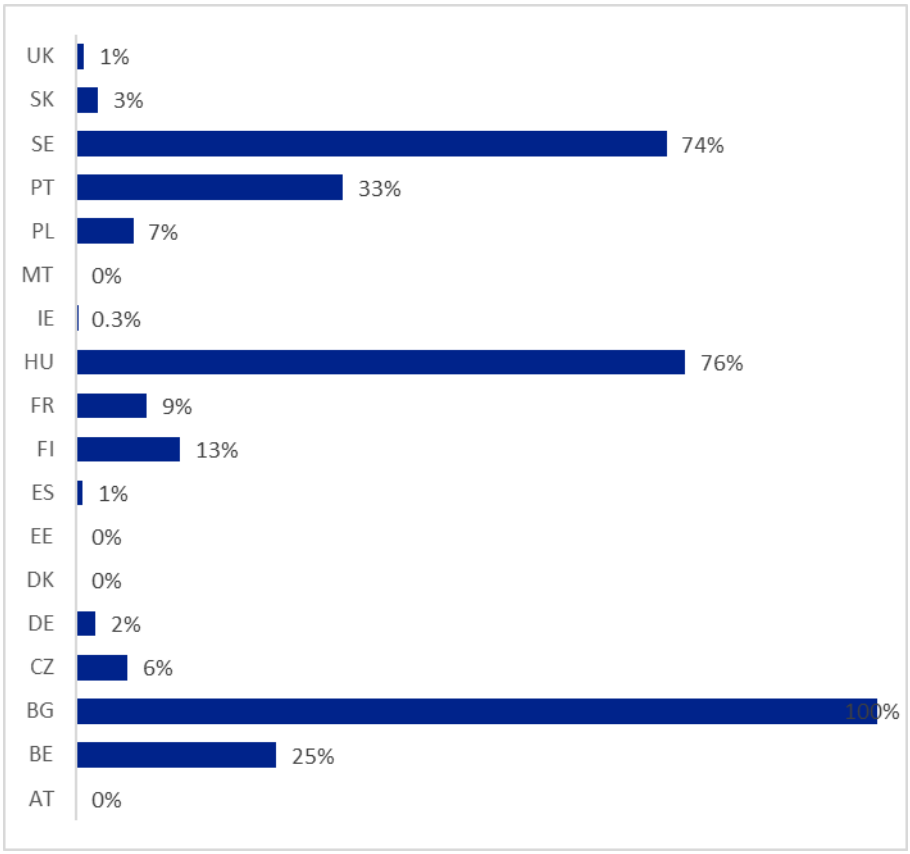
	AT	BE	BG	CZ	DE	DK	EE	ES	FI	FR	HU	IE	MT	PL	PT	SE	SK	UK
In operation	0	1	3	2	3	0	0	8	13	2	6	2	0	1	0	13	3	4
Closure/After closure	0	0	0	0	2	0	0	2	2	1	16	2	0	0	1	1	0	0

Source: Member State returns to information request under this study. No information on extractive waste facilities was received by the deadline from the following Member States: EL and RO. MT listed one Category A site which is not yet operational. HR, LT, LV, LU, NL and SI reported no relevant sites. CY reported that its only facility entered the closure phase in 2015 (and was not a Category A facility). These seven Member States have not been included in the figure

One of the conclusions of the previous analysis of the implementation at Member State level[75] was that the interpretation of the scope of the Directive varied. This was investigated and the figure below presents Category A installations as a share of total extractive waste sites reported by Member States. It shows a variation across Member States, with several including Bulgaria, Hungary and Sweden reporting a high average share of Category A sites.

[75] BiPRO, 2016

Figure 5.2 Category A installations as a share of the total extractive waste sites reported by Member States



Source: Member State returns to information request under this study. Information includes Category A sites reported as in the following phases: Operational, Closure and Post closure and also Not yet operational or no phase was indicated. MT listed one Category A site which is not yet operational.

5.1.3 Implications

Considering the particular relevance of the application of all EWD provisions to Category A facilities, all indicator-based findings of section 4 are valid here. To avoid repetition, we focus on the most important findings, complemented by further findings in particular from previous work on the study "Provision and elaboration of information for the preparation of the implementation report of Directive 2006/21/EC".

One repeated issue is that Member State authorities and economic operators are struggling with consistently applying the criteria for classification of waste facilities as Category A. Besides the indicators used in section 4, this is apparent from the information request for statistical information regarding permits for facilities in the scope of the EWD. The figures for permits for Category A facilities in operation (i.e. not including closed sites) deviate for some Member States from those indicated for the implementation report 2011-2014. A comparison is included below.

Table 5.2 Comparison of the number of Category A installations in operation reported by Member States

Member State	Reported in the triennial report questionnaire (2011-2014)	Reported in data request as of July 2017
AT	0	0
BE	0	1
BG	2	3
CY	1	ND
CZ	0	2
DE	3	3
DK	0	0
EE	0	0
EL	1	ND
ES	25	8
FI	9	13
FR	1	2
HR	0	0
HU	6	6
IE	2	2
IT	4	2*
MT	0	0
NL	0	0
PL	1	1
PT	3	0
SE	15	13
SK	3	3
UK	4	4
Total	**80**	**63**

Notes: Where no information is available for either the 'implementation questionnaire' or 'data request' Member States are not included.
ND= not determined
* Italy provided an incomplete response that covered four regions only. As a result, for further analysis the facilities reported in the triennial report questionnaire (2011-2014) has been considered instead of the information reported as part of the data request.

These differences may be partly explained by possible closure of facilities or installation of new facilities; further, the questionnaire laying the basis for the Member State implementation reports is not unambiguous thus having the potential for misunderstanding (BiPRO 2016). A possible further explanation for the deviation in figures is that some activities may fall under the Seveso Directive and there may be confusion among Member States whether the facility is to be permitted under both Directives. Regarding the latter aspect, as a starting point, to have a more comprehensive overview of the situation, the map of extractive waste facilities generated under this project was overlapped with the publicly available map of Seveso installations in the field of mining. It can be concluded that the number of overlaps is very limited – comparing a total of 14 Seveso locations that could be mapped against the map of extractive waste facilities generated under this project based on the data request, only one possible overlap could be identified (Bulgaria / Sofia Region).

However, considering these possible explanations, there is also other evidence that there are issues with correct and coherent classification. This is for instance suggested by examining the figures of Category A facilities with Eurostat data on waste and hazardous waste generation (2014), see below.

Table 5.3 Total generation of waste and hazardous waste from extractive sector in 2014 compared with Category A facilities in operation as of July 2017

Member State	Category A facilities in operation	Total Waste	Haz Waste	Non haz Waste	% haz waste
BG	3	159,280,382	11,986,539	147,293,843	7.5%
RO	2*	152,783,566	206,832	152,576,734	0.1%
SE	13	138,898,168	6,206	138,891,962	0.0%
PL	1	75,736,488	6,821	75,729,667	0.0%
FI	13	62,775,117	358,520	62,416,597	0.6%
EL	1*	47,356,920	1,755	47,355,165	0.0%
UK	4	26,291,148	148,711	26,142,437	0.6%
ES	8	18,640,873	2,468	18,638,405	0.01%
EE	0	7,904,520	2,008	7,902,513	0.0%
DE	3	7,431,893	49,540	7,382,353	0.7%
IE	2	2,706,594	20,495	2,686,099	0.8%
FR	2	2,345,765	6,127	2,339,638	0.3%
IT	4*	981,753	14,752	967,001	1.5%
SK	3	289,110	608	288,502	0.2%
PT	0	277,855	1,291	276,564	0.5%
CZ	2	233,797	20,114	213,683	8.6%
NL	0*	131,537	25,768	105,769	19.6%

Member State	Category A facilities in operation	Total Waste	Haz Waste	Non haz Waste	% haz waste
LU	0*	129,724	84	129,640	0.1%
HU	6	82,576	19,425	63,151	23.5%
BE	1	61,512	1,128	60,384	1.8%
AT	0	43,232	17,031	26,201	39%
MT	0	36,226	0	36,226	0.0%
LT	0*	24,978	173	24,805	0.7%
DK	0	11,996	4,920	7,076	41.0%
SI	0*	7,675	54	7,621	0.7%
HR	0*	5,315	1,241	4,074	23.3%
LV	0*	5,288	0	5,288	0.0%
CY	1*	ND	ND	ND	ND
EU total	**69**	**704,630,000**	**12,900,000**	**691,730,000**	**1.8%**

Notes: * indicates no information was available from the data request to Member States hence these data are from the triennial report. Figures on Total waste, Hazardous waste, Non-hazardous data taken from ESTAT, 2014 Generation of waste by waste category, hazardousness and NACE Rev. 2 activity [env_wasgen], retrieved April 2017)

There seems to be no pattern for consistently explaining the correlation between hazardous waste generation from that sector and the number of Category A facilities. The most obvious case is the one of Bulgaria where significant amounts of hazardous waste are produced from the mining and quarrying sector (amounting to nearly 93% of the total hazardous waste produced in the EU from that sector) whereas on the other hand only three Category A facilities have been reported, none of which is classified as such on grounds of containing hazardous waste (see Figure 4.1). Another example of figures which are difficult to explain are the cases of Denmark and Austria which have the highest share of hazardous waste of the mining/quarrying sector related to the total waste produced (39% and 41% respectively) while reporting no Category A facilities.

In terms of the application of the Directive, it has to be stressed that inconsistent classification has important consequences for nearly all indicators. Only if Category A facilities are correctly identified by industry and authorities, the respective mechanisms reserved for Category A facilities apply such as major accident prevention (see section 4.2).

5.2 Cyanide processes

The purpose of this section is to summarise the context of gold mining in Europe together with the use of cyanide-based technologies, and also to update the information gathered in the study 'Impact of gold extraction in the EU'[76] in particular regarding

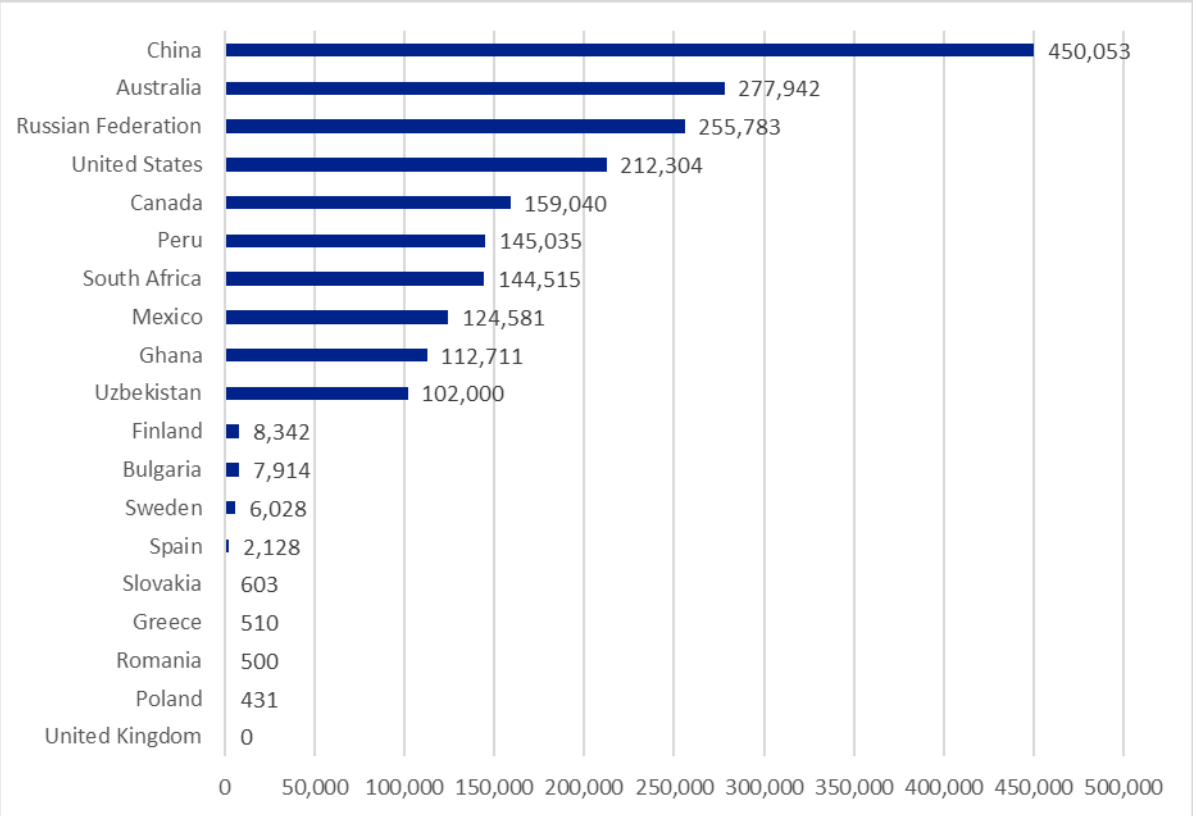
[76] http://ec.europa.eu/environment/waste/mining/pdf/IH_2010-001.pdf

alternatives to replace cyanide-based technologies and the impact of a possible ban[77] of the use of cyanide technologies in gold mining activities in the EU.[78]

5.2.1 Gold mining in Europe

From a global perspective, gold mining in the European Union is minor with a contribution of approximately 1.3% of global mine production in 2015. Finland, Bulgaria, Sweden and Spain are currently the largest gold producers in Europe. Other European countries with minor gold mine operations are Slovakia, Greece, Poland and Romania[79] (see Figure 5.3 gold mine production for 2015, listing the top 10 producing countries and European gold producing countries).

Figure 5.3 Gold production 2015 (kilograms)



Source: British Geological Survey. 2017. World Mineral Production 2011-2015 https://www.bgs.ac.uk/mineralsuk/statistics/wms.cfc?method=searchWMS

5.2.2 Use of cyanide-based technologies

Cyanide-based technologies are one part of a series of steps in the typical approach to gold production. The sequence of processing can be summarised as:

- Raw ore extraction;
- Ore crushing, grinding and grading;
- Gravity separation or flotation (to separate the heavier gold containing ore);
- Leaching to extract gold containing complexes; and

[77] Bans on the use cyanide technologies in gold production are in place in Hungary and the Czech Republic.

[78] Note that Section 4.4 on 'Application and permitting procedures' includes the parameter 'Assessment of the implementation of Best Available Techniques in the permitting procedure' which includes as an indicator 'Indicator 3: Application of BAT in relation to the use of cyanide (Article 13(6)) of the Mining Waste Directive)'.

[79] Note in 2014 and 2015 UK production was nil compared to 42kg in 2013. Portugal was also noted to potentially be a minor producer but no data is reported.

- Refining.

It is the leaching stage, using cyanide-based technologies, that is the focus here. The chemical resistance of gold becomes a disadvantage in hydrometallurgical processes as it is difficult to find reagents (also referred to as lixiviants) that can readily dissolve gold from the extracted ore. The reagents which can dissolve the gold (e.g. cyanide, chloride, sulphur complexes), are mostly aggressive and toxic. Gold concentrates from gravity separation or flotation are processed using cyanide-based leaching to recover up to > 99% gold. After leaching (which may take a number of weeks), the 'pregnant', gold containing solution is treated to recover the gold content via adsorption or precipitation. Adsorption processing uses activated carbon followed by removal of gold compounds from the carbon using a stripping solution. During precipitation, the pregnant solution is filtered to remove suspended solids and dissolved oxygen and then metallic zinc dust is then added to produce a gold precipitate. Further filtration follows to remove the gold. Following the refining stage the cyanide solution is 'barren' and is either reprocessed to enable reuse or treated[80] ready for disposal. Due to the high toxicity of cyanide the possibility of replacing cyanide with other reagents has been investigated. Other potential reagents were discussed in the 2010 report 'Impact of gold extraction in the EU'. Since 2010, further research has been carried out on alternative reagents and processes, which is discussed in the following section. [81] [82]

Globally, according to Euromines, around 90% of the gold mines use cyanide-based technologies with the remaining mines being small-scale and artisan gold extraction using other techniques (unspecified) and a small number of mines with ore bodies that, exceptionally, are amenable to removal of the gold without the use of cyanide. In the EU, according to the Artisanal and Small-scale Mining Knowledge Sharing Archive (2017), non-cyanide gold extraction is limited to French Guyana (an outermost region of the EU).

Cyanide-based technology is the dominant technology used for commercial-scale gold extraction in the EU. No information was located regarding the quantity of cyanide lixiviant used in the EU or the total quantity of waste generated (either requiring treatment or following cyanide destruction) in the EU from cyanide-based gold production.

5.2.3 Alternative technologies

A series of alternative reagents and processes have been investigated and tested for gold extraction from ores. Alternative reagents and processes and their current status are detailed in Table 5.4.

Table 5.4 Alternatives to cyanide-based technologies

Name	Description	Current status / potential
Alpha-cyclodextrin	Laboratory scale tests only have been carried out mixing starch-derived alpha-cyclodextrin with dissolved gold salt at room temperature to isolate gold. The resulting metal waste is benign relative to those from cyanide processes.	Laboratory scale test only have been carried out. If developed to feasibility, could present a technology with a benign waste although reagents (hydrogen

[80] By volatilisation, precipitation, biodegradation or oxidation.

[81] Gökelma, M., Birich, A., Stopic, S. and Friedrich, B. (2016) A Review on Alternative Gold Recovery Reagents to Cyanide. Journal of Materials Science and Chemical Engineering, 4, 8-17

[82] Laitos, J. (2013) Cyanide, mining and the Environment. Volume 30 Pace Environmental Law Review

Name	Description	Current status / potential
		bromide and nitric acid) also present safety risks
Aqua regia	A mixture of concentrated nitric and hydrochloric acid creating a strong chemical dissolver. Neither of the two acids alone are able to dissolve gold, but a mixture of ¼ nitric acid and ¾ hydrochloric acid is able to. The powerful oxidising nitric acid dissolves gold, forming trivalent gold ions. The dissolved gold ions react with chloride ions provided by hydrochloric acid to form tetrachloroaurate anions. Extraction rates up to 100% can be achieved. It is not an efficient alternative reagent to cyanide however due to its extreme corrosivity characteristic and chemical instability. It is used only in small and medium scale processes in gold refining. A further disadvantage is the loss of silver by formation of silver chloride (AgCl).	Not feasible in large scale applications due to toxicity, corrosivity and instability of the reagents (nitric and hydrochloric acids).
Bromine and iodine	Two further halide leaching reagents with a similar dissolution reaction to chlorine are bromine and iodine. These reagents are strongly oxidising and exhibit higher dissolution rates to cyanide leaching. The systems do present lower environmental toxicity than cyanide. Due to difficult handling and high reagent costs, bromine and iodine have not been used industrially. Bromine and iodine processes are unstable, technologically more difficult and more costly to apply than cyanide processes.	Not used due to difficult handling and high reagent costs. Not feasible in large scale applications.
Chlorination	Chlorine dissolves gold in aqueous solutions by formation of soluble chloride complexes. The dissolution of gold occurs in two stages: Au(I) chloride forms during the first stage on the gold surface and then $AuCl^-$ forms during the second stage. These chlorides diffuse into the solution as $AuCl^-$ or oxidise further to $AuCl^-$ which is more stable, depending on the oxidising potential of the solution. An advantage of chlorination is the high dissolution rate compared to alkaline cyanide leaching due to higher solubility of chlorides in water. However, the processing of silver and lead containing minerals in the ore with chlorine is problematic because of the formation of insoluble chloride layers on the gold surface causing a loss in metal recovery. Another disadvantage is the difficult handling of the strongly corrosive chlorine solution and the need for a closed reaction containers due to the formation of chlorine gas. The process needs	Not adaptable for large scale operations. Economically unfavourable compared to cyanide leaching. Dundee Sustainable Technologies has however built a demonstration plant for a closed-circuit chlorination process, with no liquid or gaseous effluents and inert, stable residues.

Name	Description	Current status / potential
	acidic conditions hence it is generally combined with different acidic reagents. Dundee Sustainable Technologies has reported a patented closed-circuit chlorination process that has advantages of, recycled reagents, no liquid or gaseous effluents (hence no pond requirement) and inert, stable residues. The process operates at atmospheric pressure and ambient temperature and uses bromine as a catalyst. The process tolerates base metals and is suitable for preg-robbing83 and refractory ores. The process is reported to have similar process costs to cyanide-based reagents and 10-15% lower capital costs. Extraction yields are >90% (and above 95% in most cases) and has been demonstrated using pilot plant on whole ore and concentrates. There is the potential for reduced site rehabilitation due to a smaller footprint (no tailing pond required, smaller plant). A 15 tonne per day demonstration plant is operational in Thetford Mines, Canada.	
Coal-oil agglomeration	Coal-oil-gold agglomeration (CGA) is a potential alternative to cyanide for large-scale and small-scale (i.e. artisanal) operations. However, CGA is only effective at removing free gold particles (i.e., those within alluvial deposits and some process tailings) hence it has limited potential for large-scale operations and those processing refractory ores (i.e. those ores processed in Europe). The process is reported to be quicker, cleaner, and more effective at removing free gold particles than cyanidation.	Only effective for removing free gold particles. Not effective for use with refractory ores.
Di-thiooxamide	In 2010 Anglo Operations Ltd patented a process using di-thiooxamide. The process contacts gold in the leach slurry or solution with a ligand selected from dithiooxamide (rubeanic acid), or a substituted dithiooxamide. Gold leached can then be adsorbed onto activated carbon. Tests have shown that the dithiooxamide ligand is selective for gold and other precious metals over the other constituents of the ore. The process presents advantages of potential low toxicity but chemically effective ligands and easy elimination of the ligand from waste solutions by adjustment of effluent liquors to broadly neutral pH ranges, under which conditions the solubility of the ligand is extremely low. Whilst a patent has been registered, no further development is known for this process.	Low toxicity but chemically effective ligands. Easy elimination of the ligand from waste solutions to achieve low solubility. Patented but no further development known.
Glycine	Currently in the research stage, glycine (an amino acid) has been used as a leaching agent	Currently under research. No

[83] Preg-robbing ores are those that contain organic carbon. Such ores may adsorb dissolved gold-cyanide complexes when using cyanide leaching which are then lost in the refining stage.

Name	Description	Current status / potential
	followed by activated carbon adsorption of the gold-glycine complex as per cyanide-gold complexes. Following gold removal, the glycine can be recovered and reused throughout the lifetime of the mine. At the end of life, the glycine is biodegradable. Glycine is low cost and operates 23-60 Celsius. Process times are slower than cyanide although tests at high pH (10-11) have resulted in increased gold leaching rates. The process is suitable for copper-gold ores using staged extractions and as glycine is alkaline, is suitable for extracting gold from alkaline ores such as dolomite. Ores do not require milling (reducing energy costs). Commercial scale process are not expected until at least 2017.	commercial scale trials reported.
Haber gold process	The Haber Gold Process (HGP) is reported to be cost effective, non-toxic and able to avoid the release of heavy toxic metals from processed ores. The HGP extracts gold from ores by dissolving gold into water followed by recovery. A variety of ores are reported to be possible to process (e.g. oxide and sulphide ores). The process is effective at removing micro-fine gold particles. Tests have shown that the HGP can recover more gold in less time than cyanide leaching processes, with a cost comparable to, or less than, that associated with cyanide leaching processes. However the HGP must be continually adjusted according to the unique properties of each ore body consequently, it may not be practical for many mineral deposits. No examples of use for operation at high-volume mines are reported.	Currently under research. No commercial scale trials reported.
Thiocyanate	The thiocyanate ion is an alternative less harmful leaching reagent to cyanide. Gold in an aqueous thiocyanate solution forms stable Au(I) and Au(III) complexes. The optimum leaching conditions for thiocyanate can be obtained by combining with an oxidising agent such as iron (which acts as a catalyst), in acidic conditions (pH of two) and an elevated temperature. At optimal conditions a gold extraction yield of 95% can be obtained with thiocyanate. Tests have shown that thiocyanate leaching can perform comparably to cyanide. Thiocyanate has also been shown to be more effective than thiourea and more stable than thiourea and thiosulphate. The use of thiocyanate is reported to be still at the experimental stage.	Not adaptable for large scale operations. Economically unfavourable compared to cyanide leaching. At the experimental stage.
Thiosulphate	Thiosulphate is an alternative leaching agent that causes fewer environmental impacts and is also capable of dissolving gold. Gold dissolution occurs in a neutral medium in the presence of oxygen: The dissolution rate of	Feasible but not widely used due to higher reagent cost and lower gold extraction rate.

Name	Description	Current status / potential
	gold with alkaline thiosulphate is relatively slow but can be increased with an increased reagent concentration and process temperature. Addition of dissolution catalysts (copper and ammonia) increases the rate of dissolution. However, to obtain an adequate leaching yield a high reagent consumption is necessary consequently, thiosulphate is more costly than cyanide. Extraction rates are also lower. Thiosulphate is a more effective lixiviant of preg-robbing and high-copper ores than cyanide due to lower sensitivity than cyanidation to contamination by unwanted cations. Thiosulphate is appropriate for the treatment of high grade gold concentrates and also for in-situ leaching in deep mines and for use in treating gravity separated concentrates (particularly concentrates with high cyanide soluble copper). The gold-thiosulphate complex is more difficult to extract from solution than gold-cyanide complexes and the typical carbon-in-leach or carbon-in-pulp adsorption circuits used for cyanide cannot be used. In their place, strong base ion exchange resins are used to which the gold-thiosulphate adsorbs. There remain technical difficulties related to then removing the gold-thiosulphate complexes from the resins. The process has a commercial, full-scale application at the Nevada Goldstrike mine in the US but may not be suitable for all gold extraction processes and ores due to production costs.	Potential for reduced environmental risks. Economically unfavourable compared to cyanide leaching. Has been used in commercial full-scale applications in the US.
Thiourea	Thiourea is a potentially effective gold dissolution reagent in terms of extraction rate, yield and environmental aspects. In acidic solutions it forms an anionic complex to dissolve gold. A gold extraction rate of 99% can be achieved at optimal conditions (low pH of 1-2, presence of oxygen and iron as an oxidant). Other advantages to cyanide are a low sensitivity to base metals and sulphur containing calcines, together with gold recovery from preg-robbing ores. It can also be used on refractory ores otherwise resistant to cyanide and in heap and in-situ leaching processes. Health issues are less critical. The main disadvantage of thiourea is its high cost linked to high consumption during the process due to reagent loss through oxidation and limited recyclability. Also, detoxification costs are typically high. Gold recovery from	Feasible but not used to high reagent use and associated cost. Has potential for use with preg-robbing and refractory ores resistant to cyanide. Potential for reduced environmental risks. Testing has reported that combination of thiourea, thiocyanate and ferric sulphate reduces the thiourea consumption and hence may increase commercial viability.

Name	Description	Current status / potential
	the thiourea-gold complex are often difficult to control and require further development. Testing has reported that a mixture of thiourea, thiocyanate and ferric sulphate reduces the thiourea consumption and hence may increase commercial viability.	No commercial scale trial reported.
YES process	The YES-process was patented in 1995 by YES Technologies. It is a cyanide-free, bio-catalysed leaching process utilising a bisulfide-leaching agent. The leaching agent is less toxic than cyanide. Preliminary test results suggest that the chemical reagent costs associated with the YES-process could be 80% lower than with cyanide operations. 75% gold extraction has been achieved using two-stage leaching experiments. The process remains at experimental stage.	Currently under research. No commercial scale trials reported.

From the information assessed, it is clear that cyanide-based gold extraction remains the dominant technology. Alternative reagents have been tested and have been developed to commercial scale however, the appropriateness and applicability of alternative reagents and processes is governed by ore types and alternative reagents are not without their own technical, environmental and economic issues.

The alternative reagents that may present the best opportunities for cyanide-based technologies would appear to be the following:

- **Thiosulphate**. The use of thiosulphate is feasible but not widely used due to higher reagent costs and a lower gold extraction rate. The process has a lower environmental impact risk than cyanide-based processes. Thiosulphate is a more effective lixiviant of preg-robbing and high-copper ores than cyanide and has been used in commercial full-scale applications at the Nevada Goldstrike mine in the US;
- **Chlorination** –the Dundee Sustainable Technologies closed-circuit process. Whilst traditional chlorination processes are not adaptable for large scale operations and are economically unfavourable compared to cyanide leaching, Dundee Sustainable Technologies has developed and patented a process and operated a demonstration plant for a closed-circuit chlorination process that generates no liquid or gaseous effluents and an inert, stable residue. The process is flexible in terms of ore types (tolerates base metals, suitable for preg-robbing and refractory ores) and is reported to have similar process costs and lower capital costs to cyanide-based processes. Full scale, commercial operations have yet to be developed;
- **Alpha-cyclodextrin**. Currently at laboratory scale testing, this starch-derived reagent presents a possibility of gold extraction with benign waste products relative to cyanide-based processes. Considerable further research and piloting is required however of this potential reagent before a clear conclusion of its commercial potential can be made; and
- **Thiocyanate**. Tests have shown that thiocyanate leaching can perform comparably to cyanide however, the use of thiocyanate remains at the experimental stage, and presently is not adaptable for large scale operations and economically unfavourable compared to cyanide leaching.

That cyanide-based technologies remain the dominant technology is reflected in Laitos, J. (2013)[84] which commented that "Until further research or technological breakthroughs makes one or more of the above alternatives[85] to cyanide economically competitive, technologically feasible, and environmentally safe, cyanide leaching will remain the only practical method for large scale gold extraction processes;"

5.2.4 A ban on cyanide technologies?

Bans on the use of cyanide in gold ore processing are in place in the Czech Republic and Hungary[86]. The European Parliament voted for a resolution on the ban on the use of cyanide mining technologies in the EU[87] in 2010. In response, the European Commission, in an answer provided by Commissioner Potočnik, concluded that a general ban of cyanide in mining activities was not justified from environmental and health points of views. The response noted that existing legislation (i.e. Directive 2006/21/EC) included precise and strict requirements ensuring an appropriate safety level of the extractive waste facilities and that the limit values for cyanide storage as defined in the Directive were the most stringent possible and implied in practice a destruction step of cyanide used before its storage. The response went on to note that due to the lack of better (i.e. lower environmental impact) alternative technologies, a general ban on cyanide use would imply the closure of existing mines operating in safe conditions. Furthermore, the Commission's response stated that this would be detrimental to employment without additional environmental and health added value.[88]

In reviewing the availability and the status of commercial application of alternatives to cyanide-based technologies, there does not appear to be a clear alternative that can replace cyanide-based technologies as BAT at the present time[89]. This is supported by comments at the stakeholder workshop (see section 3.3) that no further alternatives to those already identified (i.e. those set out above) were noted to be available; it was also remarked that some of the alternative reagents present similar or greater environmental risks than cyanide.

There has not been a significant material change in the application and use of alternatives to cyanide-based technologies since the 2010 response from the European Commission, hence it can be concluded that introduction of a ban would still imply the closure of existing mines. Whilst monitoring of developments in technologies should continue, a focus on the full application of the Directive by the Member States should be a priority to ensure that mines using cyanide technologies continue to operate in a safe condition.

5.3 Stability of waste management facilities

5.3.1 Impacts of stability issues from extractive waste facilities

The most common approach for managing wastes from extractive industries is to contain and collect them at the point of production and treat them on-site or near the site. Whilst 'waste facility' in the understanding of the EWD means any area designated for accumulation or deposit of extractive waste (solid, liquid, or in solution or suspension) for a defined time period, this section focuses on heaps and ponds, and the dams or other structures serving to contain, retain, confine or otherwise support them.

[84] Laitos, J. (2013) Cyanide, mining and the Environment. Volume 30 Pace Environmental Law Review

[85] Thiocyanate, thiosulphate, thiourea, coal-oil agglomeration, Haber gold process and YES process were reviewed.

[86] Roth (2010), Mines and Communities (2001), European Commission (2013)

[87] European Parliament resolution on the ban on the use of cyanide mining technologies in the EU. 2010. http://www.europarl.europa.eu/sides/getDoc.do?type=MOTION&reference=B7-2010-0240&language=EN

[88] Parliamentary questions, 23 June 2010, P-3589/2010, Answer given by Mr Potočnik on behalf of the Commission. http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=P-2010-3589&language=EN

[89] This is supported by the European Parliamentary Research services Study by E. Falck (2017) that did not report commercially available non-cyanide based technologies.

Major potential risks associated with such facilities, in particular heaps and ponds, include loss of structural integrity. Their collapse can have short-term and long-term effects. Typical short-term consequences include according to the 2009 MTWR BREF are:

- Flooding;
- Blanketing/suffocating;
- Crushing and destruction;
- Cut-off of infrastructure;
- Poisoning; and
- Casualties.

Potential long-term effects include:

- Metal accumulation in plants and animals;
- Contamination of soil; and
- Loss of animal life.

The stability of existing facilities is of concern and related incidents of dam bursts were an explicit motivation for the EU to start elaborating Communication COM(2000) 664 final "Safe Operation of Mining Activities: A Follow-Up to Recent Mining Accidents", which in turn built the starting point for the development of the EWD.

A 2001 report drafted by The ICOLD Tailings Dams Committee, with the intent of determining the causes of tailing dam incidents, concluded that lack of control of the water balance, lack of control of construction and a general lack of understanding of safe operations were amongst the main causes of failure and incidents[90]. In 2010, an investigation into 18,401 mine sites and 218 tailings dam accidents identified the main causes of recent dam failures as being unusual weather, poor management and seepage. Slope instability and structural defects were other less frequent causes of failure.[91] Most recently, ICMM has published a report with the aim of determining how best to minimise the risk of a recurrence of such a catastrophic dam failure, to this end consulting with its members. The report[92] points out that:

> "If one were to focus on [the histories of three recent accidents of foundation and in dam failures respectively, among this the Samarco facility incident in 2015] in isolation and ask the question "what needs to be done in order to prevent a recurrence" then the answer might be as follows: for all tailings facilities a comprehensive understanding of the properties and behaviour of the foundation and in slope materials upon which the stability of the facility relies is required. These properties and behaviours should be assessed by a competent engineer who should also develop designs and mitigation measures to ensure that adequate stability is achieved over the full life of the facility. A formal review of the dam stability should be carried out before any changes in the dam section or construction method are implemented. The review should include a restatement of the critical operating criteria and constraints imposed by the dam section and method of operation."

The number of major incidents continues to occur at an average of about two per year worldwide [93:]

[90] International Commission on Large Dams, Committee on Tailings Dams and Waste Lagoons (ICOLD), (2001) Tailings Dam, Risk of Dangerous Occurrences, Bulletin 121, Paris: Commission Internationale des Grands Barrages.

[91] Azam, S. and Li, Q. (2010). "Tailings dam failures: a review of the last one hundred years." Geotechnical News 28(4): 50-54.).

[92] http://www.icmm.com/tailings-report (Dec.2016)

[93] http://www.wise-uranium.org/mdaf.html the list contains since entering into force of the EWD two events from EU Member States: One case from Sotkamo, Finland (2012), and the Ajka case in Hungary (2010).

- In line with the criteria of that source, two events from EU Member States have occurred since entering into force of the EWD (one case from Sotkamo, Finland (2012), and the Ajka case in Hungary (2010));
- It is recalled (see in detail section 4.2) that according to the information identified by the Commission during 2008-2016, at least some seven events have occurred.
- In addition to the above mentioned events, a number of documented tailing dam incidents – apparently not reported under the EWD – have been researched within the framework of a 2015 study[94].

Table 5.5 Incident type and location

Country	Number of records	Type	
		Failure	Accident
UK	12	9	3
Spain	5	3	/
Bulgaria	3	3	
Germany	2	/	/

Note: "Incident": indicating breach of the dam and loss of process water or tailings; "Accidents": indicating repairs made to the dam with no loss of process water or tailings. Note there are some "Unknown" incidents comprising events that were known at a location and date, but with no failure/accident information. No information was available on the type of extractive sector from which waste originated.

5.3.2 Stability issues addressed by the Extractive Waste Directive

Stability of waste management facilities is addressed by the EWD on several occasions:

- Taking into account the consequences of lack of stability is a one of the criteria for determining whether a facility is Category A: ("A waste facility shall be classified under category A if - a failure or incorrect operation, e.g., the collapse of a heap or the bursting of a dam, could give rise to a major accident, on the basis of a risk assessment […]"); and
- Implicitly, the stability of facilities is addressed within the standard for operation as of Article 4(2) ("Member States shall ensure that the operator takes all measures necessary to prevent or reduce as far as possible any adverse effects on the environment and human health brought about as a result of the management of extractive waste. This includes the (…) the prevention of major accidents involving that facility and the limiting of their consequences for the environment and human health."). In this context, Article 4(3) stipulates that "The measures referred to in paragraph 2 shall be based, *inter alia*, on the best available techniques, without prescribing the use of any technique or specific technology, but taking into account the technical characteristics of the waste facility, its geographical location and the local environmental conditions." In addition, Art. 21 provides for an obligation on Member States to ensure that competent authorities follow or are informed of developments in BAT. Consequently, BAT were elaborated in the 2009 MTWR BREF (see below).

Further provisions of EWD directly pertaining to stability are:

- Ensuring the long-term geotechnical stability of dams and heaps rising above pre-existing ground surface is consequently, according to the EWD part of the Waste

[94] Goodwin, S., MWH Americas Inc. & Collins, F. (2015). The role of water management in tailings dam incidents,

Management Plan, to be developed for all facilities under the EWD (not only Category A facilities), and part of the application for a permit (Article 7(2) (c) EWD). Thus, the state of implementation regarding Waste Management Plans (see section 4.3) and application and permitting procedure (section 4.4) are directly relevant for the issue of stability;

- In the context of construction of new, or modifying existing, waste facilities, Article 11(2) of the Directive requires that the operator ensures that the waste facility is suitably constructed, managed and maintained to ensure its physical stability; and
- In case of any events affecting the stability of the facility, the operator has to notify the competent authority of these events (Article 11(3) EWD), see directly below.

5.3.3 2009 BREF Best Available Techniques for monitoring stability and practice in Member States

Whilst a number of parameters of the currently valid MTWR BREF (2009) are relevant for the issue of stability, this is particularly the case for those dealing with monitoring stability where BAT is described in the table below.

Table 5.6: BAT for monitoring stability

BAT for monitoring stability
Monitor in a tailings pond/dam the water level
Monitor in a tailings pond/dam the quality and quantity of seepage flow through the dam
Monitor in a tailings pond/dam the position of the phreatic surface
Monitor in a tailings pond/dam pore pressure
Monitor in a tailings pond/dam movement of dam crest and tailings
Monitor in a tailings pond/dam seismicity, to ensure stability of the dam and the supporting strata
Monitor in a tailings pond/dam dynamic pore pressure and liquefaction
Monitor in a tailings pond/dam soil mechanics
Monitor in a tailings pond/dam tailings placement procedures
For tailings pond/dam, carry out visual inspections
For tailings pond/dam, carry out annual reviews
For tailings pond/dam, carry out independent audits
For tailings pond/dam, carry out safety evaluations
Monitor in a heap: bench/slope geometry
Monitor in a heap: sub-tip drainage
Monitor in a heap: pore pressure

BAT for monitoring stability
For heaps, carry out visual inspections
For heaps, carry out geotechnical reviews
For heaps, carry out independent geotechnical audits

As part of the statistical inquiry, Member States have been asked to provide information to what extent BAT is part of the permit. The responses show a diverse picture:

- In the responses of several Member States, the respective column is left blank for all submitted locations, and thus no information in this respect is provided (Belgium, Denmark, Ireland, Slovakia);
- In other Member States, information on BAT is indicated for all facilities (Bulgaria, Estonia, Hungary, Malta). The techniques in the table above are mentioned in 6% of the cases, referring mostly to visual inspection, monitoring and geotechnical reviews for heaps, or visual inspection and annual reviews for tailings; and
- For the remaining Member States, BAT is indicated for some locations while not for all. The techniques in the table above are mentioned in approximately 6% of the cases, with the most common being the ones mentioned in the previous bullet point alongside monitoring the quality and quantity of seepage flow (tailings), monitoring the position of the phreatic surface (tailings), monitoring pore pressure (tailings, dam, heap) and monitoring of position, slope and movements (tailings and heaps).

More difficult to assess on the basis of the statistical inquiry is the question of BAT applied in practice. Conclusions or trends on BAT mentioned in MS replies cannot be derived based on data format provided by MS given the range/variety of answers.

5.3.4 Further development of the BREF

The current MTWR BREF was published in 2009, with most of the work performed in the time period 2001-2004 and the Commission has launched the process of reviewing and adapting the MTWR BREF by the end of 2017. The current work in progress draft dated September 2016 features "BAT conclusions". With respect to monitoring, the current draft lists the following two BAT conclusions:

- To control the physical stability of the extractive waste facility, BAT is to monitor certain parameters (including most of the 2009 BREFs cited above, but developing this list further) at least with [a further individually specified] frequency and to carry out inspections, reviews, audits and safety evaluations at least with the [individually specified] frequencies; and
- To control the extractive waste facility physical stability, BAT is to develop a stability monitoring plan during the design phase and implement it during the construction and operational phases.

5.3.5 Implications

The following shortcomings have been identified:

- Information from Member States does not allow for a definitive statement on how BAT is applied during permitting regarding stability issues. In particular, we have limited information as to the intervals for monitoring of different parameters; and
- Besides the aspect of permitting, all impacts of practical control and enforcement of permitted operating conditions that are discussed in section 4 apply here.
- Re-defining the approach of EWD in terms of BAT conclusions: One weakness is that although Member States are to ensure that competent authorities follow or

are informed of developments in BAT, mechanisms comparable to those of the IED are not in place[95]. Lacking this automatism, one can assume that standards may be applied and enforced in a less consistent way, although impacts from extractive waste facilities may be comparable with those from other industrial installations. In this respect, an ambitious option would be proposing an amendment to the Directive, introducing a mechanism of making BAT conclusions part of each permit comparable to the approach of the IED.

5.4 Reprocessing of extractive waste

Member States competent authorities were approached to gather information on policies and practices regarding the reprocessing of extractive waste. The aim was to gain an understanding of the national practices adopted to encourage the recovery of extractive waste by means of recycling, reusing or reclaiming such waste, where this is beneficial in accordance with existing environmental standards at Community level and with the requirements of the EWD where relevant.

Responses were received from 22 Member States (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovenia, Spain, Sweden and the UK).

Information was requested on the following:

- Existing policies or strategies aimed at encouraging the reprocessing of extractive waste;
- Examples of good practice with regard to the reprocessing of extractive waste;
- Examples of obtaining economic value from 'historic' extractive waste through reprocessing/recycling; and
- Examples of good practice in managing and mitigating environmental liabilities from extractive activities.

5.4.1 National policies and practice

Out of the Member States providing responses, four Member States (Belgium, Bulgaria, Ireland and Sweden) have indicated that a dedicated strategy (or guidance) has been adopted on reprocessing waste from the extractive industry. However, these are often quite brief, in some instance, comprising simply a statement encouraging the reuse or reprocessing of extractive waste. In addition, for nine Member States (Austria, Croatia, Czech Republic, Estonia, Germany, Italy, Malta, Poland, Romania and Spain) while there is no dedicated policy, relevant provisions are included as part of the wider national policy on waste or resource efficiency.

Furthermore, three Member States indicated that no strategy was adopted because there is little or no mining activity, this is the case for Denmark, Latvia and Luxembourg. Cyprus, Hungary and the UK do not appear to address extractive waste reuse specifically.

Hungary added that reusing waste heaps is considered to be a mining activity which must be authorised by the competent authority. Furthermore, the Hungarian Office for Mining and Geology has commissioned the Hungarian Geological and Geophysical Institute to prepare an assessment to identify the quality, quantity and the possible exploitation options of the secondary raw materials in the extractive waste facilities.

[95] i.e. under IED regime, permits for installations covered by the Directive need to describe conditions based on the application of BAT, in particular limit values for emissions to air, water and land. The Commission organises an exchange of information between experts from the EU Member States, industry and environmental organisations ("Sevilla process") on BAT, which results in the adoption of "BAT conclusions" (Commission Implementing Decisions) as part of larger BREFs, which are published by the Commission. The BAT conclusions have to be used by competent authorities as the reference for setting permit conditions, becoming part of the reference standard for permits (Article 14(3) IE Directive). Existing installations have to comply with the BAT conclusions within four years after publication of the BREF (Article 21(3) IE Directive)

The table below presents the information reported as relevant by Member States, note that in several instances, links to the national legislation were provided which does not provide many details on reprocessing extractive wastes. This seems to indicate that reprocessing of waste is not considered as an activity deemed of being singled out in several of these Member States and as such relevant information is a bit more difficult to identify.

Table 5.7 Overview of legislative provisions relevant for reprocessing of wastes in Member States

Member State	National provision reference	Detail of the national provision
Austria	▪ Minerals Strategy[96]; ▪ Mining Act (BGBl. I Nr. 38/1999 last amendment with BGBl. I Nr. 80/2015); ▪ Resource Efficiency Action Plan[97]; and ▪ Resource Use in Austria - Report 2015[98]	1 – A strategy for raw materials has been adopted in Austria in 2012, which includes securing long-term access to local resources, fair and non-discriminatory access to resources on world makers and efficient handling of raw materials through increase of resource efficiency and improvement of recycling. 2 – The national Austrian legislation transposing the EWD 3 – The initial resource efficiency action plan was adopted in 2012, it was replaced in 2016 by the RESET 2020 action plan. The plan has a section dedicated on sustainable raw material management however it does not explicitly refer to extractive waste. 4- Detailed overview of resource use in 2015, mining and quarrying sector was the third sector in terms of size of domestic material input, following chemicals and construction sectors. None of the documents refer to reprocessing of mining or extractive wastes.
Belgium	▪ Order of the Walloon Government of 14 June 2001[99]; and ▪ Order of the Walloon Government of 9 May 1985[100].	1 – This order foresees the recovery of extractive waste according to their type in the following applications. For example, topsoil and loose rock which are unpolluted can be used for backfilling operation, development works in urban sites, reclaim work of polluted sites; calcareous dust can be used as souring agent in chemical industry and flocculating agent in water treatment industry. Other unplanned used can be authorised providing it is demonstrated that the intended reuse will not give rise to environmental pollution or harm human health. 2 - This order focuses on valorisation of coal spoil heaps and the spoil heaps and classifies them in three categories: ▪ heaps which can be reprocessed without any further condition; ▪ heaps which could be reprocessed provided the fact that a study demonstrates that this process will not impact environment; and

[96] http://www.bmwfw.gv.at/EnergieUndBergbau/Rohstoffstrategie/Seiten/default.aspx

[97] https://www.bmlfuw.gv.at/dam/jcr:9c16665c-078a-4709-9752-771179e7cde4/Ressourceneffizienz%20Plan.pdf and https://www.bmlfuw.gv.at/umwelt/nachhaltigkeit/ressourceneffizienz/aktionsplan_ressourceneffizienz_reset/reset2020_initiative.html

[98] https://www.bmlfuw.gv.at/umwelt/nachhaltigkeit/ressourceneffizienz/ressourcennutzung_daten_trends/ressourcenbericht15.html

[99] https://wallex.wallonie.be/index.php?doc=4723&rev=4020-2185

[100] https://wallex.wallonie.be/index.php?mod=voirdoc&script=wallex2&PAGEDYN=indexBelgiqueLex.html&MBID=1985023482

Member State	National provision reference	Detail of the national provision
		▪ heaps which cannot be reprocessed due to land development, urbanisation or environmental reasons.
Bulgaria	National Strategy for Development of Mining Industry (Appendix 6) [101]	Appendix 6 includes an overview of waste generated by mines by types of industry and present the distribution of facilities throughout the country. The strategy includes as a principle the importance of recycling and reusing raw materials.
Croatia	Ordinance on the management of waste from extractive industries OO 128/2008[102]	The legislation transposing the EWD which includes the promotion of recovery of waste by recycling or reuse.
Czech Republic	1- Act No. 157/2009 Coll. 2- Raw Material Policy of the Czech Republic in the area of Mineral Resources[103]	1 – The legislation transposing the EWD which includes the requirements of Article 5 of the Directive. 2 – The raw material policy includes provisions on the recovery of waste from the extractive industries, for example the use of raw materials from facilities such as waste dumps or tailing pond. The policy also encourage the efficient and sustainable use of available mineral reserves and strict protection of reserved mineral deposits.
Estonia	1- Waste act[104] 2- National Waste Management plan 2014-2020[105]	1 – National waste legislation transposing the requirements of the EWD 2 – The plan refers to extractive waste however provisions on specific reprocessing could not be identified
Germany	Waste Management Plan of facilities Raw Material strategy for specific lander (e.g. Saxon Raw Materials Strategy[106] and the Federal Raw Materials Strategy[107])	Strategies refer to strengthening the efficiency of raw materials extraction but also increasing the efficiency of raw materials extracting while supporting research and data management on the recovering of metals.
Ireland	Management of Waste from the Extractive Industries[108]	Describes the obligation of operators and authorities when dealing with waste from extractive activities.

[101] https://www.me.government.bg/bg/themes/nacionalna-strategiya-za-razvitie-na-minnata-industriya-1575-295.html
[102] http://narodne-novine.nn.hr/clanci/sluzbeni/2008_11_128_3674.html
[103] Not available yet as approval of the document is still ongoing
[104] https://www.riigiteataja.ee/en/eli/ee/520012015021/consolide/current
[105] http://www.envir.ee/et/eesmargid-tegevused/jaatmed/riigi-jaatmekava-2014-2020
[106] https://publikationen.sachsen.de/bdb/artikel/16194
[107] http://www.bmwi.de/Dateien/BMWi/PDF/rohstoffstrategie-der-bundesregierung
[108] http://www.epa.ie/pubs/advice/waste/extractive/Guidance-On-The-Waste-Management-Regulations-2009-WEB.pdf

Member State	National provision reference	Detail of the national provision
Italy	1- 2014 report on mining activities in Italy[109] 2- Guidance on the implementation of the EWD[110]	1 – Overview of the role of mining industries in the country including economic impacts. One chapter (4) is dedicated on reducing the extraction by increasing the reuse of inert waste. 2 – Guidance on definitions related to the EWD
Lithuania	Order for mining industry waste[111]	National legislation transposing the EWD
Malta	1- S.L. 549.50 Waste Management (Management of Waste from Extractive Industries and Backfilling) Regulations, 2009[112] 2- S.L. 549.63 Waste Regulations, 2011[113] 3- Waste Management Plan for the Maltese Islands 2014-2020[114]	1 and 2 – National legislation transposing the EWD 3 – Plan refers to the use of limestone waste quarried for the construction industry and the backfilling of waste into spent quarries for rehabilitation purposes.
Poland	National Waste Prevention Programme[115]	Presents good practice with regards to reducing waste, look specifically at waste generated by extractive industry in particular during the exploration, production and processing of ores and other minerals. The list of good practices include possible use / reuse of the waste.
Romania	Management policy declaration on efficient resources use[116]	Example of a statement of policy for health, safety and environment from a mining company.
Slovenia	Waste Management Programme of Slovenia[117]	The document covers extractive waste and notes that relatively few are generated in Slovenia. It indicates that extractive waste is usually used to refill excavation voids and for rehabilitation and construction material while ensuring the stability of deferred extractive waste, preventing the pollution of soil, surface water and groundwater and monitoring the sites.
Spain	1- Royal Decree 975/2009 from 12 June[118]	1 – The Decree transposes the Directive into national legislation and states that one of the

[109] http://www.legambiente.it/sites/default/files/docs/rapporto_cave_2014_web.pdf

[110] http://www.geologitoscana.it/contents/repository/documenti/lettura%20ragionata%20del%20D.Lgs.%2011 7_2008.pdf

[111] https://www.e-tar.lt/portal/lt/legalAct/TAR.B479E03BAB4F

[112] http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11564&l=1

[113] http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11514&l=1

[114] https://environment.gov.mt/en/document%20repository/waste%20management%20plan%202014%20-%202020%20-%20final%20document.pdf

[115] https://www.mos.gov.pl/g2/big/2014_10/a400f6bb998e8fbc1bc8451fe5c41b11.pdf

[116] http://www.hidroconstructia.com/rom/management.html

[117] http://www.mop.gov.si/fileadmin/mop.gov.si/pageuploads/zakonodaja/varstvo_okolja/operativni_programi/op_odpadki.pdf

[118] http://www.boe.es/buscar/pdf/2009/BOE-A-2009-9841-consolidado.pdf

Member State	National provision reference	Detail of the national provision
	2- National Plan Framework for waste[119]	objectives of the extractive waste management plan is to encourage the recovery of extractive waste through recycling, reuse or recovery. There are provisions detailing the conditions for this reuse (see art 36) 2 – Chapter 17 of the National Plan focuses on extractive waste and inter alia encourage the recycling and valorisation of waste, promote research on new use for waste from extractive industry.
Sweden	1- General strategy for extractive minerals [120] 2- EPA strategy on long-term management of extractive waste [121] 3- Guidelines on reusing extractive waste for construction projects[122]	1 – General strategy document for sustainable use of minerals in Sweden 2 – The Environmental Protection Agency and the Swedish Geological Survey are working on a strategy on the management of extractive waste, taking into account the assessment of costs and remediation measures. This is expected in April 2017. 3 – Guidance handbook on facilitating the recycling of waste in construction. It foresees that municipality is to be notified of reuse of waste only when there is a risk of contamination. The guidance includes information on how to establish the risk of contamination.
UK	Environmental guidance on permitting[123]	General guidance on permitting of installations including those involving extractive waste.

5.4.2 Permitting

From analysis of information returned by Member States regarding permitting as part of this study, a narrow range of waste reprocessing was observed (waste reprocessing was noted on only approximately 15% of permits). The approaches recorded fell into the following broad categories:

- Reuse of waste rock: for roads, backfill of underground and surface mines (both within and outside the permitted site) and construction of dams, embankments and harbours;
- Reuse of impermeable materials (e.g. clay) for dam and landfill linings;
- Grading of waste rock suitable for use as aggregate;
- Use of overburden earth for noise barrier construction and landscaping;
- Use of (clean, uncontaminated) tailings for soil enrichment;
- Use of magnesite tailings in the steel industry;
- Extraction of phosphorous from tailings (under investigation);
- Extraction of primary sulphur not previously extracted (under investigation); and
- Reuse of process water.

119 http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/planes-y-estrategias/pemaraprobado6noviembrecondae_tcm7-401704.pdf
120 http://www.regeringen.se/rapporter/2013/02/n2013.02/
121 http://www.naturvardsverket.se/Miljoarbete-i-samhallet/Miljoarbete-i-Sverige/Regeringsuppdrag/Strategi-for-hantering-av-gruvavfall/
122 http://www.naturvardsverket.se/Om-Naturvardsverket/Publikationer/ISBN/0100/978-91-620-0164-3/
123 https://www.gov.uk/government/publications/environmental-permitting-guidance-core-guidance--2

It can be observed that the information returned focussed mainly on the reuse of waste rock and overburden for construction related purposes and only a limited number of secondary extraction of minerals from tailings and waste was reported. This indicates that reprocessing activities are typically considered as being focussing on the productive utilisation of inert waste materials rather than on pursuing innovative reprocessing of waste and tailings to extract greater value associated with valuable substances and minerals.

5.4.3 Case studies of selected practice

Member States were asked to provide examples of good practice on reprocessing of extractive waste. A total of six case studies were identified based on the information reported by Member States, these are presented in the boxes below.

Reprocessing of limestone in oil shale quarry

Member State
Estonia

Stakeholders
Eesti Energia[124]: mining operators, producers and sellers
Ahtme Killustik[125], Viru Keemia Grupp[126], Purustaja[127]: producers and sellers

Practice
Limestone layers in oil shale quarry reprocessed in limestone crushing plants as limestone gravels used for cement production.

History / background
Estonia has mineral resources such as oil shale and carbonate rock. It is the largest commercially exploited oil shale deposit in the world. Since 1980 the production has declined, from a peak of 30 million tonnes of oil shale to an average of 12-15 million tonnes per year. The shale mining is conducted in the North-East part of Estonia.

Activities / programme / description of the practice
The limestone layers located within the oil shale are considered to be a waste when they are moved out of the quarry. This characterisation is due to the fact that it is taken out of its environment and that it needs further treatment before it can be used. The limestone extracted is reprocessed. There has been an increase in the reprocessing due to the improvement of technologies and limestone crushing plants can produce up to 500 000 tonnes of crushed rock per year.

Benefits (environmental / cost / other)
Re-use of by-product of mining

Transferability
Limited, depending on presence of limestone in quarry.

BRAVO – Bauxite Residue and Aluminium Valorisation Operations

Member State
Ireland – University of Limerick coordinates the project and is supported by the Irish Environmental Protection Agency[128]

Stakeholders
30 stakeholders (private companies, SMEs, research organisations, NGOs and academic) involved in the aluminium value chain from extraction to recycling including for example Euromines, Ecocem, Rio Tinto and European Aluminium.

Practice
The BRAVO project has five core activity areas:

[124] https://www.energia.ee/en/killustik
[125] http://www.ahtmekillustik.ee/meie-tooted.html
[126] http://www.vkg.ee/
[127] http://www.purustaja.ee/killustik/
[128] http://bravoeip.eu/bravo-team-university-of-limerick/

1. Al-Ore: looking at optimising the alumina and aluminium manufacturing process to improve the sector competitiveness and European employment levels, with a focus on increasing the recyclability of the by-products including the red mud;
2. Al-Source: looking at using the bauxite residue (red mud) as a source of critical raw materials such as gallium, titanium, selenium, germanium, dysprosium and cerium;
3. Al-Build: looking at producing construction raw materials from red mud based on the residue from Al-Source activity;
4. Al-Chain: looking at developing a waste residue value chain building on the outputs of the three previous core activities; and
5. Al-Aware: focusing on raising public awareness, acceptance and trust on aluminium activities and management of red mud.

Background
Red mud is a by-product the Bayer process which is the bauxite refinement process used to create aluminium.

Activities
1. To boost the innovation capacity of the aluminium value chain with respect to secondary raw materials recovery;
2. To foster international co-operation among 30 key players ,their 54 members across the aluminium value chain from extraction to recycling;
3. The creation of new value chains for the recovered raw materials from by-products of the manufacturing process by collaboration and integration of downstream industries;
4. To test the viability of solutions and holistic processing concepts for secondary raw materials processing via pilot actions;
5. To mobilise a significant part of the aluminium value chain to increase the impact of research , innovations and achieve technology transfer both along the aluminium value chain and from parallel industries such as recycling;
6. To enhance the conditions of the raw materials value chain to optimise raw materials flows through improved cooperation of actors;
7. To promote socially acceptable, environmentally responsible and economically viable technologies; and
8. Waste as a resource: generation of a more valuable waste which can be processed to recover critical raw materials.

Benefits (environmental / cost / other)
Identifying ways to make use of the red mud which is environmentally damaging due to its alkaline content. The 2010 spill of red mud in Kolontar in Hungary led to the death of 10 people and contaminated a large area including the Marcal river.

Transferability
The aims of the project are to identify options for the whole aluminium value chain that can be replicated.

Reprocessing of flotation tailings

Member State
Poland

Practices
Further processing of extractive waste. In addition, aggregates are produced from the extractive wastes heap in the form of red shale.

Description of the practices
Poland described a range of practices, including:
1. Aggregates produced from extractive wastes are used in buildings and road construction or when conducting reclamation works on brownfield areas. For example, waste in the brown coal mine of Bełchatów are generated from aggregates and sand washing in amount from 15 000 to 40 000 thousand tonnes per year which is then used in backfilling operations[129];
2. Poland provided the example of the Zakłady Górniczo-Hutnicze Bolesław being constructed which is a flotation tailings processing plant. The installation will have a processing capacity of two million tonnes of waste per year and is located next to an extractive waste facility. The plant will use the flotation tailings deposited in the nearby extractive waste facility as input for treatment technology. The aim is to produce zinc concentrates from flotation waste. The plant was expected to start operation at the end of 2016 and it will be the first large scale installation of the secondary processing of tailings in Europe[130]; and
3. In opencast mining, overburden rocks are being stored and processed separately. Those that can bring economic benefits (e.g. clay, sand, gravel, and aggregates) are processed. [131]

[129] http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-article-BSL7-0043-0017
[130] http://zghboleslaw.pl/en/
[131] http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-article-BSL8-0016-0012

Reprocessing of flotation tailings

Benefits (environmental / cost / other)
Environmentally and economically justified[132].

Transferability
The practices described by Poland are transferrable.

Reprocessing of extractive waste from a closed mine in Spain

Member State
Spain

Stakeholders
Strategic Minerals Spain[133], mine of Penouta

Practice
Reprocessing of a closed mine's waste and reclamation of the site.

History / background
The mine's operations date from 1906 when shallow excavation of quartz was undertaken. Further operations started in 1965 and in the following six years approximately 700,000 tonnes of tin were extracted. The mine closed in 1985. In 2011, 2012 and 2013 surveys were conducted in the area. The surveys found that during the earlier operations of the mine, large amounts of tin and tantalum minerals were deposited in the floatation tailings. It was found that 8.8 Mt of minerals with grades of 450 g/t of tin and 45g/t of tantalum were present. These minerals are now valuable, in particular tantalum which is needed in many electronics devices such as mobile phones.

Activities
Processing of extractive wastes to extract tin and tantalum minerals. Further minerals available are clay, quartz, feldspar and mica. Strategic Minerals Spain was provided with the right to exploit the resource and which is expected to be an important source to meet Europe's tantalum needs[134]. The processing will be done through grinding of the ore, concentration of minerals and magnetic separation. It does not involve chemicals processing. Finally, water is being reused with 75% of water re-circulated.

Benefits (environmental / cost / other)
Recycling minerals available and future remediation of the mine site.

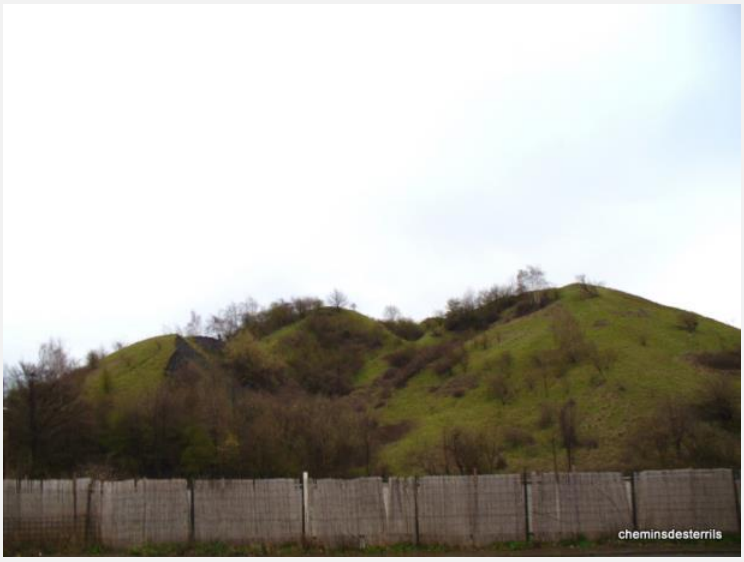
Reclamation of extractive waste disposals site in Belgium

Member State
Belgium

Practice
Two examples of reclamation of sites were provided. In Charleroi, old extractive waste heaps have been replanted and offer leisure spaces within an urban area. Reclamation was initiated in 1990 following the Rio Conference and the concern for the loss of biodiversity and green spaces. Belgium found that old heaps were rich with biodiversity and that unique ecosystems would develop.[135]

[132] http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-article-AGHM-0050-0021
[133] http://www.strategicminerals.com/nuestro-trabajo/penouta/
[134] http://www.euromines.org/files/publications/mining-journal-feature-december-2013-spain.pdf
[135] https://cheminsdesterrils.be/2010/12/12/les-terrils-dans-le-paysage/

Reclamation of extractive waste disposals site in Belgium



In Moha, the mining company Carmeuse has re-developed an old decantation pond of a limestone quarry and surrounding site into a natural reserve which welcome a range of biodiversity.[136] This was supported by the reclamation of the land, the planting of trees and of an orchard which includes apple trees, pear trees, cherry trees and plum trees. While a large range of bird and aquatic species have now been observed, the most surprising aspect was the increase of birds of prey that have nested in the abandoned cliff from the quarry.

Description of the practice
The local authority has adopted a programme for the development of these heaps. However it also recognised that some may contain some valuable resources that could benefit from being re-processed. Thus it distinguish**es** three categories of heaps:
1. Those that cannot be exploited;
2. Those that can be exploited; and
3. Those that need further investigation.

Once the heap is being registered as a 'natural zone of scientific interest' then the mineral exploitation cannot be resumed. The description of the steps taken by Carmeuse are part of the cessation of activities and end of production of the mining site.

Benefits (environmental / cost / other)
Providing recreational and green spaces for public enjoyment, providing biodiversity rich areas within urban areas**.** Demonstrating high level of site reclamation after mining activities.

Transferability
This practice is transferable to any comparable waste heap. Similarly, the steps taken by Carmeuse can be replicated by other companies.

Reclamation of a mine in Cumbria, UK

Member State
UK

Stakeholders.
The Environment Agency with the National Trust[137], Newcastle University, Coal Authority and Defra

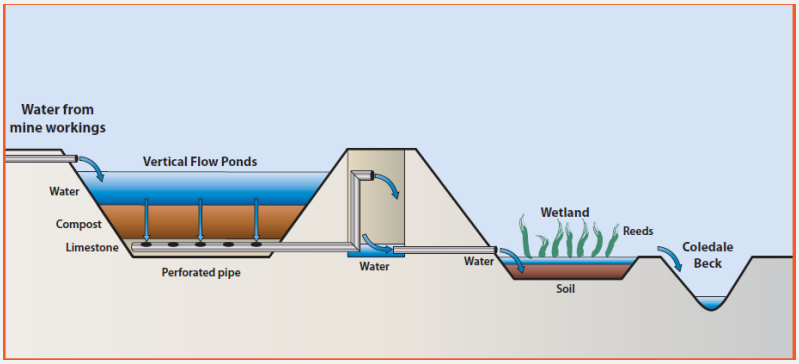
Practice
Reclamation of mining waters of a mining site, now owned by the National Trust and located in a sensitive environmental area.

[136] http://www.carmeuse-hemptinne.be/uploads/docs/Brochure%20CM%20BIODIVERSITY.pdf
[137] A charitable organisation that aims to preserve land, buildings and artefacts for the benefit of the nation.

Reclamation of a mine in Cumbria, UK

History / background
Force Crag mine was exploited for lead, zinc and barites between 1835 and 1991, during which time the workings discharged approximately three tonnes of metals each year into a watercourse. This resulted in significant pollution of surface water, with over 60 times the environmental quality standard (EQS) of zinc, and more than 40 times the EQS of cadmium. This had a major impact on over 10km of watercourse as well as Bassenthwaite Lake. Because of its historical value, the mine site is designated SSSI and Scheduled Ancient Monument, which placed additional constraints on the options available for remediation.

Description of the practice
A passive treatment of zinc was installed at Force Crag which is the first system in the UK to undertake such a process.
Similar systems are operating in the USA, but for plants that are considerably larger. Both the location and restrictions of Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI) designations imposed very strict size limits on the Force Crag treatment scheme. The passive treatment scheme relies on a mixture of 45% PAS100 compost, 45% woodchips, 10% digested sewage sludge. Bacteria reduce the sulphate in the mine water to sulphide that mops up all the metals which then accumulate in the compost. When the compost cannot take up any more metals, it is replaced and the metals recovered.



The scheme was designed by Newcastle University and built by the Coal Authority at a cost of nearly £1million. Work began on the Force Crag passive treatment scheme in September 2013, and it started operating in March 2014. After three years of scoping and feasibility study it took just six months to complete the build and has a low annual operating expenditure around £20k per year.

The photos below show the build progress from initial stages to completion of the vertical flow ponds.

Reclamation of a mine in Cumbria, UK

Benefits (environmental / cost / other)
The scheme has been found to make a significant difference to the environment, with water quality of the Coledale Beck significantly improved. The metals zinc, cadmium, and lead entering the beck have decreased by over 90% and the water in Bassenthwaite Lake, which is partly fed by the beck, is expected to rise to "good status" under the Water Framework Directive classification. The vertical flow ponds have succeeded in removing 95% of metals and based on this initial success, it is planned to explore the potential for the system to treat more of the audit flow without compromising performance of the reactor beds. The scheme is performing better than was anticipated and the benefits of cleaning up the Force Crag mine water are estimated to be £1.6m - £4.9m over 25 years, at a cost of ~£1.5m.

Transferability
Options to replicate this on other sites could be considered.

6. Conclusions

6.1 Information availability and quality

A variety of sources were used to gather information. Sources encompassed the results of the reporting from Member States on the implementation of the Directive for the second reporting period[138], engagement with stakeholders (industry, academia, NGOs), review of Member States' competent authority websites and direct engagement with Member States (including a data request on permit information and questionnaire on reprocessing of waste) and a broad literature review. In addition, initial findings based on these sources was discussed at a stakeholder workshop from which further views and information were recorded (see Appendix D). Section 3.2 presents a review of information collected and its quality. The following conclusions on information availability and quality can be made:

- **Member State implementation report information:** information varies between the reports provided by Member States presenting uncertainties regarding data robustness and reliability;
- **Consultation of NGOs:** two out of five NGOs responded to information requests. Information was limited in scope (e.g. Mining Watch Romania's focus was mostly on Romania) and representativeness (e.g. the EEB response was from two members, from the Netherlands and Germany). However, information did identify shortcomings in implementation useful for the analysis;
- **Consultation of trade associations:** one out of five trade associations responded to information requests. The response received from Euromines was highly relevant even if responses were generic and covered only specific Member States;
- **Engagement with mining experts:** responses were gathered from three particular experts and proved very useful in assessing the specific thematic areas of Category A installations, cyanide and stability of waste management facilities and also regarding technological developments in the sector and the cost of waste management, but more limited in relevance to assessing gaps in implementation;
- **Direct engagement with Member States – data request on permits:** 21 Member States responded to the data request. For those Member States where information was received, information was provided in some cases regarding the application of BAT measures applied, length of validity of permits, renewal period for permits and wider general data on the number of permits, status of the mines and materials being mined. Poorer information was provided regarding control measures and reprocessing practices in permits. The main limitation was EU wide comparability of the information reported;
- **Direct engagement with Member States – questionnaire on reprocessing:** sufficient information was available for the purpose of the analysis although not all Member States were represented and detail provided was variable;
- **Literature review:** more than 200 academic and scientific articles were reviewed together with information on Member State websites relating to the EWD. Quality and relevance varied according to sources and scope of the literature;
- **National legislation (including national guidance / national guidelines):** detail in the legislation varied according to Member State with some have detailed provisions and others relying on guidance or other regimes;
- **Statistical information from Eurostat:** data are available on waste generation from the 'Mining and quarrying' sector regarding a range of waste types; waste arisings tonnage being dominated by those classified as 'Mineral and solidified wastes';

[138] http://ec.europa.eu/environment/waste/mining/pdf/report_mining_waste.pdf

- **Information provided by Member States on events (Article 11(3) and 12(6) of EWD:** these reports were made available and assessed in the course of the review and analysis of the Member States report on the implementation of the EWD (BiPRO, 2016); and
- **Stakeholder workshop:** comments, observations and clarifications made at the workshop were valuable in understanding the views of Member States and other stakeholders regarding key issues on implementation and the need for the themes of any future guidance.

Overall, the availability and quality of information varied across the themes examined and between the sources used.

6.2 Summary of implications and potential solutions

6.2.1 Member State enforcement and control

The information available under the selected indicators was not complete and detailed enough to enable full assessment of how Member States are enforcing and controlling the application of the EWD however, the following can be concluded.

Inspectors (expertise and number)

According to Euromines, inspectors are well qualified in countries with a 'mining history', but this is not always the case in other Member States. The same source of information recommends the use of private independent certification/audit systems to complement inspectors from competent authorities as already in use in the UK and Ireland. Workshop stakeholders considered that there should be a minimum level of competence for inspectors carrying out facility inspections. Stakeholders highlighted that a variety of approaches are used regarding facility inspection (e.g. risk based inspections, self-assessment). Furthermore, stakeholders suggested clarifications regarding who does what and when in the inspection process and they considered the 2012 report on inspections[139] as a good basis for further work on EWD facility inspections. To this end, some stakeholders suggested that it may be beneficial to provide a checklist to enable consistent inspections to be achieved across Member States. Such a checklist would need to set out the principal questions/issues and account for different requirements (i.e. should consider proportionality) regarding Category A and non-Category A facilities and also inert and non-inert facilities.

Inventories of closed and abandoned sites

Member States have set up inventories of closed and abandoned sites[140], most of them available online. From the 21 Member States where the inventory of closed and abandoned sites is applicable, there are 17 inventories available online (AT, CY, CZ, EE, EL, ES, FI, FR, HU, IE, IT, PT, RO, SE, SI, SK and UK) and one is temporarily unavailable online (PL). It was not possible to confirm for three Member States (BE, BG, DE) whether they have an inventory. Based on the 18 Member States for which there is data available, 3,462 closed and abandoned waste facilities have been registered at national level by competent authorities. 1,027 out of the 3,462 facilities (30%) were in mines extracting metallic minerals. The rest that could be allocated were 3% non-metallic minerals, 2% fuels, 2% coal, 1% precious metals, 5% combinations. It was not possible to identify whether inventories are updated periodically[141], however the date when they were last updated was available in most cases and ranged from 2011 to 2017. There is limited information on how Member States select the closed facilities

[139] http://ec.europa.eu/environment/waste/mining/pdf/Annex2_guidelines_inspection.pdf

[140] The competent authorities of BE, BG, DE have been contacted to confirm whether an inventory exists, without success. HR, LT, LU, LV, MT, and NL stated that it was not applicable as either there were no facilitates in the Member State or that there were no abandoned sites. Although SI stated the same in its 2011-2014 implementation report, an inventory does exist and is available online.

[141] Save for Greece, however the inventory has not been updated every three years as intended.

pursuant to Article 20 of the Directive although some Member States stated that they had used the available guidance[142] to inform development of the inventory.

Cases of non-compliance

No detailed comparison between Member States can be achieved based on the reporting of non-compliance cases. To ensure that the reporting on non-compliance cases is more accurate and detailed, it may be relevant to gather more specific information (e.g. type of non-compliance, category of the facility, type of sanctions). This information could be considered in updated implementation reporting; it is noted that it is currently under consideration whether the triannual reporting format is best suited to gathering information on implementation.

Tests and sampling by competent authorities

The competent authorities do not carry out their own tests/sampling, but rely instead on the tests performed by companies due to limited financial and technical resources. Whether there are obligations on the operator of the extractive waste facilities to carry out tests and samples and to record them in view of inspections or to send them to the Competent Authorities is an issue that could be further investigated as part of the triannual reporting.

6.2.2 Accident prevention

After discussing and ultimately rejecting a number of different other possible indicators, it was decided to use the number of events reported by Member States as the main indicator. The number of reported events is low. This may be due to the effectiveness of the safety measures and thorough accident prevention planning both by operators and competent authorities under the terms of the Directive. However, a contrasting explanation may be that not all incidents of this kind are reported in accordance with the Directive.

Guidance for event reporting

It is possible that, to improve effectiveness and consistency of implementation of Directive requirements in this area, the planned guidelines on the implementation of the EWD could feature a specific section on reporting expectations of Member States in respect of events.

External emergency plans at Category A facilities

According to the available data, two thirds of the Category A facilities in the EU have an external emergency plan. This appears to be a gap in implementation. There are examples of Member States which have not yet prepared external emergency plans for some of the Category A facilities located in their territory.

6.2.3 Waste management plans

Firm conclusions on the implementation of requirements regarding WMPs are difficult to reach in the absence of sufficient data. However, the following solutions and measures may help support effective and consistent implementation.

Guidelines for operators and competent authorities

Guidance on the content of WMPs was identified in the UK and Ireland suggesting that guidance on this subject could be beneficial to promote consistency. Regarding verification that WMPs include all the elements listed in Article 5(3), nine Member States included provisions in implementing Regulations describing the minimum content of WMPs. This demonstrates transposition rather than actual implementation. As a result of this and feedback obtained at the stakeholder workshop, it was concluded that it would be useful for Member States to have best practices on extractive waste management plans, including illustrative waste management plans.

[142] Guidance document for a risk based pre-selection protocol for the inventory of closed waste facilities, prepared by the Inventory of closed waste facilities ad-hoc group (as sub-committee of the technical adaptation committee for Directive 2006/21/EC)

The issue of correct and consistent interpretation by operators and authorities of waste and facility classification requirements is critical as incorrect classification could result in Category A sites not being identified and also, WMPs not containing relevant information and safeguards and hence risks to humans and the environment being presented. Clear guidance on these issues could address this.

The issue of guidance regarding WMPs was discussed at the stakeholder workshop in March 2017 at which it was noted that the scope of any guidance should be determined following further engagement with Member States and if developed, guidance should be at a generic level and not attempt to address detailed (i.e. site or process specific) aspects. Furthermore, if good practice examples of WMPs are developed, such examples should include WMPs for both Category A and non-Category A facilities and the varying degrees of risk and size of facilities should also be considered to enable appropriate examples to be demonstrated; in addition, consideration of guidance for facilities in or nearing closure phase may also be important. Finally, some stakeholders would find it useful to implement clear and measurable criteria to evaluate the quality of waste management plans submitted by operators.

6.2.4 Application and permitting procedures

Based on information returns from Member States, 3,754 extractive waste permits were recorded across the EU as of July 2017. 3,228 (86%) were recorded as being operational, 460 (12%) in the closure / post closure phases and 66 (2%) were reported as not operational or unknown. Regarding products, of the 2,013 permits for which information was available, the majority (79%) related to non-metallic minerals and 10% to metallic minerals. The remaining permits related to coal, oil and gas, geothermal energy and 'exploration'. 1,739 (46%) permits concern inert waste, 518 (14%) permits concern non-inert waste and no information was provided for 1,497 (40%) permits. 90 permits (2%) related to Category A facilities with 95% confirming that they are not Category A and 2% with no data. Whilst more than one reason was sometimes noted for Category A classification, the majority (66%) were classified based on the Directive's Annex III first indent regarding the potential for a failure or incorrect operation potentially giving rise to a major accident.

Out of a total of 3,228 extractive waste facilities in operation, 234 (6%) had their permits renewed in the last 5 years (359 or 10% since the entry into force of the Directive). There are also 534 facilities (14%) that have not had their permits renewed, but which obtained the first permit after the entry into force of the Directive. 773 (24%) were granted a permit before the entry into force of the Directive. Information was not available for around half of the facilities in operation.

Information for this parameter was of mixed coverage and detail hence only indicative conclusions can be made.

Interlinkages between permitting regimes

Workshop participants requested some clarification of the interlinkages between EWD permits and other regimes (such as the Industrial Emissions Directive (IED) and Seveso) which could be addressed in guidance. Based on limited available information from Member States on extractive waste facilities permits and on Seveso permits, no significant overlaps between Seveso facilities and EWD facilities permits was identified, which may suggest that Member States are not always aware that both Directives must apply (with the exception of Article 6 of the EWD if the installation is also covered by Seveso).

Best Available Techniques

Based on information collected from Member States on permits, 2,595 note or make reference to BAT. Information collected differed depending on permits in Member States (e.g. where recorded, some permits recorded a single BAT and others 40) and a great amount of information was missing. Overall, it was not possible to derive clear findings from the information collected from Member States on application of BAT in permits

other than that information from Member States on this subject was often poor and inconsistent in what was reported as BAT.

Whereas the EWD requires Member States to ensure that competent authorities follow or are informed of developments in BAT, one weakness is that BAT may not necessarily always be followed during permitting and thus no uniform standards are applied and enforced, although impacts from extractive waste facilities may be comparable with those from other industrial installations. In this respect, an ambitious option would be proposing an amendment to the Directive, introducing a mechanism of making BAT conclusions part of each permit comparable to the approach of the IED.

With regard specifically to the use of cyanide and stability of dams and heaps, the available literature includes generic information on the application of BAT in the permitting procedures in relevant Member States. A total of 46 BAT were reported by the main gold producers in the EU in response to the information request to Member States. The BAT reported for gold mine facilities were related to water erosion prevention, monitoring of stability, groundwater monitoring, and use of safety manual and independent audits. On the stability of dams and heaps, a limited number of Member States provided information on monitoring and risk management measures to be applied by extractive waste facilities operators. More detailed information could, however, be requested in the Member State's reporting questionnaire (e.g. detailed description of the application of BAT and justification on the use of cyanide). The next questionnaire could request information on the application of the BREF on the management of waste from extractive industries.

Timeframe of extractive waste facilities permitting procedures

Under this indicator, the information available was not complete and often not detailed. Concerning the timeframe of the permitting procedure for extractive waste facilities, incomplete information was gathered on the situations in Germany, Greece and Sweden. The information highlights that the permitting procedure for extractive waste facilities is linked to the overall mining permitting procedure and that the timeframe varies from one case to another. It may be relevant to seek further information on the practices for extractive waste facilities permitting procedures to gather information on the public participation involvement in these procedures (e.g. information on Member State public participation requirements, on the number of public complaints and on number of comments received).

Public complaints against public participation procedure

No information was identified regarding public complaints against public participation procedures within the permitting process in Member States. Concerning the role of the public one NGO provided an opinion that more involvement and engagement of the public in the permitting procedure of mining activities is required. The NGO suggested that the local community's consent should be compulsory for Category A waste management facilities.

6.2.5 Financial guarantee

This area of intervention was evaluated assessing the existence of guidelines or methods to implement the Commission's guidelines (Decision 2009/335/EC) on the establishment of financial guarantees. Overall, there was a good information available but little information available on practical steps undertaken for setting the level of financial guarantees at Member State level, apart from very few examples. There were examples of general guidance on setting up financial guarantees and a guidance document at EU level from 2008, based on the MonTec (2008) study. However, examples of specific guidance at Member State level were scarce. A report published by the Swedish National Audit in 2015 highlighted that, in Sweden, financial guarantees are established (mainly in the form of bank guarantees) but have practical problems. The report highlighted a high risk of taxpayers paying for the rehabilitation of sites, either due to the insufficient coverage of the guarantees or regarding periods during which facilities were not covered by a guarantee. Inspections were highlighted as having utmost relevance to validate and monitor the status of guarantees. Although

the consideration of third parties is included in the national legislation of the majority of the Member States assessed, limited evidence has been found on whether Member States are actually considering the involvement of third-parties in the performance of rehabilitation work in practice when calculating the amount of financial guarantees. Only one example of this was found in the updated guidance for the review of mining operations published by the Swedish Geological Survey (Sveriges Geologiska Undersökning, 2017).

Solutions to enhance the implementation of the Directive with regard to financial guarantees

The information assessed indicates that whereas there are no major implementation issues related to this provision, Member States would benefit from having examples of good practice which could be referred to. Workshop stakeholders expressed that they would find it useful to discuss the best approaches to financial guarantees involving financial institutions and insurance companies, as such organisations may need to be involved in setting up or underwriting the guarantees. The issue of financial guarantees could be a potential theme of further cooperation with the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL).

6.2.6 Waste facility classification

Waste facility classification was assessed using one parameter of the assessment framework (Assessment of classification of extractive waste facilities) comprising one indicator (Existence of guidelines and / or specific binding requirements to classify extractive waste facilities (e.g. definition of a 'certain threshold') according to Annex III). Inspections were found to be important to assess whether the criteria followed by operators and authorised by Member State authorities is compliant with Annex III. Also, there may be issues with Category A facilities that are also Seveso installations which may be covered by a Seveso permit rather than by an extractive waste permit, although they would need to comply with the provisions of Directive 2006/21/EC (save Article 6).

Consistency of interpretation of Annex III of the Extractive Waste Directive

Stakeholders generally considered at the workshop organised in March 2017 by the Commission that guidance was not necessary for this as definitions are clear. A compliance promotion exercise could still support addressing discrepancies in waste facility classification, given that they would be mainly due to reporting inconsistencies or improper interpretation of Annex III (in particular its first indent).

6.2.7 Closure and post closure phase

According to the information submitted by Member States as part of the information collection exercise undertaken for this project, there are 460 extractive waste facilities that are in their closure/post closure phase (12% of all the facilities reported as part of the data request). From them, 27 are classified as Category A facilities. The inventories of closed and abandoned sites were also assessed and, from those that are publicly available, information was extracted on the number of sites that form part of them. As of 30th June 2017, 3,462 facilities have been included in the 18 inventories that are available. From them, 52% were heaps, 2% dams, 3% ponds and 1% other (in 42% of the cases, the type of facility was not included in the inventory[143].

The analysis of the available information highlighted that there was guidance to develop a prioritisation system for the inventory of closed and abandoned sites required under Article 20. One of these guidance documents (the TAC guidance developed by Stanley et al., 2011) has been used by several Member States to inform development of inventories.

Review of the inventories of closed and abandoned sites

To address the request of some stakeholders for more transparency on closed and abandoned sites, a possible solution could be the development of an EU-wide inventory.

[143] Lithuania, Latvia, Luxembourg, Malta, the Netherlands and Slovenia do not have an inventory but stated that there was no facility for which it was applicable

However, stakeholders at the workshop had mixed opinions regarding the usefulness of such an EU-wide inventory. A possible advantage of such an approach would be increasing awareness and transparency with regard to transboundary effects of extractive waste facilities located close to the borders with other Member States. If such inventory is developed, it should specify that national approaches to selecting closed and abandoned sites may have differed and therefore data may not necessarily be comparable.

6.2.8 Transboundary effects

Based on the (incomplete) information provided by Member States that responded to the request for information made as part of this study, it appears that at least some 40 waste facilities are located near the borders of other Member States, mainly between Portugal and Spain and between Ireland and the UK (Northern Ireland). To assess transboundary effects, the existence of coordination mechanisms to ensure information is forwarded to other Member States was used, the information being taken from the Member States' implementation reports. It can be concluded that Member States have established the relevant procedures and defined the relevant authorities involved in this process. From this perspective, implementation of the requirements of the EWD in terms of transboundary effects is good. However, findings on how well these procedures are applied in practice are scarce due to lack of cases.

Guidance for transboundary communication

No interest was expressed for guidance by stakeholders or Member States for this aspect. However rapid communication and cooperation between Member States in the event of an incident was considered of most importance to avoid environmental damage. Although there is no evidence that performance is low, it may be appropriate to present possible approaches for transboundary communication as part of the planned general guidance on implementation of the Directives (while respecting Member State autonomy for designing competent authorities and appropriate procedures).

6.3 Thematic areas

6.3.1 Category A facilities

Considering the particular relevance of the application of all EWD provisions to Category A facilities, all indicator-based findings of section 4 are valid in respect of Category A facilities. From the analysis made, it would appear that application of the criteria for classification of waste facilities as Category A by Member State authorities and economic operators is inconsistent; an indication of this is the deviation for a number of Member States in data provided for Category A facilities in the context of the request for statistical information as part of this study compared to those indicated for the implementation report 2011-2014 (although deviating figures may partly be due to the fact that some new facilities may have been permitted and others may have closed in the meantime).

Although during the workshop, a number of stakeholders were of the opinion that legislation is sufficiently clear, it may be that provision of guidance on interpretation of the criteria for classification of facilities as Category A as part of the planned guidelines on the implementation of the EWD would be useful to facilitate consistent implementation. Several Member States stressed the importance of a proper consideration of the first indent of Annex III of the Directive ("incorrect operation").

6.3.2 Cyanide processes

Regarding cyanide-based gold extraction techniques, the following can be concluded:

- Cyanide-based techniques remain the dominant technology for gold production in the EU;
- Alternative reagents have been tested and some have been developed to commercial scale outside the EU. However, the appropriateness and applicability of

alternative reagents and processes is governed by ore types and alternative reagents are not without their own technical, environmental and economic issues;

- In reviewing the availability and the status of commercial application of alternatives to cyanide-based technologies, there does not appear to be a clear alternative that can replace cyanide-based technologies as BAT at commercial scale at the present time in the EU;
- There has not been a material change in the application and use of alternatives to cyanide-based technologies since 2010, hence the introduction of an EU-wide ban would still imply the closure of existing mines; and
- Whilst monitoring of developments in alternative technologies should continue, a focus on the full application of the Directive by the Member States should be a priority to ensure that mines using cyanide technologies continue to operate in a safe condition.

6.3.3 Stability of waste management facilities

In terms of stability of waste management facilities, it can be concluded that since these aspects are relevant foremost regarding the operation of the facility and the conditions stipulated in the permit, the current revision of the existing BREF on the management of extractive waste is crucial.

6.3.4 Reprocessing of extractive waste

Member States competent authorities were approached to gather information on policies and practices regarding the reprocessing of extractive waste. 22 Member States responded. Only a limited number (four) indicated they have dedicated strategies / statements regarding extractives waste and a further nine indicated that extractive waste is covered in wider waste management or resource efficiency strategies. The Hungarian Office for Mining and Geology noted that it has commissioned work to identify the quality, quantity and the possible exploitation options of secondary raw materials in the extractive waste facilities. Overall it can be concluded that Member State policies on reprocessing of extractive wastes are limited.

From analysis of information returned by Member States regarding permitting as part of this study, a narrow range of waste reprocessing was observed with a focus on the reuse of waste rock and overburden for construction related purposes. Only a limited number of examples indicated reprocessing waste and tailings to extract minerals indicating that at the current time, reprocessing activities are typically the productive utilisation of inert waste materials rather than innovative reprocessing activities to extract greater value associated with recovery of substances and minerals.

In addition to policies, case studies were also examined. This included projects aimed at increasing reuse/recyclability of bauxite residue (red mud), producing zinc concentrates from flotation waste, and extracting tin and tantalum minerals from flotation tailings.

Appendix A
Assessment Framework

Area of intervention	Thematic area			Parameter to assess implementation	Indicator		
	1	2	3		Indicator name	OI	RI
Member State enforcement and control	X	X	X	Effectiveness of enforcement, in relation to: a) enforcement authorities' powers and competencies	Cases of non-compliance identified over the two reporting periods		X
	X	X	X		Existence of coordination mechanisms between inspection bodies (if several involved)	X	
	X	X	X		Number of inspections per mining facility	X	
	X	X	X		Financial resources allocated to inspections by Member States	X	
	X	X	X		Expertise of inspectors (diploma, technical training, etc.), how many inspectors per site	X	
	X	X	X	b) Inspection programmes with clear priorities	Evidence of Competent Authority carrying out sampling of extractive waste, laboratory tests and / or stress tests*	X	
	X	X	X		Proportion of inspection programme with priorities related to: o Cat. A installations (if relevant) o Cyanide (if relevant) o Stability of facilities	X	
	X	X	X		Inspection programme with priorities in place and based on defined criteria**	X	
	X				Number of inspection visits per year**	X	
	X	X	X	c) Assessment of implementation of inventory of closed waste facilities	Frequency of the update of the inventory**	X	
	X	X			Availability of an inventory*	X	
Major accident prevention	X			Assessment of major accident policies, in relation to: a) Existence and adequacy of safety management system, including appointment of a safety manager	Number of major accidents*		X
	X				Changes in the number of major accidents in two reporting periods		X
	X				Recording and reporting of near missed events	X	

Area of intervention	Thematic area			Parameter to assess implementation	Indicator		
	1	2	3		Indicator name	OI	RI
	X				Number of near miss events		X
	X				Changes in the number of near miss events between the reporting periods		
	X				Legal requirements to appoint a safety manager applicable to safety manager e.g. minimum professional qualifications	X	
	X				Number of Cat A facilities with complete safety management policy and systems in place	X	
	X				Number of Annex 1 elements covered by safety management system	X	
	X			b) Adequacy of coverage of the external (Competent Authority) emergency plan	Number of Category A facilities with an external emergency plan	X	
Waste management plans	X	X	X	Assessment of the Waste Management Plans (WMP) in relation to: Appropriateness of pollution prevention measures in the WMP	Existence of guidelines for operators to prepare WMP**	X	
	X	X	X		Verification that the WMP includes the elements listed in Article 5(3) of the Directive**	X	
	X	X	X		Number of WMPs that have been reviewed in the last 5 years		X
Application and permitting procedures	X	X	X	Assessment of the permitting procedure in relation to compliance with permit requirements (including requirements on construction and management of waste facilities)	Existence of guidelines and / or awareness raising campaigns for operators on preparing permit applications	X	
		X			Permitting conditions related to cyanide based technologies and related impacts (concentration thresholds of cyanide in ponds)	X	
					Permitting conditions related to stability of waste management facilities	X	
			X		Permitting conditions related to reprocessing of extractive waste	X	

Area of intervention	Thematic area			Parameter to assess implementation	Indicator		
	1	2	3		Indicator name	OI	RI
	X	X	X		Timeframe to reconsider and update permit conditions	X	
	X	X	X		Method or measures in place to assess the competence of the person in charge of the extractive waste facility	X	
	X	X	X		Existence of coordination mechanism in case of involvement of several authorities	X	
	X	X	X		Permitting authorities' expertise on extractive waste issues (e.g. dedicated extractive waste expert or link with extractive waste specialist organisation)	X	
	X	X	X		Timeframe of the permitting procedure (in months)		X
	X	X	X		Number of permit applications received per year		X
	X	X	X		Number of permit applications rejected / withdrawn per year		X
	X	X	X		Number of permits granted per year		X
	X	X	X	Reconsideration of permits	Existence of guidance / rules on interpreting 'substantial changes'	X	
	X	X	X		Existence of guidance / rules on interpreting 'substantial changes to BAT'	X	

Area of intervention	Thematic area			Parameter to assess implementation	Indicator		
	1	2	3		Indicator name	OI	RI
	X	X	X		Existence of guidance / rules on interpreting 'periodically reconsider'	X	
	X	X	X		Number of permits reconsidered in last reporting period		X
	X	X	X		Share of existing permits that have been reconsidered		X
	X	X	X	Assessment of public participation in the permitting procedure	Information tools explaining how the public can participate in the permitting procedure	X	
	X	X	X		Public participation timeframe	X	
	X	X	X		Public complaints against public participation procedure		X
	X	X	X	Assessment of the implementation of Best Available Techniques in the permitting procedure	Competent authorities' actions to promote the application of BAT (e.g. guidance, toolkits, checklists) in general**	X	
		X			Competent Authority actions to promote application of BAT in relation to the use of cyanide	X	
			X		Competent Authority actions to promote application of BAT in relation to dam and heap stability	X	

Area of intervention	Thematic area			Parameter to assess implementation	Indicator		
	1	2	3		Indicator name	OI	RI
		X			Application of BAT in gold extractive facilities*		X
					Application of BAT in relation to dam and heap stability*		X
Financial guarantee	X	X	X	Assessment of implementation of financial guarantee	Existence of guidelines or method to implement the Commission's guidelines on the establishment of the financial guarantee (Decision 2009/335/EC)**	X	
Waste facility classification	X			Assessment of classification of extractive waste facilities	Existence of guidelines and / or specific binding requirements to classify extractive waste facilities (e.g. definition of a 'certain threshold') according to Annex III	X	
	X				On-site visits to verify classification of extractive waste facility	X	
Closure and post closure phase			X	Assessment of closure and after closure procedures for waste facility	Frequency of reporting of monitoring results by operators	X	
			X		Risk-based assessment to identify the sites (including the methodology developed by the ad-hoc group)**	X	
			X		Number of post-closure accidents (including number reported to the EC)		X
			X		Number of rehabilitated closed waste facilities		X
Transboundary effects	X	X	X	Assessment of the procedure in case of transboundary effects	Existence of coordination mechanisms to ensure information is forwarded to other Member States**	X	
	X	X	X				X

Area of intervention	Thematic area			Parameter to assess implementation	Indicator		
	1	2	3		Indicator name	OI	RI
					Timeframe to inform public concerned		
	X	X	X		Tools in place to inform public concerned		X

Notes:
*= Key indicator
**= Key indicator for which little information exists
Greyed out cells= Removed indicators
OI = Output indicator which are identifiable products of implementation such as risk assessments and programmes of inspections.
RI = Result indicator which are the end effects such as the number of major accidents or number of facilities using cyanide-free processes.

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Appendix C
Additional information

Table C.1 Summary of how "waste characterisation" is covered in the different guidance documents of the UK

Guidance	Coverage
England and Wales (general, Defra, 2010)	The only reference is that waste management plans must include "waste characterisation in accordance with Annex II to the Directive, and an estimate of the total quantity of extractive waste to be generated;"
England and Wales (additional, EA, 2011)	The guidance includes: -Explanation of the purpose of characterising the waste: the operator and the authority need relevant information on the waste to be managed to assess and monitor its properties, behaviour and characteristics and ensure that it is managed safely in the long term. Also, it will help the operator decide options for managing it and related mitigation measures. -Waste categories: Inert, non-hazardous non-inert and hazardous. Definitions as in the Directive. -Box with the waste characterisation criteria for each waste category. For instance, the criteria for hazardous waste: ▪ It is listed as hazardous in the List of Waste Regulations; and ▪ It is a specific batch of waste which is determined pursuant to regulation 8 of the Hazardous Waste (England & Wales) Regulations 2005 or the Hazardous Waste (Wales) Regulations 2005 to be a hazardous waste, i.e. it has been determined to be hazardous by the Secretary of State, Welsh Assembly Government. -The operator has to ensure that the information and data for waste characterisation are appropriate, of adequate quality and representative of the extractive waste at the site. This information may already be in other technical reports. -Box with potential sources of information for waste characterisation: Existing investigations and studies, existing applications for permits/authorisations, e.g. planning permissions or extraction licences, geological surveys, list of inert extractive waste. -Sampling is only indicated when the information is unavailable or insufficient. If sampling is necessary, further guidance has been developed by the Commission (this is also provided in an appendix for reference). -References have to be provided. -Box with the information to be provided in the WMP for extractive waste characterisation. For example, the information to be provided on hazardous waste is: A description of the waste's physical and chemical characteristics, in the short and long term, with particular reference to its stability under surface atmospheric conditions. This should include consideration of the type of mineral being extracted and the nature of any overburden to be removed; Classification of the waste in accordance with the relevant entry in the List of Waste Regulations; A description of any chemical substances to be used during treatment of the mineral resource and their stability; A description of the method of deposition; and The nature of any waste transport systems to be employed.

Guidance	Coverage
Wales (Natural Resources Wales, 2014)	As in EA (2011) above
Scotland (SEPA, 2010)	The text covering this subject is: "Once the classification and categorisation process is complete, the behaviour of waste to be stored within each extractive waste area or waste facility needs to be characterised (unless the waste is being placed back in the void for rehabilitation or construction). Decision 2009/360/EC confirms that the purpose of characterisation is to obtain the relevant information on the waste to be managed in order to be able to assess and monitor its properties, behaviour and character. This decision clarifies the requirements in the MWD and Schedule 2 of the Regulations and is intended to ensure that it is managed under environmentally safe conditions in the long term. Characterisation should assist the determination of the options for managing extractive waste and the related mitigation measures in order to protect human health and the environment." Also, the guidance document includes: -Sources to be used for waste characterisation -Headings that have to be included in the waste characterisation section of waste management plans (background Information; geological background to the deposit being worked; nature of the waste and its intended handling; geotechnical behaviour of the waste; and geochemical characteristics and behaviour of the waste.) -Each of this headings is covered in subsections of the guidance. Annex C (questionnaire): Characterise the waste in accordance with Directive 2009/360/EC (see Chapter 4) and provide a statement of the estimated total quantities of extractive waste to be produced during the operational phase.
Northern Ireland (DOE, 2010)	As Scotland above.

Sources: Defra, 2010. Environmental Permitting Guidance. The Mining Waste Directive for the Environmental Permitting (England and Wales) Regulations 2010. UK Department for Environment, Food and Rural Affairs; EA, 2011. EPR 6.14: How to comply with your environmental permit. Additional guidance for: mining waste operations. UK Environment Agency; Natural Resources Wales, 2014. How to comply with your environmental permit. Additional guidance for: Mining waste operations (EPR 6.14); SEPA, 2010. Guidance on the management of extractive waste (Scotland) Regulations 2010. Scottish Environmental Protection Agency; DOE, 2010. Mining Waste Directive Guidance Document. DOE planning. Minerals Unit

Table C.2 Minimum content of waste management plans as stated in the national legislation

MS	Minimum content of the Waste Management Plan as set out in each Member State's legislation
Austria	1.The characterisation of the extractive waste referred to in Annex II of Directive 2006/21 /EC, in conjunction with Decision 2009/360/EC and the total amount of extractive waste likely to be generated during the operating phase, 2. The methods by which this extractive waste is produced and any after-treatment to which it is subject, 3. Information on the location of the extractive waste facility and a survey of the nature of the area that could be contaminated by this facility, 4. The description of possible adverse effects on the environment and human health caused by the disposal of extractive waste and the measures to be taken to minimise environmental impact, in particular with regard to contaminated water, leachate and water and wind erosion during the operation and after closure. Also, the plan shall describe the geological, hydrological and hydrogeological, seismic and geotechnical conditions of the site where the extractive waste facility is located, 5. The measures for the protection of water, soil and air, in particular by monitoring the physical and chemical stability of the waste disposal system, e.g. through measuring and monitoring devices, regular cleaning of overflow channels and channels, 6. The control and monitoring measures carried out by a natural person who has the technical requirements and experience for the supervision and inspection of an extractive waste facility, 7. The decommissioning plan, including rehabilitation, post-closure and monitoring, 8. The classification of the extractive waste facility in accordance with the criteria set out in Annex III of Directive 2006/21/EC, in conjunction with Decision 2009/337/EC, including the necessary information on the relevant facts and reasons for the classification, 9. Major accident prevention measures and arrangements, including the information necessary to draw up internal emergency plans and external emergency and safety plans for category A facilities, in accordance with Section 119b (6) of the Waste Management Act and 10. An assessment of the possible risk of accidents in installations which are not classified under Category A of Annex III of Directive 2006/21/EC.
Bulgaria	1. Type and proposed category of the facility accompanied by a justification; 2. Parameters of the extractive waste and estimated quantities; 3. Description of the activity producing extractive waste; 4. Possible risks for environment and measures to prevent them, including measures for the prevention of water, air and soil pollution; 5. Proposed control and monitoring procedures; 6. Proposed plan for closing down of the facility; 7. Measures to prevent major accidents and an emergency plan in cases of Category A facilities; 8. In the extractive waste management plan concerning a facility containing cyanide the operator shall propose measures for the reduction of the concentration of the light acid decomposable cyanide to the lowest possible level using BAT

MS	Minimum content of the Waste Management Plan as set out in each Member State's legislation
Estonia	1. Waste facility type and category according to the established criteria. If the operator does not estimate that a category A is required, it must be sufficiently justified alongside identifying potential accident hazards; 2. In the case of category A waste facilities, the plan should provide information on the major-accident prevention programme, safety management system and internal emergency plan. 3. Waste characterisation and estimated quantities during the operational phase. 4. Extractive waste generating activities and subsequent waste processing. 5. A description of how the extractive waste storage can damage the environment and human health, during operation and after its closing and minimisation measures. 6. Proposed monitoring and control measures. 7. Waste facility closure and post-closure plans, including rehabilitation, closure of operations, aftercare and monitoring. 8. Measures to reduce the impact on surface and groundwater, soil and air. 9. Sufficient information to allow the competent authority to assess the operator's ability to comply with other legislation
Greece	1. The proposed classification of the installation, 2. When a category A is required, a report containing a summary of the safety management system and the major-accident prevention policy, as well as the internal management plan. 3. When the operator deems that a category A is not required, information justifying this shall be provided, alongside including an identification of possible accident hazards. 4. Waste characterisation and an estimation of the waste quantities to be produced during the operational phase. 5. The description of the process by which the waste is produced. 6. Description of the way in which the disposal of this waste can affect the environment and human health, and the preventive measures that must be taken to minimise this impact during the operational phase of the facility and after-closure thereof. These measures shall pay particular attention to the following: -Location of the facility along with the possible alternative locations and the justification of the decision taking into account protected areas, and the characteristics of the site (geological, hydrological, seismic and geotechnical). -Design of the extractive waste facility to prevent and minimise short-term and long-term soil, air, groundwater and surface water pollution in compliance with the national legislation, the Dangerous Substance Directive and the Water Framework Directive -Ensure the effective collection of polluted water and leachate -Water and wind erosion reduction as technically feasible and economically viable -The proper construction, management and maintenance of the waste facility in order to ensure waste stability and pollution prevention -Measures for the rehabilitation of the site and after-closure monitoring 7. Proposed programme and procedure for the regular monitoring and control of installations 8. Closure and after-closure plan 9. Measures to comply with other environmental legislation 10. Measures to prevent and minimise the production of leachate and pollutions of groundwater and soil. This will include the process water and leachate collection system

MS	Minimum content of the Waste Management Plan as set out in each Member State's legislation
	11. Proposed measures for the control and monitoring for the waste and excavation void where the waste is being returned to the void; 12. Land survey 13. In the case of presence of cyanide, measures to limit the concentration of the decomposable acid dissociable cyanide in the pond to the lowest level possible using BAT 14. Document demonstrating that the management of the waste facility is entrusted to a competent person and ensure the monitoring of the technical development and staff training
Spain	1. Waste characterisation (geochemical and geotechnical characteristics) 2. Proposed classification of the installation (Category A or not) 3. Description of the activity generating the extractive waste and subsequent treatment 4. Impacts to the environment and human health 5. Monitoring and control procedures. 6. Construction and management design of the waste facilities 7. Land survey of the area potentially affected. 8. Closure and post-closure plan
Finland	1. A description of the extractive waste resulting from the activity and its properties 2. An estimate of the total quantity of extractive waste, a description of the recovery and disposal of waste, as well as information on the exploitation of extractive waste; 3. A description of the extractive waste facility and its surroundings, as well as the waste classification of the risk of major accident; 4. Depending on the classification of the extractive waste facility, either provide evidence that the major accident prevention policy, safety management system and internal emergency plan will be put into effect or provide an identification of the potential accident hazards. 5. A description of the soil, water and groundwater in the area of extractive waste and the surroundings to which the waste can cause a burden; 6. Information on the extractive waste and the environmental impact of extractive waste facility; 7. Information on the actions to be taken to minimise soil, water, groundwater and air pollution, and other impacts during operation and closure; 8. A description of the follow-up and monitoring procedures in operation and closure; 9. Information on the closure and post-closure activities including monitoring and control; 10. The competent authority may request any other information required to assess whether the plan complies with other environmental legislation.
Ireland	1.The proposed classification for the waste facility in accordance with the criteria laid down in Schedule 3 and Commission Decision 2009/337/EC 2. Where a Category A waste facility is required, a document demonstrating that a major-accident prevention policy, a safety management system for implementing it and an internal emergency plan will be put into effect 3. When the operator considers that a Category A waste facility is not required, sufficient information justifying this, including an identification of possible accident hazards, 4. Waste characterisation in accordance with Schedule 2 and Commission Decision 2009/360/EC and a statement of the estimated total quantities of extractive waste to be produced during the operational phase,

MS	Minimum content of the Waste Management Plan as set out in each Member State's legislation
	5. A description of the operation generating such waste and of any subsequent treatment of the waste 6. A description of how the environment and human health may be adversely affected by the deposit of such waste and the preventive measures to be taken in order to minimise environmental impact during operation and after closure, 7. The proposed control and monitoring procedures 8. The proposed plan for closure, including rehabilitation, after-closure procedures and monitoring as provided for in Regulation 12, 9. Measures for the prevention of water status deterioration in accordance with the Water Framework Directive and for the prevention or minimisation of air and soil pollution 10. A survey of the condition of the land to be affected by the waste facility, 11. A map of the boundary showing the limits of extractions.
Romania	The extractive waste management plan shall include: treatment, recovery and disposal of waste resulting from mining activities mining during the license, closure and post-closure phases of the mine/quarry for reducing environmental impact and human health hazards.
UK	1. The proposed classification of the extractive waste facility; 2. where a Category A facility is required, evidence that the major accident prevention policy, safety management system and internal emergency plan will be put into effect 3. Where an operator considers a Category A facility is not required, information justifying this, including an identification of the potential accident hazards; 4. Waste characterisation in accordance with Annex II to the Directive, and an estimate of the total quantity of extractive waste to be generated; 5. A description of the operation generating the waste; 6. A description of any treatment of the generated waste; 7. A description of the risks to the environment and human health posed by the deposit of the waste; 8. A description of the preventative measures to be taken to minimise environmental impact over the life cycle of the extractive waste facility including location, construction, closure and aftercare; 9. The control and monitoring procedures including for the waste and excavation void where the waste is being returned to the void; 10. The proposed plan for closure, after care and monitoring; 11. Measures for the prevention of water status deterioration in accordance with the Water Framework Directive and for the prevention and minimisation of soil and air pollution; and 12. A survey of the land to be affected by the extractive waste facility.

Source: National legislation transposing the Directive of the EU Member States indicated above (available online)

Table C.3 Application of BAT in extractive waste facilities of gold mines in the EU

BAT	Member States where it is applied (Number of facilities reporting its use)
Destruction of the remaining free cyanide prior to discharge in the pond	FI (3)
Water erosion prevention	BG (1), ES (9), FI (2)
Monitoring of stability	BG (1), FI (8), SK (2)
Dry waste management	ES (1)
Metals precipitation via pH increase	SE (1)
Emergency planning	BG (1), FI (3)
Reduced reagent consumption	BG (1)
Dusting prevention	BG (1), FI (4)
Water management plan	BG (1)
Groundwater monitoring	BG (1), FI (9), SK (2)
Surface water monitoring	SK (2)
Prevention of the generation of acid rock drainage	BG (1)
Passive treatment of acidic effluents	FI (1)
Process water reuse	BG (1), FI (2)
Use of conventional dams	BG (1), FI (7)
Adequate maintenance of drainage	BG (1), FI (2)
Safety manual and independent audits	BG (1), FI (12)
Annual reviews at tailings ponds/dams	BG (1), FI (3)
Staff training	BG (1), FI (5)
Tailings management	BG (1)
Closure and post-closure plan planning and updating	BG (1)
Seepage flow monitoring	BG (1), FI (1)
Seepage prevention or management where quality is detrimental or flowrate is high	FI (1)
Soil mechanics monitoring	BG (1)
Monitoring of tailings placement procedures at tailings ponds/dams	BG (1), FI (4)

BAT	Member States where it is applied (Number of facilities reporting its use)
Visual inspections at tailings ponds/dams	BG (1), FI (5)
Investigation of possible uses of tailings and waste rock	BG (1), FI (2)
Evaluation and follow-up of incidents	BG (1)
Pipeline monitoring	BG (1), FI (1)
Prevention and reduction of tailings/waste rock	BG (1)
Backfilling of waste rock	FI (1)
Suspended solids and dissolved metals removal prior to discharge of the effluent to receiving watercourses	FI (1)
Neutralise alkaline effluents with sulphuric acid or carbon dioxide	FI (1)
Sedimentation ponds	FI (3)
Use the once in a 100 year flood as the design flood for the sizing of the emergency discharge capacity for low hazard dams	FI (1)
Use the once in 5,000-10,000 year flood as the design flood for the sizing of the emergency discharge capacity for high hazard dams	FI (3)
Strip the natural ground below the retaining dam of all vegetation and huminous soils	FI (8)
Fit-for-purpose construction material for dams	FI (6)
Diverted or alternative discharge facilities (for dams)	FI (5)
Record of design and construction changes	FI (6)
External evaluator for the evaluation of a too high pore pressure and pore monitoring	Fi (4)
Upstream method of construction	FI (5)
Provision of decant facilities	FI (5)
Measure ground movements with deep inclinometers	FI (3)
Diversion of natural external run-off	Fi (3)
Water-level, phreatic surface and pore pressure monitoring	Fi (3)

BAT	Member States where it is applied (Number of facilities reporting its use)
Total	46 techniques reported by 31 facilities [one in Bulgaria, 10 in Spain, 17 in Finland, one in Sweden and two in Slovakia)

Source: Consultation on the use of BAT among Member States.
Note: Some facilities apply more than one BAT

Table C.4 Information on criteria, thresholds and classification systems available in several Member States

Country	Type of information available	Description	Thresholds identified – Size / height / slope	Thresholds identified – Presence of substances	Thresholds identified – Distance to pathways and receptors and risk of spreading	Classification system
Austria	Information the Austrian inventory of extractive waste facilities	Description of the type of information available in the inventory and classification system for the sites	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	0 = no information 1 = no risk 2 = possible risk for water and/or soils 3 = high concentration levels in soils and/or water
Czech Republic	Database of extractive waste facilities	Basic Information (type, location, position, shape, mineral composition, age, size, date …), evaluation (composition, relations, significance), supplementary information	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	-

Country	Type of information available	Description	Thresholds identified – Size / height / slope	Thresholds identified – Presence of substances	Thresholds identified – Distance to pathways and receptors and risk of spreading	Classification system
Hungary	Methodology to select sites for the inventory of closed sites (based on the definition of criteria)	Criteria for the selection of sites to investigate further for their potential inclusion in the inventory of closed sites	Tailings lagoon: Height >4 m within 50 m of the facility; Heaps: Height (>20m), Area (>10,000m2), slope of base (>1:12)	Presence of sulphide ore; Presence of As, Cd, Cr, Co, Hg, Ni, Pb, Sb, Se, Sn, Te, Th, Tl, U, or Zn; Hazardous chemicals used to process the ore; volume of materials above 10,000 m3	Low permeability layer of 10 m thick or more; exposure to wind (yes/no); distance to water course (not defined); uncovered sites; village of >100 people <1km; nationally protected species <1km; national park or Natura 2000 <1km; economically important species <1km.	-
Ireland	Guidance / Presentation of methodology to select sites for the inventory of closed sites (based on the definition of criteria by GSI)	GSI methodology: Various criteria based on known failures at the site, presence of certain substances and distances to pathways and receptors	Heaps: Height (>20m), Area (>10,000m2), slope of base (>1:12 or ~5°)	Presence of sulphide ore; Presence of Ag, As, Ba, Be, Cd, Cr, Co, Cu, Hg, Ni, Pb, Sb, Se, Sn, Te, Tl, U, V, Zn or asbestos; Hazardous chemicals used to process the ore	Distance to receptors: Population centres (<1km), Natura 2000 sited (<1km), water course/body (<1km), agricultural land or livestock (<1km), Pathways: Water course/body within 1km, groundwater protection (e.g. high permeability layer), exposure to	Scoring system for historical mines: From V (no risk), to I (>2000 points, high risk, full risk assessment required)

Country	Type of information available	Description	Thresholds identified – Size / height / slope	Thresholds identified – Presence of substances	Thresholds identified – Distance to pathways and receptors and risk of spreading	Classification system
					wind, uncovered sites.	
Italy	Database of extractive waste facilities	See table above for parameters described	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	(lowest risk) B, MB, M, MA, A (highest risk)
Slovakia	Criteria for evaluation of environmental impact of mining	Criteria such as status (closed, active), use of chemicals in processing, subsidence, slope deformation and other geodynamic phenomena, other negative changes of relief and terrain hydrogeological and water economy conditions	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	I (remediation required) to III (low or minor impact)
Sweden	Method for Inventories and Risk Classification of Contaminated Sites	Based on: hazardousness, contamination level, potential for migration, sensitivity and value of asset	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	The thresholds are not described, only the information collected	1 : Very high risk for humans and the environment, 2 : High risk, 3 : Moderate risk, 4 : Low risk
UK	Guidance	Description of criteria and examples of what the Authorities consider category A installations	Judgment by competent authorities	Judgment by competent authorities	Judgment by competent authorities	-

Sources:

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Irish EPA (2012) and Stanley (2013): Information on the approach taken in Ireland. Available at: http://www.epa.ie/pubs/advice/waste/extractive/Guidance-On-The-Waste-Management-Regulations-2009-WEB.pdf and http://www.mta.gov.tr/v2.0/duyuru/duyurular/20131106-jeolojik-arastirmalar-calistayi/2-Gun/TAIEX_Mine_waste_Turkey.pdf, respectively

Defra (2010), DOE (2010), SEPA (2010), EA (2011) and Natural Resources Wales (2014): Information on the approach taken in the UK. Links: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69323/pb13636-ep2010miningwaste.pdf, https://www.planningni.gov.uk/downloads/final_doe_planning_mwd_guidance-2.pdf, http://www.gov.scot/Resource/0042/00427370.pdf, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296493/LIT_8451_eb68e4.pdf and https://naturalresources.wales/media/2115/how-to-comply-with-your-environmental-permit-epr-614-additional-guidance-for-mining-waste-operations.pdf, respectively

Spreadsheet database with the information of all the facilities included in the 18 available inventories of closed and abandoned sites (Art. 20):

Appendix D
Stakeholder workshop summary report

Summary report
Stakeholder workshop on the implementation of the Extractive Waste Directive 14th March 2017

1. Purpose of this report

The purpose of this report is to provide an analysis of the results of the seminar and aspects to be incorporated into the final report. Furthermore, it keeps presents a record of the main points made and discussed by stakeholders attending the 'Stakeholder workshop on the implementation of the Extractive Waste Directive', held on 14th March 2017.

The following Annexes are included:

- Annex A: main points recorded during the workshop;
- Annex B: agenda for the meeting;
- Annex C: list of attendees; and
- Annex D: background paper provided to delegates prior to the meeting;

2. Introductions

The Commission outlined the purpose of the day and background to the work to date regarding review of implementation of the Extractive Waste Directive (EWD). In particular, the Commission noted the objective of the seminar was to gather feedback on possible solutions for improving the implementation of the Directive.

It was noted that the seminar is supported by a study on the implementation of the EWD that has been initiated by the Commission. The main driver for the study resulted from the conclusion that the information received by Member States in the context of the required triannual reporting does not allow a full assessment of Member States' performance regarding the implementation of the Directive or on the reasons for any possible shortcomings, either in its entirety or regarding specific provisions. The aims of the study are to:

- Provide a comprehensive overview of the implementation of the Directive, indicating possible difficulties in their implementation and, if possible, exposing the root causes; and
- Address the specific provisions relating to the management of Cat. A facilities, the use of cyanide based technologies, the stability of tailing dams and ponds, and the reprocessing of closed mining sites.

It was noted that the study is not yet complete. Once finalised, it will be made publicly available in the second half of 2017.

The Commission invited all delegates to provide brief introductions to their organisations and their roles. The consultants then made a series of presentations to set the context for each theme and to summarise initial findings of the work. After each presentation workshop participants provided comment and discussion was

moderated by the Commission. The main points recorded for each theme are presented in the following sections.

3. Analysis

The following presents the key aspects made at stakeholder workshop of 14th March 2017 that require incorporation and consideration in the analysis within the final project report. For a detailed record of comments made by stakeholders, refer to Appendix A.

Member State enforcement and control

- A variety of approaches are used regarding facility inspection including:
  - Risk based whereby inspection frequencies are determined in relation to the nature of risks presented by the facilities;
  - Self-assessment, whereby site operators or independent experts audit sites and send reports to the competent authority;
  - Global inspection whereby inspections are not specific to the site;
  - Inspection processes based on checklist approaches referring to the facility Waste Management Plans (WMPs); and
  - Inspection processes were noted to differ across regions within some Member States.
- Some Member States called for a 'checklist' of principal questions/issues. Such a list should concentrate on the main aspects and not extend to detail;
- There was a recognition that there should be a minimum level of competence for inspectors carrying out facility inspections;
- Clear distinction between monitoring that is required as a condition of permits which may be carried out in detail and inspections which may review the monitoring carried out;
- A call for clarification of who does what and when in the inspection process;
- Proportionality of inspections is required (e.g. Cat. A; non-Cat. A to be differentiated between inert and non-inert); and
- The 2012 report on inspections was seen as a good basis for further work on EWD facility inspections.

Waste facility classification

- Overall, definitions of waste and for a waste facility in the existing legislation and Decisions were considered as sufficiently clear by the industry and several representatives from Member States. The issue of discrepancies in waste facility classification across Member States may rather be one of ensuring accurate and consistent reporting than unclear definitions;
- However, one Member State called for a clarification of the definition of 'extractive waste' and another stressed the importance of the first indent of Annex III of EWD on Cat. A (regarding 'incorrect operation') which may be useful to consider in any future EC guidance which would help ensure consistent interpretation; and
- A compliance promotion exercise could address such issues as well as issues of reporting inconsistences.

Permitting

- There was a call for clarification of the interlinkages between EWD permits and other regimes (such as the Industrial Emissions Directive (IED) and Seveso) which could be addressed in guidance.

Financial guarantee

- There would be value in discussing best approaches to financial guarantee involving necessary stakeholders (e.g. insurance companies and financial and legal sector stakeholders);
- Various suggestions regarding approaches were made including legally binding agreements accessible by Member States, the inclusion of aspects such as company financial stability and facility risk in determining the level of guarantee, and the determining of good practice on calculating the amount of required guarantee; and
- The subject of financial guarantees and discussion of possible options and/or good practice could be a potential theme of work for the European Union Network for the Implementation and Enforcement of Environmental Law (the IMPEL network).

Waste management plan

- The scope of the development of guidance needs further clarification in respect of the aspects of WMPs that Member States would value guidance on;
- If developed, guidance should be at a generic level and not attempt to address detailed (i.e. site or process specific) aspects; and
- Where good practice examples of WMPs are developed, such examples should include WMPs for both Cat. A and non-Cat. A facilities to enable the examples of appropriate WMPs to be demonstrated. The varying degrees of risk and size of facilities should also be considered if developing example WMPs. Consideration of guidance for facilities in or nearing closure phase may also be important.

Transboundary effects

- There is no need for specific guidance on transboundary aspects for mining waste accidents; and
- Of most importance is the rapid communication and cooperation between Member States in the event of an incident. To facilitate this, a web-based list of key contact points, kept up-to-date would could ensure quick and effective communications.

Inventory of closed extractive waste facilities

- The TAC guidance has been referred to by several Member States in the development of their inventories of closed facilities; and
- Regarding the usefulness of a possible EU-wide inventory, stakeholders had mixed views. The most important aspect was perhaps that the inventories were available in Member States and needed to be kept up to date. It was noted that there may be some benefit in understanding potential transboundary impacts of closed facilities where they are adjacent to Member State borders.

Cyanide-based processes in gold production

- No further alternatives to those already identified were noted to be available at a commercial scale; and

- It was remarked that some of the alternative reagents present similar or greater environmental risks than cyanide.

Author	Reviewer
.....	.....
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Appendix A
Main points recorded during the workshop

A.1 Member State enforcement and control

Questions for stakeholders

- Do you consider the approach proposed in the external report mentioned above[1] as fit for purpose? If not, please provide suggestions for improvement. Is the ambition level proposed in this report proportionate to the risks to be managed?
- Do you have any examples of good practices relating to inspection of extractive waste facilities that could be replicated in other Member States?

Comments and discussion

- HU (Hungary): currently has no list of good practice or checklist for inspection. Each site is treated individually. It would be useful to have a list of principal questions for inspections. HU agrees that guidelines could serve as a basis to set up general principles but a checklist would be too specific;
- SE (Sweden): has a system of self-assessment by operators (which is delivered by the operator or consultants). Self-assessments are sent to the inspector of competent authority. SE has previously provided an opinion on the 2012 report[2]. SE considers that inspection frequency should be based on risk assessment. SE noted that it is developing a long-term strategy for the management of extractive waste and part of this strategy will be the development of good practice for extractive waste management. Proper waste characterisation in the short and long-term is essential;
- EE (Estonia): has a similar self-reporting system as SE;
- ES (Spain): the 2012 report is good. ES has a specific site-based approach. ES is unsure whether its inspections for non-Cat. A facilities are fit for purpose hence guidelines would be appreciated;
- FR (France): due to no formal template for inspection, different regions have varying approaches to inspection, hence a checklist would be useful which would need to be translated. Note that inspections are carried out by inspectors of 'classified installations' covering all types of industrial installations;
- IT (Italy): there are differences between the north and south of IT regarding approach to inspections. Inspections in the north are considered better than inspections in the south. Across 20 regions, the result is differences in approach and problems with collection of data. The Ministry in IT is working on harmonising inspections and collecting data, using the EC information request as a template. It would hope that an EU checklist would assist with a better, more consistent approach to inspections;
- HR (Croatia): Does not have mining activities nor Cat A facilities. It is important to distinguish between waste and materials that can be reused;

[1] Final report on 'Establishment of guidelines for the inspection of mining waste facilities, inventory and rehabilitation of abandoned facilities and review of the BREF document', 2012 at http://ec.europa.eu/environment/waste/mining/pdf/Inspection-Rehabilitation_BREF_report.pdf

[2] http://ec.europa.eu/environment/waste/mining/pdf/Annex4_comments_guidance.pdf

- CY (Cyprus): has 13 facilities falling under the Extractive Waste Directive (EWD). The delegate coordinates permit issuing and inspections. For inspections, a checklist is developed on the basis of Article 5 of the EWD on Waste Management Plans, and then checks are made whether the operator complies with the measures required. CY would appreciate guidance from the Commission on inspections. Operator provides chemical analysis of waste which is reported every year to competent authorities;
- IE (Ireland): system is based on self-monitoring regime. The onus for inspection is on the operator in the first instance. The permit specifies the inspections to be carried out by the operator or an independent expert. There are three possible levels of inspection – self, independent expert or by the competent authority. IE has used the 2012 report as a basis, but has struggled with some definitions therein (e.g. 'onsite engineer', 'site owner', 'independent expert' – what defines 'independent'? Can they be involved in the design of a facility? What is an 'independent audit'? Definition of 'non-compliance'?). The approach used in IE is a combination of that used for the (old) IPPC regime and EWD requirements. EWD itself does not provide clarity on all requirements, so guidelines would be helpful. So far IE has used Industrial Emissions Directive (IED) requirements for inspection as a template. IE considers that the 2012 work has scope for improvement, perhaps providing more technical guidelines, with further guidance on definitions;
- PL (Poland): considered the guidance document should be checklist of main issues (i.e. not going into fine details). PL noted that the mandatory use of independent experts could be a problem for PL due to the fact that it is optional at present in PL legal system;
- DK (Denmark): interested to learn from the experience of other Member States;
- Euromines (Industry, EU): there should be a distinction between monitoring required by the permit (based on permit and the Best Available Techniques Reference document (BREF)) and inspections. It was noted that different models are used in different Member States and that guidance on who does what and when would provide useful clarity (but this need not be completely harmonised). Euromines stated its preference for a three-tier system with the involvement of operators, independent inspectors and governments (competent authorities). Proportionality of the degree of inspections is important, i.e. guidelines applicable to Cat. A facilities may not be applicable to non-Cat. A facilities. Euromines has examples of good practice on inspections from SE, FI, PL, and PT:
    - Commission: it was noted that the 2012 report already distinguishes between Cat. A and non-Cat. A facilities.
- Austrian Mining & Steel Association (Industry, AT): was in agreement with Euromines' comments, particularly regarding proportionality of inspections. Inspections should be based on risk.
- SveMin (Industry, SE, also representing Euromines): supports what stated by Euromines and Austrian Mining and Steel Association. SveMin expressed concern regarding the use of checklists as there is no replacement for the competence of an inspector. There is a need for requirements on competence in the guidelines. SE is dealing mainly with Cat. A facilities, hence with a checklist based approach inspections may not focus on the main issues, hence a risk-based approach is necessary. Competence is required in both the competent authorities and independent inspectors; a checklist is not a substitution for competence;
- Fundacja rt (NGO, PL): The lack of availability of inspection reports is an issue; a list of Cat. A facilities should be made public. Suggested that there should be a checklist for Member State owned facilities that is different to non-Member State owned facilities;
- AGQ Mining and Bioenergy on behalf of Aminer (Association of Andalusian extractive and related industry [i.e. research, analysis, services]) (Industry, ES): would welcome guidelines on inspection. Would like inspections to be linked to permitting requirements to avoid the duplication of effort;

- SOMINCOR (Industry, PT): we mainly deal with Cat. A facilities hence it is important to have good guidelines that should not be too detailed. SOMINCOR uses various guidelines (including from Canada) regarding inspections. They considered that inspections should be linked to particular site requirements. SOMINCOR stressed that they support Euromines' position;
- London Mining Network (NGO, UK): there is a need to examine the competence of inspectors. A SE audit concluded that financial guarantees are not sufficient to manage issues. Welcomes the Commission's plans to take forward guidelines on inspections. Considers that inspections need to take account of wider issues, e.g. is the company economically fit for purpose to manage the associated facilities;
- Eusalt (Industry, EU): no comments in addition to those of Euromines';
- Tuprag-Eldorado Gold / Euromines Gold Group (Industry, TR-EU): questioned whether there have been failures due to a lack of inspection. Asserted that failures occur at sites +20 years old and that more recent mines are managed using strictest requirements. Questioned whether the same requirements should apply to old vs. new waste facilities. Noted that inspections should focus on checking the integrity of the systems in place. Monitoring is done against parameters identified in the permit. Guidelines should not be too detailed;
- Commission: observed that no one suggested that the guidelines should be updated hence could it be concluded that the 2012 report is fit for purpose, whilst noting that monitoring and inspections are two distinct aspects. Noted that expertise and competence is an issue that requires addressing and also that proportionality of the guidelines is important:
  - Industrial Minerals Association (Industry, EU): noted that the chapter in the 2012 report on monitoring was only of partial interest as it focusses on if monitoring can be done rather than if monitoring is needed; and
  - Euromines: expects Best Available Techniques (BAT) conclusions on monitoring to be in the revised draft of the BREF[3].

A.2 Waste facility classification

Questions for stakeholders

- Are you aware of a structured approach being used in EU Member States for the categorisation of 'extractive waste' and also, for waste generated by the extractive sector that is not to be considered as extractive waste? If so, what information is available?
- Are you aware of a structured approach being used in the EU Member States for the categorisation of extractive 'waste facilities'? If so, what information is available?
- Would there be added value in having EU level guidance on categorisation of (extractive) waste, waste facilities, and in particular Cat. A facilities, as a complement to the Commission Decision mentioned in the problem definition? If so, what form should it take? Do you have any examples of good practice, case studies; decision trees, or other?
- Are there different categorisation systems used in Member States (e.g. instead of categorising a facility as Cat. A, it might be categorised according to a national system, e.g. for categorisation of dams)? If so, what are the advantages/disadvantages of national systems?

Comments and discussion

- Euromines (Industry, EU): existing legislation and other documents are available for waste classification, e.g. BREF and the CEN standard and these are sufficiently clear. There are also

[3] http://susproc.jrc.ec.europa.eu/activities/waste/index.html

interpretations by the European Court of Justice. Is clear what is extractive waste and an extractive waste facility. If there is an issue, it is more regarding consistent reporting than definitions and classification;

- SE: considers that the definitions of waste and waste facility are clear. In SE, the necessary definitions have been implemented in legislation. SE stressed the importance of the first indent of Annex III of Decision 2009/335/EC, which includes an 'incorrect operation which could give rise to a major accident' among the criteria to qualify (even if waste is not hazardous) as Cat. A facilities;
- AGQ Mining & Bioenergy SL on behalf of Aminer (Industry, ES): inert and non-inert/non-hazardous waste facilities need clearer definition. The EU-wide map could better reflect the category of non-inert/non-hazardous waste facilities. Cat. A definition is clear;
- Tuprag-Eldorado Gold / Euromines Gold Group (Industry, TR-EU): there are many tonnes of waste produced and spot samples of waste could produce perverse results as such samples may or may not illustrate hazardous properties. How waste is managed should form part of the classification of whether a facility is Cat. A or not. The mining practices at a facility should be taken into account in classification. In addition, there is a need to consider quantities of waste. The classification system should be tailored for extractive industries as waste is produced in much higher quantities than in other industries;
- Commission: are people thinking in terms of Cat. A or dam category?
    - Tuprag-Eldorado Gold / Euromines Gold Group (Industry, TR-EU): it would be helpful if a distinction could be made between 'impoundments' and 'dams'; need also to take into account dry stack tailing management;
    - London Mining Network (NG), UK): upstream tailing dams are more hazardous hence dam category is of interest. Risk presented by operational practice is also important, e.g. a waste may be inert but still may present a risk if not managed appropriately. The NGO specifically referred to increased sizes of tailings dams occasioned by increased mined volumes and decreasing ore grades. The NGO raised concerns over the increase of potential hazards due to this trend;
    - FR: has permits for Cat. A and also non-hazardous non-inert waste. FR did not report to the Commission on inert waste. Regions only report on Cat. A facilities; and
    - SE: has both a general dam categorisation for inspections and a Cat. A categorisation for permitting. Stressed that the importance of taking into account what an 'incorrect operation' means and not just focus on dam failure, e.g. waste rocks may not be hazardous as such but can still result in acid mine drainage.
- PL: some hazardous drilling wastes are generated in small volumes and are transported elsewhere for processing (i.e. they are not treated on site). It is important to consider that some waste is used for construction purposes (non-hazardous waste). This is a factor to be considered as it may lead to inconsistencies when comparing waste generated and waste accumulated in extractive waste facilities;
- ES: definitions of 'waste' and 'waste facility' are clear. However, the definition of what is 'extractive waste' is not clear. A clearer definition is required to be used at EU level. Regarding Cat. A classification, Annex III first indent is not clear. Guidance on the first indent would likely lead to more consistency. ES would welcome new criteria for the scale of operation;
- Industrial Metals Association Europe (Industry, EU): the acid drainage potential of waste needs to be addressed in waste management plans. IMA does not see that more guidance would clarify the situation. IMA considers that the definition of extractive waste is clear. Overall, waste classification and facility classification are already clear;

- HU: regarding guidance on waste facility classification, perhaps it is not necessary to consider this further. The issues are more related to reporting. Need to distinguish on the EU map between waste facilities in operation and those in closure phase; and
- Commission: it would appear that issues surrounding waste facility classification may be linked to a reporting issue rather than to a lack of guidance and difficultly of EWD interpretation. However a compliance promotion exercise could address some of the issues identified (e.g understanding of the first indent of Annex III of EWD; understanding of what is 'extractive waste").

A.3 Permitting

Questions for stakeholders

- Is there a need to clarify the interlinkages between the three Directives mentioned above? If yes, how should this be done?

Comments and discussion

- Fundacja rt (NGO, PL): when permits are combined in an integrated permit, the document may be much longer to read, in which case more time should be provided for the public consultation phase;
- Industrial Metals Association Europe (Industry, EU): suggested that the question should be how can we clarify the interlinkages between mining permits and other permitting regimes:
  - Commission: clarification that some activities covered under Annex I of the IED may be relevant (e.g. processing of non-ferrous metals; waste management). Seveso III also applies to operational tailings disposal facilities, including tailing ponds or dams, containing dangerous substances.
- Euromines: questioned the selection of the indicators for permitting and financial guarantee aspects and considered that discussion on alternative methods to ensure stability of heaps should be discussed as part of the review of the BREF on the management of extractive waste rather than in this workshop;
- FR: has a single integrated permitting system covering classified industrial installations and considers this approach to be effective;
- SE: has an integrated permitting approach. It might be useful to have more clarity on the interaction between the EWD and IED; and
- London Mining Network (NGO, UK): information on who the competent authorities are should be disclosed online EU-wide to ensure transparency in respect of permitting and public consultation. Relevant information can be found in Environmental Liability Directive reports but not in EWD reports. Is concerned about the lack of emergency plans in 25% of Cat. A facilities.

A.4 Financial guarantee

Questions for stakeholders

- Do you see added value in a workshop on good practices in the field of financial guarantees? What should be the scope of such a workshop?

Comments and discussion

- Tuprag-Eldorado Gold / Euromines Gold Group (Industry, TR-EU): financial guarantee is a concept that is not well understood. There would be great value to a workshop on good

practice. This should involve the necessary stakeholders such as insurance companies, the finance and legal sectors to advise and debate the issue. It warn that the insurance and finance sectors may suggest limiting the scope of the financial guarantee;

- IE: in IE agreements have been reached that are legally binding and so that the state can access funds if needed. IE has put much effort into this area (since the 1990s) and is willing to share experiences;
- Commission: suggested that the IMPEL network could be a useful vehicle for such a debate;
- London Mining Network (NGO, UK): questioned whether if finance does not want to meet the risk, then what should be done? A 'what if' debate is required. Also included in the process should be risk assessment of the company itself, i.e. its economic stability, reserves, etc. together with the technical management processes proposed (e.g. dewatering of tailings):
  - Eldorado Gold / Euromines Gold Group: LMN makes a good point. What if finance / insurance institutions will not support? Would companies then need to provide money at the beginning to address any possible problems or during closure? Risk of not investing if too high guarantees are required.
- SE: there could be a value in determining how to make good calculations to ensure good financial security (e.g. for closure). In addition, third parties should be involved regarding performing such calculations;
- Euromines (Industry, EU): has no objection to a workshop;
- SveMin (Industry, SE. Also representing Euromines): In Sweden, it is only possible in practice to use bank guarantees or cash in the bank as a guarantee. SveMin would welcome other instruments to be considered. The Swedish audit referred to by LMN on the inadequacy of financial guarantees did not distinguish between old and new mines; and
- Commission: acknowledged the interest shown for a workshop on this subject.

A.5 Waste Management Plan

Questions for stakeholders

- Are you aware of any guidance or WMP you would consider as good practice?

Comments and discussion

- SveMin (Industry, SE. Also representing Euromines): is this coordinated with work in the Circular Economy package regarding guidance for the management of mining waste?
  - Commission: yes this is coordinated.
- PL: is the question regarding guidance for WMP development of practices? Does WMP also cover recovery? WMPs typically focus on the deposit, while information on recovery is found in the background section of WMPs:
  - Commission: The question is about compilation of best practice for the development of WMPs. WMPs are focussed on both waste management and waste recovery and so should take account of a wide context.
- SE: is the scope of the guidance regarding how the WMP is described and made or about best practice on waste management:
  - Commission: there is no intention to overlap with the BREF. It is for stakeholders to determine the scope of the guidance, e.g. to address the most challenging aspects of Art 5 of EWD.

- SE: WMPs can be complex and long documents, with different parts of varying importance. What parts of WMPs should the guidance address as it is not feasible / necessary to identify best practice for all parts of a WMP?
    - Commission: it is for Member States to advise which parts of WMP development would benefit from the provision of guidance.
- SveMin (Industry, SE. Also representing Euromines): if good practice examples of WMPs are used, then it should be ensured that examples of both Cat. A and non-Cat. A are provided;
- Euromines (Industry, EU): we have various documents that contribute to guidance to WMPs covering various aspects (Environmental Impact Assessment, Natura 2000, BREF, Commission decisions). The size of a facility is important. When developing guidance for WMP development, there is a need to focus on general aspects and not detail. In Europe, we are in the process of closing many mines, which were established prior to the concept of WMPs; it is perhaps the absence of WMPs for mines in the closure and/or post closure stage that is the most significant gap present at the moment and hence guidance on WMPs for mines in such stages could be beneficial for the future;
- Industrial Metals Association Europe (Industry, EU): WMPs are site and condition specific. There is no feedback from operators that there is a need for guidance on WMPs. The sector does not see a need for guidance; and
- Commission: from comments made it can be concluded that any guidance should not become involved in details of an installation but should be set at a generic level. The precise scope of the exercise should be further clarified.

A.6 Inventory of closed extractive waste facilities

Questions for stakeholders

- To what extent is the guidance note[4] developed by the subcommittee of TAC on pre-selection of closed facilities useful?
- Are there additional specific criteria in place or is there guidance available in Member States to select the mining waste sites to be included in inventories?
- Would you consider the development of a publicly available EU wide inventory of closed facilities based on existing national inventories to be useful?

Comments and discussion

- Fundacja rt (NGO, PL): an EU wide inventory of closed waste facilities would be useful;
- DK: is not aware that the TAC guidance was used in developing DK's inventory of closed sites, would need to confirm this;
- HU: An inventory has been prepared and the TAC guidance was useful in this process. The HU inventory is based on this guidance;
- SE: for the inventory of closed extractive waste sites the same method is used for contaminated sites which existed before the drafting of the TAC guidance;
- EE: understands that the company that developed the inventory of closed sites for EE used the guidance and assume that it was useful;

[4] http://ec.europa.eu/environment/waste/mining/pdf/Pre_selection_GUIDANCE_FINAL.pdf

- ES: has developed an inventory of closed sites and took into account the TAC guidance to develop it. The development of an EU-wide inventory may raise issues of disparity of criteria used across Member States;
- FR: is unsure if the guidance was used in development of its inventory of closed sites;
- IT: uses a risk-based method to compile the inventory;
- HR: does not have an inventory of closed sites but started a process of improving information on closed sites in 2016;
- CY: developed its inventory in 2012. It is assumed that the inventory is based on the guidance. The inventory is useful to identify how abandoned mines impact on the environment and hence to prioritise remediation interventions;
- IE: developed an approach based on risk. The inventory was published in 2010 (pre-dating the guidance). However, it believed it used a very similar approach to the process described in the guidance because one of the authors of the pre-selection guidance is from the Irish Geological Survey (G. Stanley). The inventory has not been updated recently. Two mines are in closure mode (i.e. not yet fully closed) and will be added to the inventory of closed sites;
- PL: has an inventory of closed facilities and considers that it would be useful to develop the same approach across Member States;
- Commission: would an EU wide inventory be useful?
  - SE: asked for the purpose of an EU-wide inventory; and
  - Industrial Metals Association Europe (Industry, EU): if there were a benefit for an EU-wide inventory it could be linked to possible transboundary impacts i.e. for sites close to another Member State it may be useful to understand whether or not a neighbour has adjacent closed sites and if there is possible risk from them.

A.7 Transboundary effects

Questions for stakeholders

- Are the possible transboundary effects of extractive waste facilities distinct from other sectors to such an extent as to justify dedicated guidance?
- Are you aware of generic guidance on transboundary effects that could be relevant for managing transboundary effects from extractive waste facilities?

Comments and discussion

- Euromines (Industry, EU): there is no need for specific guidance addressing possible transboundary effects, e.g. other industrial facilities could result in accidents with transboundary impacts, and mines are no different. What is important is rapid cooperation between Member States in the event of an incident. A web-based list of key contact points, kept up-to-date would be relevant to ensure quick and effective communications;
- London Mining Network (NGO, UK): Impacts on non-EU countries should also be considered. The NGO referred for instance to discharges of liquid effluents with a high pH from alumina production in France into the Mediterranean sea, which may result in trans-boundary impacts. The requirement to report immediately must be retained;
- None of the other participants expressed particular support for a sector specific guidance document; and
- Commission: it can be concluded that there is limited appetite for guidance on transboundary aspects.

A.8 Guidance on implementation

Questions for stakeholders

- Do you consider the proposed guidance as a useful tool to improve the implementation of the Directive?
- Does the list miss any important issue? and
- In view of limited resources, which priority topics should be covered in such guidance among items 2.2 – 2.7?

Comments and discussion

- Commission: is there anything missing that should be part of the proposed Compliance Promotion activity?
  - London Mining Network (NGO, UK): assessment of acid waste typification (SE and FI (Finland) have developed good practice on this) and integrity of waste facilities. According to the NGO representative, FI would have been contracted to undertake CEN work on testing cyanide, The NGO referred to the existence and use of Global Acid Rock Drainage (GARD) guidelines, but consider that they are very generic, and might not contribute sufficiently for acid rock drainage potential to be anticipated.
- Commission: is waste typification already addressed by the BREF?
  - SveMin (Industry, SE. Also representing Euromines): yes, it is addressed; and
  - Industrial Metals Association Europe (Industry, EU): such technical issues should be addressed under the BREF.
- Tuprag-Eldorado Gold / Euromines Gold (Industry, TR-EU): Circular Economy needs to be addressed by the EWD. It would be useful to clarify the issue of waste vs. ore that is yet to be fully processed. Reprocessing 'waste' has become a problem to receive permits whereas what is actually happening is the ore is being further processed to extract more value;
- Hellas Gold (Industry, EL): we should look at how we can maximise reuse and recycling in mining waste operations.(e.g. construction material);
- London Mining Network (NGO, UK): need to be careful when reprocessing extractive waste as rehabilitation of old mines may have taken place and there is quite a lot of public opposition to re-mining; and
- SveMin (Industry, SE. Also representing Euromines) there are some useful concepts in the EWD e.g. WMPs and emergency plans; risk-based approach. That the waste hierarchy is included in the EWD from the WFD is difficult to deal with. Further thinking is required regarding the waste hierarchy in the context of EWD before developing guidance, e.g. through more efficient processing the total amount of copper that could be extracted over the life-time of a mine would increase but this would also increase overall waste volumes. This needs to be considered as getting as much resource as possible out of an existing mine is good resource management while this may go against the principle of waste prevention/reduction.

A.9 Use of cyanide-based processes in gold production

Questions for stakeholders

- Are you aware of further alternative processes that could replace cyanide in gold mining in the EU?

Comments and discussion

- SveMin (Industry, SE. Also representing Euromines): different mineralogies require different processes. The issue is not whether or not there are alternatives to cyanide based processes but the appropriateness of the technique to the mineralogy otherwise an operator could see gold ending up in tailings which is not resource efficient. From some ores, it is possible to produce a sellable flotation concentrate that will be further refined in a smelter (without cyanide leaching);
- Commission: requested clarification regard what the process of heap leaching is:
  - Tuprag-Eldorado Gold / Euromines Gold Group (Industry, TR-EU): heap leaching is in the existing BREF. It is a process for the low grade ores, perhaps <0.5g/t gold. A pyramid heap is placed onto an impermeable surface and leached. It is the only process that allows recovery of some metals, including gold and silver. The process is used worldwide e.g., Eldorado has a mine in Turkey that has been in operation for over 13 years without problems. The other main process is vat leaching. Cyanide, although toxic, is simple to manage. El Dorado has not yet obtained permits for planned facilities in Romania and hence has not been able to apply any specific techniques. Now the concentration of weak acid dissociable cyanide at the point of discharge of the tailings from the processing into the plant is less than 1 ppm in new gold mines; and
  - Hellas Gold (Industry, EL): as it could not receive a permit for cyanide use, the company decided to recover gold as a by-product of copper production. Gravimetric approaches are applied in the Skouries gold-porphyry deposit to recover the contained free gold. Flash smelting (pyrometallurgical method) is applied in the Olympias refractory auriferous arsenopyrite concentrate due to the availability of copper from the nearby Skouries deposit for the production of copper as main product and gold as by-product. The extraction processes are specific solutions to the characteristics of the ore.
- Commission: are you aware of alternative processes that require leaching?
  - AGQ Mining & Bioenergy SL on behalf of Aminer (Industry, ES): there are no alternatives. Some of the alternative reagents are worse than cyanide.
- London Mining Network (NGO, UK): when using cyanide, only cyanide has to be measured. Should degradation products also be monitored? London Mining Network suggested that there is no actual incentive to trial alternatives. They referred to thiourea, thiocyanates and ferric sulphide which are cyanidation by-products.

A.10 Re-processing

- Hellas Gold (Industry, EL): 2.5 million tonnes of old tailings were removed and treated to extract auriferous arsenopyrite concentrate. This was an environmental rehabilitation project with parallel commercially beneficial activity; ; and
- SveMin (Industry, SE): a lot of waste rocks has been reprocessed to extract “more of the same”, e.g. iron at old iron ore mines. Significant amounts of rare earth metals can be found in mining waste and the Swedish iron ore tailings are known phosphate deposits but so far, these resources was not deemed economically recoverable.

A.11 Commission conclusions

- Inspection guidelines: no extra document was identified beyond the 2012 report commissioned to an external contractor. There is objection to develop inspection guidelines on the basis of this report;

- Waste facility classification: the discrepancies identified between Member States may be due to misunderstandings in the reporting phase. Reporting must be improved, including at local level. EC guidance could address some key concepts (e.g. 'incorrect operation' in Annex III of EWD) as part of the compliance promotion exercise;
- Permitting: Interaction with other legislation, e.g. IED, should be clarified;
- Financial guarantees: there is interest in exchanging good practices and stakeholders see an added value in a workshop on this subject. The Commission will get in touch with IMPEL[5] to examine the possibility of an IMPEL workshop on this topic and to ensure that any work done already by IMPEL is considered;
- Best practices in extractive waste management plans: there is a need to clarify the scope of any exercise further;
- Transboundary effects: there is no call for guidance specific to the extractive sector; and
- Closed sites: TAC guidance was used by at least a few Member States to draw up their national inventories; an EU wide inventory may be useful to have a better picture of possible transboundary effects, although it could compile inventories which may have been drawn up using different criteria.

[5] European Union Network for the Implementation and Enforcement of Environmental Law

Appendix B
Workshop agenda

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT
Directorate B – Circular Economy & Green

Stakeholders' workshop on the implementation of Directive 2006/21/EC on the management of waste from extractive industries

14th March 2017

(09:30 to 17:00)
Room JDE 70, European Committee of the Regions Building Jacques Delors-Rue Belliard 101, 1040 Brussels

Draft agenda

Each session will start with a presentation from the contractor (Amec Foster Wheeler E&I UK Ltd; BiPRO GmbH; Milieu) on the basis of preliminary findings of the on-going study on the implementation of the Extractive Waste Directive. It will then be followed by an exchange of views with stakeholders. A background paper will be provided to registered participants two weeks before the meeting.

09:30	**1. REGISTRATION & COFFEE**
10:00	**2. INTRODUCTION**
10:15	**3. MEMBER STATES ENFORCEMENT AND CONTROL** (CAPACITY, SKILLS, INSPECTIONS)
11:10	**4. WASTE FACILITY CLASSIFICATION**
12:00	**5. PERMITTING AND FINANCIAL GUARANTEES**
12:30	**Lunch break**
13:30	**6. WASTE MANAGEMENT PLANS**
14:10	**7. INVENTORY OF CLOSED WASTE FACILITIES**
14:30	**8. TRANSBOUNDARY EFFECTS**
14:50	**Coffee break**
15:10	**9. ISSUES TO BE COVERED IN THE COMMISSION GUIDANCE ON IMPLEMENTATION**
15:40	**10. UPDATE ON USE OF CYANIDE IN GOLD EXTRACTION AND POSSIBLE ALTERNATIVES**
16:10	**11. REPROCESSING OF MINING WASTE**
16:35	**12. SUMMARY AND NEXT STEPS**
17:00	**CLOSE**

Appendix C
List of attendees

Name	Organisation
Member State Stakeholders	
Eibhlin Doyle	Irish Ministry of environment
Marcin Cykowski	Polish Ministry of the Environment
Bogusława Madej	State Mining Authority (Poland)
Benita Thostrup	Danish Environmental Protection Agency
Szilvia Banyacski	Hungarian Office for Mining and Geology
Ann-Marie Fällman	Swedish Environmental Protection Agency
Raul Kurrista	Estonia
Antonio Cabrera Marianini	Spanish Ministry of Agriculture and Fishing, Food and Environmental Affairs
Anne Laure Vouilloux	French ministry of environment
Patrice Piantone	BRGM
Emorfia Konstantinidi	Ministry Of Agriculture, Rural Development and Environment (Cyprus)
Marianna Morabito	Italian Ministry of environment
Darko Horvat	Ministry Of Environment And Energy (Croatia)
Other Stakeholders	
Roger Doome	IMA-Europe
Antigoni Effraimidou	Industrial Minerals Association Europe (IMA Europe)
Guillermo Gea Ortiz	EEB (NGO)
Corina Hebestreit	Euromines
Christine Marlet	Eurogypsum aisbl
Magali Risch	FEAD
Benoit Lussis	UEPG (European Aggregate Association) and FEDIEX (Belgian Extractive Industry Association
Lars-Åke Lindahl	SveMin
Kuba Gogolewski	Fundacja rt (NGO)
Caterina De Matteis	IOGP
Rocco Lagioia	ITRB
Tobias Andres	VKS – Verband der Kali- und Salzindustrie e.V.

	Name	Organisation
	Juan José Álvarez Rueda	Orovalle Minerals SL
	Esther Fernández López	Orovalle Minerals SL
	Manuel José Garcia	AGQ Mining & Bioenergy SL
	Emmy Gazea	HELLAS GOLD SA
	Helmuth Landsmann	GKB Bergbau
	Caner Zanbak	(EUROMINES) TUPRAG-Eldorado Gold Corp
	Jale Sakiyan Ates	Eldorado Gold Corporation
	Verena Kolroser	Austrian Mining and Steel Association (Euromines)
	Mafalda Oliveira	SOMINCOR / LUNDIN MINING CORPORATION
	Annalisa Bortoluzzi	Eurometaux
	Richard Harkinson	London Mining Network
	Sandrine Lauret	Eusalt
	Estela Gonzalez vazquez	MATSA
	Consultant team	
	Daren Luscombe	Amec Foster Wheeler
	Juan Calero	Amec Foster Wheeler
	Florent Pelsy	MILIEU
	Ferdinand Zotz	BIPRO
	EU Institution Stakeholders	
	Audrey Parizel	Committee of the regions
	Maurice Hameleers	EP Research service (trainee)
	Florence Limet- ENV	DG ENV
	Christian Wimmer- ENV	DG ENV
	Helena Maria Cavaco Viegas	DG GROW
	Magnus Gislev	DG GROW

Appendix D
Background paper provided prior to the meeting

Background paper:
Stakeholders workshop on the implementation of the Extractive Waste Directive – 14th March 2017

1. Background

1.1 Policy context and triannual reporting general conclusions

Directive 2006/21/EC[1] on the management of waste from extractive industries (hereinafter the Directive, the Extractive Waste Directive or the EWD) provides for measures, procedures and guidance to prevent or minimise the adverse effects on the environment and risks to health resulting from the management of waste from the extractive industries.

Article 18 of the EWD requires that every three years Member States must submit to the Commission a report on the implementation of the Directive on the basis of a questionnaire. There have been two reporting periods (2008-2011 and 2011-2014). For further information regarding the triannual reports, please refer to the European Commission report on the implementation of the Directive[2]. Previous consultant studies on the implementation of the Directive are available for the first reporting period[3] and the second reporting period[4]. Finally a recent report from the European Parliament research service addressed the implementation of the Extractive Waste Directive[5].

1.2 Seminar objective

The objective of the seminar is to gather feedback on possible solutions for improving the implementation of the Directive.

1.3 Supporting study

The seminar is supported by a study on the implementation of the EWD that has been initiated by the Commission. The main driver for the study resulted from the conclusion that the information received by Member States in the context of the required triannual reporting does not allow a full assessment of Member States' performance regarding the implementation of the Directive or on the reasons for any possible shortcomings, either in its entirety or regarding specific provisions. The aims of the study are to:

- Provide a comprehensive overview of the implementation of the Directive, indicating possible difficulties in their implementation and, if possible, exposing the root causes; and

[1] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02006L0021-20090807
[2] http://ec.europa.eu/environment/waste/mining/pdf/report_mining_waste.pdf
[3] http://ec.europa.eu/environment/waste/studies/mining/Study%20Implementation%20report%20Extractive%20Waste%20Directive.pdf
[4] http://ec.europa.eu/environment/waste/studies/mining/waste_extractive_industries.pdf
[5] http://www.europarl.europa.eu/sides/getDoc.do?type=COMPARL&reference=PE-594.105&format=PDF&language=EN&secondRef=01

- Address the specific provisions relating to the management of Category A facilities, the use of cyanide technologies, the stability of tailing dams and ponds, and the reprocessing of closed mining sites.

This study is not yet complete. Once finalised, it will be made publically available in the second half of 2017. Preliminary data suggest that information to further assess the implementation of the Directive has been collected on some aspects of the Directive but that further efforts (outside the scope of this study) are necessary to arrive at a better understanding of the issue.

This background note takes into account information presented in the study.

2. Implementation problems and proposed solutions

Each subsection below presents a problem definition on implementation issues the Commission has identified, one or more proposed solutions and several questions. Seminar attendees should consider these questions in advance with the aim of bringing ideas and evidence to the discussion.

2.1 Member State enforcement and control

Problem definition

Information provided by Member States in the two reporting periods suggests that the provisions relating to inspections may not be understood and implemented in the same way. Moreover, the number of inspections reported by Member States varies considerably. These findings are further detailed in the ongoing study:

- Number of non-compliance cases: few countries with extractive waste facilities have identified non-compliance issues. It is not possible to assess whether the limited number of cases of non-compliance is due to a high compliance rate from mining waste companies or to insufficient enforcement and control measures set in place by Member States.
- Expertise of inspectors and their number per site: insufficient information was provided to assess fully this indicator; one source suggests that inspectors in countries without a mining history may not be as well qualified as in those with such history; in a few Member States inspection is outsourced.
- Competent Authorities' sampling of mining waste, laboratory tests and/or stress tests: in general, competent authorities do not carry out their own tests/sampling but rely instead on tests performed by companies due to lack of financial/technical resources.

Proposed solution

- Development by the Commission of inspection guidelines:

In 2001 the European Parliament and the Council adopted a Recommendation providing for minimum criteria for environmental inspections (2001/331/EC). Based on this Recommendation, a contractor carried out in 2012 preparatory work for inspection guidelines covering extractive waste facilities in general and including specific guidelines for Category A facilities. The following draft takes into account comments made by Member States and stakeholders at that time:
http://ec.europa.eu/environment/waste/mining/pdf/Annex2_guidelines_inspection.pdf

Based on the report, the Commission could develop draft technical guidelines on inspections that would be adopted by Comitology. This procedure involves Member State experts. This could be accomplished in 2018.

Questions for stakeholders

- Do you consider the approach proposed in the external report mentioned above as fit for purpose? If not, please provide suggestions for improvement. Is the ambition level proposed in this report proportionate to the risks to be managed?

- Do you have any examples of good practices relating to inspection of extractive waste facilities that could be replicated in other Member States?

2.2 Waste facility classification

Problem definition

The number of extractive waste facilities reported by Member States appears low in comparison to information on extractive waste generated. For example, six Member States report that there are no extractive waste facilities on their territory while some of these states host extractive industries that generate waste.

The Commission has adopted a list of wastes that include a section on wastes resulting from exploration, mining, quarrying, and physical chemical treatment of minerals (2000/532/EC). However, material has first to be designated as waste before this list applies.

The Commission has adopted a decision[6] on criteria for the classification of waste facilities as Category A facilities; however, information provided by Member States in the reporting periods 2008-2011 and 2011-2014 suggests a significant level of variation in the number of Category A facilities designated by Member States and discrepancies between the numbers of facilities reported and the volumes of hazardous extractive waste generated.

Proposed solution

- Assessment of the understanding in Member States of what constitutes "extractive waste", extractive "waste facilities" and how Category A facilities are identified.

Questions for stakeholders

- Are you aware of a structured approach being used in EU Member States for the categorisation of "extractive waste" and also, for waste generated by the extractive sector that is not to be considered as extractive waste? If so, what information is available?
- Are you aware of a structured approach being used in the EU Member States for the categorisation of extractive "waste facilities"? If so, what information is available?
- Would there be added value in having EU level guidance on categorisation of (extractive) waste, waste facilities, and in particular Category A facilities, as a complement to the Commission Decision mentioned in the problem definition? If so, what form should it take? Do you have any examples of good practice, case studies; decision trees, or other?
- Are there different categorisation systems used in Member States (e.g. instead of categorising a facility as Category A, it might be categorised according to a national system, e.g. for categorisation of dams)? If so, what are the advantages/disadvantages of national systems?

2.3 Permitting

Problem definition

The permits issued under the Extractive Waste Directive can be combined with those required by other EU legislation such as the Industrial Emission Directive (IED) 2010/75/EU and the Seveso Directive (2012/18/EC). It is unclear to what extent facilities that meet the criteria for Category A and should have a permit based on the EWD are actually permitted on the basis of the IED or the Seveso Directive.

[6] 2009/337/EC

The Directive requires competent authorities to periodically reconsider and, where necessary, update permit conditions (Article 7.4). Reports from Member States do not allow assessment of how this provision is applied in practice.

Proposed solution

- Assessment of how Member States apply EWD, Seveso and IED in operational permits with a view to develop good practice for integrated permitting.
- Assessment of current practice for the updating of permits in Member States with a view to developing good practice for permit reconsideration.

Questions for stakeholders

- Is there a need to clarify the interlinkages between the three Directives mentioned above? If yes, how should this be done?

2.4 Financial guarantee

Problem definition

In 2009, the European Commission adopted Decision 2009/335/EC providing information on setting financial guarantees. The Decision leaves it up to Member States to determine a more detailed methodology for assessing the value of guarantees.

In addition to setting a financial guarantee, the Directive requires that Member States periodically review the appropriateness of financial guarantees. This provision is being implemented differently in Member States. Specific guidance was identified in a limited number of Member States. An IMPEL project[7] is on-going regarding how to set financial provisions to meet potential environmental obligations.

Proposed solution

- Foster a wider dissemination of existing good practice.

Questions for stakeholders

- Do you see added value in a workshop on good practices in the field of financial guarantees? What should be the scope of such a workshop?

2.5 Waste Management Plan

Problem definition

Since the entry into force of the EWD, on 1 May 2008, operators have submitted extractive waste management plans (EWMPs) as part of permit applications, and competent authorities in the different Member States have been tasked with approving these EWMPs and monitoring their implementation. As a result of the many years of experience with EWMPs, a substantial knowledge base has now been established across the whole of the EU territory, which should enable the identification of good practices that merit widespread implementation across the extractive sector.

[7] IMPEL report including case studies: http://www.impel.eu/wp-content/uploads/2016/12/FR-2016-20-Financial-Provision-2016.pdf

Proposed solution

- Compile good practice and foster a wider dissemination of existing good practice.

Questions for stakeholders

- Are you aware of any guidance or EWMPs you would consider as good practice?

2.6 Transboundary effects

Problem definition

Article 16(3) of EWD requires Member States to ensure *inter alia* that: in the event of an accident involving a Category A waste facility likely to have significant adverse effects on the environment of, and any resultant risks to human health in, another Member State, information provided by the operator to the competent authority is immediately forwarded to the other Member State to help minimise the consequences of the accident for human health and to assess and minimise the extent of the actual or potential environmental damage.

From the 19 Member States that have reported Category A facilities in their territories, four reported for the period 2011-2014 that Category A facilities under their jurisdiction may have an impact to another Member State (in brackets the number of facilities in question): Spain (2), Ireland (4), Italy (2), and Sweden (2).

Overall, Member States have established the relevant procedures and defined the relevant authorities involved in this process. From this perspective, implementation of the requirements of the EWD in terms of transboundary effects is good. However, findings on how well these procedures are applied in practice are scarce due to lack of cases.

Proposed solution

- Guidance on appropriate transboundary communication. This could be developed regarding what "significant adverse effects on the environment" on another Member State can be, aiming to lead to a more consistent understanding of this concept across Member States.

Questions for stakeholders

- Are the possible transboundary effects of extractive waste facilities distinct from other sectors to such an extent as to justify dedicated guidance?
- Are you aware of generic guidance on transboundary effects that could be relevant for managing transboundary effects from extractive waste facilities?

2.7 Inventory of closed extractive waste facilities

Problem definition

Member States have either set up an inventory of closed waste facilities (including abandoned waste facilities) or concluded that there are no closed facilities on their territory that would require inclusion in a national inventory.

Various Member States (Austria, Czech Republic, Hungary, Ireland, Italy, Slovakia, Sweden and the UK) apply a risk assessment method for various purposes, including prioritising facilities for an inventory of closed sites. A sub-committee of the TAC has developed guidance in 2011 for a risk-based pre-selection of closed facilities[8]. It is not known to what extent this method follows the above mentioned guidance. There is no information on the frequency of updates of the inventories.

[8] http://ec.europa.eu/environment/waste/mining/pdf/Pre_selection_GUIDANCE_FINAL.pdf

Proposed solution

- EU-wide inventory of closed extractive waste facilities that meets the requirements specified in Article 20.

Questions for stakeholders

- To what extent is the guidance note developed by the subcommittee of TAC on pre-selection of closed facilities useful?
- Are there additional specific criteria in place or is there guidance available in Member States to select the mining waste sites to be included in inventories?
- Would you consider the development of a publically available EU wide inventory of closed facilities based on existing national inventories to be useful?

2.8 Guidance on implementation

The Commission announced in its report adopted in September 2016 its plan to issue general guidance on the implementation of the provisions set out in the Directive. The issues identified were:

- 2.2 Waste facility classification
- 2.3 Application and permitting procedures
- 2.4 Financial guarantee
- 2.5 Waste Management Plan
- 2.6 Transboundary effects
- 2.7 Inventory of closed extractive waste facilities

This exercise could be based on a structured dialogue with Member State experts on their interpretation of the related provisions of the Directive and the tools currently used for their implementation. Operators and other stakeholders could be involved to inform this dialogue. The objective would be to arrive at a more uniform implementation of the Directive.

Questions for stakeholders

- Do you consider the proposed guidance as a useful tool to improve the implementation of the Directive?
- Does the list miss any important issue?
- In view of limited resources, which priority topics should be covered in such guidance among items 2.2 – 2.7?

2.9 Use of cyanide-based processes in gold production

Problem definition

Cyanide is a toxic substance and its use in mining causes concerns amongst citizens. The transboundary dimension of unplanned cyanide releases became apparent in the 2000 Baia Mare cyanide spill in which a mining accident in Romania caused river pollution that killed a large number of fish and affected the drinking water supply in Romania, Hungary, Serbia and Bulgaria.

The European Parliament voted for a resolution on the ban on the use of cyanide mining technologies in the EU[9] in 2010. In contrast, the European Commission concluded that a general ban on the use of cyanide in mining activities was not justified from environmental and health perspectives. The Commission noted that existing legislation (i.e. Directive 2006/21/EC) included precise and strict requirements ensuring an appropriate safety level of the mining waste facilities and that the limit values for cyanide storage as defined in the Directive were the most stringent possible and implied in practice a destruction step of cyanide used before its storage. The Commission announced however that it would review the availability of alternatives to the cyanide process.

Proposed solution

Appendix A to this document presents a series of alternative reagents and processes that have been investigated and tested for gold extraction from ores. This assessment concludes that there has not been a significant change in the application of commercially available alternatives to cyanide-based technologies and their respective technical, environmental and economic issues, hence it can be concluded that the introduction of a ban would still imply the closure of existing mines.

Whilst monitoring of developments in technologies should continue, a focus on the full application of the Directive by the Member States should be a priority to ensure that mines using cyanide technologies continue to operate in a safe condition.

Questions for stakeholders

- Are you aware of further alternative processes that could replace cyanide in gold mining in the EU?

2.10 Reprocessing of mining waste

Three examples of good practices identified in Member States will be presented at the meeting. There are no questions to participants ahead of the meeting.

[9] European Parliament resolution on the ban on the use of cyanide mining technologies in the EU. 2010. http://www.europarl.europa.eu/sides/getDoc.do?type=MOTION&reference=B7-2010-0240&language=EN

Appendix A
Assessment of available processes for gold extraction

Cyanide-based technologies are one part of a series of steps in the typical approach to gold production. The sequence of processing can be summarised as:

- Raw ore extraction;
- Ore crushing, grinding and grading;
- Gravity separation or flotation (to separate the heavier gold containing ore);
- Leaching to extract gold containing complexes; and
- Refining.

Cyanide-based technologies are used in the leaching stage. Due to the high toxicity of cyanide the possibility of replacing cyanide with other reagents has been investigated. Globally, according to Euromines, around 90% of the gold mines use cyanide-based technologies with the remaining mines being small-scale and artisan gold extraction using other techniques (unspecified).

Alternative technologies

A series of alternative reagents and processes have been investigated and tested for gold extraction from ores. The principle alternative reagents and processes and their current status are summarised below.

Alternatives to cyanide-based technologies

Name	Current status / potential
Alpha-cyclodextrin	Laboratory scale test only have been carried out. If developed to feasibility, could present a technology with a benign waste
Aqua regia	Not feasible in large scale applications due to toxicity, corrosivity and instability of the reagent.
Chlorination	Not adaptable for large scale operations. Economically unfavourable compared to cyanide leaching. Dundee Sustainable Technologies has however built a demonstration plant for a closed-circuit chlorination process, with no liquid or gaseous effluents and inert, stable residues.
Bromine and iodine	Not used due to difficult handling and high reagent costs. Not feasible in large scale applications.
Coal-oil agglomeration	Only effective for removing free gold particles. Not effective for use with refractory ores.
Glycine	Currently under research. No commercial scale trials reported to date.
Haber gold process	Currently under research. No commercial scale trials reported.
Thiocyanate	Not adaptable for large scale operations. Economically unfavourable compared to cyanide leaching. At the experimental stage.
Thiosulphate	Feasible but not widely used due to higher reagent cost and lower gold extraction rate. Economically unfavourable compared to cyanide leaching. Has been used in commercial full-scale applications in the US.
Thiourea	Feasible but not used to high reagent use and associated cost. Has potential for use with preg-robbing and refractory ores resistant to cyanide. Testing has reported that combination of thiourea, thiocyanate and ferric sulphate reduces the thiourea consumption and hence may increase commercial viability.
YES process	Currently under research. No commercial scale trials reported.

From the information assessed, it was clear that cyanide-based gold extraction remains the dominant technology. Alternative reagents have been tested and have been developed to commercial scale however, the appropriateness and applicability of alternative reagents and processes is governed by ore types and alternative reagents are not without their own technical, environmental and economic issues.

The alternative reagents that may present the best opportunities for cyanide-based technologies would appear to be the following:

- Thiosulphate. The use of thiosulphate is feasible but not widely used due to higher reagent costs and a lower gold extraction rate. The process has a lower environmental impact risk than cyanide-based processes. Thiosulphate is a more effective lixiviant of preg-robbing and high-copper ores than cyanide and has been used in commercial full-scale applications at the Nevada Goldstrike mine in the US;
- Chlorination –the Dundee Sustainable Technologies closed-circuit process. Whilst traditional chlorination processes are not adaptable for large scale operations and are economically unfavourable compared to cyanide leaching, Dundee Sustainable Technologies has developed and patented a process and operated a demonstration plant for a closed-circuit chlorination process that generates no liquid or gaseous effluents and an inert, stable residue. The process is flexible in terms of ore types (tolerates base metals, suitable for preg-robbing and refractory ores) and is reported to have similar process costs and lower capital costs to cyanide-based processes. Full scale, commercial operations have yet to be developed;
- Alpha-cyclodextrin. Currently at laboratory scale testing, this starch-derived reagent presents a possibility of gold extraction with benign waste products relative to cyanide-based processes. Considerable further research and piloting is required however of this potential reagent before a clear conclusion of its commercial potential can be made; and
- Thiocyanate. Tests have shown that thiocyanate leaching can perform comparably to cyanide however, the use of thiocyanate remains at the experimental stage, and presently is not adaptable for large scale operations and economically unfavourable compared to cyanide leaching.

That cyanide-based technologies remain the dominant technology is reflected in Laitos, J. (2013)[10] which commented that "Until further research or technological breakthroughs makes one or more of the above alternatives[11] to cyanide economically competitive, technologically feasible, and environmentally safe, cyanide leaching will remain the only practical method for large scale gold extraction processes;"

Cyanide processes (when adequately and sustainably managed) are currently BAT in gold extraction, as no appropriate alternatives are available for full, economic scale operations for the rock types currently extracted. There is information of examples of the current BAT used in the EU. 46 BAT were quoted by the facilities of the main gold and silver producers in the EU.

Author	Reviewer
……	……
Victoria Cherrier	Daren Luscombe

[10] Laitos, J. (2013) Cyanide, mining and the Environment. Volume 30 Pace Environmental Law Review

[11] Thiocyanate, thiosulphate, thiourea, coal-oil agglomeration, Haber gold process and YES process were reviewed.

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Appendix E
Weblinks to information on closed and abandoned sites

	Links to national inventories	Other links identified
AT	Not available online	http://www.bmwfw.gv.at/EnergieUndBergbau/SicherheitImBergbau/Documents/Bestandsaufnahme%20nach%20Art.%2020.pdf
BE	-	http://geoportail.wallonie.be/WalOnMap/ (Catalogue: Sol et Sous-sol, Déchets miniers)
BG	http://eea.government.bg/bg/nsmos/soil/opisminob.doc [The link does not work so it was not possible to confirm that they do have an inventory that is currently available]	http://eea.government.bg/bg/nsmos/spravki/2012/soil1
CY	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/3FC88CAC22E5817AC225814C003CF79C?OpenDocument	http://www.moa.gov.cy/moa/environment/environment.nsf/1C48B6A00C5D8072C225793D0026F18F/$file/Klistes_i_Kai_Egkatelimmenes_Egkatastaseis_Exoriktikon_Apovliton.pdf
CZ	http://www.geology.cz/extranet/sgs/ulozna-mista-tezebniho-odpadu/registr-rizikovych-uloznych-mist	-
DE	-	-
DK	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required)	http://naturstyrelsen.dk/vandmiljoe/havet/raastoffer/raastofindvinding-paa-land/nedlukkede-udvindingsaffaldsanlaeg/
EE	http://www.envir.ee/sites/default/files/suletud_jaatmehoidlate_invent_i_etapp_2011.pdf http://www.envir.ee/sites/default/files/suletud_jaatmehoidlate_invent_ii_etapp_2012.pdf http://www.envir.ee/sites/default/files/kaevandamisjaatmediietapparuandelisad_2011.pdf	-
ES	http://www.minetur.gob.es/energia/mineria/Mineria/Paginas/Mineria.aspx http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/prevencion-y-gestion-residuos/	http://www.minetur.gob.es/energia/mineria/Mineria/Paginas/Mineria.aspx
FI	http://www.ymparisto.fi/download/noname/%7B338BC4F5-62BF-4C76-A755-A6F1CB06E2E0%7D/44798	http://www.ym.fi/fi-FI/Ajankohtaista/Julkaisut/YMra242013_Suljettujen_ja_hylattyjen_kai%2825033%29

	Links to national inventories	Other links identified
FR	https://www.ecologique-solidaire.gouv.fr/sites/default/files/2017%2003%2017%20Tableau_Mise_en_ligne%20Inventaire%20DDIE%20pour%20site%20internet.pdf	
GR	http://www.ypeka.gr/LinkClick.aspx?fileticket=L%2bY%2fWnsXHkY%3d&tabid=824&language=el-GR	http://www.ypeka.gr/Default.aspx?tabid=824&language=el-GR&SkinSrc=%5BG%5DSkins%2F_default%2FNo+Skin&ContainerSrc=%5BG%5DContainers%2F_default%2FNo+Container&dnnprintmode=true
HR	Croatian mining authorities stated in the workshop on the implementation of the Directive (March 2017) that there was not an inventory yet and that they were working on it. In further communication, Croatia stated that they had not identified any sites for which Article 20 was applicable yet. Croatia joined the EU in July 2013	
HU	http://www.mbfh.hu/home/html/index.asp?msid=1&sid=0&hkl=537&lng=1	http://elginfo.elgi.hu/mwf/mwf2012.pdf
IE	http://watermaps.wfdireland.ie/ExtractiveFacilities/SearchResults.aspx?entrymode=SiteStatus&querytext=Closed	http://www.epa.ie/enforcement/extractiveindustriesregister/#.VtbXB-YYt34 http://www.epa.ie/enforcement/mines/#.VtbXS-YYt34
IT	http://www.isprambiente.gov.it/it/banche-dati/strutture-di-deposito-di-tipo-a [The link is an online repository with one link for each of the Italian regions with Art. 20 sites (16 regions) and a statistical summary]	
LT	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required)	
LU	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required)	http://www.environnement.public.lu/etablissements_classes/dossiers_thematiques/gestion_dech_industrie_extractive.pdf
LV	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required)	
MT	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required)	http://www.mepa.org.mt/quarries-envpermitting

	Links to national inventories	Other links identified
NL	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required)	http://www.infomil.nl/onderwerpen/integrale/handboek-eu/afval/winningsafval/uitvoering-effecten/
PL	http://www.gios.gov.pl/zalaczniki/bip/spis_zouow_20120424.pdf [The website is currently in reconstruction; the inventory was provided as a Word document in the meantime]	No public list found but the relevant webpage and competent authority: http://bip.umwd.dolnyslask.pl/dokument,iddok,8655,idmp,291,r,r Guidance for identifying closed and abandoned mines: http://www.gios.gov.pl/bip/zamowienia_zalaczniki/165/zalacznik_20120301.pdf Synthesis of guidance: https://www.mos.gov.pl/fileadmin/user_upload/odpady/Synteza_wytyczne_wielkosci_i_formy_gwarancji_finansowej.pdf
PT	http://www.dgeg.pt?cr=13014	
RO	http://www.minind.ro/resurse_minerale/Inventar_Iazuri_de_Decantare_iulie_2012.pdf [Ponds] http://www.minind.ro/resurse_minerale/Inventar_halde_iulie_2012.pdf [Heaps]	http://www.minind.ro/resurse_minerale/Obiective_miniere_la_06.08.2012.pdf
SE	http://www.naturvardsverket.se/upload/sa-mar-miljon/mark/avfall/Inventering-av-gruvor/forteckning-nedlagda-anlaggningar-12-04-27.pdf	
SI	The Member State stated that there are no sites for which Article 20 is applicable (No inventory required). However, there is an inventory available online: http://www.arso.gov.si/varstvo%20okolja/odpadki/poro%C4%8Dila%20in%20publikacije/PORO%C4%8CILO%203%20FAZE_21022014.pdf It is not clear whether the inventory was not available when Slovenia submitted the implementation report (2013-2015).	Guidance for identifying closed and abandoned mines: http://www.arso.gov.si/varstvo%20okolja/odpadki/poro%C4%8Dila%20in%20publikacije/PORO%C4%8CILO%203%20FAZE_21022014.pdf
SK	http://charon.sazp.sk/Odpady_tp/Ulozisko.aspx	
UK	England: http://www.environment-agency.gov.uk/homeandleisure/139297.aspx Northern Ireland: http://www.planningni.gov.uk/index/advice/advice_apply/advice_special_studies/advice_special_studies_minerals.htm Scotland: - Wales:http://publications.environment-agency.gov.uk/PDF/GEHO0512BWIB-E-E.pdf	England and Wales: http://apps.environment-agency.gov.uk/wiyby/139297.aspx See also this report - inventory on closed sites (2014): https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/288582/LIT_6797_7d390c.pdf NI: DOENI has compiled an Inventory of closed waste facilities in Northern Ireland with the assistance BGS and GSNI: http://www.planningni.gov.uk/de/index/advice/advice_apply/advice_special_studies/inventory_pdf.pdf Scotland: http://www.gov.scot/Resource/0047/00470179.pdf

Appendix F
Extractive Waste Directive online information by Member State

Websites on extractive waste

The competent authorities in the majority of Member States have established webpages on extractive waste. Information was identified for 21 Member States. These are typically located within the Ministry of Environment's or Environment Agency's websites, or other portals of information managed by the Ministry of Environment. Other examples of ministries responsible for managing these webpages included the Ministry of Energy and the Ministry of Industry.

The level of detail of the information presented on these websites varied between Member States. The more developed webpages include a host of information including guidance documents and other relevant background material. Where no dedicated webpage is available, information is contained within other webpages dedicated to either waste or mining. Links to the relevant webpages are presented in the table below along with a brief comment detailing the available information and competent authority responsible for managing the webpage. Information regarding implementation of the Directive specifically was not located on the webpages as they are focussed on provision of information.

Overview of Member State website links with general information

Member States	Link	Comment
Austria	http://www.en.bmwfw.gv.at/Energy/Seiten/TheAustrianMineralResourcesPlan.aspx	The website of the Federal Ministry of Science, Research and Economy has dedicated webpages on mining, with links to legislation concerning extractive wastes and abandoned and closed mines.
Belgium	Wallonia: http://environnement.wallonie.be/enviroentreprises/pages/etatenviindustrie.asp?doc=syn-ext-dep Flanders: http://www.ovam.be/afval-materialen. Brussels: No mining activities in Brussels	A dedicated webpage has been set up for Wallonia via the website for the Ministry of Environment, providing an outline of the issues and actions for change. No dedicated webpages were identified for Brussels or Flanders.
Bulgaria	https://me.government.bg/bg/themes-c333.html	The website for the Ministry of Energy has dedicated webpages on extractive waste, with information concerning management options, permits and legislation.
Cyprus	http://www.moa.gov.cy/moa/mines/minesSrv.nsf/dmlenvironment_gr/dmlenvironment_gr?OpenDocument	The Ministry of Agriculture, Natural Resources and Environment's website has dedicated webpages on extractive waste, with information concerning management options, permits and legislation.

Member States	Link	Comment
Czech Republic	http://www.geology.cz/extranet/sgs/dulni-dila	The Czech Geological Survey's website (a state-run website managing geoscientific information for the government) has dedicated webpages on extractive wastes and mining. The resource includes information concerning management options, permits, a register of abandoned and closed mines and legislation.
Germany	http://www.laga-online.de/servlet/is/23876/	Mining and extractive waste is managed at Länder level in Germany. A Federal Working Group on Mining Waste has been established which has collated the list of competent authorities across the Länder with links to the relevant websites. The level of information varies by Länder with some only providing links to legislation and others setting out guidance and background material.
Denmark	http://naturstyrelsen.dk/vandmiljoe/havet/raastoffer/raastofindvinding-paa-land/	The Nature Agency's website has a dedicated webpage on extractive wastes outlining the general terms of requirements and providing links to relevant legislation and guidance among other things.
Estonia	http://www.envir.ee/et/maapou	The website of the Ministry of Environment has dedicated webpages on mining with links to legislation on extractive wastes
Spain	http://www.minetur.gob.es/energia/mineria/Mineria/Legislacion/Paginas/Legislacion.aspx	The website of the Ministry of Industry, Energy and Tourism has dedicated webpages on mining. This includes links to legislation on extractive wastes and the register of abandoned and closed mines.
Finland	http://www.ymparisto.fi/fi-FI/Kulutus_ja_tuotanto/Jatteet_ja_jatehuolto/Jatehuollon_vastuut_ja_jarjestaminen/Kaivannaisjatteet	The Finnish environmental associations (Ministry of the Environment, Finnish Environment Institute SYKE, and the Housing Finance and Development Centre of Finland) have a joint website called ENVIRONMENT.fi (YMPARISTO.fi). This website includes dedicated webpages on extractive waste with links to legislation and guidance among other things.
France	http://www.developpement-durable.gouv.fr/-Sous-sol-.html	The website of the French Ministry of the Environment, Energy and Sea includes dedicated webpages on extractive waste, with links to legislation, guidance, the register of abandoned and closed sites, and a dedicated webpage on mining uranium.
Greece	http://www.ypeka.gr/Default.aspx?tabid=824&language=el-GR	The Environment and Energy Ministry's website includes a dedicated webpage on extractive waste with links to legislation, reports and relevant events.

Member States	Link	Comment
Croatia	http://puo.mzopu.hr/default.aspx?id=4090	The website for the Ministry of Environment and Nature Protection has a dedicated webpage on extractive waste, with links to guidance, legislation and background material.
Hungary	http://www.mbfh.hu/home/html/index.asp?msid=1&sid=0&hkl=547&lng=1	The Hungarian Mining and Geology Office has a dedicated webpage on extractive waste within its website. This includes links to legislation and guidance, and information concerning abandoned and closed mines.
Ireland	http://www.epa.ie/enforcement/mines/#.VtbXS-YYt34	The Environmental Protection Agency's website has dedicated webpages on mining. There is limited information concerning extractive wastes on these webpages although it does include a link to its register of abandoned and closed sites and the relevant legislation.
Italy	http://www.isprambiente.gov.it/it/banche-dati/strutture-di-deposito-di-tipo-a	The website for the Institute for Protection and Environmental Research (ISPRA) (a state run organisation) includes a dedicated webpage on abandoned and closed site with links to legislation on extractive waste.
Lithuania	http://www.am.lt/VI/index.php#a/6810; https://www.lgt.lt/index.php?option=com_content&view=article&id=166:naudingosios-iskasenos&catid=171:apie-lietuvos-geologija&Itemid=1127&lang=lt	No dedicated webpage on extractive waste was identified on the Ministry of Environment's website. The Lithuanian Geological Survey's website includes a dedicated webpage on mining but no information on extractive waste was located on this website.
Luxembourg	http://www.environnement.public.lu/dechets/legislation/flux_de_dechets_specifiques/index.html	The Ministry of Environment is responsible for matters concerning extractive waste, and a link to the national legislation is located on its website under waste management.
Latvia	http://www.varam.gov.lv/lat/likumdosana/normativie_akti/?doc=3150	The Ministry of Environment's website includes dedicated webpages on mining with links to legislation on extractive waste.
Malta	http://www.mepa.org.mt/quarries	The Malta Environment and Planning Authority's website includes a dedicated webpage on extractive waste. This includes a brief outline of the issues and the processes in place to manage extractive waste.
Netherlands	http://www.infomil.nl/onderwerpen/integrale/handboek-eu/afval/winningsafval/	The Ministry of Infrastructure and the Environment's website includes a dedicated webpage on extractive waste outlining relevant Dutch and European legislation with links to the original documents.

Member States	Link	Comment
Poland	https://www.mos.gov.pl/pl/srodowisko/odpady/odpady-z-przemyslu/	The Ministry of Environment's website includes information on extractive wastes under its dedicated webpages on waste. This includes links to legislation, guidance and other relevant materials.
Portugal	http://www.dgeg.pt/; http://www.apambiente.pt/index.php?ref=16&subref=84&sub2ref=222	The Directorate General for Energy and Geology's website includes a webpage on mining with no information currently available (with a notice to say that it is under development). The Ministry of Environment's website includes only a few lines on extractive waste.
Romania	http://www.minind.ro/ [144]	The Ministry of Economy, Trade and Business's website includes a dedicated webpage on mining and extractive waste. It includes links to information on mining permits, legislation, abandoned and closed sites, and other relevant documents.
Sweden	http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Gruvor/	The Swedish Environmental Protection Agency's website includes dedicated webpages on mining and extractive waste. It includes links to the relevant legislation, guidance and statistics on extractive waste.
Slovenia	http://www.arso.gov.si/varstvo%20okolja/odpadki/; http://www.arso.gov.si/varstvo%20okolja/poro%C4%8Dila/poro%C4%8Dila%20o%20stanju%20okolja%20v%20Sloveniji/odpadki.pdf	The Environment Agency's website includes dedicated webpages on waste, and has posted a report on how waste legislation and waste management works in Slovenia, including that of extractive waste (2006).
Slovakia	https://www.minzp.sk/sekcie/temy-oblasti/geologia/tazobny-odpad.html; http://charon.sazp.sk/Odpady_tp/	The Ministry of Environment's website includes information on extractive wastes under its dedicated webpages on geology. This includes links to the legislation and a state run environmental portal with a dedicated webpage on extractive waste.
United Kingdom	https://www.gov.uk/government/publications/environmental-permitting-guidance-the-mining-waste-directive	The UK government's website includes a dedicated webpage on extractive waste with links to the relevant legislation, guidance and the respective environment agencies for the devolved administrations responsible for permitting and recording abandoned and closed sites.

Note: All web links were last accessed 4 March 2016.

Availability of information on permits granted under the EWD

An overview of available information is presented below. In summary, the majority of Member States do not include the complete information on permits directly online, rather information can be provided on request – only four Member States include direct links to copies of the permits on their competent authority websites (Cyprus, Denmark, Estonia and Malta). Rather, Member States generally provide a list of permits with a

[144] To access the relevant webpage follow: 'Domenii/ Sectoare' and then 'Resurse minerale'

summary of information, including for example the name of the operator and organisation, its location, the substance mined and activities required by the permit. In the case of six Member States, this summary permit information is publically available online in a searchable inventory (Bulgaria, the Czech Republic, Ireland, Lithuania, Slovakia and Spain). No information on permits was found in the case of seven Member States. Lastly, it should be noted that Luxembourg and the Netherlands reported that no permits have been issued.

Overview of Member State website information on permits

Member States	Link	Comment
Austria	http://www.bmwfw.gv.at/EnergieUndBergbau/BergIS/Seiten/default.aspx	Basic permit information is available online and mapped geographically. Permit information includes the type of mining authorised, the name and location of the authorisation, and the raw mineral material mined.
Belgium	Wallonia: http://geoportail.wallonie.be/WalOnMap/#BBOX=135636.45046421952,201385.54029573253,99440.4160532984,151431.14503475637. Flanders: No information found. Brussels: n/a.	Permits for extractive waste in Wallonia are mapped geographically. No further detail concerning the permits can be accessed by this tool. No information found concerning permits was found for Flanders. No mining activities are reported in Brussels.
Bulgaria	http://pdbase.government.bg/forms/public_permits.jsp?rios=0&teritory=0&district=0&popular=0&act=0&ewc=&find=&RuchFind=Search	A searchable inventory of all permits is available online.
Cyprus	http://www.moa.gov.cy/moa/Mines/MinesSrv.nsf/4738f9dbd07d213cc2256fb3003d76d0/4a382845f0233b86c22570e60036333e?OpenDocument	Currently there is only one active mine operating in Cyprus. Permit details are available online, along with the application and annual reporting report.
Czech Republic	http://www.geology.cz/extranet/sgs/dulni-dila/poddolovana-uzemi	The State Geological Survey is responsible for maintaining a register of mining permits and all associated activities. The register is publicly available online.

Member States	Link	Comment
Germany	Baden Württemberg: http://www.lgrb-bw.de/bergbau/zustaendigkeiten_der_landesbergdirektion/bergbauberechtigungen. Overview: http://www.laga-online.de/servlet/is/23876/.	Permits are granted at Länder level in Germany. At present, mines are active in the following Länder: • Baden Württemberg; • Bavaria; • Brandenburg; • Hessen; • Niedersachsen (Lower Saxony); • North Rhine Westphalia; • Rheinland Pfalz; • Saarland; • Sachsen (Saxony); • Sachsen-Anhalt; and • Thüringen. Information concerning permits is made available by the competent authorities for the respective Länder and varies accordingly. E.g. in Baden Württemberg, permits are mapped geographically according to the substance mined. Information concerning all regions has not been sourced at this stage but links to the relevant competent authorities in the overview webpage should direct to relevant information on permits.
Denmark	http://naturstyrelsen.dk/vandmiljoe/havet/raastoffer/raastofindvinding-paa-havet/indvindingstilladelser/auktionsomraader-indvindingstilladelser/	Permits are available publicly online. A complete list with links to copies of the permits is available on the Nature Agency's website.
Estonia	http://www.envir.ee/et/maavara-kaevandamise-loa-taotlused	Permits are available publicly online. A complete list with links to copies of the permits is available on the Ministry of Environment's website.
Spain	https://geoportal.minetur.gob.es/CatastroMinero/BusquedaBasica.do	A searchable inventory of all permits is available online.
Finland	http://www.ymparisto.fi/fi-FI/Asiointi_luvat_ja_ymparistovaikutusten_arviointi/Luvat_ilmoitukset_ja_rekisterointi/Maaainesten_ottamiseen_liittyva_ilmoitus_ja_luvat	Permits are granted at municipal level and information concerning permits is made available by the competent authorities for the respective municipality.
France	http://www.developpement-durable.gouv.fr/Inventaire-article-20.html	A list of permits is available online with information concerning the geographic location, the name of the organisation, the sector, substance mined and an outline of actions required by the permit.
Greece	http://www.ypeka.gr/LinkClick.aspx?fileticket=JLNa0i8XaZQ%3d&tabid=824&language=el-GR	An overview of permits according to their classification of waste is publicly available online. No further information concerning the permits was found on the competent authority's website.
Croatia	n/a	No information was found.

Member States	Link	Comment
Hungary	http://www.mbfh.hu/home/html/index.asp?msid=1&sid=0&hkl=547&lng=1	An overview of permits is publicly available. A map is also publicly available. No further information concerning the permits was found on the competent authority's website.
Ireland	http://www.epa.ie/enforcement/extractiveindustriesregister/#.VtbXB-YYt34	A searchable inventory of all permits is available online.
Italy	http://unmig.mise.gov.it/unmig/cartografia/cartografia.asp	Permits for extractive waste in Italy are mapped geographically. No further detail concerning the permits can be accessed by this tool.
Lithuania	https://www.epaslaugos.lt/portal/service/15625/8820?searchId=21be9b2c-6c3f-4419-ae08-80f72e0e0838	According to the competent authority, a searchable inventory of all permits is available online. However, we have been unable to register to access the database.
Luxembourg	http://www.environnement.public.lu/etablissements_classes/dossiers_thematiques/gestion_dech_industrie_extractive.pdf	No permits have been issued.
Latvia	n/a	No information was found.
Malta	http://www.mepa.org.mt/quarries-envpermitting	A list of permits is available online with information concerning the location, the name of the organisation, substance mined and activities on site along with a link to a copy of the permit.
Netherlands	http://www.infomil.nl/onderwerpen/integrale/handboek-eu/afval/winningsafval/uitvoering-effecten/	No information on permits is available online since no permits were granted;
Poland	https://www.mos.gov.pl/pl/srodowisko/odpady/odpady-z-przemyslu/; https://www.mos.gov.pl/fileadmin/user_upload/odpady/Sprawozdanie_ws_wykonania_Dyrektywy_2006_21_WE.pdf	An overview of permits according to their classification of waste is publicly available online (p.26 of the implementation report). No further information concerning the permits was found on the competent authority's website.
Portugal	n/a	No information was found.
Romania	http://www.minind.ro/resurse_minerale/Inventar_Iazuri_de_Decantare_iulie_2012.pdf	A list of permits is available online with information concerning the location, the name of the organisation, substance mined and activities on site.
Sweden	http://www.naturvardsverket.se/Stod-i-miljoarbetet/Vagledningar/Gruvor/Miljo--och-tillstandsprovning-/	No information was found. The link is for permit applications and a point of contact.
Slovenia	n/a	No information was found.

Member States	Link	Comment
Slovakia	http://charon.sazp.sk/Odpady_tp/	Information concerning permits is publicly available online along with supporting documents such as management plans, summary reports on the monitoring and controls, etc. However, we have been unable to register to access the database.
United Kingdom	England – Public register (https://environment.data.gov.uk/public-register/view/search-waste-operations) Wales – Public register (https://nrwregulatory.naturalresources.wales/Permits) Northern Ireland (http://appsd.daera-ni.gov.uk/wastelicences/) https://www.gov.uk/guidance/check-if-you-need-an-environmental-permit	England and Wales hold information of environmental permits in two registers that are specific to waste operations (including extractive waste). Northern Ireland holds a similar register but it is not clear whether it includes extractive waste facilities. A similar register was not found in Scotland (it was only applicable to WEE). The UK also has a link for permit applications and a point of contact.

Note: All web links were last accessed 4 March 2016.

Appendix G
Summary of selected extraction and tailings management techniques

Summary of selected minerals and main extraction and tailings management techniques[145]

Mineral	Extraction technique	Mineral processing	Tailings / other key waste characteristics	Tailings /other key waste material management	Closure and after- care techniques
Aluminium / Alumina	Open pit and underground	Bayer process (Alumina)	Elevated pH, red mud: d80<10 µm, process sand: d80<1000 µm	Slurried or thickened	Dewater and dry cover, discharge treatment
Base metals	Open pit and underground (cut- and-fill, room and pillar, blasthole stoping)	Flotation and leaching for Au	d_{80}: 50 – 100 µm, often ARD potential	Slurried or thickened. some backfill (coarse fraction)	Dewater and dry cover or wet cover
Chromium	Open pit	Dense medium and magnetic separation	Containing Cr and Ni	Slurried	No information available related to current projects in the EU
Iron	Open pit, underground (large- scale sub-level caving)	Magnetic separation, dense medium separation	No ARD potential, mostly SiO_2 and Fe_xO_y	Fines: slurried, coarse: heaps	Dewater and dry cover
Manganese	Underground	Only crushing	No tailings	NA	NA
Precious metals	Open pit and underground	CN leaching, spirals, shaking table	Some have ARD potential, in case of CN leach: containing cyanide, complexed metals, cyanate, thiocyanate	Slurried, some backfill (coarse fraction), CN destruction	Dewater and dry cover, wet cover, raised groundwater table

[145] The information is intended as a summary of typical operations and is not a generalisation of all management techniques used for each of the products included in the table. Based on Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities, European Commission, 2009 with further input from Amec Foster Wheeler's in-house extractive industries experts.

Mineral	Extraction technique	Mineral processing	Tailings / other key waste characteristics	Tailings /other key waste material management	Closure and after- care techniques
Tungsten	Open pit and underground (sublevel stoping, sublevel caving, cut- and-fill)	Flotation, dense-medium separation, shaking tables	$_{d}80$=100 µm, no ARD potential	Slurried, some backfill (coarse fraction)	Dewater and dry cover
Barytes	Open pit, underground	All techniques e.g. jigging, dense medium, flotation	-	Often no tailings, fines as slurry, sometimes backfilled, coarse tailings on heaps or sold as aggregates	-
Borates	Open pit, underground	Dissolution, crystallisation, drying/cooling	Clays and calcareous minerals, fine clays particles and flocculants	Coarse tailings first on heaps and then backfilled, slurry in ponds	-
Feldspar	Quarrying	Sometimes none, otherwise optical separation, flotation, electrostatic or magnetic separation	Solids contain fine sands and micas, 10% iron oxides, some flocculants, process water: pH 4.5, some fluoride	Coarse tailings on heaps, slurries are backfilled or ponded	-
Fluorspar	Open pit and underground (cut- and-fill, room and pillar)	Dense medium separation, flotation,	Mostly silica (90%), Fe and Al oxides	Backfilling and process water re-use, slurries mostly to ponds, in one case fine tailings into sea	After-care period of 10 yrs. expected to monitor heavy metals, fund for closure/after-care costs

Mineral	Extraction technique	Mineral processing	Tailings / other key waste characteristics	Tailings /other key waste material management	Closure and after- care techniques
Kaolin	Quarrying	No comminution, magnetic separation, flotation	Fine sands and micas, <1% iron oxides, some flocculants, process water: pH 4.5, some phosphates, sulphates, foam inhibitor	Coarse tailings on heaps, slurries in ponds lined with clay, in one case dewatered fines are transferred to heaps	Dewater and dry cover
Limestone / calcium carbonate	Open pit/quarry	Limestone: washing; calcium carbonate: flotation, magnetic separation	Limestone: <0.25 mm	Slurries in ponds, in one case the pond is a former quarry, sometimes the slurry is dried and the tailings discarded onto heaps	Dewater and dry cover
Phosphate	Open pit	Flotation	-	Slurries in ponds	-
Strontium	Open pit	In one case none, in the other dense medium and flotation	Coarse fraction from the dense-media pre-concentration and the fines tailings from flotation	Coarse tailings are backfilled, flotation slurry in ponds	-
Talc		Often only comminution, sometimes flotation	-	Flotation tailings in ponds, which through dewatering become heaps	-

Mineral	Extraction technique	Mineral processing	Tailings / other key waste characteristics	Tailings /other key waste material management	Closure and after- care techniques
Potash	Underground (room and pillar, longwall, sublevel stopping)	Hot leaching, flotation, electrostatic separation, dense medium separation	Liquid and solid tailings, containing sodium chloride with other salts, clay and anhydrite	Solid tailings on heaps, liquid tailings into deep wells or surface waters, in one case marine discharge of liquids and solids, some solid tailings are backfilled	Heaps remain unchanged and dissolve over time
Coal	Open pit and underground (longwall)	Coarse fractions in jigs or dense medium, flotation for fines	Clay, shale, sandstone, sulphides, some reagents, can be radioactive	Backfilling often too costly, coarse tailings on heaps or in old pits, fines in ponds, sold or filtered and to heaps	Landscape integrated heap design agreed with authorities and communities
Shale gas	Hydraulic fracturing followed by gas extraction	None required for gas	Drilling tailings from drilled rocks (various) and shale target formation Produced water and flowback, residuals of fracturing fluid from fracturing process	Landfill disposal Treatment prior to consented discharge to surface water	Landscaping and restoration of the site following by well integrity testing
Tight gas	Hydraulic fracturing followed by gas extraction	None required for gas	Drilling tailings from drilled rocks (various) and the target formation Produced water and flowback, residuals of fracturing fluid from fracturing process	Landfill disposal Treatment prior to consented discharge to surface water	Landscaping and restoration of the site following by well integrity testing

Mineral	Extraction technique	Mineral processing	Tailings / other key waste characteristics	Tailings /other key waste material management	Closure and after- care techniques
Tight oil	Hydraulic fracturing followed by oil extraction	Processing	Drilling tailings from drilled rocks (various) and the target formation Produced water and flowback, Residuals of fracturing fluid from fracturing process	Landfill disposal Treatment prior to consented discharge to surface water	Landscaping and restoration of the site following by well integrity testing
Coal bed methane	Dewatering of rock structure. Occasionally hydraulic fracturing	None required for gas	Drilling tailings from drilled rocks (various) and the target formation Water from dewatering. Residuals of fracturing fluid from fracturing process if used	Landfill disposal Treatment prior to consented discharge to surface water	Landscaping and restoration of the site following by well integrity testing

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