Horses for Courses: CRIRSCO Template and UN Framework Classification

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**Chairman of PERC and a PERC representative on the Committee for Mineral Reserves International Reporting Standards (CRIRSCO)
Two distinct reasons for public reporting of exploration results, resources and reserves:

- Governmental, inter-governmental, or NGO reporting of mineral resource estimates and forecasts.
  - Objectives: Reliable mineral inventory to underpin minerals policies (especially cross border e.g. Europe), available to exploration and mining companies to attract inward investment and exploration activity

- Disclosure for companies quoted on stock exchanges.
  - Objectives: Reliable, transparent information for investors and potential investors
Resolving confusion

- There is confusion amongst some practitioners as to which system should be used (and when)
- The idea of a universal system for all minerals is attractive to some – an international common language
Systems for public reporting of mineral reserves and resources

• Two international systems for classifying and reporting solid mineral reserves and resources:
  – that developed by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) and
Systems for public reporting of mineral reserves and resources

• Key definitions and terminology used for reporting solid mineral reserves and resources (and exploration results) within these two classifications have been aligned with each other through extensive co-operative efforts between CRIRSCO and UNECE since the mid 1990s (parallel to similar collaboration between SPE and UNECE for oil and gas with the PRMS classification)
Key features – CRIRSCO template

The CRIRSCO template is the set of standard definitions and principles which are incorporated in the family of standards developed nationally by the National Reporting Organisations that collectively comprise CRIRSCO:

- JORC (Australia)
- CIM (Canada)
- SAMREC/SAMVAL (South Africa)
- PERC (Europe)
- SME (United States)
- Comisión Minera de Chile (Chile)
- NAEN (Russia)
Key features – CRIRSCO template

- Whilst the core of the various standards is practically identical (and becoming ever more closely aligned), the incorporation of national regulatory requirements in some of the standards provides important differences – the standards that are mandatory or reference standards are commonly referred to as ‘codes’.

- For the geoscientist, a report prepared under one national standard can readily be referenced to the requirements of another
Key features – CRIRSCO template

- A basis for defining public reporting standards on a national/regional basis
- Transparency, Materiality, Competence are central principles
- Three sorts of information: exploration results, mineral resources, mineral reserves
- Exploration results can be quoted only as ‘raw’ data, not tonnage and grade
- Resources are estimates of mineral in the ground
- Reserves are estimates of mineral as mined (allowing for losses/dilution)
Key features – CRIRSCO template

- Reports are prepared by or under the supervision of a Competent Person (Qualified Person in Canada) who signs off and takes personal responsibility
- CPs/QPs must have minimum relevant experience and hold professional qualifications – acceptable qualifications (titles) are listed in all the codes and standards; for some jurisdictions (e.g. Chile) registration may also be required
- Recognition between NROs of suitable qualifications (RPO agreements) – periodic auditing of listed RPOs and membership classes by other NROs and by regulatory bodies
- Discipline of professionals is by professional bodies. Discipline of companies listing and relying on the report is through the stock exchange regulator
Relationship between exploration results, mineral resources & mineral reserves in the CRIRSCO template

Exploration Results

MINERAL RESOURCES  MINERAL RESERVES

Increasing level of geological knowledge and confidence

Inferred

Indicated  Probable

Measured  Proved

Consideration of mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors
(the “Modifying Factors”).
Relationship between exploration results, mineral resources & mineral reserves in the CRIRSCO template

Exploration Results

MINERAL RESOURCES  MINERAL RESERVES

Inferred

Indicated

Measured

Probable

Proved

Many professionals (including geologists and other geoscientists) may be responsible for progression along this axis

Geologists with appropriate experience and professional credentials responsible for progression down this axis

Increasing level of geological knowledge and confidence

Consideration of mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (the "Modifying Factors").
Key features – United Nations Framework Classification

- Classification for resources of solid minerals and for oil and gas
- Only a classification; no underlying principles as it is not a reporting standard
- Geologically based – no equivalent to ‘modifying factors’ of CRIRSCO
- Includes all possible material – including “uneconomic” and even “undiscovered” (so includes stuff that may not even exist!)
- Does not include reserves: only ‘in-situ’ material
Key features – United Nations Framework Classification

- CRIRSCO resource categories mapped to corresponding UNFC categories (common terminology)
- CRIRSCO Template is the set of commodity-specific definitions in UNFC for all solid minerals
- SME PRMS oil and gas resource categories also mapped to UNFC
- There is also a direct mapping between CRIRSCO and PRMS
Close relationship between CRIRSCO and UNFC

• “In accordance with the existing agreements with CRIRSCO and SPE, they have provided the commodity-specific specifications for minerals and petroleum via the CRIRSCO Template and SPE-PRMS. Along with the Generic Specifications, these provide the foundation and keystones for consistent application of UNFC-2009.” -- UNECE report ECE/ENERGY/GE.3/2011/2, 10th June 2011
The UNFC Cube
Fundamentals explained
UNFC: United Nations Framework Classification for Fossil Energy and Mineral Resources

The UNFC cube consists of three axis

- Socio-economic viability
- Geological knowledge
- Project feasibility

In an early stage of exploration, the geological knowledge is limited, the project feasibility and socio-economic viability uncertain.

The project is represented by: E3-F3-G4 or 334

G4: limited geological knowledge

E3: Socio-economic viability uncertain

F4: project feasibility uncertain
E2: development seems economically viable

Geological knowledge has increased, development of project has become more feasible and economically more viable

F2: development is feasible

Project has moved from 334 to 222

G2: Geology is better understood
E1: field producing

Project has been developed, is economically viable and is producing

Project has moved from 222 to 112

F1: field developed and producing

G1: Geological knowledge
The final version of the UNFC cube with most-used categories
A simplified, 2D model is available to classify most common categories

<table>
<thead>
<tr>
<th>Total Commodity Initially in Place</th>
<th>Extraction</th>
<th>Sales Production</th>
<th>Non-Sales Production$^a$</th>
<th>Categories</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E</td>
</tr>
<tr>
<td>Future recovery by commercial</td>
<td>Commercial</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>development projects or mining</td>
<td>Projects$^c$</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>operations</td>
<td></td>
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<tr>
<td>Potential future recovery by</td>
<td>Potentially</td>
<td></td>
<td></td>
<td>2$^e$</td>
</tr>
<tr>
<td>contingent development projects</td>
<td>Commercial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or mining operations</td>
<td>Projects$^d$</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Non-Commercial</td>
<td></td>
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<td>3</td>
</tr>
<tr>
<td>Additional quantities in place</td>
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<tr>
<td>associated with known deposits$^g$</td>
<td></td>
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<td></td>
<td>3</td>
</tr>
<tr>
<td>Potential future recovery by</td>
<td>Exploration</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>successful exploration activities</td>
<td>Projects</td>
<td></td>
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<tr>
<td>Additional quantities in place</td>
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<tr>
<td>associated with potential</td>
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<td>deposits$^g$</td>
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</tbody>
</table>
A simplified, 2D model is available to classify most common categories

<table>
<thead>
<tr>
<th>Total Commodity Initially in Place</th>
<th>This column describes the potential recovery</th>
<th>This column describes the type of project</th>
<th>These columns categorize the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future recovery by commercial development projects or mining operations</td>
<td>Commercial Projects</td>
<td>Class</td>
<td>Categories</td>
</tr>
<tr>
<td>Potential future recovery by contingent development projects or mining operations</td>
<td>Potentially Commercial Projects</td>
<td></td>
<td>E</td>
</tr>
<tr>
<td>Additional quantities in known deposits</td>
<td>Non-Commercial Projects</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Potential future recovery by successful exploration activities</td>
<td>Exploration Projects</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Additional quantities in potential deposits</td>
<td>Place associated with deposits</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Notes:

a. Production

b. Categories:
1. High
2. Medium
3. Low
4. Not Classifiable
Conclusions

• These two systems are related and use consistent vocabulary but they are not interchangeable
• Neither provides (or could provide) a universal tool that can be applied to any situation where public reporting of mineral resources is necessary.
• In our opinion, any move to adoption of only one international system for solid minerals would be highly undesirable – the appropriate system should be chosen to match the objectives of the reporting in question.
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