DRAFT
Chain of Custody Standard for Responsibly Mined Materials 2.0

October 2023

IRMA

Initiative for Responsible Mining Assurance

Initiative for Responsible Mining Assurance DRAFT Chain of Custody Standard for Responsibly Mined Materials

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Disclaimer

The Initiative for Responsible Mining Assurance (IRMA) DRAFT Chain of Custody Standard for Responsibly Mined Materials v. 2.0 is being released for public consultation, inviting input from diverse stakeholders and from entities across supply chains on base-level requirements for tracking verified IRMA-achieving materials from the mine through the supply chain to the end consumer.

This draft document aims to improve and address gaps in the DRAFT Chain of Custody Standard for Responsibly Mined Materials v. 1.0 released for public consultation in 2020. It is not a finished document, nor seeking final review, but rather is structured to invite comments, recommendations, and input on a set of consultation questions to improve the Chain of Custody Standard.

This DRAFT Chain of Custody Standard for Responsibly Mined Materials v. 2.0 has been prepared and updated by the IRMA Secretariat based on learnings from public engagement and pilots on v. 1.0., including input from a wide range of stakeholders and entities across supply chains.

The DRAFT Chain of Custody Standard v. 2.0 is shared in its current form to continue to catalyze global conversation and stakeholder input. It does not represent content that has been endorsed by IRMA's multistakeholder Board of Directors. IRMA's Board leaders seek the wisdom and guidance of all readers to answer the questions in this document and inform this opportunity to improve the IRMA Chain of Custody Standard.

IRMA is dedicated to a participatory process including public consultation with a wide range of affected people globally and seeks feedback, comments, questions, and recommendations for improvement of this Standard. IRMA believes that diverse participation and input is a crucial and determining factor in the effectiveness of a Standard that is used to improve environmental and social performance in a sector. To this end, every submission received will be reviewed and considered.

Thank you for your input to inform development of this Standard.

Preamble

Modern societies rely on mined minerals to function. Nearly everything manufactured or constructed—from buildings to roads to computers to automobiles—contains material mined from the Earth. Mining provides important employment and financial opportunities for host communities and host countries. But it is a complex and intensive process that can impact the physical environment, such as through the loss of habitat or contamination of water, and may affect local communities' social and economic lives, such as through displacement of livelihoods or cultural impacts.

Many negative environmental and social impacts can be prevented, mitigated, or remediated if mines operate in a manner that is aligned with best practices. IRMA's *Standard for Responsible Mining* v.1.0 specifies a set of objectives and leading performance requirements for environmentally and socially responsible practice at the mine site. The IRMA *Standard for Responsible Mining* serves as the basis of a voluntary system offering independent third-party audits of environmental and social performance measures at industrial scale mine sites around the world.

In response to demands from end users for independently verified socially and environmentally responsible mined materials, IRMA has developed a standard and system to track and provide assurance about the origin and impacts of mined materials being purchased and sold in the marketplace. The IRMA *Chain of Custody Standard for Responsibly Mined Materials* (IRMA Chain of Custody Standard) sets out specific requirements for tracking material from verified IRMA-achieving mines and mineral processors to market, enabling Entities operating within the supply chain and end users to make credible claims about IRMA-achieving material.

These systems are powerful tools that when applied provide a measurable demonstration of due diligence in responsible sourcing, as described by the Organisation for Economic Co-operation and Development (OECD). OECD describes this as "an on-going, proactive, and reactive process through which companies can ensure that they respect human rights and do not contribute to conflict."[1]

This standard is designed to be compatible with other standards programs that ensure responsible sourcing of mined materials downstream of the mine (e.g., ResponsibleSteel, Responsible Jewellery Council). In addition, this Standard has been developed to work in concert with existing and emerging traceability services and technologies (e.g., block chain, mineral ID scanning, testing, etc.).

IRMA released an initial draft CoC standard in 2020 for public review and comment. This revised draft responds to comments on the 2020 version, including the addition of controlled blending and book-and-claim accounting models to align with practical realities of complex supply chains. The revised draft also includes expanded

[1] OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas, Third Edition, OECD © 2016.

normative guidance, including examples of supply chains for multiple materials that have or are currently undergoing independent third-party IRMA audits. **We welcome comments on this draft via email at comments@responsiblemining.net.**

Introduction

NOTE FOR REVIEWERS: Changes have been made to make to ensure consistency with ISO 22095.

Proposed additions and changes:

- The sub-section on Purpose has been renamed Overview and Purpose and includes information addressing the prior sub-sections on Scope and Methodology of Evaluation, Version and Effective Date, and Application and Certification.
- New sub-sections have been added describing the Chain of Custody Design and Chain of Custody Models.
- The Terms and Definitions have been revised to be consistent with ISO 22095 and the revised text contained in this version of the CoC. Feedback on terms and definitions is welcome.

CONSULTATION QUESTION 1.1-1

Background: IRMA seeks to raise the bar of mineral-development-related practices globally, rather than just codify existing legal practices. Therefore, while this chapter establishes host country law as the base-level expectation, it also requires that IRMA requirements, which tend to surpass most national laws, also be met.

A suggestion has been made that this chapter could also be expanded to require entities to track and maintain compliance with other obligations such as organizational and industry standards, codes of practice, public voluntary commitments, and agreements signed with community groups or non-governmental organizations that are relevant to the topics of the IRMA standard.

Question: Do you support expanding the scope of this chapter as per the suggestions above? Why or why not?

Overview and Purpose

The IRMA Chain of Custody (CoC) Standard was developed to provide the base-level requirements for tracking of verified IRMA-achieving material, from the mine through the supply chain to the end consumer. The IRMA CoC Standard is for use by Entities processing or trading IRMA-achieving minerals and/or metals along the supply chain. Such Entities shall be assessed by an IRMA-approved Certification Body which will enable them to pass on an IRMA claim for qualifying material.

The IRMA CoC Standard will, as needed, be supplemented by Appendices specifying normative requirements and/or guidance for specific mineral supply chains. This version of the IRMA CoC Standard includes normative guidance in **Appendix 1** for graphite, iron, lithium, nickel, and platinum group metals. Although recycled materials are not presently available for IRMA certification, they are an important part of the metals supply chain; Appendix 1 also contains normative guidance for recycled materials accounting when mixed with IRMA achieving materials.

The IRMA CoC Standard aims to:

1. Provide Entities in the supply chain with a common set of requirements for sourcing, tracking, accounting, handling and selling IRMA-achieving mined materials.
2. Establish requirements that can be independently audited to provide objective evidence for the flow of IRMA-achieving mined materials through

the supply chain and allow for IRMA CoC-certified Entities to make claims regarding the sale of IRMA-achieving materials.

International Standard *ISO 22095 Chain of Custody – General terminology and models*[2] together with *AMIRA P754: Metal Accounting, Code of Practice and Guidelines*[3] are commonly identified as current industry best practice. The IRMA CoC Standard is consistent with those sources, subject to additional IRMA requirements as identified herein. The IRMA CoC Standard is also designed to be consistent with other initiatives such as the London Platinum and Palladium (LPPM) Responsible Platinum/Palladium Guidance, ResponsibleSteel, and Responsible Jewellery Council. However, the IRMA CoC Standard has specific requirements and models that may be different in some cases.

The IRMA CoC Standard's requirements are applicable to any Entity operating at any step in the supply chain. In this document, the term "chain of custody models" is used to describe the approach taken to control inputs and outputs and associated information in a particular chain of custody system. For a particular commodity it is possible that more than one chain of custody model may be used to describe different processes or procedures in the supply chain. As each chain of custody model represents a different level of physical presence of the specified characteristic in the output, this document provides general guidance on the application of the defined chain of custody models, including initial guidance on the circumstances under which each chain of custody model might be appropriate.

The IRMA CoC Standard first provides general terminology, information on chain of custody design, and describes the chain of custody models applicable to the IRMA CoC Standard. It then provides the IRMA CoC Standard requirements and claims for Entities active in the chain of custody followed by the IRMA CoC Certification Process. Appendix 1 contains normative industry guidance for specific mineral commodities. This review draft includes normative guidance for graphite, iron, lithium, nickel, and platinum group metals, with additional commodities to be added as required. It also provides normative guidance for recycled materials mixed with IRMA achieving materials. Appendix 2 provides additional information on how the chain of custody models and claims should be applied with respect to the IRMA Standard.

Chain of Custody Design

Although frequently considered as interchangeable, the concepts of traceability and chain of custody are not identical. A *chain of custody* is a chain of responsibility for the custodianship of materials or products as they move through a supply chain. Its purpose is to ensure that the IRMA-achievement levels and IRMA achieving quantities that are claimed for a particular material or product (or for the market as a whole) are indeed the ones that are actually delivered or credited in the output.

[2] First Edition 2020-10 Reference number ISO 22095:2020E.
[3] AMIRA International, Release 3, February 2007.

A chain of custody system encompasses the set of measures supporting responsibility for the custody of minerals, metals, materials and products as ownership or control is transferred from one Entity to another within the relevant supply chain. A chain of custody for minerals usually involves more than one Entity and may involve numerous Entities once warehousing, trading and fabrication are considered. Chain of custody will include documentation such as quantity of IRMA-achieving material produced, IRMA-achievement levels or levels, mine origin certificate, transport documentation, export and import records and factory receipts.

Traceability means the ability to follow the trail of metals or minerals along the chain of supply by monitoring and tracking chain of custody. For example, by using the chain of custody system, auditors can trace IRMA-achieving material to the mine of origin.

In order to make claims about an Entity's mined materials or products, rather than the chain of custody itself, further evidence on conformity with IRMA-achievement levels as described herein shall be provided. To maintain IRMA-achievement levels, the following functions in an organized chain of custody are addressed:

- Organizing: overseeing and managing the chain of custody so that there is an unbroken chain that complies with the requirements;
- Requirements setting: setting the specific requirements for the organized chain of custody;
- Conformity assessment: evaluating whether IRMA CoC Standard requirements are met.
- Implementing: implementation by individual Entities active in the chain of custody;

Chain of Custody Models

The IRMA CoC Standard allows for five different chain of custody models for chain of custody systems. Each model has specific requirements that allow different claims to be made about materials or products that are delivered using that chain of custody model. The five chain of custody models allowed by the IRMA CoC Standard are:

1. Identity Preserved Model - *chain of custody model* in which the materials or products originate from a single *source* and their *IRMA Standard achievement levels* are maintained throughout the supply chain;
2. Segregated Model - *chain of custody model* in which *IRMA Standard achievement levels* of a material or product are maintained from the initial *input* to the final *output*;

3. Controlled Blending Model - *chain of custody model* in which materials or products with a set of *IRMA Standard achievement levels* are mixed according to certain criteria with materials or products without that set of characteristics resulting in a known proportion of the *IRMA Standard achievement levels* in the final output;

4. Mass Balance Model - *chain of custody model* in which materials or products with a set of *IRMA Standard achievement levels* are mixed according to defined criteria with materials or products without that set of characteristics.

5. Book and Claim Model - *chain of custody model* in which the physical flow of material with a set of IRMA Standard achievement levels is not connected, but an administrative record of flow is maintained to ensure the quantity and achievement levels booked are not exceeded by the claims.

NOTE FOR REVIEWERS: IRMA CoC Draft V1.0 allowed for three different chain of custody models: Identify Preserved, Segregated and Mass Balance. This revision adds the Controlled Blending and Book and Claim chain of custody models. It also recognizes both the rolling average percentage implementation method and credit method for the Mass Balance model.

CONSULTATION QUESTION

Background: The first draft Chain of Custody Standard incorporated three different material accounting systems: Identity Preserved, Segregation, and Mass Balance. These three models share the common trait of documenting the physical flow of material through the supply chain, enabling documentation of the percentage of IRMA material, corresponding IRMA achievement level of that material, and the specific IRMA audited mine site or combination of mine sites, in a final end product. The October 2020 draft did not document physical presence of material and were not considered acceptable by some IRMA Board members.

Following review of comments received on the October 2020 draft, consultation with a wide range of stakeholders, and retention of specialized expertise, we see the need to include a book and claim system in the IRMA Chain of Custody Standard.

The rationale for including a book and claim system includes the following:

1. Supply chains for certain materials, such as platinum group metals (PGMs), lithium, and other mined materials where downstream processes are concentrated result in mixing material from multiple mine sources. Not allowing a book and claim system would require physical segregation of IRMA mined materials in a matter that would not be practical, as the processes used are continuous and require a blended feed. The existing processes at significant expense, would require complete retrofitting so they can be treated in batches, which would be required to segregate IRMA and non-IRMA materials. While future mine development is likely to be more integrated, nearly all current mine materials supply chains result in significant mixing as downstream processing takes place.

2. Nearly all current mined materials supply chains also rely significantly on inputs and transfers that include tolling, brokering, trading, warehousing, and shipping. Maintaining segregation of IRMA and non-IRMA materials will require modification of existing practices and significant additional new or dedicated space and logistics capacity. This will require significant capital investment as well as adoption of blockchain or similar tracking methods that are being developed and adopted but are not presently in place.

3. Existing chain of custody models for mined materials are not widely used because they do not include a book and claim option and are therefore not practical for some supply chains. Due to the concentration of some materials under a few major downstream processors and the level of third-party inputs and transfers into the system, book and claim is the only model that will recognize a limited quantity of IRMA materials entering the system until

increased IRMA update occurs within a sector. We want to promote an IRMA Chain of Custody Standard that is practical and is actively used in the world to enhance supply chain transparency and engagement in the IRMA system.

In general, and especially at this phase of IRMA's growth, the IRMA Chain of Custody Standard is designed to encourage greater transparency and participation of mine sites, mineral processors, purchasing companies, and other points along the supply chain in the IRMA system. Adding a book and claim approach will support these objectives and can be adapted over time as more material comes into the IRMA system and we learn from application of the book and claim approach.

The revised draft Chain of Custody Standard uses International Standard Organization (ISO) 22095 for Chain of Custody as a template and includes a book and claim supply chain model. While there is no physical custody of material or products involved in the book and claim model, it requires that for each purchase for which a claim is made, materials or products with the same specified characteristics have been produced. This will be explicitly stated in claims to ensure transparency.

Question: Do you support the inclusion of the Book and Claim model in the IRMA Chain of Custody Standard? Why or why not?

One of the basic purposes of the IRMA CoC Standard is to ensure that whichever chain of custody model or combination of chain of custody models is adopted, its integrity is safeguarded. The choice as to which chain of custody model should be used depends on various factors with regards to the quality and benefits the Entities in the supply chain intend to achieve, in addition to the nature of the processes and practices used in each step of the supply chain specific to each mineral commodity.

Table 1 summarizes the key properties of the five chain of custody models. Each of the chain of custody models is linked to different options for making claims regarding the specified characteristics.

While expectations can vary greatly, there are two main types of expectations that are typically identified. The first main type of expectation is *item-based* where the material or product received bears all the characteristics identified by associated information. Identify preserved and segregated models satisfy item-based expectations of organizations active in the chain of custody, consumers, or other end users.

Table 1. Summary of Properties of the Chain of Custody Models in the IRMA CoC Standard
(modified from ISO 22095:2020)

PROPERTIES OF CHAIN OF CUSTODY MODELS	MODELS WITHOUT MIXING		MODELS WITH MIXING		BOOK AND CLAIM
	Identity Preserved	Segregated	Controlled Blending	Mass Balance	
Connection between administrative document flow and the physical flow of materials and products	Yes	Yes	Yes	Yes	No
Item-based expectations satisfied	Yes	Yes	Yes, for the % with Specified Characteristics	No	No
Market-based expectations satisfied	Yes	Yes	Yes	Yes	Yes
Mixing material with specified characteristics and material with non-specified characteristics is possible	No	No	Yes	Yes	Yes
Assurance that volumes with specified characteristics sold match (or do not exceed) volumes of material with specified characteristics bought	Yes	Yes	Yes	Yes, within the specified time period	Yes, but no physical flow, and claimed volumes shall not exceed booked volumes
Specified characteristics preservation linked to volume reconciliation over a set time period	No	No	Yes	Yes	Yes
Physical separation of material or products to ensure that the specified characteristics are physically present in the output	Yes	Yes	Yes, for the part with Specified Characteristics	No	No
Identify source of a material or product (or material component or product component)	Yes	No	No	No	No

The other main type of expectation is *market-based* where taken as a whole, the market for the material or product received delivers the characteristics identified by associated information. Market-based expectations imply that the organizations active in the chain of custody, consumers or other end users are satisfied that on average or in the proportions specified, the purchase of such materials or products will deliver the claimed characteristics. The book and claim model is also market-based. While there is no physical custody of material or products involved, the book

and claim model aims to ensure that for each purchase for which a claim is made, materials or products with the same specified characteristics have been produced.

Additional information including examples and calculation methods for each of the CoC models is provided in **Appendix 2**.

General Terms and Definitions

For the purposes of the IRMA Chain of Custody (CoC) Standard, the following terms and definitions[4] apply. For the purpose of relatability, the terms and definitions are provided in the following three categories:

- Terms related to chain of custody and supply chain
- Terms related to roles and responsibilities
- Terms related to conformity assessment and traceability

The term *Entity* in this document means any company, corporation, partnership, individual, or other type of business or organization directly engaged in the supply chain.

Terms related to chain of custody and supply chain

chain of custody - process by which *inputs* and *outputs* and associated information are transferred, monitored and controlled as they move through each step in the relevant *supply chain*.

chain of custody system - set of measures designed to implement a *chain of custody*, including documentation of these measures.

chain of custody model - approach taken to control *inputs* and *outputs* and associated information in a particular *chain of custody system*.

characteristic - distinguishing feature

input - material or product that enters an *Entity* or part of an *Entity*.

output - material or product that leaves an *Entity* or part of an *Entity*.

process - set of interrelated or interacting activities that use *inputs* to deliver an intended *output*.

product characteristic - distinguishing feature of a material or product (e.g., IRMA transparency, 50, 75, 100)

production characteristic - distinguishing feature of one or more production processes in the *supply chain*.

site - location with geographical boundaries at which defined activities under the control of an *Entity* are carried out.

[4] Terms and definitions are based on ISO 22095, *Chain of Custody – General terminology and models* (ISO 22095:2020E), First Edition, 2020.

source - specific originator at a location of a material or product with a *specified characteristic*.

specified characteristic - set of *product characteristics* and/or *production characteristics* that the *chain of custody* is designed to maintain. (e.g., IRMA achieving or IRMA achievement level)

supply chain - series of processes or activities involved in the production and distribution of a material or product through which it passes from the *source*.

Terms related to roles and responsibilities

corporate management - person or group of people who direct and control an Entity at the highest level

Terms related to conformity assessment and traceability

audit - *process* for obtaining relevant information about an object of *conformity assessment* and evaluating it objectively to determine the extent to which *specified requirements* are fulfilled.

certification - third-party attestation related to an object of *conformity assessment*, with the exception of accreditation.

claim - declared information regarding the *specified characteristics* of a material or product.

conformity - fulfillment of a *specified requirement*.

conformity assessment - demonstration that *specified requirements* are fulfilled.

first-party conformity assessment activity - *conformity assessment* activity that is performed by the *Entity* that provides or that is the object of conformity assessment.

inspection - examination of an object of *conformity assessment* and determination of its *conformity* with detailed requirements or, on the basis of professional judgement, with general requirements.

second-party conformity assessment activity - *conformity assessment* activity that is performed by an Entity or person that has a user interest in the object of conformity assessment.

third-party conformity assessment activity - *conformity assessment* activity that is performed by an Entity or person that is independent of the provider of the object and has no user interest in the object of conformity assessment.

traceability - ability to trace the history, application, location or source(s) of a material or product throughout the *supply chain*.

traceability system - manual or electronic system that provides the ability to access any or all information relating to the material or product under consideration throughout their life cycle, by means of accessing documented information.

verification - confirmation of truthfulness, through the provision of objective evidence that *specified requirements* have been fulfilled.

1. MANAGEMENT SYSTEM REQUIREMENTS

NOTE FOR REVIEWERS: Changes have been made to ensure consistency with ISO 22095.

Proposed additions and changes: Version 1 of this draft IRMA CoC Standard contained the following sections:

1.1 Sourcing Policy and Commitment to IRMA

1.2 Designation of Responsibility

1.3 Documented Processes and Procedures

1.4 Record Keeping and Document Control Systems

1.5 Training

1.6 Internal Evaluation System

This revised Version 2 contains the following sections:

1.1 General Requirements

1.2 Competence

1.3 Internal Assessment Program

1.4 Complaints Procedure

1.5 Outsourcing

1.6 Communication

Version 1 included Section 1.1 Sourcing Policy and Commitment to IRMA. Version 2 eliminates this requirement, however, Version 2 new Section 1.4 Complaints Procedure is similar to Version 1 requirement 1.1.1.c) Grievance Mechanism.

Version 1 included Section 1.2 Designation of Responsibility. Similar requirements are included in Version 2 Section 1.1 General Requirements 1.1.5.b)

Version 1 included Sections 1.3 Documented Processes and Procedures and 1.4 Record Keeping and Document Control Systems which are now addressed in Revised Version 2 Section 2.0 Documentation and Assurance.

Version 1 included Section 1.5 Training. Similar requirements are included in Version 2 Section 1.2 Competence.

Version 1 included Section 1.6 Internal Evaluation System. Similar requirements are included in Version 2 Section 1.3 Internal Assessment Program.

Version 2 includes new Sections 1.5 Outsourcing and 1.6 Communication.

CONSULTATION QUESTION 1.-1

Background: There is no requirement for a policy commitment to conform with the IRMA Standard. In many cases all of an Entity's production may not conform with the IRMA CoC Standard.

Question: Do you support eliminating the Sourcing Policy and Commitment to IRMA? Why or why not?

CONSULTATION QUESTION 1.-2

Background: This revised version of the Draft IRMA CoC Standard has been restructured and reworded to be consistent with ISO 22095. ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO 22095 is a first edition (2020) and includes recommendations for chain of custody including general terminology and models.

Question: Do you see any reason not to utilize ISO 22095 as the initial basis for the requirements of the IRMA CoC Standard? This version includes some IRMA and mined materials-specific customization of ISO 22095; additional recommendations in this regard are welcome.

CONSULTATION QUESTION 1.-3

Question: Do you support the overall proposed changes to this section? If no, what if any changes would you recommend instead?

Background: We reference AMIRA P754 Code and Guidelines: Release 3 or a recognized equivalent.

Question: Can you identify other metal accounting systems consistent with AMIRA?

1.1. General Requirements

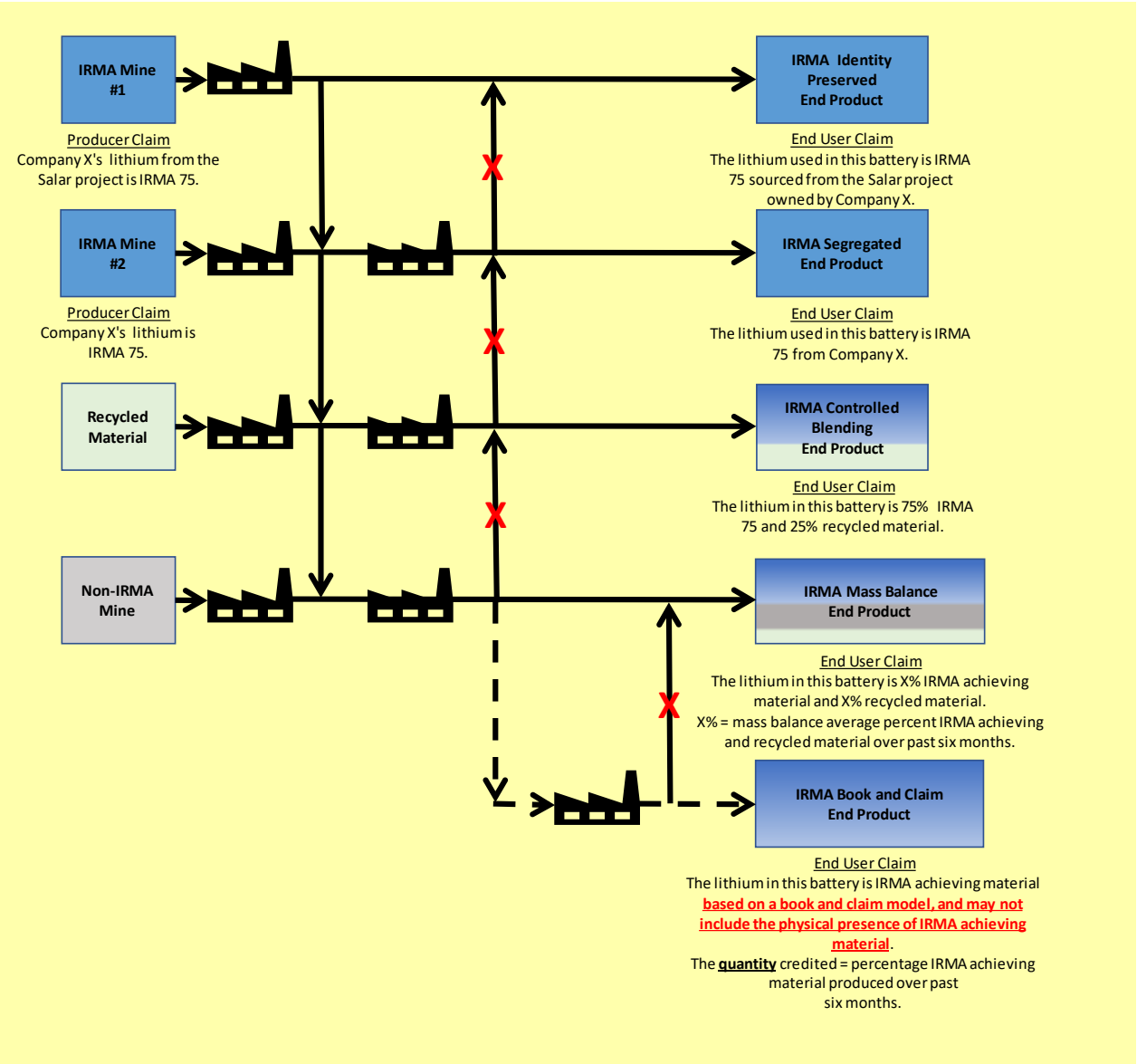
1.1.1. The general requirements when implementing chain of custody models apply to all Entities active in a chain of custody and to all chain of custody models that are applied.

- The Entity shall implement and maintain a chain of custody system adequate to the Entity type and complexity to ensure the continuous conformity to all applicable chain of custody requirements.
- All Entities active in the chain of custody shall fulfill the requirements of the IRMA CoC Standard.

1.1.2. The Entity shall establish and implement one or more of the chain of custody models described in Appendix B for all materials or products with specified characteristics and shall be transparent about the model chosen.

1.1.3. The Entity shall only use the same chain of custody model as its supplier or a model with lower physical presence of the specified characteristic in the output.

NOTE FOR REVIEWERS: The below graphic illustrates how this works in practice. As mixing with other IRMA mines, recycled material, or non-IRMA mines occurs as part of the downstream processing and/or manufacturing processes, it is not allowable to take some portion of the downstream processing, once mixing has occurred, and make a claim that would not identify that the material is in fact mixed with other materials, or in the case of book and claim, of unknown origin. This is a critical requirement in that it prevents end users from making fraudulent claims and therefore is an important aspect of the IRMA CoC.



1.1.4. An Entity should apply the rules for ethical claims and supporting information when using chain of custody models to prevent misleading claims on the material or product.

1.1.5. The Entity shall ensure that the chain of custody system:

a) Specifies the boundaries and applicability of the system to establish its scope. The scope shall be documented;

b) Specifies the personnel responsible and their roles for implementing the various requirements of a specific chain of custody model;

c) Specifies the procedures needed for the implementation of a specific chain of custody model. These procedures shall:

I. take into account the requirements of the specific chain of custody model;

II. specify the documented information that needs to be kept by the entity;
III. provides documented information, including templates, forms, records, and documents necessary for conformity with this document;
IV. Specifies the use of a Metal Accounting system consistent with AMIRA P754 Code of Practice and Guidelines: Release 3 or a recognized equivalent.

1.2. Competence

1.2.1. The Entity shall:

a) determine the necessary competences of person(s) doing work under its control that affect the performance of its chain of custody system;
b) ensure that these persons are competent on the basis of appropriate education, training, and/or experience, where applicable, take actions to acquire the necessary competence, and evaluate the actions taken;
c) retain documented information as evidence of competence.

1.3. Internal Assessment Program

1.3.1. The Entity shall regularly evaluate the performance of its chain of custody system. The evaluation shall, at a minimum, address:

a) monitoring, measuring, analyzing and evaluating the performance of the chain of custody system;
b) conducting audits to evaluate the performance of the chain of custody system procedures and the conformance with all applicable requirements. The frequency shall be at least annual, and any additional audits required shall be based on an assessment of risk. The type of audit shall be appropriate to the risks identified and defined by the Entity. These audits shall cover all processes and the selected sites handling the product. If annual assessment of all sites is not possible, the Entity active in the chain of custody may prioritize particular sites based on a documented risk assessment.
c) review by top management of the Entity's chain of custody system, at planned intervals, at least annually. The management review shall be documented.
d) The Entity shall establish and implement documented procedures to handle non-conformities (including those related to delivered materials and products) that are related to the Entity's chain of custody. The Entity shall ensure that appropriate corrective actions are taken within a defined timeframe. Non-conformities and the resulting actions taken shall be documented.
e) If the Entity becomes aware of any non-conformities, it shall immediately and proactively inform the chain of custody organizer and its relevant partners throughout supply chain.

1.4. Complaints Procedure

1.4.1. The Entity active in the chain of custody shall ensure that complaints received regarding the Entity's conformity to the requirements applicable to the scope of the Entity's chain of custody system are considered. The complaints procedure shall at least provide that the Entity:

a) acknowledges the receipt of the complaint to the complainant within an appropriate timeframe defined by the Entity;
b) investigates the complaint and specifies its proposed actions in response to the complaint within an appropriate timeframe defined by the Entity;
c) notifies the complainant if more time is needed to complete the investigation;
d) takes appropriate actions with respect to complaints and any deficiencies found in processes that affect conformity to the requirements;
e) notifies the complainant when the complaint is considered to be adequately addressed and closed.

1.4.2. Documented information shall be maintained on complaints and consequent action, including resolution. The procedure for handling complaints shall be made publicly available.

1.5. Outsourcing

1.5.1. The Entity active in the chain of custody shall have responsibility for all outsourcing and contractors related to the Entity's chain of custody. The Entity's chain of custody shall include all outsourced operations. This includes those involved in the manufacturing of materials or products whether onsite or offsite.

1.5.2. The Entity shall establish written outsourcing agreements with their contractor(s). The agreement shall give the Entity or the Entity's representative access to the contractor's operations to ensure that requirements connected to the chain of custody and the requirements of this document are met.

1.6. Communication

1.6.1. The Entity active in the chain of custody shall determine the internal and external communication relevant to the chain of custody system applied. The Entity shall ensure that the relevant requirements for implementation of the chain of custody system applied are communicated effectively across all relevant stakeholders, including personnel and suppliers.

NOTE FOR REVIEWERS: "Suppliers" is intended to apply to other Entities providing only the commodity to the Entity active in the chain of custody. It is not intended to apply to all suppliers. As an example, if the Entity is tolling concentrate from another IRMA mine, it would be important to ensure that the other Entity understands that the concentrate was only produced by the intended IRMA mine, and not some other source. Similarly, if a controlled blending approach is being used, key operations personnel need to be informed of the need to maintain the amounts of material being blended at the intended proportions.

2. DOCUMENTATION AND ASSURANCE

NOTES FOR REVIEWERS: Changes have been made to ensure consistency with ISO 22095.

Proposed additions and changes:

Version 1 included Sections 1.3 Documented Processes and Procedures and 1.4 Record Keeping and Document Control Systems which are now addressed in this section.

Version 1 also included Section 2 Sourcing and Receiving Eligible Inputs which are also addressed in this revised Section 2.

CONSULTATION QUESTION 2.-1

Background: This Chain of Custody Standard aims to be compatible with blockchain and other technologies.

Question: Do you find the requirements in this section to be blockchain compatible?

CONSULTATION QUESTION 2.-2

Background:

Question: Do you find the requirements to be reasonable? Do you suggest any changes?

CONSULTATION QUESTION 2.-3

Question: Do you support the overall proposed changes to this section? If no, what if any changes would you recommend instead?

2.1. Documentation

2.1.1. The Entity active in the chain of custody shall maintain complete and up-to-date documented information relevant to demonstrating the Entity's conformity with all applicable chain of custody requirements.

2.1.2. Retention time for all documented information, including purchase and sales documents, training records, and production records, shall respect the retention time of the relevant chain of custody, and shall be specified considering among other factors, long-term effects and the lifetime of the material or product. The Entity should be able to confirm the status of materials or products held in stock at all times.

2.1.3. Documented information relating to all transactions shall be available (documents are generated when a transaction is registered, or when an overview of all transactions and events is registered) and should allow verification of the chain of custody model at an appropriate level. This documented information shall identify the material or products at stake and describe their physical flow where relevant. The information may consist of written documents and procedures and/or an automated control of the chain of custody system.

2.1.4. Control of documented information. The Entity shall establish and maintain documented information to demonstrate conformance with all applicable requirements in this document. Information from external entities or other stakeholders deemed necessary for planning, operation, and management of the

chain of custody shall be identified. For the control of documented information, the Entity shall, define, at a minimum:

a) distribution, access, retrieval, and use;
b) adequate protection (e.g., from loss of confidentiality, improper or malicious use, or loss of integrity);
c) storage and preservation, including preservation of legibility;
d) change(s) in version;
e) retention time and disposal (considering e.g., confidentiality);
f) who in the Entity authorized any changes in version.

2.1.5. The Entity shall allow relevant Entities in the chain of custody to have access to the documented information and for visits to production sites.

NOTE FOR REVIEWERS: Requirement 2.1.5. was included to be consistent with ISO 22095.

CONSULTATION QUESTION

Background: The purpose of this requirement is to allow a downstream Entity to inspect an upstream Entity to verify their IRMA claims at any time. Concerns have been raised that this requirement could result in onerous accommodation of customer visits and that it creates mandates and obligations which are both impractical and burdensome and pose various legal conflicts, particularly regarding protection of intellectual property. Additionally, any site visits would be required to conform with certain conditions including fulfilling all safety requirements.

A potential benefit of participation in the IRMA Chain of Custody Standard is for customers to rely on the IRMA independent audit process including site visits and reports. Conversely, numerous customer visits can require significant resources in terms of personnel time and accommodation.

Question: Do you support this requirement? Why or why not? Do you think this could be addressed by defining "relevant" Entities? If so, how would you define a relevant Entity?

2.2 Assurance

2.2.1. The Entity in the chain of custody shall operate a control system for ensuring, assessing, and monitoring that the materials or products received are delivered to specification. The scheduling for such checks shall be on an annual basis and documented. The type of assessment used will be a second-party conformity assessment activity. This chain of custody system shall include:

a) confirmation that the supplied input complies with the specified characteristics;
b) confirmation that all inputs comply with the minimum requirements for the chain of custody model used (See Section 3);
c) confirmation that input and output have met IRMA Standard Achievement Levels requirements, as appropriate to the chain of custody model;
d) identification of the material or product based on the defined IRMA Standard Achievement Levels (where relevant);
e) confirmation of purchase, sale, complaints and transportation documents associated with the output;
f) ensuring that each transaction is clearly identifiable;
g) documentation relating to the sale of material or product, including a reference to the corresponding chain of custody model;

h) a process that ensures that suppliers and outsourced activities are assessed initially, and periodically thereafter, at least annually, to ensure that they meet all of the relevant requirements.

NOTE FOR REVIEWERS: This requirement is in addition to an initial and three-year interval IRMA CoC Standard audit that is the equivalent of a third-party conformity assessment activity.

3. MATERIAL ACCOUNTING

NOTE FOR REVIEWERS: The Chain of Custody Models in the Introduction section above includes the rationale for adding the Controlled Blending and Book and Claim chain of custody models and for recognizing both the rolling average percentage implementation method and credit method for the Mass Balance model.

Version 1 included Section 3. Accounting and Segregation System Requirements which in Version 2 is Section 3. Material Accounting.

Changes have also been made to ensure consistency with ISO 22095.

CONSULTATION QUESTION 3.-1

Background: Book and Claim will require IRMA to establish a registry to ensure that claims are not oversold

Question: Should IRMA create a registry to log claims?

CONSULTATION QUESTION 3.-2

Question: Do you support the overall proposed changes to this section? If no, what would you recommend instead?

3.1. IRMA CoC Standard Requirements for Identify Preserved Model

3.1.1. An Entity active in the chain of custody applying the identity preserved model shall ensure that the material or product with an IRMA achievement level is physically separated and clearly identifiable throughout all stages of the production and transportation and the trading process. The Entity shall ensure that the material or product is clearly identifiable to a particular single source. This shall be achieved by demonstrating:

a) physical separation of inputs and outputs with IRMA achievement levels including single source from any other inputs and outputs during, for example, production, transport, and storage;
b) clear identification of the materials or products during the process; and
c) the output quantities corresponding to the input quantities are in line with an appropriate conversion factor.

3.1.2. The Entity active in the chain of custody shall define which IRMA achievement level of the material or product is maintained (including the source) and which materials or products are kept physically separated from all others.

3.2. IRMA CoC Standard Requirements for Segregated Model

3.2.1. The Entity active in the chain of custody applying the segregated model shall ensure that the material or product with IRMA achievement levels is physically separated and clearly identifiable throughout all stages of the production and the trading process. This shall be achieved by:

a) physical separation of inputs and outputs with IRMA achievement levels from any other inputs and outputs during, for example, production, transport, and storage;
b) clear identification of the material or products during the process;
c) the output quantities corresponding to the input quantities in line with an appropriate conversion factor.

3.2.2. The Entity active in the chain of custody shall define how the same IRMA achievement levels are maintained and kept physically separated from materials of different IRMA achievement levels, if applicable.

3.3. IRMA CoC Standard Requirements for Controlled Blending Model

3.3.1. The Entity active in the chain of custody shall ensure that the quantity of physical inputs and outputs (volume or weight) at the site are monitored and documented. The Entity shall ensure that the output supplied to customers from a site does not exceed the percentage of input with IRMA achievement levels received at the site. The percentage of controlled blended output delivered is always subject to the available percentage as determined by input, current stock, or combination thereof. This shall be achieved by:

- physical separation of blended material or product in terms of production, transport and storage;
- clear identification of the blended material or product during the process;
- the output quantities corresponding to the input quantities in line with an appropriate conversion factor.

3.3.2. The Entity active in the chain of custody shall deliver the required percentage of each output with IRMA achievement levels in accordance with the requirements of the chain of custody system.

3.3.3. Materials or products with IRMA achievement levels shall be processed over a period of no more than one year. For the inventory balancing period, the incoming percentage of controlled blending input shall be known beforehand in order to determine the percentage of conforming output before delivery. The ratio determines the delivered percentage of controlled blending output per contained volume (e.g., batch, shipment, storage facility).

3.4. IRMA CoC Standard Requirements for Mass Balance Model

3.4.1. Rolling Average Percentage Method. The Entity shall calculate the average percentage of the inputs and outputs of a defined category including IRMA achievement levels for each material or product. For each material or product, the Entity shall define claim periods, which shall correspond to the claimed relation of

the input to the output. These input and output claim periods shall not exceed one year.

3.4.2. Credit method. The Entity shall calculate the credit of the inputs and outputs of a defined category including IRMA achievement levels for each material or product as follows:

- The conversion factor shall be defined within each material or product at each site and it shall be applied to define the amount of credit to enter the credit account, when using the output as the basis for calculation, or to withdraw the credit when using the input as the basis for calculation.
- The credit account balance shall be calculated for each period according to the formula given in Appendix 1. For each material or product, the organization shall set up and maintain a credit account for each type of input used as an output declaration. The organization shall ensure that the credit account is not overdrawn within the balancing period.
- An organization using the credit method shall deduct from the credit account the respective credit of the output, up to the limit in, but not exceeding, the credit account within the balancing period.
- The balancing period shall not exceed the evaluation period. The balancing period should be as short as possible. The length of the balancing period shall be evaluated, taking into account the varying needs of different sectors and the desired effectiveness of the system.
- Credits shall expire after a defined period of time (no longer than two years).

NOTE FOR REVIEWERS: The two different methods for using the Mass Balance Model are illustrated in the following example:

A smelter calculates using the Rolling Average Percentage Method during a six-month period that they received 10,000 tonnes of IRMA 75 material containing 30% nickel that was commingled with 20,000 tonnes of other non-IRMA materials also containing 30% nickel. Based on 98% recovery this resulted in the production and claim using this method as:

30,000 tonnes Ni x 30% x .98 = **8,820 tonnes Ni containing 33% IRMA 75 Material.**

Alternatively, the smelter calculates the production and claim using the Credit Method as:

10,000 tonnes Ni x 30% x .98 = **2,940 tonnes Ni containing 100% IRMA 75 Material.**

It is likely that until significant uptake is made for a commodity allowing for a mass balance claim using the rolling average percentage method to result in significant (i.e., 90% IRMA Material) concentrations of IRMA Material, that the Credit Method which would allow an end user to claim use of only IRMA Material will be preferred.

3.4.3. The inputs and outputs shall be balanced. The Entity shall ensure a zero or positive balance within the balancing period.

3.4.4. The Entity shall provide evidence that volumes of material or products with specified characteristics supplied to customers are balanced with the volumes bought by the Entity with the same IRMA achievement levels.

NOTE FOR REVIEWERS: This is applicable to all Entities, including traders/brokers, in the commodity supply chain and is critical to ensuring the accountability (both physically and socially) of all IRMA claims. The balancing of claims made by producers and users in an unbroken manner is fundamental to any Chain of Custody. Without this information being provided as evidence, including to IRMA for internal accounting purposes, there can be no credibility regarding claims.

3.5. IRMA CoC Standard Requirements for Book and Claim Model

3.5.1. The Entity shall calculate the credit of the inputs and outputs of a defined category including IRMA achievement levels for each material or product as follows:

- The conversion factor shall be defined within each material or product at each site and it shall be applied to define the amount of credit to enter the credit account, when using the output as the basis for calculation, or to withdraw the credit when using the input as the basis for calculation.
- The credit account balance shall be calculated for each period according to the formula given in Appendix 1. For each material or product, the organization shall set up and maintain a credit account for each type of input used as an output declaration. The organization shall ensure that the credit account is not overdrawn within the balancing period.
- An organization using the credit method shall deduct from the credit account the respective credit of the output, up to the limit in, but not exceeding, the credit account within the balancing period.
- The balancing period shall not exceed the evaluation period. The balancing period should be as short as possible. The length of the balancing period shall be evaluated, taking into account the varying needs of different sectors and the desired effectiveness of the system.
- Credits shall expire after a defined period of time (to be determined by IRMA).

3.5.2. The inputs and outputs shall be balanced. The Entity shall ensure a zero or positive balance within the balancing period.

3.5.3. The Entity shall provide evidence that volumes of material or products with specified characteristics supplied to customers are balanced with the volumes bought by the Entity with the same IRMA achievement levels.

3.6. Conversion Factor

3.6.1. The conversion factor shall be defined for each material or product with IRMA Achievement Levels at each site depending on the processing or handling performed. The Entity shall ensure that the conversion factor is accurate and justifiable.

3.6.2. The conversion factors used within each processing facility are determined by the Entity, are indicated in documented information relating to the transformation of the material or product and are kept up-to-date.

3.6.3. When using the credit method, the conversion factor shall be applied to define the amount of credit to enter the credit account, when using the output as basis for calculation, or to withdraw the credit when using the input as basis for calculation.

3.7. Inventory Balancing

3.7.1. Within the chain of custody, the quantities received and supplied to customers shall be reconciled within a one-year accounting period in order to verify that the outputs relate appropriately to the inputs. The Entity active in the chain of custody shall document the total quantity (volume or mass or units) of materials or products received and supplied to the customer within the appropriate specified timeframe. The documentation shall include:

a) stock remaining from the previous accounting period;
b) inputs received;
c) inputs still in stock;
d) outputs still in stock;
e) outputs supplied to customer.

3.8 Multiple Chain of Custody Systems

3.8.1. If the Entity is implementing more than one chain of custody system in the operation(s) (e.g., one of their clients require physically segregated batches of products while others use mass balance), the Entity shall keep a separate accounting for products acquired through each chain of custody system used. The Entity may group various products that share similar characteristics in terms of product type, quality and production process into product groups.

NOTE FOR REVIEWERS: This is an additional requirement informed by RSB-PRO-20-001 – Version 3.2. – RSB Chain of Custody Procedure Requirement 1.10. It has been added recognizing that there may be Entities who will implement more than one chain of custody system in their operations.

4. SALES AND SHIPPING

NOTE FOR REVIEWERS: Significant changes have been made to this section based on review of other CoC schemes, most notably RSB-PRO-20-001 – Version 3.2. – RSB Chain of Custody Procedure. This has led to a distinction between the information required for Entities at various stages in the supply chain. Additionally, it has led to the recognition that there needs to be an IRMA Claims Registry.

Section 4.1 General Requirements includes the information required in Version 1 but requires additional information and information specific to the stage in the supply chain. Section 4.2. Registry Requirements is new.

CONSULTATION QUESTION 4.-1

Background: The list of records in required in 4.1.2. was adapted from the RSB Chain of Custody Procedure which had three similar categories and was revised for a) mining and on-site mineral processing; b) mineral processing and manufacturing; and c) storage facilities, warehouse and traders.

Question: Do you agree with the three proposed categories (e.g., a), b), c) as described? If no, how would you revise the categories?

CONSULTATION QUESTION 4.-2

Background: The list of records required in 4.1.2. a), b), and c) was also adapted from the RSB Chain of Custody Procedure, revised with respect to mined materials and IRMA.

Question: Do you have any suggestions for additional records that should be retained?

CONSULTATION QUESTION 4.-3

Background: To verify that IRMA claims are valid and that double-counting does not occur, an IRMA Claims Registry is being proposed as described in Section 4.2. This requirement is particularly important where Book and Claim transactions take place as they must be tracked and validated through the use of an independent registry. Given the expectations of the IRMA Standard this same approach is being applied for all claims.

Question: Do you support this requirement? If no, what are your concerns? Please also provide any suggestions you have as to how to address those concerns while still requiring a registry.

CONSULTATION QUESTION 4.-4

Background: This Chain of Custody Standard aims to be compatible with blockchain and other technologies.

Question: Do you find the requirements in this section to be blockchain compatible?

CONSULTATION QUESTION 4.-5

Background:

Question: Do you find the requirements to be reasonable? Do you suggest any changes?

4.1. General Requirements

4.1.1. The Entity shall have all necessary infrastructures (e.g. software or other tools) and operating procedures in place to effectively operate the chain of custody system and ensure that IRMA-achieving material can be tracked continuously without interruption through all processing and trading steps taking place within the scope of certification between the acquisition of the material and forwarding to clients.

4.1.2. The Entity shall document all sites where IRMA-achieving material is acquired, handled, and forwarded and where internal processing steps occur, with additional requirements for site records as follows:

a) Mining including on-site mineral processing:
   - IRMA achievement level and chain of custody model employed;
   - List of all recipients of IRMA achieving material (e.g., downstream mineral processing, collection points, storage facilities, warehouse, traders), including their address and contracts;
   - Additional input material used by the Entity but provided by third parties;
   - Production records (quarterly);
   - Sales orders, sales invoices, dispatch information—including dates; customers to which the batch or lot was dispatched; delivery records;
   - Stock records, including inventory balancing, for storage sites;
   - Transporter or shipper details.

b) Downstream off-mine-site mineral processing and manufacturing:
   - List of all suppliers of IRMA-achieving material, and copy of their valid IRMA certificates;
   - Purchase documents including, e.g., purchase orders, contracts, invoices and goods receipts inspections, delivery notes and received quantities;
   - Processing information including the conversion factors and specification of quantities of materials and products, stored and finished;
   - Production records;
   - Sales orders, sales invoices, dispatch information, including dates, customers to which the batch or lot was dispatched, delivery records;
   - Stock records including inventory balancing;
   - Transporter or shipper details;
   - Records of mass balance calculation (if relevant);
   - List of sites, status (in production/not in production);
   - Chain of custody model employed;
   - List of all recipients of IRMA-achieving material (e.g. collection points, storage facilities, warehouse, traders), including their address and contracts;
   - Additional sites used by the Entity but owned by third parties.

c) Storage Facilities, Warehouse and Traders
   - List of all suppliers of IRMA-achieving material, and copy of their valid IRMA certificates
   - Purchase documents including, e.g., purchase orders, contracts, invoices and goods receipts inspections, delivery notes and received quantities;
   - Sales orders, sales invoices, dispatch information, including dates, customers to which the batch or lot was dispatched, delivery records;
   - Stock records including inventory balancing;
   - Transporter or shipper details;
   - List of all collection points, including name and address;

- Record of mass balance calculation (if relevant);
- If the Entity is not the legal owner of the storage site, a written contract between the Entity and the legal owner of the site will be required to forward products with an IRMA achievement claim included with the product information.

4.1.3. The operator shall keep these records for 5 years.

4.2 Registry Requirements

4.2.1. The Entity shall record the following information for IRMA-achieving material in the IRMA registry at each step:

a) For incoming IRMA achieving material ("acquisition"):
   - Description of the incoming material, including technical specification, if available;
   - IRMA achievement level of the raw material that was used to produce the product;
   - Country of origin;
   - Quantity of IRMA achieving material(s) and IRMA achievement level
   - Date of acquisition and (if different from the date of acquisition) date of entry in the participating Entity's chain of custody tracking and management systems;
   - Location of the site where IRMA achieving material is acquired;
   - Name and address of supplier(s);
   - Name and address of the last production/processing site;
   - If the previous production/processing site is managed by an external third party, the name and address of this external third party;
   - Valid certificate number and name of Certification Body;
   - Chain of custody model employed at the supplier's last site;

b) For IRMA-achieving material in process within the scope of IRMA achieving validation ("handling"):
   - Identification and description of the process;
   - Name and address of the site(s) where the production steps occur;
   - Conversion factor(s) used in processing of each group of products (where relevant);

c) For outgoing IRMA-achieving material ("forwarding"):
   - Description of the product, including technical specification, if available;
   - IRMA achievement level of the raw material that was used to produce the product;
   - Country of origin;
   - Quantity of IRMA-achieving material(s) and IRMA achievement level
   - Date of shipment;
   - Name and address of customer(s) and delivery site;

- Name and address of production/processing site or storage site(s) from which the product is forwarded;
- If the site from which the product is forwarded is managed by an external third party, the name and address of this external third party;
- Unique number of the delivery note (e.g., Bill of lading, or invoice #);
- ID number of batch;
- Valid certificate number and name of Certification Body;
- Chain of custody model employed

NOTE FOR REVIEWERS: The IRMA Registry would enable the registration, issuance, holding, transfer and retirement of product units/certificates/credits. The IRMA Registry would be an electronic data storage system that is formally recognized by IRMA and provides for traceability in the Registry of IRMA Claims. The Registry would be used in two ways. The first would be by IRMA-achieving mines and mineral processors who produce and distribute products to verify their claims. The second would be by purchasers of IRMA-achieving materials.

It is critical that an IRMA Registry be created to verify Book and Claim credits as this process is used to transfer and/or retire those credits. IRMA will provide further guidance regarding registry users and requirements for registration, claims, transfer, and retirement.

5. IRMA CLAIMS

NOTES ON THIS SECTION: This section has been significantly changed from Version 1 based on further consideration of the five different Chain of Custody models and the specific types of claims that can be made for IRMA-achieving materials.

Version 1 addressed only claims for segregated versus mixed materials and primarily addressed recognition of different IRMA achievement levels. This revised version addresses each individual CoC model with particular emphasis on the type of claims that are allowed specific to each model. It includes Figures that are based on similar Figures in Appendix 2 for similar CoC models that are intended to illustrate the different claims.

CONSULTATION QUESTION 5.-1

Background: In developing the claims contained in this section IRMA recognizes that particular circumstances and related claims are numerous, and valid claims should not be limited to a small set identified in this document. In this section IRMA aims to set out requirements that ensure claims are truthful and are verified by IRMA.

Question: IRMA is presently asking all Entities to allow for internal review of all claims by IRMA and flagging invalid claims as they occur. Do you believe this process should continue?

CONSULTATION QUESTION 5.-2

Question: Do you support the overall proposed changes to this section? If no, what changes do you recommend instead?

5.1 Claims for Identify Preserved Model IRMA-Achieving Materials

The identity preserved chain of custody model allows for input that originates from a single source. In the identity preserved model, the material or product is kept physically separated and its characteristics are maintained throughout the supply chain. Materials or products are clearly identifiable throughout the supply chain as originating from the single source.

Producer Claims

- 100% [*identify IRMA achievement level*] [*identify metal or mineral*] from [*identify source and location*].
- This [*identify metal or mineral*] entirely originates from an [*identify IRMA achievement level*] source.
- This [*identify metal or mineral*] entirely originates from an IRMA assessed source.

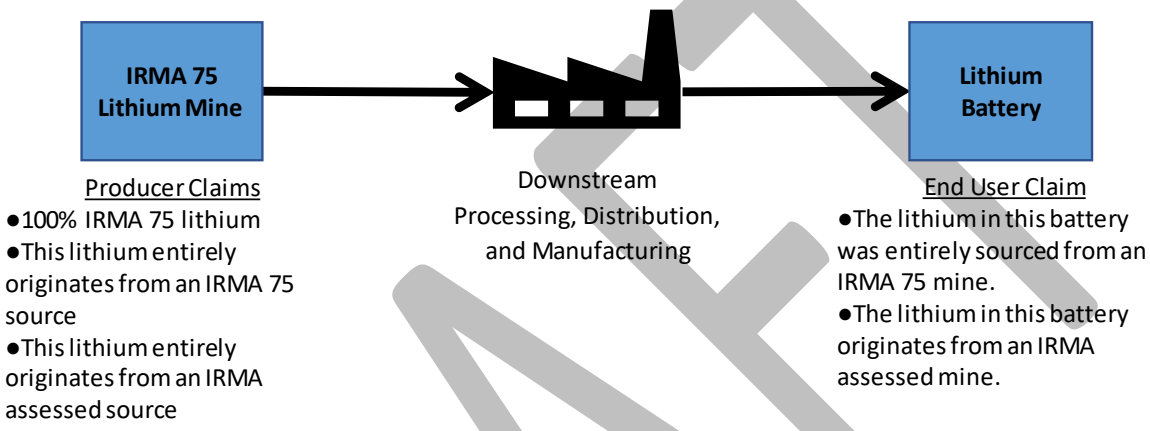
End-User Claims

- The [*identify metal or mineral*] in this [*identify product*] was entirely sourced from an [*identify IRMA achievement level*] mine.

- The [*identify metal or mineral*] in this [*identify product*] originates from an IRMA assessed mine.

A simplified illustration of the identity preserved model for a single tier in the supply chain is shown in Figure 1. The figure shows an example where a production lot from a single individual mine/mineral processing facility producing lithium with IRMA 75 achieving material is provided to an Entity that then produces a battery that is 100% from that source and having the same IRMA 75 achievement level.

Figure 1. IRMA Identity Preserved Model Claims



5.2 Claims for Segregated Model IRMA-Achieving Materials

The segregated model is a chain of custody model in which, from initial input to final output, the *IRMA Standard achievement levels* are maintained. Inputs from different sources may be mixed, based on identical characteristics. However, the identity of any particular source might be lost.

Producer Claims

- 100% [*identify IRMA achievement level*] [*identify metal or mineral*] from [*identify sources and location*].

- This [*identify metal or mineral*] entirely originates from [*identify IRMA achievement level*] sources.

- This [*identify metal or mineral*] entirely originates from IRMA assessed sources.

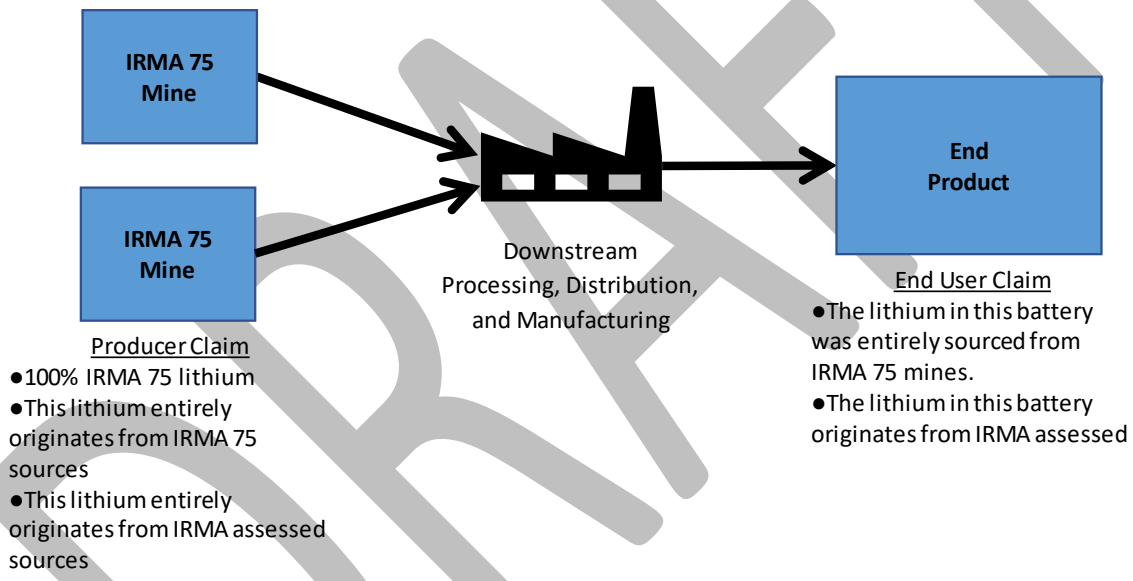
End-User Claims

- The [*identify metal or mineral*] in this [*identify product*] was entirely sourced from a [*identify IRMA achievement level*] mines.

- The [*identify metal or mineral*] in this [*identify product*] originates from IRMA assessed mines.

A simplified illustration of the segregated model is shown in Figure 2. The figure shows an example where production from two mine/mineral processing facilities producing lithium with IRMA 75 achieving material are provided to an Entity that then produces a product that is from the two sources with the same IRMA 75 achievement level.

Figure 2. IRMA Segregated Model Claims



5.3 Claims for Controlled Blending Model IRMA-Achieving Materials

The controlled blending model is a chain of custody model in which materials or products with a set of *IRMA Standard achievement levels* are mixed according to certain criteria with materials or products without that set of characteristics. This results in a known proportion of the *IRMA Standard achievement levels* within all parts of the final output.

Producer Claims

- [*identify fixed percent*] [*identify IRMA achievement level*] [*identify metal or mineral*] from [*identify source and location*] and [*identify fixed percent*] non-IRMA [*identify metal or mineral*].

- This [*identify metal or mineral*] is [*identify fixed percent*] [*identify IRMA achievement level*].

- This [*identify metal or mineral*] is [*identify fixed percent*] IRMA assessed.

End-User Claims

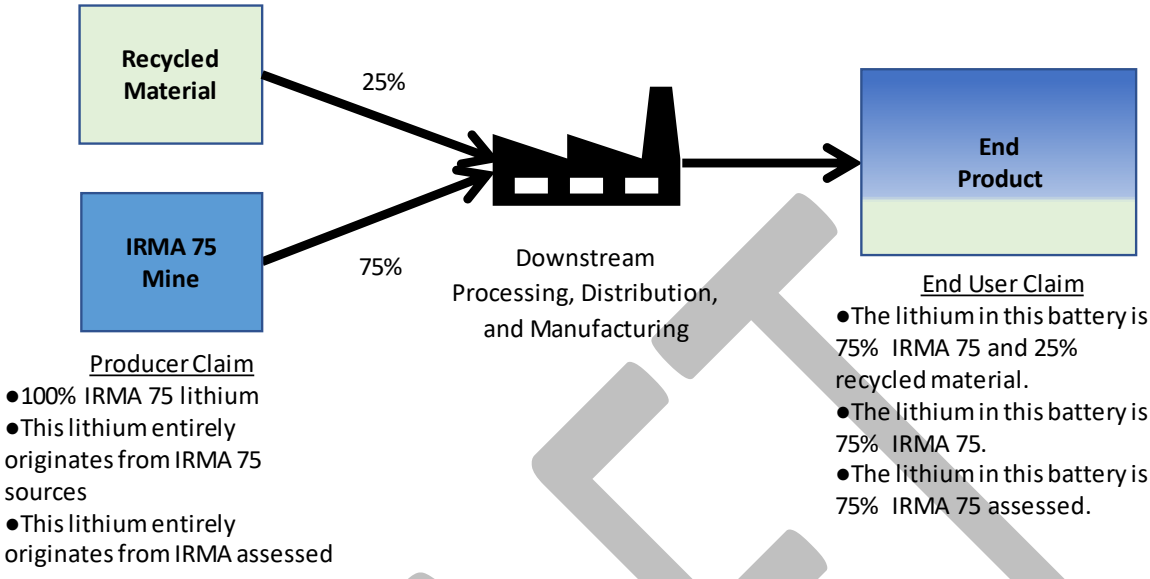
- The [*identify metal or mineral*] in this [*identify product*] is [*identify fixed percent*] [*identify IRMA achievement level*] and [*identify fixed percent*] non-IRMA [*identify metal or mineral*].

- The [*identify metal or mineral*] in this [*identify product*] is [*identify fixed percent*] [*identify IRMA achievement level*].

- The [*identify metal or mineral*] in this [*identify product*] is [*identify fixed percent*] IRMA assessed.

A simplified illustration of the controlled blending model assuming one of two inputs would be IRMA achieving is shown in Figure 3. The figure shows an example where production from a mine/mineral processing facility with IRMA 75 achieving material and recycled material are provided to an Entity that then produces a product that is from the two sources blended at a 3:1 ratio (75% IRMA 75, 25% Recycled Material).

Figure 3. IRMA Controlled Blending Model Claims



5.4 Claims for Mass Balance Model IRMA-Achieving Materials

The mass balance model is a chain of custody model in which materials or products with *IRMA Standard achievement levels* are mixed with materials or products without some or all of these characteristics, resulting in a claim on a part of the output, proportional to the input. The achievement of the proportionality on the output can involve intermediate steps with other defined relations to the input. This chain of custody model gives the Entity active in the chain of custody the opportunity to
account for continuous processes with multiple inputs between multiple sites with differing IRMA-achieving levels and different non-IRMA materials.

Producer Claims

- [*identify variable percent*] [*identify IRMA achievement level*] [*identify metal or mineral*] from [*identify source and location*]
- This [*identify metal or mineral*] is [*identify variable percent*] [*identify IRMA achievement level*].
- This [*identify metal or mineral*] is [*identify variable percent*] IRMA assessed.

End-User Claims

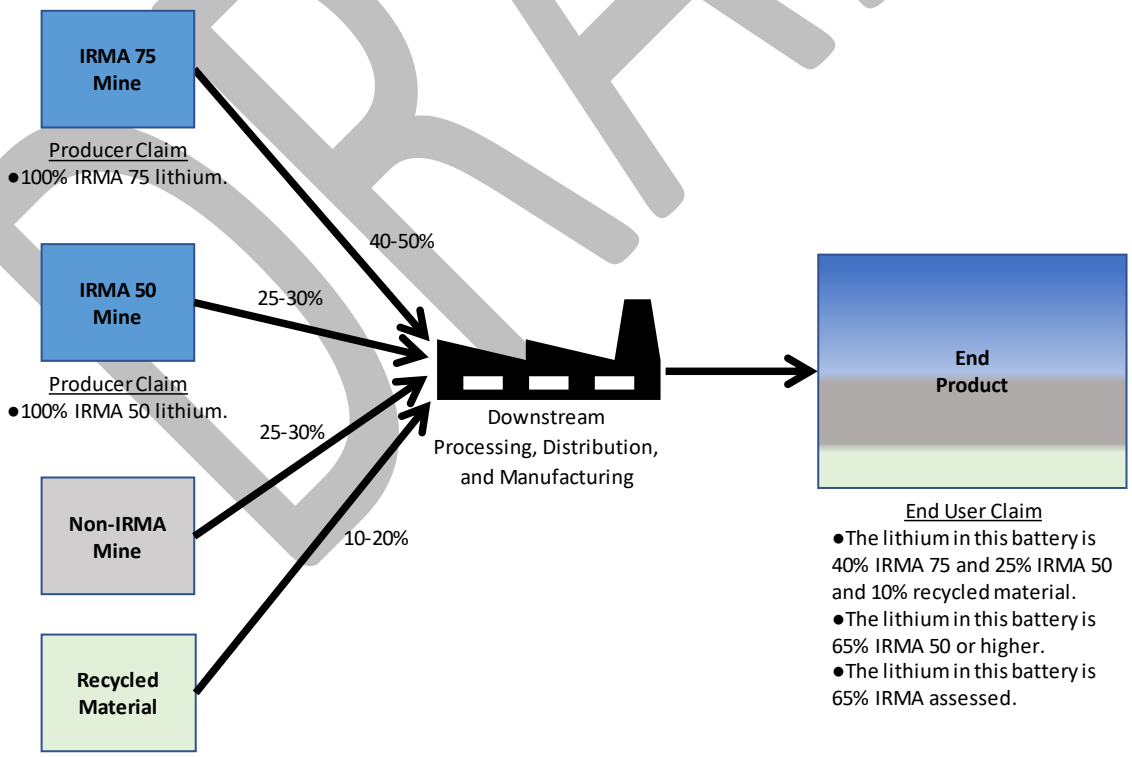
- The [*identify metal or mineral*] in this [*identify product*] is [*identify variable percents*] [*identify IRMA achievement levels*] and [*identify percent*] non-IRMA or recycled [*identify metal or mineral*].

- The [*identify metal or mineral*] in this [*identify product*] is [*identify variable percent*] [*identify lowest IRMA achievement level*] or higher.

- The [*identify metal or mineral*] in this [*identify product*] is [*identify variable percent*] IRMA assessed.

A simplified illustration of the mass balance model assuming two inputs would be IRMA achieving is shown in Figure 4. The figure shows an example where production from two mine/mineral processing facilities with IRMA 75 and IRMA 50 achieving material and material from a non-IRMA mine in addition to recycled material are provided to an Entity that then produces a product that is from the four sources. The percentage of material from any given source changes over time and the percentages are based on the mass balance requirements described in Annex 2, and for the purpose of claims in this example are assumed to be: 40% IRMA 75 Mine, 25% IRMA 50 Mine, 25% non-IRMA mined material, and 10% recycled material.

Figure 4. IRMA Mass Balance Model Claims



5.5 Claims for Book and Claim Model IRMA-Achieving Materials

The objective of the book and claim model is to ensure that for each purchase for which a claim is made, materials or products with the same specified characteristics have been produced. The book and claim model is most suitable for intangible materials or products and in circumstances where the entire market is controlled.

The book and claim model is an alternative chain of custody model in which the administrative record flow is not connected to the physical flow of materials or products throughout the supply chain. After production the information on specified characteristics within the supply chain is decoupled from any material or product. Credits are issued when materials or products enter the market. The credits may be traded and sold independently of the physical delivery of materials or products.

Producer Claims

- The [*identify metal or mineral*] from [*identify source and location*] has contributed [*identify quantity*] [*identify IRMA achievement level*] book and claim credits. No actual physical flow of materials can be verified.

- This [*identify metal or mineral*] contains [*identify quantity*] [*identify IRMA achievement level*] book and claim credits. No actual physical flow of materials can be verified.

- This [*identify metal or mineral*] contains [*identify quantity*] IRMA assessed book and claim credits. No actual physical flow of materials can be verified.

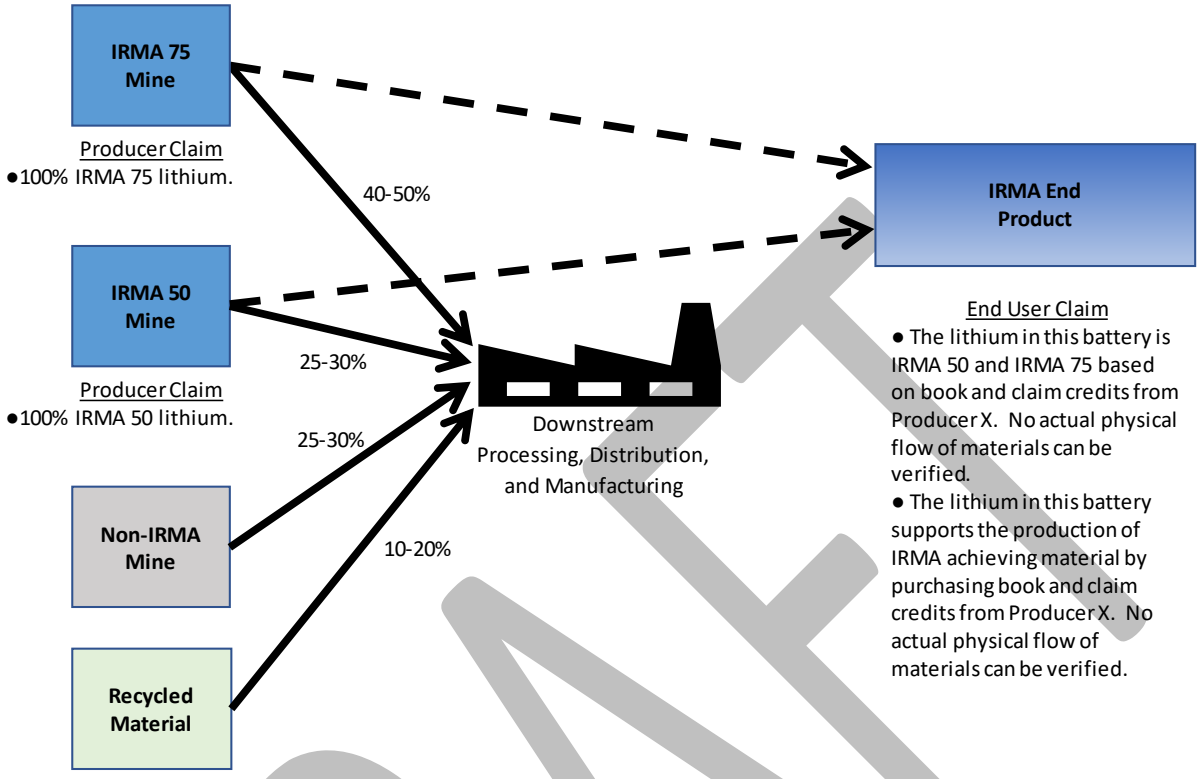
End-User Claims

- The [*identify metal or mineral*] in this [*identify product*] is based on [*identify IRMA achievement level*] book and claim credits. No actual physical flow of materials can be verified.

- The [*identify metal or mineral*] in this [*identify product*] supports the production of [*identify IRMA achievement level*] by purchasing book and claim credits [*identify source*]. No actual physical flow of materials can be verified.

A simplified illustration of the book and claim model assuming two inputs would be IRMA achieving is shown in Figure 5. The figure shows an example where production from two mine/mineral processing facilities with IRMA 75 and IRMA 50 achieving material and material from a non-IRMA mine in addition to recycled material are provided to an Entity. The producers, instead of providing the material as IRMA material to the downstream Entity, elect to sell their book and claim credit to the downstream end producer without any actual physical presence of the material.

Figure 5. IRMA Book and Claim Model Claims



NOTE FOR 5.5: The Book and Claim system enables the purchase and selling of IRMA achieving materials without the need for segregation and tracing throughout the supply chain. At the end, products do not necessarily contain IRMA achieving material but have contributed to sourcing and production of IRMA achieving material. This enables companies to demonstrate their support of IRMA's objectives.

CONSULTATION QUESTION

Background: As indicated by the required text, this draft version requires that all Book and Claim model claims must be accompanied by the statement "No actual physical flow of materials can be verified." While the proposed wording is factually correct, it comes across as negative, and it has been suggested that more nuanced wording could be used, reflecting the contribution the producer is making to responsible sourcing.

Question: Do you support this requirement that Book and Claim model claims include the language "no actual physical flow of materials can be verified?" Why or why not? If not, what would you propose for alternative language?

6. IRMA CHAIN OF CUSTODY VERIFICATION PROCESS

The process for achieving IRMA Chain of Custody verification is summarized as follows:

1. APPLICATION – An Entity wishing to pass on an IRMA claim to their customers, completes an application for an IRMA Chain of Custody verification audit with an IRMA-approved Audit Firm (AF). The CoC verification is for the Entity that wishes to provide the claim to customers and encompasses verification of the Entity and upstream providers of IRMA achieving material. Individual mine or mineral processing sites do not require CoC verification, but any downstream claim by an Entity must be verified up to the mine or mineral processing sites.

2. PROPOSAL AND AGREEMENT – The Entity provides documents requested by the AF for the development of the proposal and, if agreed by the Entity, the AF will enter into an agreement with the Entity to provide assessment services.

3. ASSESSMENT – The Entity undergoes an audit of its management system and relevant documentation and records, to evaluate the Organization's conformance with the IRMA Chain of Custody Standard to source and/or supply IRMA-achieving material. The AF auditor may identify non-conformances (NCs) and/or corrective action requests. Any NCs identified as critical (i.e., Major NC) will require the effective implementation of corrective actions prior to award of an IRMA Chain of Custody verification.

4. CHAIN OF CUSTODY VERIFICATION – Once the AF is satisfied that the Entity has met requirements for verification, including the resolution of all major non-conformances (if any), the Entity will be awarded IRMA Chain of Custody verification and authorized to begin making IRMA claims regarding its verified status and that of the eligible material the Entity sells while verified.

5. SURVEILLANCE AUDIT – Surveillance audits are required to ensure the Entity's continued conformance with the CoC Standard. Minor NCs identified during the previous audit must be found to have been effectively resolved by the time of the surveillance audit. Minor NCs that have not been effectively resolved will be elevated to Major NCs with a shortened timeline that must be met to avoid suspension of the verification. Major NCs identified during surveillance audits shall be resolved within three months of the audit date to avoid suspension.

6. VERIFICATION RENEWAL – IRMA Chain of Custody verifications are valid for 3 years, pending successful completion of surveillance audits. The Entity will need to

undergo a re-verification assessment before the verification expiration date to continue making IRMA claims.

Appendix 1. Normative Industry Guidance

NOTES ON THIS SECTION: This section is new and aims to enhance supply chain transparency and identify rules, guidelines, or characteristics for IRMA's CoC Standard specific to individual mined and processed materials.

CONSULTATION QUESTION 6.-1

Question: Do you have specific information to provide regarding one or more of the supply chains below? We welcome your input.

CONSULTATION QUESTION 6.-2

Question: Do you think this normative guidance should be attached?

The following sections provide rules, guidelines, or characteristics for IRMA's CoC Standard specific to individual mined and processed materials. Each section provides a description of the supply chain based on the most commonly used current mining, processing, and manufacturing methods. Potential new sources and methods are identified in some cases. Recycling, both internal and external, are also identified in some cases. The information is not intended to be exhaustive or cover all possible supply chains but rather provides examples.

This draft version contains normative guidance for graphite, iron, lithium, nickel, and platinum group minerals (PGMs). Additional normative guidance for mined materials will be added in the future or on request.

Although IRMA is not presently assessing consumer recycling facilities or recycle streams that enter into the mined materials supply chain, normative guidance is provided in this section for addressing both internal recycling and claims combining IRMA achieving and recycled materials. IRMA intends to give further consideration to recycled materials which are critical to a circular economy.

1 Graphite

Graphite is a form of pure carbon that occurs naturally or can be derived synthetically from petroleum coke which is a byproduct of petroleum refining. It has key properties, including chemical inertness, thermal stability, high electrical conductivity, and lubricity (slipperiness) that make it suitable for many industrial applications. This includes batteries, metallurgy, and steelmaking. For some of these uses, such as battery anodes, no suitable substitutes are currently available. Steelmaking and refractory applications in metallurgy currently use the largest amount of produced graphite; however, emerging technology uses in battery applications, both for EVs and industrial scale use, will substantially increase world demand for graphite.

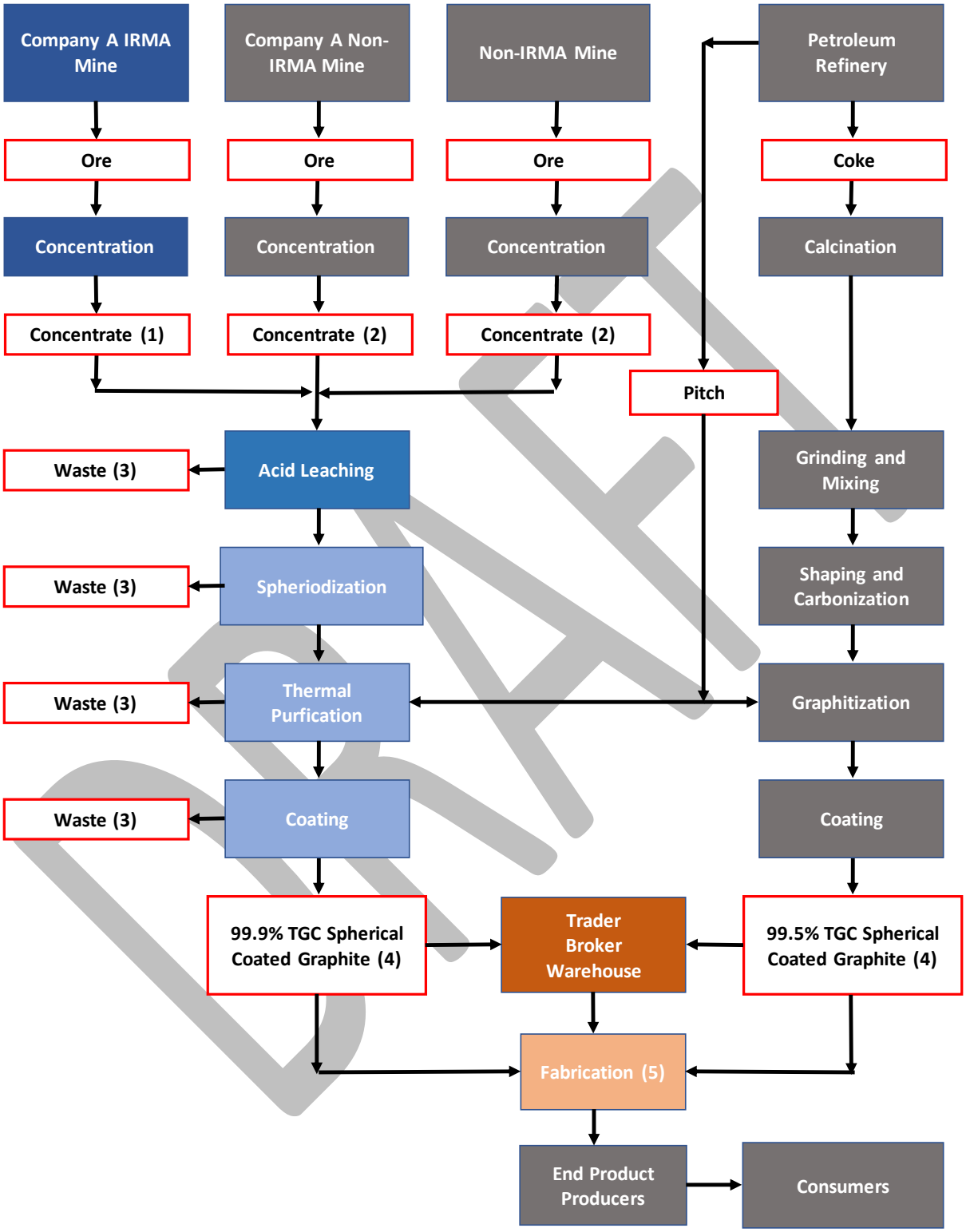
Synthetic graphite is manufactured from hydrocarbon sources that produce petroleum coke using high-temperature heat treatment, and it is more expensive to produce than natural graphite. Graphite ores are classified as “amorphous” (micro-crystalline), and “crystalline” (“flake” or “lump or chip”). Thermally metamorphosed coal is the usual source of amorphous graphite. Disseminated crystalline flake graphite is mined from carbonaceous metamorphic rocks, and lump or chip graphite is mined from veins in high-grade metamorphic regions.[5]

The processes for producing graphite from mine to end use are shown in Figure 1. The processes shown are not intended to be exhaustive but instead intended to be typical and for the purpose of explaining the likely flow of IRMA achieving graphite given current industry practice with an emphasis on chain of supply for decarbonization purposes such as energy storage batteries.

Natural graphite is mined to produce ore from both open pit and underground mine operations. Concentration processes for graphite vary from simple hand sorting and screening of high-grade ore at some amorphous graphite deposits and at high-grade vein operations, to multistage crushing, screening, washing, and flotation cycles required to produce high-quality and high-purity graphite flake and powder products. Graphite concentrates may contain from 50% to greater than 90% total graphite carbon (TCC). The concentrates are then chemically treated using hydrofluoric acid (HF) to elevate to a purity higher than 99%.

[5] Robinson, G.R., Jr., Hammarstrom, J.M., and Olson, D.W., 2017, Graphite, chap. J of Schulz, K.J., DeYoung, J.H., Jr., Seal, R.R., II, and Bradley, D.C., eds., Critical mineral resources of the United States—Economic and environmental geology and prospects for future supply: U.S. Geological Survey Professional Paper 1802, p. J1– J24, https://doi.org/10.3133/pp1802J.

Figure 1. Graphite Production Supply Chain



The next step involves the micronizing of flake graphite by reducing it in size to 10-20 micron particles (for reference, a human hair is about 70 microns in diameter). This is done in a step by-step process as the flakes move through a cascading series of mills. They are crushed by impact, collision, friction, and shearing using a high-speed rotating plate and classified to separate the target size range, which then goes into the next mill. Micronized and rounded material is then chemically purified to produce graphite with even higher TGC levels, from approximately 95% TGC to 99.9% TGC.[6] During this process approximately 2/3 of the graphite contained in the ore is rejected as waste.

Processes that would limit environmental impacts and energy intensity are being developed but are not currently in commercial use. Additionally, the processes utilize significant amounts of petroleum and coal tar binder pitch during the forming process and impregnation pitch for the densification of baked carbon bodies.

The process for production of synthetic graphite involves introduction of petroleum coke to calcination followed by grinding and mixing, shaping and carbonization, graphitization, and coating to produce spherical graphite. The graphitization cycle (i.e., the final step before the final product) is the most significant manufacturing process. During this step, the preprocessed needle coke is heated to temperatures of almost 3,000 degrees Celsius. Graphitization takes place in purpose-built furnaces to withstand the extreme heat required for this process. The main purpose of this step is to convert the carbon in the needle coke into graphite. Graphitization removes impurities from the needle coke feedstock, further improving its total graphite content (TGC) and strengthening its structure.[7]

IRMA CoC Standard Normative Requirements for graphite are as follows:

1.1 Individual IRMA mine production including concentration as indicated by **(1)** shall form the basis of the IRMA-achieving claim in terms of achievement level and quantity of graphite produced achieving that level. The supply chain data should show the achievement level, quantity of graphite concentrate produced, percent TGC and total quantity of TGC, for each individual IRMA source mine.

1.2 Non-IRMA mine production including concentration as indicated by **(2)** that is mixed into downstream processing feedstock shall also be accounted for in terms of quantity of concentrate, percent TGC and total quantity of TGC. The supply chain data does not need to provide the information for each individual non-IRMA mine, but can agglomerate the information so long as the individual mine sources are identified.

[6] The chemicals used in this step are typically hydrofluoric and sulfuric acid. The use of acids such as HF is one of the reasons why almost all of today's spheroidized coated graphite is produced in China.
[7] Amrish Ritoe, Irina Patrahau, Michel Rademaker, *Graphite Supply Chain Challenges and Recommendations for a Critical Mineral,* The Hague Centre for Strategic Studies, March 2022.

1.3 Downstream processing losses of TGC as indicated by **(3)** do count against an IRMA claim and must be consistent with mass balance accounting of those losses.

1.4 Downstream addition of TGC such as from the addition of pitch should be accounted for in final products and IRMA claims should be diluted accordingly consistent with mass balance accounting practices.

1.5 Spherical graphite as indicated by **(4)** and other graphite products produced and sold, traded, brokered or warehoused, and delivered to fabricators, should show the achievement level, quantity and TGC contents for the involved IRMA-achieving metals.

1.4 If products are not ready for fabrication, but require additional processing, for example by a toll facility, for an IRMA claim on those materials to be made, if they are mixed with other materials in the toll facility, the claim would have to be diluted by the total inputs to the tolling facility. The Entity producing the materials could only make an IRMA claim by acknowledging the further dilution.

1.6 Graphite used in fabrication, as indicated by **(5)** and delivered to end product users, should show the IRMA achievement level, quantity, and TGC contents received from fabricators and delivered to Consumers.

1.7 Internal process recycling should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. In order to retain an IRMA claim the recycled material must report back to the smelting or refining facility of origin and be accounted as part of later production.

1.8 Consumer recycling should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. While there is no IRMA claim for consumer recycled materials, the percentage content of consumer recycled materials should be accounted for and added as an addition to the IRMA claim (e.g., the graphite used in this battery anode consists of 25% IRMA 75 achievement level material and 25% post-consumer recycled material.)

2 Iron

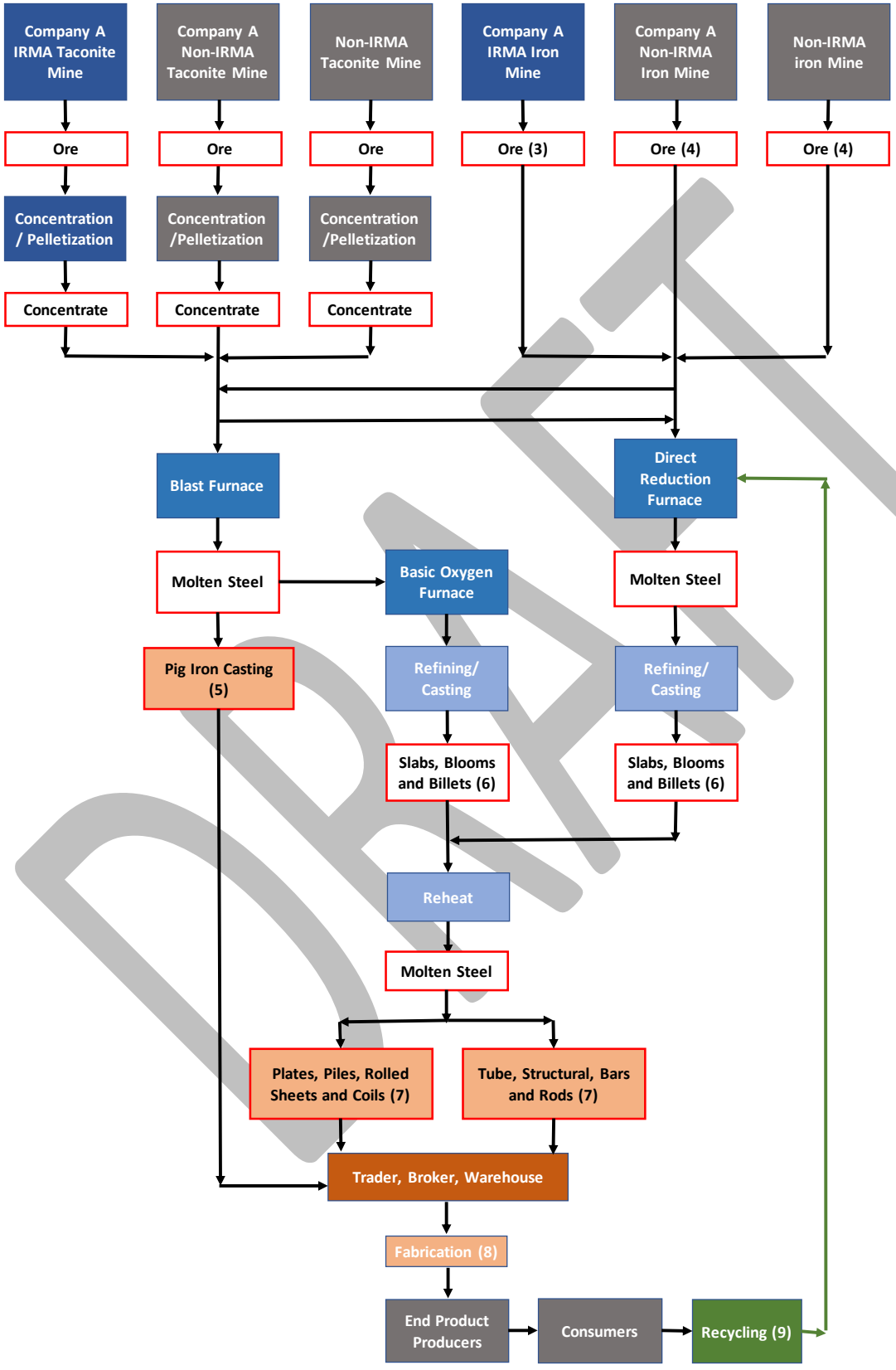
Iron ore is a mineral substance which, when heated in the presence of a reductant, will yield metallic iron (Fe). It almost always consists of iron oxides, the primary forms of which are magnetite (Fe_3O_4) and hematite (Fe_2O_3). Iron ore is the source of primary iron for the world's iron and steel industries. Almost all (98%) iron ore is used in steelmaking. Iron ore is mined in about 50 countries. Australia and Brazil together dominate the world's iron ore exports, each having about one-third of total exports.

The processes for producing iron from mine to end use are shown in Figure 2. The processes shown are not intended to be exhaustive but instead intended to be typical and for the purpose of explaining the likely flow of IRMA achieving iron given current industry practice.

Iron is mined to produce ore from both open pit and underground mine operations. Direct shipping ores, which are not concentrated, are transported as mined or possibly after screening. Direct shipping ores are generally hematite, magnetite, or goethite. Lower-grade ores, such as from taconite deposits, require further processing. Processing of taconite consists of crushing and grinding the ore to liberate iron-bearing particles, concentrating the ore by separating the particles from the waste material (gangue), and pelletizing the iron ore concentrate. Concentration of magnetite uses magnetic separation techniques whereas non-magnetic hematite is concentrated by froth flotation. Various combinations of magnetic separation and flotation may be used to concentrate ores containing various iron minerals (magnetite and hematite, or maghemite) and wide ranges of mineral grain sizes. Flotation is also often used as a final polishing operation on magnetic concentrates. In pelletizing, moistened concentrates are fed to a rotating drum or an inclined disc, the tumbling action of which produces soft, spherical agglomerates. These “green” balls are then dried and hardened by firing in air to a temperature in the range of 1,250° to 1,340° C (2,300° to 2,440° F). Finally, they are slowly cooled. Finished pellets are round and have diameters of 10 to 15 millimeters, making them almost the ideal shape for the blast furnace.

Steel production from iron ore can occur using one of two processes. The traditional blast furnace produces pig iron from iron ore by the reducing action of carbon (supplied as coke) at a high temperature in the presence of a fluxing agent such as limestone. The direct reduction electric arc furnace approach is used to reduce iron from iron ore. Heat is generated from an electric arc between electrodes. Oxygen is blown into the furnace, and lime and other materials are added to combine with the impurities and form slag. Molten iron is extracted and poured out via a tapping spout. It is then processed again in an electric arc furnace to make steel—particularly special quality steel. It is then processed again in an electric arc refurnace to make steel—particularly special quality steel.

Figure 2. Iron-Steel Production Supply Chain



Next, the molten steel is poured and solidified in a continuous caster. This produces semi-finished products. These can be either slabs, which have a rectangular cross-section, blooms, or billets, which have a square cross-section. Lastly, these blank products are used to form a finished product. Depending on the particular geometries required, some will need to undergo heat treatment to achieve particular mechanical properties.

IRMA CoC Standard Normative Requirements for iron are as follows:

2.1 Individual IRMA mine production including from taconite mines following concentration, as indicated by **(1)** and from direct shipping mines **(3)** shall form the basis of the IRMA-achieving claim in terms of achievement level and quantity of iron produced achieving that level. The supply chain data should show the achievement level and quantity of iron for each individual IRMA mine.

2.2 Non-IRMA mine production including from taconite mines or direct shipping mines by the same Entity that would be fed to smelting facilities is indicated by **(2)** and **(4)**. The supply chain data does not need to show the quantity of nickel for each individual non-IRMA mine but can agglomerate the total so long as the individual mine sources are identified.

2.3 Output from smelting and refining in the form of pig iron casting **(5)**, and slabs, blooms and billets **(6)** shall be tracked to downstream reheating and their production of various shapes, and indicated by **(7)** that are then used in fabrication as indicated.

2.4 If products are not ready for fabrication, but require additional processing, for example by a toll facility, for an IRMA claim on those materials to be made, if they are mixed with other materials in the toll facility, the claim would have to be diluted by the total inputs to the tolling facility. The Entity producing the materials could only make an IRMA claim by acknowledging the further dilution.

2.5 Smelting and refining conversion losses do count against an IRMA claim and must be consistent with mass balance accounting of those losses.

2.6 Individual iron and iron compounds produced and sold, traded, brokered or warehoused, and delivered to fabricators, should show the achievement level and quantity for the involved IRMA-achieving metal.

2.7 Individual metals or materials used in fabrication, as indicated by **(8)** and delivered to end product users, should show the IRMA achievement level and quantity of iron received from fabricators and delivered to Consumers.

2.8 Internal process recycling should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. In order to retain an IRMA claim the recycled material must report back to the processing facility of origin and be accounted as part of later production.

2.9 Consumer recycling as indicated by **(9)** should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. While there is no IRMA claim for consumer recycled materials, the percentage content of consumer recycled materials should be accounted for and added as an addition to the IRMA claim (e.g., The iron used in this battery consists of 25% IRMA 75 achievement level material and 50% post-consumer recycled material).

3 Lithium

Lithium, the lightest of all metals, is used in batteries (rechargeable and primary), ceramics, glass, lubricants, metallurgy, air treatment, pharmaceuticals, and polymers. Rechargeable lithium-ion batteries are particularly important in efforts to reduce global warming at both the EV and industrial scale.

Currently, lithium is extracted from brines that are pumped from beneath arid sedimentary basins and extracted from granitic pegmatite ores. The leading producer of lithium from brine is Chile, and the leading producer of lithium from pegmatites is Australia. Other potential sources of lithium include clays, geothermal brines, oilfield brines, and zeolites.

Lithium is traded in three forms: mineral concentrates, mineral compounds, and refined metal. Lithium minerals—mainly spodumene, petalite, and lepidolite—are mined from pegmatites and are used mostly as feedstock for glasses and ceramics. Most lithium compounds (for example, lithium carbonate, lithium chloride, and lithium hydroxide) are obtained from brines. Lithium metal is obtained by electrolysis from lithium chloride.

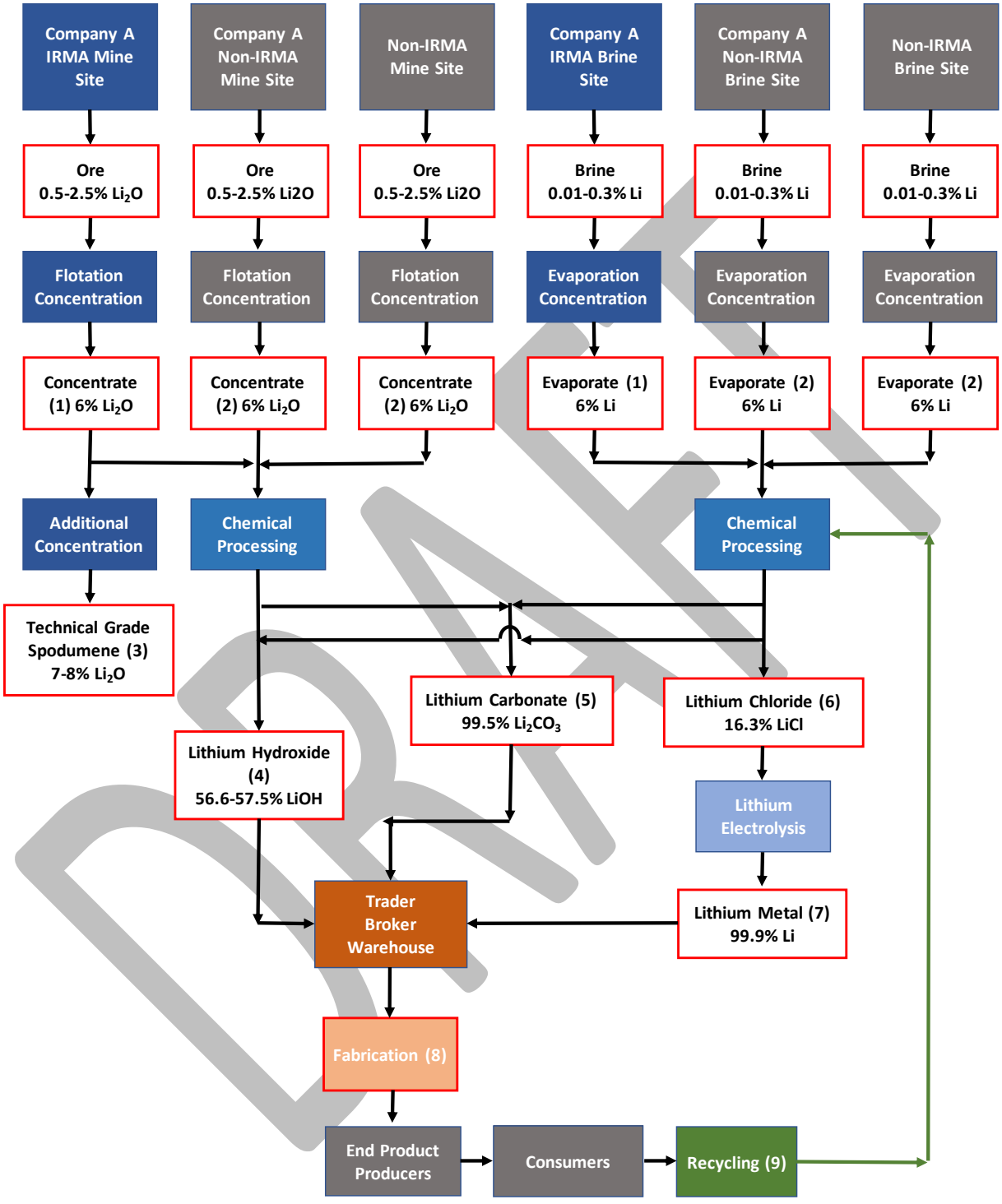
The processes for producing lithium from mine sites, including brine extraction sites, to end use are shown in Figure 3. The processes shown are not intended to be exhaustive but instead intended to be typical and for the purpose of explaining the likely flow of IRMA achieving lithium given current industry practice with an emphasis on chain of supply for decarbonization purposes such as energy storage batteries.

Ore from lithium containing pegmatites (LCTs) is extracted from open pit hardrock mines followed by concentration by flotation and in some cases other methods. The resulting concentrate, containing approximately 6% lithium oxide (Li_2O), is then transported for chemical processing into lithium hydroxide (LiOH) or lithium carbonate ($Li_2CO_{3)}$. Technical grade spodumene may also be produced using additional concentration processes resulting in 7-8% lithium oxide. Processes vary, but typically lithium concentrate is heated and pulverized and then mixed with sulfuric acid. The slurry is heated, filtered, and concentrated through evaporation processes to form lithium hydroxide or lithium carbonate.

Lithium containing brine is extracted from wells where it is pumped to the surface and distributed to evaporation ponds of various ages. The natural evaporation process can take months or years and results in a concentrated brine or evaporate containing approximately 6% lithium. The liquid concentrate is transported for chemical processing into lithium hydroxide, lithium carbonate, or lithium chloride. The chemical processes used typically include the following steps: pre-treatment using filtration or ion exchange to remove unwanted constituents from the brine; chemical treatment including solvent extraction and precipitation to separate products and byproducts; filtration to remove precipitated solids; and chemical treatment to form lithium hydroxide, lithium carbonate, lithium chloride and other

lithium compounds. Lithium chloride is converted by electrolysis to metal resulting in 99.9% lithium.

Figure 3. Lithium Production Supply Chain



IRMA CoC Standard Normative Requirements for lithium are as follows:

3.1 Individual IRMA mine production including from brine operations and concentration or evaporation, as indicated by **(1)** shall form the basis of the IRMA-achieving claim in terms of achievement level and quantity of lithium produced achieving that level. The supply chain data should show the achievement level and quantity of lithium for each individual IRMA mine. Non-typical production sources of lithium such as from hardrock clay or direct lithium extraction would be similarly addressed.

3.2 Non-IRMA mine production including from brine operations and concentration or evaporation by the same Entity that would be fed to chemical processing and lithium conversion facilities is indicated by **(2)**. The supply chain data does not need to show the quantity of lithium for each individual non-IRMA mine but can agglomerate the total so long as the individual mine sources are identified.

3.3 Lithium compounds and metal produced from chemical processing and lithium conversion as indicated by **(3)** through **(7)** should show the achievement level and quantity of lithium for the agglomerated IRMA-achieving metals. Mass balance accounting for conversion should be consistent with Table 1.

3.4 If products are not ready for fabrication, but require additional processing, for example by a toll facility, for an IRMA claim on those materials to be made, if they are mixed with other materials in the toll facility, the claim would have to be diluted by the total inputs to the tolling facility. The Entity producing the materials could only make an IRMA claim by acknowledging the further dilution.

3.5 Chemical processing and lithium conversion losses do count against an IRMA claim and must be consistent with mass balance accounting of those losses.

3.6 Individual lithium and lithium compounds produced and sold, traded, brokered or warehoused, and delivered to fabricators, should show the achievement level and quantity for the involved IRMA-achieving metal.

3.7 Individual metals or materials used in fabrication, as indicated by **(8)** and delivered to end product users, should show the IRMA achievement level and quantity of lithium received from fabricators and delivered to Consumers.

3.8 Internal process recycling should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. In order to retain an IRMA claim the recycled material must report back to the processing facility of origin and be accounted as part of later production.

3.9 Consumer recycling as indicated by **(9)** should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. While there is no IRMA claim for consumer recycled materials, the percentage content of consumer recycled materials should be accounted for and added as an addition to the IRMA

claim (e.g., The lithium used in this battery consists of 25% IRMA 75 achievement level material and 50% post-consumer recycled material.)

Standard industry terminology may be used including Lithium Carbonate Equivalent (LCE) provided the following conversion factors are utilized:

Table 1. Conversion Factors for Lithium Compounds and Minerals

CONVERT FROM	CONVERT TO				
	LITHIUM METAL (Li)	LITHIUM HYDROXIDE MONOHYDRATE ($LiOH.H_2O$)	LITHIUM CARBONATE (Li_2CO_3)	LITHIUM CHLORIDE (LiCl)	CHEMICAL GRADE SPODUMENE (7% Li)
Lithium Metal (Li)	1.000	6.047	5.324	6.108	14.286
Lithium Hydroxide Monohydrate ($LiOH.H_2O$)	0.165	1.000	0.880	1.010	2.363
Lithium Carbonate (Li_2CO_3)	0.188	1.136	1.000	1.147	2.683
Lithium Chloride (LiCl)	0.164	0.990	0.872	1.000	2.339
Technical Grade Spodumene (7% Li)	0.070	0.423	0.373	0.428	1.000

4 Nickel

Nickel is primarily sold for first use as refined metal (cathode, powder, briquet, etc.) or ferronickel. About 65% of the nickel consumed in the Western World is used to make austenitic stainless steel. Another 12% goes into superalloys (e.g., Inconel 600) or nonferrous alloys (e.g., cupronickel). Both families of alloys are widely used because of their corrosion resistance. The aerospace industry is a leading consumer of nickel-base superalloys. Turbine blades, discs and other critical parts of jet engines are fabricated from superalloys. Nickel-base superalloys are also used in land-based combustion turbines, such those found at electric power generation stations. The remaining 23% of consumption is divided between alloy steels, rechargeable batteries, catalysts and other chemicals, coinage, foundry products, and plating. The principal commercial chemicals are the carbonate ($NiCO_3$), chloride ($NiCl_2$), divalent oxide (NiO), and sulfate ($NiSO_4$).[8]

Primary nickel is produced from two very different ores, sulfides and lateritic. Sulfide ores are often found in conjunction with copper-bearing ores and may be mined by underground or open pit methods. Lateritic ores are normally found in tropical climates where weathering, with time, extracts and deposits the ore in layers at varying depths below the surface. Lateritic ores are mined by open pit methods. The processes for producing nickel from mine site to end use are shown in Figure 4.[9,10] The processes shown are not intended to be exhaustive but instead intended to be typical and for the purpose of explaining the likely flow of IRMA achieving nickel given current industry practice with an emphasis on chain of supply for decarbonization purposes such as energy storage batteries.

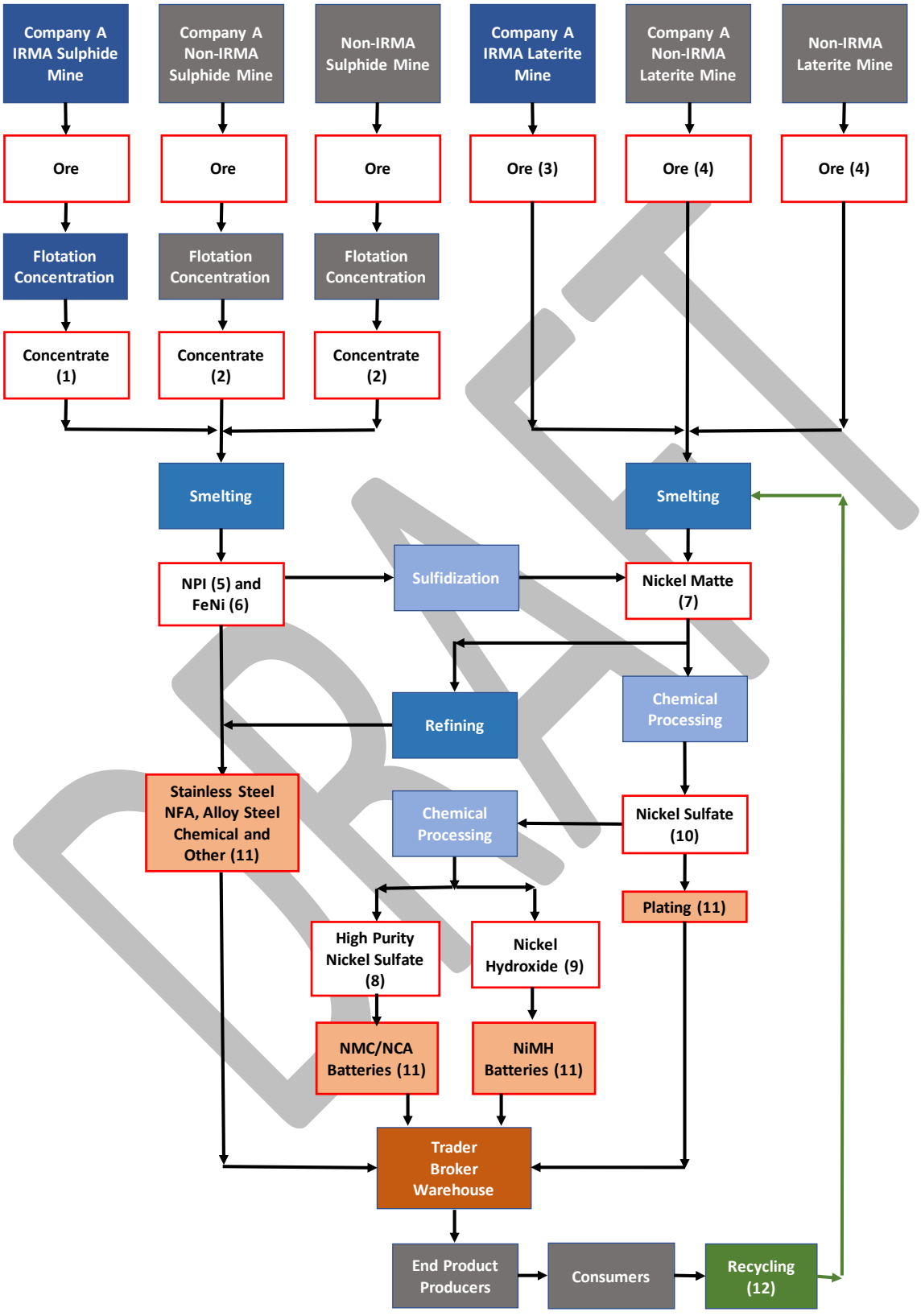
Sulfidic Ore Processing. Nickel sulfide ore from open pit or underground mining is typically upgraded by froth flotation to form a high-grade nickel concentrate. The concentrate is dried and then fed to Flash the smelting process. Flash smelting is the most common process for smelting, but electric smelting is also used for more complex raw materials. Electric smelting requires a roasting step before smelting to reduce sulfur content and volatiles. Older nickel-smelting processes, such as blast or reverberatory furnaces, may also still be in use. In flash smelting, dry sulfide ore containing less than 1% moisture is fed to the furnace along with preheated air, oxygen-enriched air (30–40% oxygen), or pure oxygen. Iron and sulfur are oxidized. The heat that results from exothermic reactions is adequate to smelt concentrate, producing a liquid matte (up to 45% nickel) and a fluid slag.

[8] https://www.usgs.gov/centers/national-minerals-information-center/nickel-statistics-and-information

[9] https://www.crugroup.com/knowledge-and-insights/case-studies/2019/understanding-costs-of-new-nickel-sulphate-supply-in-south-east-asia/

[10] Source Extractive Metallurgy of Nickel, Cobalt and Platinum Group Metals, Editor(s): Frank K. Crundwell, Michael S. Moats, Venkoba Ramachandran, Timothy G. Robinson, William G. Davenport, El Sevier, 2011. ISBN 9780080968094, https://doi.org/10.1016/B978-0-08-096809-4.10012-7.

Figure 4. Nickel Production Supply Chain



Furnace matte still contains iron and sulfur, and these are oxidized in the converting step to sulfur dioxide and iron oxide by injecting air or oxygen into the molten bath. Oxides form a slag, which is skimmed off. Slags are processed in an electric furnace prior to discard to recover nickel. Process gases are cooled, and particulates are then removed by gas-cleaning devices.

The process results in the production of Ferro Nickel (FeNi) and/or Nickel Pig Iron (NPI) which is a low-grade ferronickel invented in China as a cheaper alternative to pure nickel for the production of stainless steel. These products are typically used for the production of stainless steel, nickel ferro alloys (NFA), alloy steel, chemical and other products. More recently, these products are being subjected to sulfidization and converted to Nickel Matte which is then used downstream to produce nickel sulfate as an alternative to nickel sourced from laterite ores.

Lateritic Ore Processing. Nickel laterite ores have a high percentage of free and combined moisture, which must be removed. Drying removes free moisture; chemically bound water is removed by a reduction furnace, which also reduces the nickel oxide. Lateritic ores have no significant fuel value, and an electric furnace is needed to obtain the high temperatures required to accommodate the high magnesia content of the ore. Some laterite smelters add sulfur to the furnace to produce a matte for processing. Most laterite nickel processers run the furnaces to reduce the iron content sufficiently to produce ferronickel products. Hydrometallurgical processes based on ammonia or sulfuric acid leach are also used. Ammonia leach is usually applied to the ore after the reduction roast step.

Nickel Refining. Various processes are used to refine nickel matte. Fluid bed roasting and chlorine-hydrogen reduction produce high-grade nickel oxides (more than 95% nickel). Vapor processes such as the carbonyl process can be used to produce high-purity nickel pellets. In this process, copper and precious metals remain as a pyrophoric residue that requires separate treatment. Use of electrical cells equipped with inert cathodes is the most common technology for nickel refining. Electrowinning, in which nickel is removed from solution in cells equipped with inert anodes, is the more common refining process. Sulfuric acid solutions or, less commonly, chloride electrolytes are used.

Nickel Matte Conversion to Nickel Sulfate. Nickel Matte from smelting or from other sources is leached with sulfuric acid to form nickel sulfate which is then used for plating, or is further chemically processed to produced high purity nickel sulfate, which is used in the manufacture of nickel-manganese-cobalt (NMC) and lithium-manganese-aluminum (NMA) batteries. Alternatively, nickel sulfate is converted to nickel hydroxide which is used in the manufacture of nickel-metal-hydride (NiMH) batteries.

IRMA CoC Standard Normative Requirements for nickel are as follows:

4.1 Individual IRMA mine production including from sulfide mines following concentration, as indicated by **(1)** and from laterite mines **(3)** shall form the basis of the IRMA-achieving claim in terms of achievement level and quantity of nickel

produced achieving that level. The supply chain data should show the achievement level and quantity of nickel for each individual IRMA mine. Non-typical production sources of nickel such as from hydrometallurgical extraction should be similarly identified.

4.2 Non-IRMA mine production including from sulfide mines or laterite mines by the same Entity that would be fed to smelting facilities is indicated by **(2)** and **(4)**. The supply chain data does not need to show the quantity of nickel for each individual non-IRMA mine but can agglomerate the total so long as the individual mine sources are identified.

4.3 Output from smelting in the form of NPI, FeNi, and nickel matte as indicated by **(5)**, **(6)** and **(7)** respectively shall be tracked to downstream processes and their production of high purity nickel sulfate **(8)**, nickel hydroxide **(9)** and nickel sulfate **(10)** and to their final use in fabrication as indicated.

4.4 If products are not ready for fabrication, but require additional processing, for example by a toll facility, for an IRMA claim on those materials to be made, if they are mixed with other materials in the toll facility, the claim would have to be diluted by the total inputs to the tolling facility. The Entity producing the materials could only make an IRMA claim by acknowledging the further dilution.

4.5 Smelting, refining, and chemical processing and conversion losses do count against an IRMA claim and must be consistent with mass balance accounting of those losses.

4.6 Individual nickel and nickel compounds produced and sold, traded, brokered or warehoused, and delivered to fabricators, should show the achievement level and quantity for the involved IRMA-achieving metal.

4.7 Individual metals or materials used in fabrication, as indicated by **(11)** and delivered to end product users, should show the IRMA achievement level and quantity of nickel received from fabricators and delivered to Consumers.

4.8 Internal process recycling should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. In order to retain an IRMA claim the recycled material must report back to the processing facility of origin and be accounted as part of later production.

4.9 Consumer recycling as indicated by **(12)** should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. While there is no IRMA claim for consumer recycled materials, the percentage content of consumer recycled materials should be accounted for and added as an addition to the IRMA claim (e.g., The nickel used in this battery consists of 25% IRMA 75 achievement level material and 50% post-consumer recycled material).

5 Platinum Group Metals

The platinum group metals (PGMs) or elements (PGEs) are platinum (Pt), palladium (Pd), ruthenium (Ru), rhodium (Rh), iridium (Ir) and osmium (Os). The leading use for PGMs is in catalytic converters to decrease harmful emissions from forms of transportation that use combustion engines including automobiles, trucks, and heavy equipment. PGMs are also used in catalysts for bulk-chemical production and petroleum refining; dental and medical devices; electronic applications, such as in computer hard disks, hybridized integrated circuits, and multilayer ceramic capacitors; glass manufacturing; investment; jewelry; and laboratory equipment.[11]

PGMs are not currently viewed as a key green energy mineral resource. However, PGMs are considered to be a critical mineral by the U.S. Geological Survey, noting that PGMs are indispensable to many industrial applications but mined in a limited number of places and noting that the supply, because of the concentration of PGMs in a few locations globally, could be disrupted by economic, environmental, political, and social events.[12]

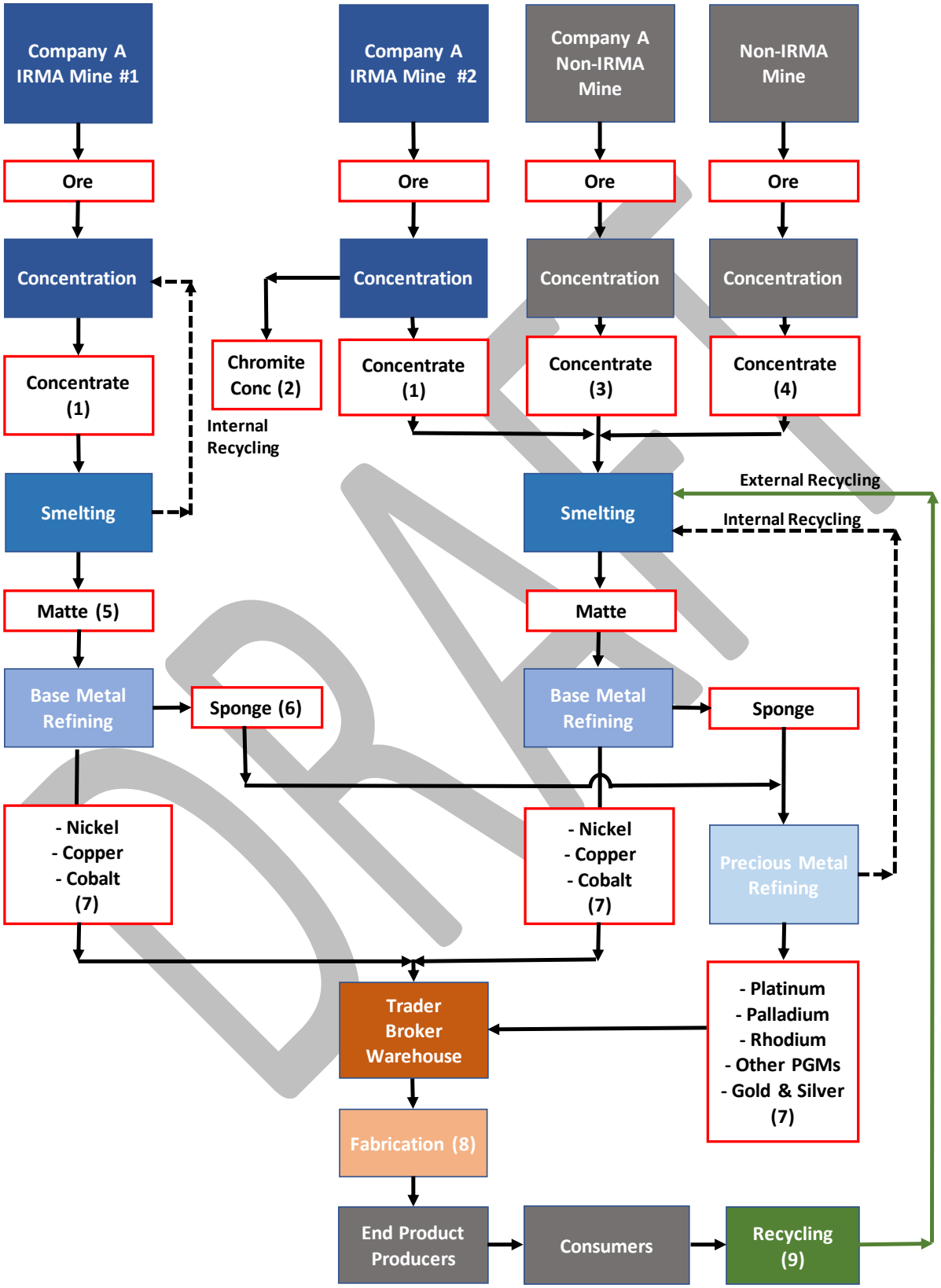
A generalized supply chain for PGMs is shown in Figure 5. The processes shown are not intended to be exhaustive but instead intended to be typical and for the purpose of explaining the likely flow of IRMA achieving PGMs given current industry practice.

The main source of minerals for PGMs are chromite and sulfide ores. The richest PGM containing orebodies are mined for PGMs as primary products and are based on mining ultramafic and mafic (e.g., geologically very old) igneous rocks which occur in Canada, Russia, South Africa, United States, and Zimbabwe. PGMs may also be produced as by-products or co-products of copper nickel mining, with examples being the Norilsk deposit in north-western Siberia, and the Sudbury deposit in Canada.[13]

PGM mining is performed via either open pit or underground mining at large scale. The ore extracted from PGM mine production contains PGM bearing sulfides and alloys. The typical first step in treatment used for all PGM production is concentration using froth flotation. PGM concentration facilities are typically located adjacent, or in close proximity, to the mining operations.

[11] Hughes, A.E.; Haque, N.;Northey, S.A.; Giddey, S. *Platinum Group Metals: A Review of Resources, Production and Usage with a Focus on Catalysts*. Resources 2021, 10, 93.
[12] USGS Mineral Commodity Summary 2022 – Platinum Group Metals.
[13] Zientek, M.L., Loferski, P.J., Parks, H.L., Schulte, R.F., and Seal, R.R., II, 2017, *Platinum-group elements,* Chapter N of Schulz, K.J., DeYoung, J.H., Jr., Seal, R.R., II, and Bradley, D.C., eds., Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply: U.S. Geological Survey Professional Paper 1802, p. N1–N91.

Figure 5. PGM Production Supply Chain



The concentrate from flotation is then treated by smelting which is conducted to oxidize the sulfides and remove other impurities from the concentrate, and produce a base metal, PGM and precious metal rich matte. The smelting process is highly similar whether the PGMs are produced as primary products or as by-products.

PGMs containing materials from recycling, which are typically sourced from automobile exhaust catalytic converters, are introduced during the smelting process. This may be one of the best examples of recycling of commodities in that the catalytic converters for automobiles are easily identifiable and external to the car itself, making them easily recoverable (and subject to theft). The metal is contained and of high value, the material is easily extracted, and is highly amenable to introduction to conventional smelting processes already used for primary PGM production.

The next step, refining of individual PGMs, requires highly complex metallurgical and chemical processes and therefore is only performed by a limited number of facilities worldwide. PGM refining consists of two steps. The first is base metal refining which typically uses a hydrometallurgical autoclave leaching process to sequentially leach nickel, copper, and cobalt along with other impurities and produce a final concentrate or "sponge" that contains PGMs and gold. The base metals are produced individually in either metal or chemical form. In the next step the metal sponge is refined and separated into individual PGMs using organic solvents, ion exchange and electrolytic processes or other methods. Refining of base metals is sometimes performed in sequence with and at the same site as smelting, however at other sites both refining of base metals and PGMs takes place at the same facility. Most primary PGM refineries are owned by primary PGM mining producers, however there are others which are independent from the PGM mining companies and may also be involved in product fabrication.

The final step before the end use of PGMs as auto catalysts is product fabrication, where the individual PGMs are combined and formed into a catalyst which is then enveloped by a container producing a "catalytic converter" that can then be easily installed as an end product by a combustion engine vehicle manufacturer.

IRMA CoC Standard Normative Requirements for PGMs are as follows:

5.1 Individual IRMA mine production including concentration, as indicated by **(1)** shall form the basis of the IRMA-achieving claim in terms of achievement level and quantity of metals or minerals produced achieving that level. The supply chain data should show the achievement level and quantity of metals or minerals for each individual IRMA mine.

5.2 If an IRMA mine produces chromite or another metal or mineral as a by-product from concentration, as indicated by **(2)** then that material can also be claimed as IRMA-achieving.

5.3 Non-IRMA mine production including concentration by the same Entity that would be fed to common smelting and refining facilities is indicated by **(3)**. The

supply chain data does not need to show the quantity of metals or minerals for each individual non-IRMA mine but can agglomerate the total so long as the individual mine sources are identified.

5.4 Non-IRMA mine production including concentration by an external Entity that would be tolled in an Entity's smelting and refining facilities is indicated by **(4)**. The supply chain data does not need to show the quantity of metals or minerals for each individual external mine but can agglomerate the total so long as the individual mine sources are identified.

5.5 If IRMA mine production is sent to a smelting facility owned by the Entity which then sends the product to another location owned by the same Entity for downstream refining, as indicated by **(5)** then the supply chain data does not need to show the transfer of metals between smelting and refining. However, if the Entity sends a downstream product to another Entity for downstream refining, as indicated by **(6)**, then the supply chain data does need to show the transfer of metals between smelting and refining.

5.6 Individual metals or materials produced from metallurgical processing as indicated by **(7)** should show the achievement level and quantity of metals or minerals for the agglomerated IRMA-achieving metals.

5.7 If products are not ready for fabrication, but require additional processing, for example by a toll facility, for an IRMA claim on those materials to be made, if they are mixed with other materials in the toll facility, the claim would have to be diluted by the total inputs to the tolling facility. The Entity producing the materials could only make an IRMA claim by acknowledging the further dilution.

5.8 Smelting and refining losses do count against an IRMA claim and must be consistent with mass balance accounting of those losses.

5.9 Individual metals or materials produced and sold, traded, brokered or warehoused, and delivered to fabricators, as indicated by **(8)** should show the achievement level and quantity of metals or minerals for the involved IRMA-achieving metals.

5.10 Internal process recycling should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. In order to retain an IRMA claim the recycled material must report back to the smelting or refining facility of origin and be accounted as part of later production.

5.11 Consumer recycling as indicated by **(9)** should be accounted for as per IRMA Standard CoC Normative Guidance Section 6. Recycled Materials. While there is no IRMA claim for consumer recycled materials, the percentage content of consumer recycled materials should be accounted for and added as an addition to the IRMA claim (e.g., The palladium used in this catalytic converter consists of 25% IRMA 75 achievement level material and 50% post-consumer recycled material.)

6 Recycled Materials

Recycling takes place in several ways in the production of mined materials. Many mined materials utilize processes and manage materials using internal transfers and recycle loops. Other steps in the process chain recycle excess or waste material, from fabrication for example, by transferring it to upstream processors within the same chain of supply, or outside the chain of supply. Additionally, post-consumer recycled material may be introduced into the chain of supply. All these potential aspects of recycling present particular challenges for metallurgical accounting and the determination of input and outputs relative to *IRMA Standard Achievement Levels*. However, provided mass balance principles are utilized for recycled materials, such as this CoC requires, their part in the supply chain can be accounted for accurately.

IRMA CoC Standard Normative Requirements for Recycled Materials:

Internal transfers and recycle loops, which are not considered net inputs or outputs by an Entity, should be addressed by meeting the following requirement:

6.1.1. Within the chain of custody, the quantities internally transferred and recycled shall be reconciled within a six-month accounting period to verify that the outputs relate appropriately to the inputs. The Entity active in the chain of custody shall document the total quantity (volume or mass or units) of internally transferred and recycled materials or products within the appropriate specified timeframe. The documentation shall include:
a. recyclable material in stock remaining from the previous accounting period;
b. recyclable inputs received;
c. recyclable inputs still in stock;
d. recyclable outputs still in stock;
e. recyclable outputs supplied to customer.

Transfers and recycle loops to upstream processors within the same supply chain should be addressed by meeting the following requirement:

6.2.1. Within the chain of custody, the quantities externally transferred and recycled to Entities within the same chain of supply shall be reconciled within a six-month accounting period to verify that the outputs relate appropriately to the inputs. The Entity active in the chain of custody shall document the total quantity (volume or mass or units) of externally transferred and recycled materials or products within the appropriate specified timeframe. The documentation shall include:
a. recyclable material in stock remaining from the previous accounting period;
b. recyclable inputs received;
c. recyclable inputs still in stock;
d. recyclable outputs still in stock;
e. recyclable outputs supplied to customer.

Transfers and recycle loops to upstream processors outside the same supply chain should be accounted for as a loss of corresponding material meeting an *IRMA Standard Achievement Levels*.

Post-consumer recycled material should be addressed by meeting the following requirement:

6.3.1. Within the chain of custody, the quantities of post-consumer recycled material introduced within the chain of supply shall be reconciled within a six-month accounting period to verify that the outputs relate appropriately to the inputs. The Entity active in the chain of custody shall document the total quantity (volume or mass or units) of post-consumer recycled materials or products introduced to the chain of supply within the appropriate specified timeframe. The documentation shall include:
a. post-consumer recyclable material in stock remaining from the previous accounting period;
b. post-consumer recyclable inputs received;
c. post-consumer recyclable inputs still in stock;
d. post-consumer recyclable outputs still in stock;

Appendix 2. Chain of Custody Models

NOTES ON THIS SECTION: This section is new and aims to provide additional clarifying information regarding the five CoC models.

CONSULTATION QUESTION A.2.-1

Question: Do you find this section to be a helpful addition to the CoC Standard? If yes, please note what is helpful. If no, please note why it is not helpful. Recommendations on this section are welcome.

1. Identity Preserved Model

The identity preserved chain of custody model allows for input that originates from a single source. In the identity preserved model, the material or product is kept physically separated and its characteristics are maintained throughout the supply chain. Materials or products are clearly identifiable throughout the supply chain as originating from the single source.

The specified characteristics of the material or product determined by the specific source it originates from must be maintained by the Entities active in the chain of custody. The chain of custody must ensure the material or product can be traced all the way back to the source from which it originates. A simplified illustration of the identity preserved model for a single tier in the supply chain is shown in Figure 1. The figure shows an example where a production lot from a single individual mine/mineral processing facility with IRMA achieving material of a particular level (X_1) is provided to an Entity that then produces a product lot that is 100% from that source and having same achievement level.

Figure 1. IRMA Identity Preserved Model (adapted from ISO Std No. 22095:2020)

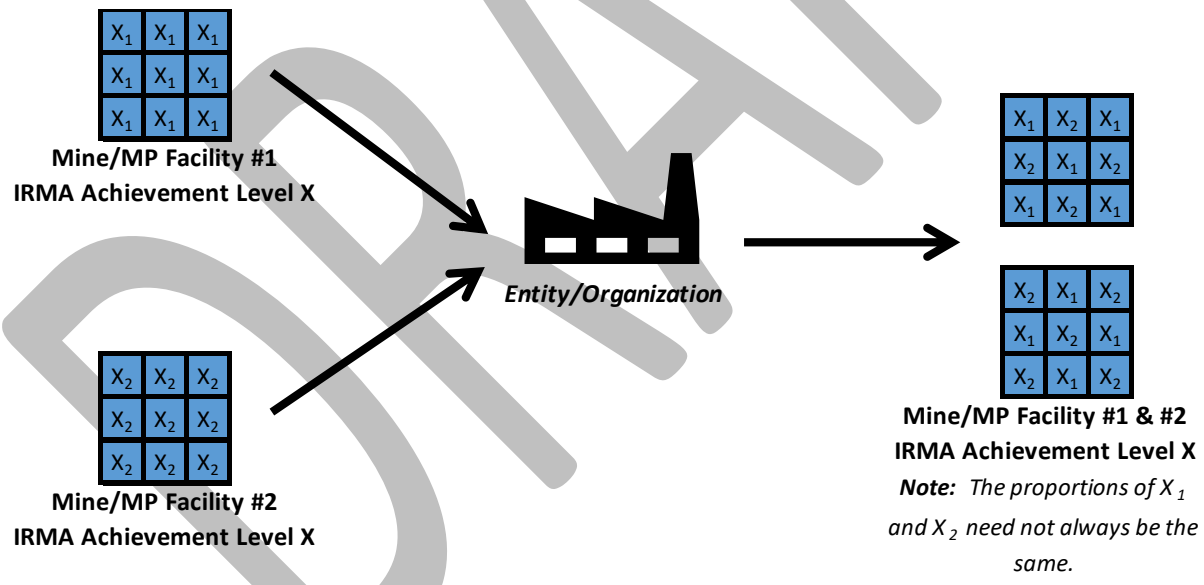
The identity preserved model ensures that the materials or products are 100% identifiable from the original source and therefore satisfies item-based expectations of organizations active in the chain of custody, consumers, or other end users. The identity preserved model is most applicable to situations where a mine/mineral processing facility's produced material's properties are retained and further downstream processing is performed in dedicated batches or at dedicated facilities.

2. Segregated Model

The segregated model is a chain of custody model in which, from initial input to final output, the *IRMA Standard achievement levels* are maintained. Inputs from different sources may be mixed, based on identical characteristics. However, the identity of any particular source might be lost.

In the segregated model, materials or products with certain *IRMA Standard achievement levels* are kept physically separated and their characteristics are maintained throughout the supply chain. The inputs will have identical characteristics but may have different sources. A simplified illustration of the segregated model is shown in Figure 2. The figure shows an example where production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X_1, X_2) are provided to an Entity that then produces a product that is from the two sources with the same achievement level. As indicated by the different apportioning of the two lots of X_1 and X_2 from the individual sources in the two lots produced by the Entity, the proportions of X_1 and X_2 need not always be the same.

Figure 2. IRMA Segregated Model (adapted from ISO Std No. 22095:2020)



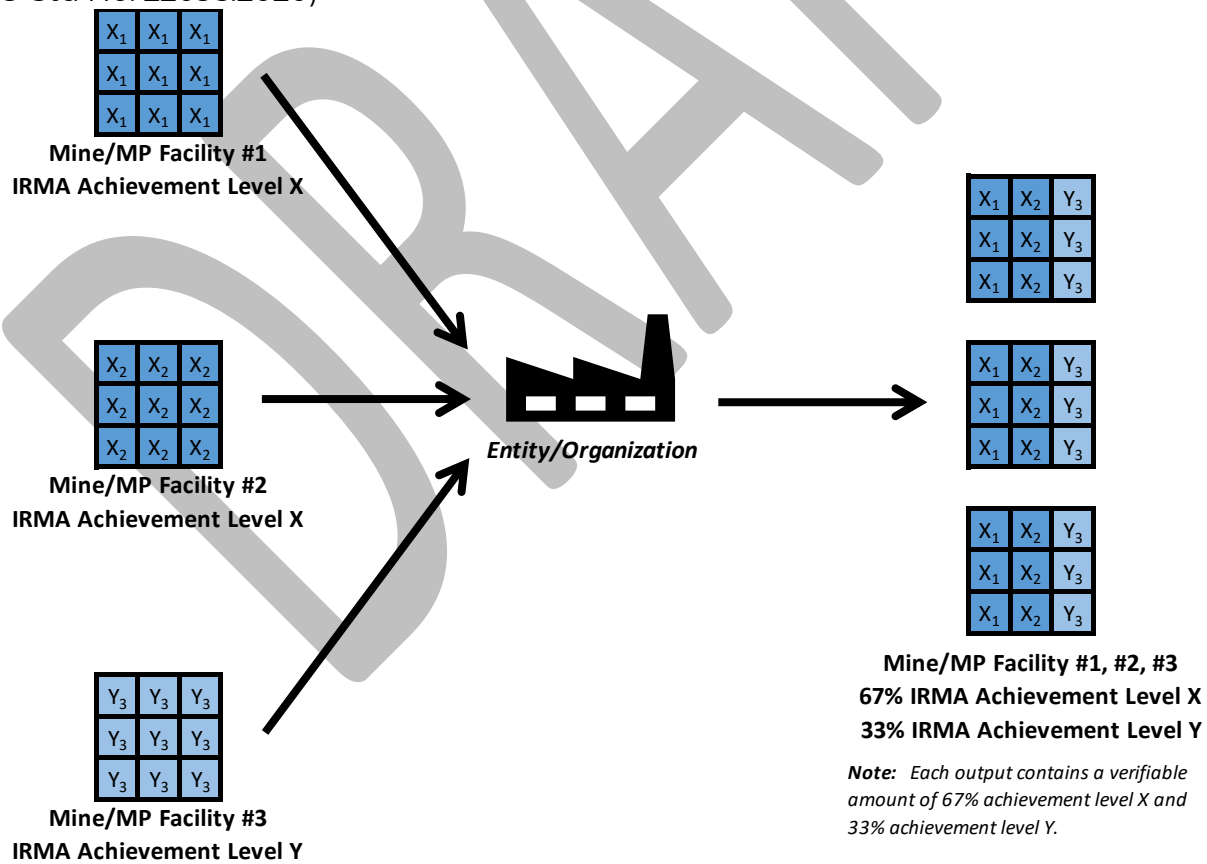
The segregated model ensures that the materials or products are identifiable from the original sources of the same IRMA achievement level and therefore satisfies item-based expectations of organizations active in the chain of custody, consumers, or other end users. The segregated model is most applicable to situations where two or more mines or mineral processing facilities produce identical IRMA-achieving level products whose materials properties are retained and further downstream processing is performed for the combined materials in dedicated batches or at dedicated facilities.

3. Controlled Blending Model

The controlled blending model is a chain of custody model in which materials or products with a set of *IRMA Standard achievement levels* are mixed according to certain criteria with materials or products without that set of characteristics. This results in a known proportion of the *IRMA Standard achievement levels* within all parts of the final output.

The ratio between inputs is known for all outputs at all times for a contained volume (e.g. batch, shipment, storage facility). The output percentages can therefore be ensured in all cases. A simplified illustration of the controlled blending model assuming all inputs would be IRMA achieving is shown in Figure 3. The figure shows an example where production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X_1, X_2) and a third mine/mineral processing facility with IRMA achieving material of a different level (Y_3) are provided to an Entity that then produces a product that is from the three sources with the same achievement level. As indicated by the three lots produced by the Entity, the proportions of X_1, X_2 and Y_3 would always to be the same.

Figure 3. IRMA Controlled Blending Model (100% IRMA Achieving) (adapted from ISO Std No. 22095:2020)



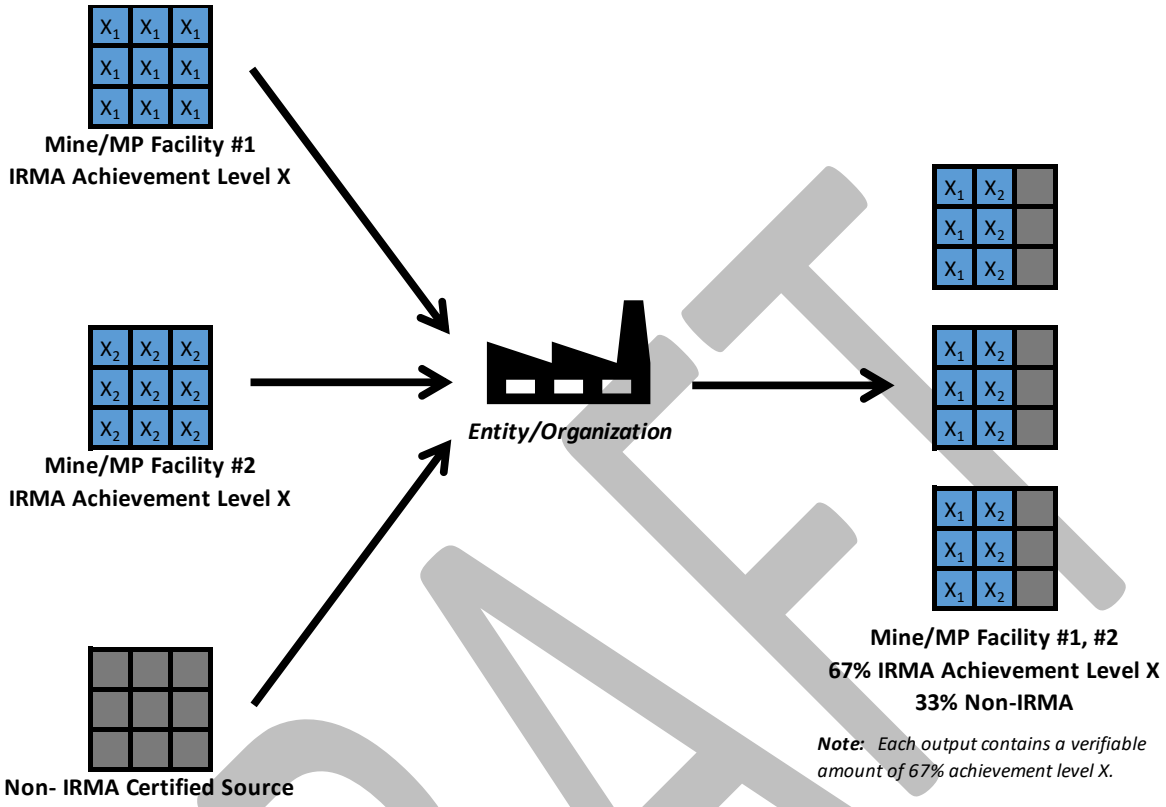
A simplified illustration of the controlled blending model assuming only part of the inputs would be IRMA achieving is shown in Figure 4. The figure shows an example where production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X_1, X_2) and a third mine/mineral processing facility with non-IRMA achieving material[14] of a different level (indicated by grey shaded boxes) are provided to an Entity that then produces a product that is from the three sources with the same achievement level. As indicated by the three lots produced by the Entity, the proportions of X_1, X_2, and the non-IRMA achieving material would always to be the same.

An example of controlled blending would be taking the production from three IRMA achieving mines and individually stockpiling their production over a year, then blending the three stockpiles to provide a consistent mixture of feed for downstream processing and retaining the same mixture of IRMA achieving materials throughout the production process.

The controlled blending model ensures verifiable quantities of materials or products are identifiable from the original sources of different IRMA achievement levels and therefore satisfies item-based expectations of organizations active in the chain of custody, consumers, or other end users. The controlled blending model is most applicable to situations where one or more mines or mineral processing facilities producing different IRMA-achieving level products are mixed and further downstream processing is performed for the combined materials in the exact same proportions in dedicated batches or at dedicated facilities.

[14] Non-IRMA achieving materials could include recycled materials or materials from a specialized source. IRMA does not presently measure recycled materials as IRMA achieving but may do so in the future.

Figure 4. IRMA Controlled Blending Model (67% IRMA Achieving) (adapted from ISO Std No. 22095:2020)



4.Mass Balance Model

The mass balance model is a chain of custody model in which materials or products with *IRMA Standard achievement levels* are mixed with materials or products without some or all of these characteristics, resulting in a claim on a part of the output, proportional to the input. The achievement of the proportionality on the output can involve intermediate steps with other defined relations to the input. This chain of custody model gives the Entity active in the chain of custody the opportunity to account for continuous processes with multiple inputs between multiple sites with differing IRMA-achieving levels and different non-IRMA materials.

For Entities using the mass balance model, two implementation methods may be used.

1. Rolling average percentage implementation method. The rolling average percentage method is based on the use of a fluctuating proportion of input bearing specified characteristics entering the Entity over a defined claim period, allowing a claim of an average percentage to be made for the output over the claim period.

   The rolling average method would report the average percent of a product having IRMA achieving material over a six-month period. For example, this would allow a producer to claim for 1,000 kg of a commodity that 30 percent is IRMA achieving.

2. Credit method. The credit method is applicable when two or more types of input are used in a material or product. The recorded output amount of each type shall be equivalent to the physical input, taking into account the conversion factor. For calculation methods see **Appendix 4.**

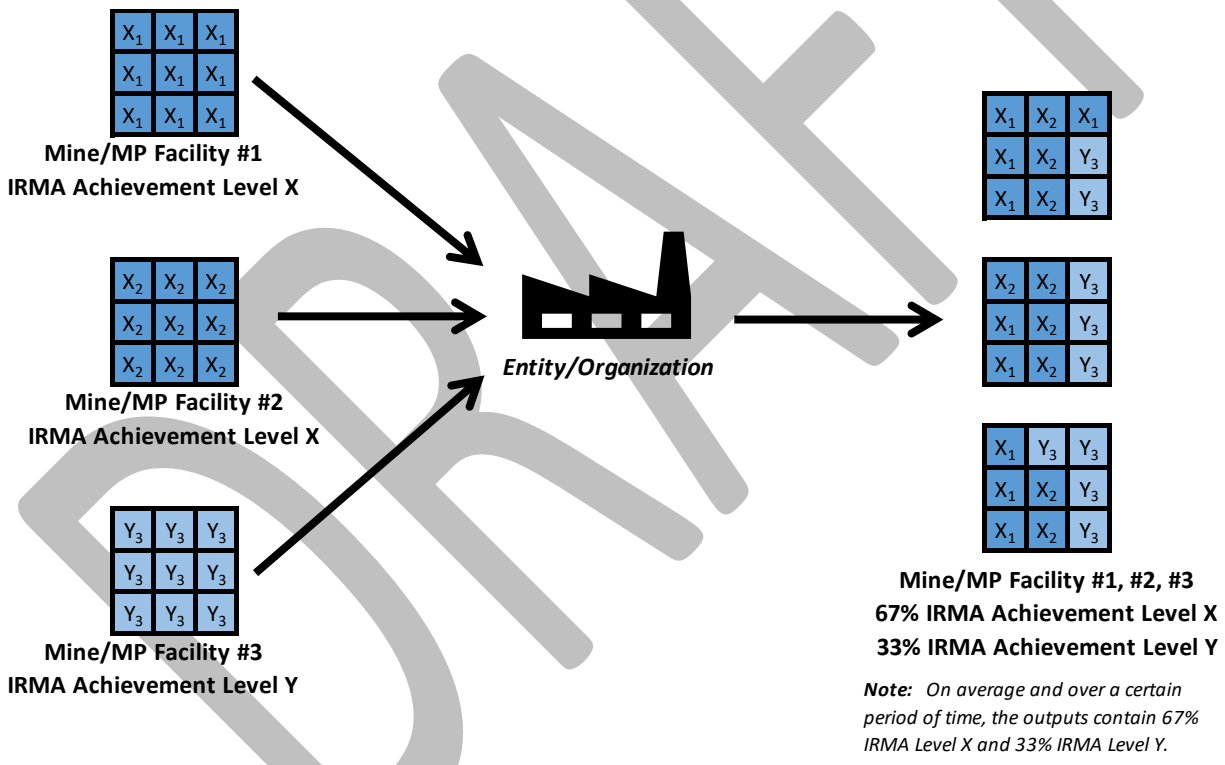
   The credit method would report the quantity of a product having IRMA achieving material over a six-month period. For example, this would allow a producer to claim for 1,000 kg of a commodity that is 30 percent IRMA achieving that 300 kg of IRMA achieving material was produced.

A simplified illustration of the mass balance model is shown in Figure 5. The figure shows an example where production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X1, X2) and a third mine/mineral processing facility with IRMA achieving material of a different level (Y3) are provided to an Entity that then produces a product that is from the three sources with the same achievement level. As indicated by the three lots produced by the Entity, the proportions of X1, X2 and Y3 would not always to be the same. On average and over a certain period of time, typically from 1 month to one year depending on commodity, the outputs contain 67% IRMA Level X and 33% IRMA Level Y.

A simplified illustration of the mass balance model assuming only part of the inputs would be IRMA achieving is shown in Figure 6. The figure shows an example where

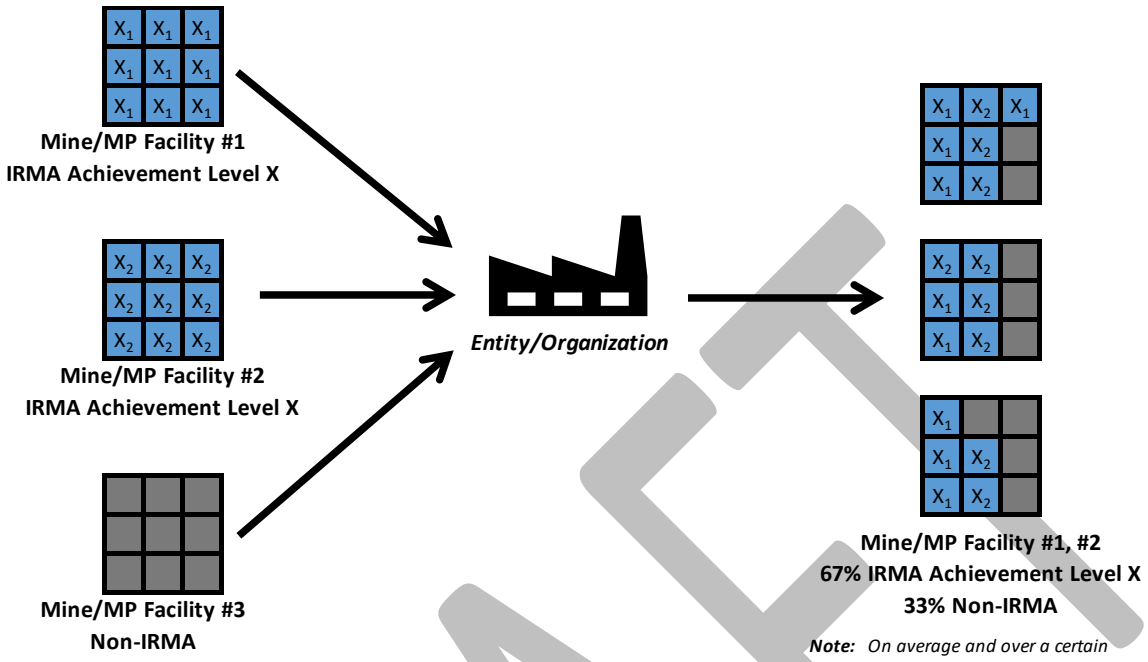
production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X_1, X_2) and a third mine/mineral processing facility with non-IRMA achieving material[15] (indicated by grey shaded boxes) are provided to an Entity that then produces a product that is from the three sources with the same achievement level. As indicated by the three lots produced by the Entity, the proportions of X_1, X_2 and the non-IRMA achieving material would not always to be the same. On average and over a certain period of time, the outputs contain 67% IRMA Level X and 33% non-IRMA.

Figure 5. IRMA Mass Balance Model (100% IRMA Achieving) (adapted from ISO Std No. 22095:2020)



[15] Non-IRMA achieving materials could include recycled materials or materials from a specialized source. IRMA does not presently measure recycled materials as IRMA achieving but may in the future.

Mass Balance Model (67% IRMA Achieving) (adapted from ISO Std No. 22095:2020)



Note: *On average and over a certain period of time, the outputs contain 67% IRMA Level X and 33% IRMA Level Y.*

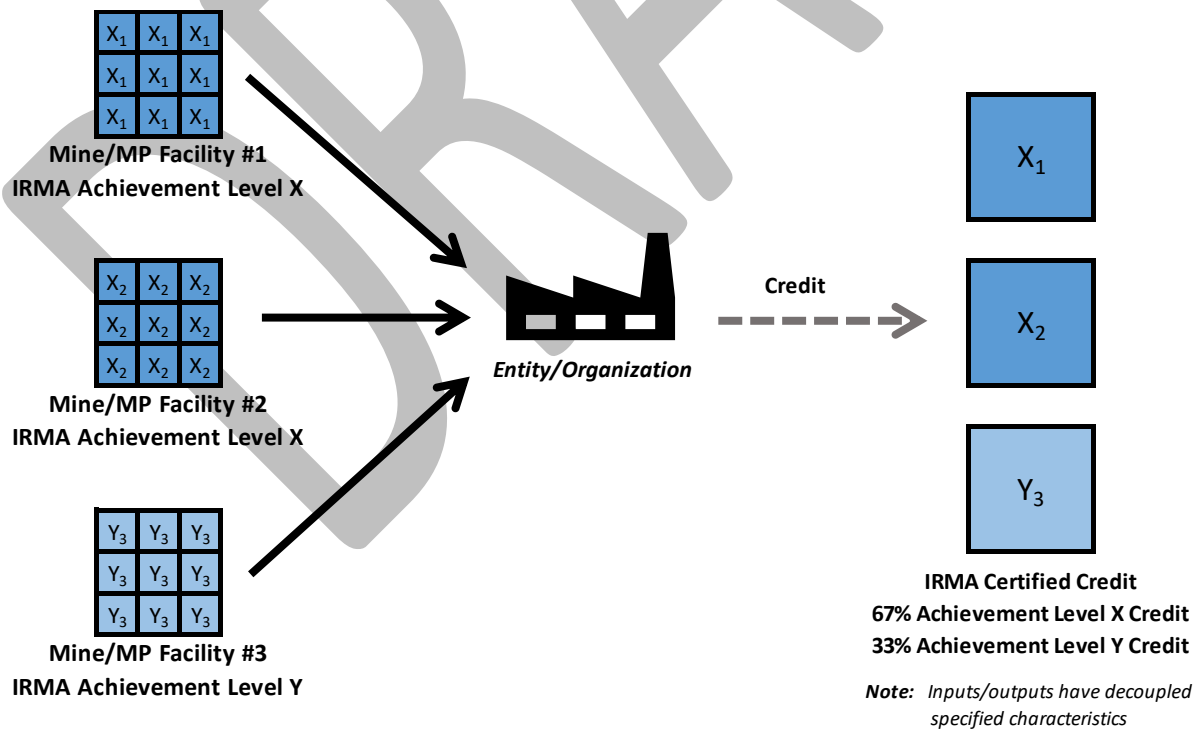
5. Book and Claim Model

The objective of the book and claim model is to ensure that for each purchase for which a claim is made, materials or products with the same specified characteristics have been produced. The book and claim model is most suitable for intangible materials or products and in circumstances where the entire market is controlled.

The book and claim model is an alternative chain of custody model in which the administrative record flow is not connected to the physical flow of materials or products throughout the supply chain. After production the information on specified characteristics within the supply chain is decoupled from any material or product. Credits are issued when materials or products enter the market. The credits may be traded and sold independently of the physical delivery of materials or products. The entry to the market of materials or products under book and claim may take place after part of the supply chain has operated under another chain of custody model.

A simplified illustration of the book and claim model is shown in Figure 7. The figure shows an example where production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X1, X2) and a third mine/mineral processing facility with IRMA achieving material of a different level (Y3) are provided to an Entity. As indicated by the three lots produced by the Entity, the Entity would produce credits in proportions of X1, X2 and Y3.

Figure 7. IRMA Book and Claim Model (100% IRMA Achieving) (adapted from ISO Std No. 22095:2020)



A simplified illustration of the book and claim model assuming only part of the inputs would be IRMA achieving is shown in Figure 8. The figure shows an example where production from two mine/mineral processing facilities with IRMA achieving material of a particular level (X1, X2) and a third mine/mineral processing facility with non-IRMA achieving material (indicated by grey shaded boxes) are provided to an Entity that then produces credits in the proportions of X1, X2 and the non-IRMA achieving material.

Figure 8. IRMA Book and Claim Model (67% IRMA Achieving) (adapted from ISO Std No. 22095:2020)