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Section:
National Instrument 43-101

Sub-section:
Mineral Resources in a Global Standard

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Author

- Cristian has 22 years of experience in operations and consulting, in multiples commodities as Cu, Mo, Au, Ag, Fe, Co, U and others, the Americas, Europe, Africa and Asia. He has been working for mineral resources estimation, geological modelling, ore control, geological exploration, mining reconciliation, geometallurgical modelling, control of database, sampling and QA/QC protocols, design and control of drilling campaigns, geochemical sampling, surface and drill-hole logging. He has participated in the work execution as in audits, due diligence, technical reports (NI 43-101 and JORC) and project management. During the last 8 years, he has participated in the evaluation of the Exploration Results and/or Mineral Resources in more than 40 mining projects and/or mines in South America. QP by Chilean Mining Resource and Reserve Commission (CMC) and Australasian Institution of Mining and Metallurgy (AusIMM)
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- Employment history:
  - ASGEOMIN – Chile, Geology and Mineral Resources Technical Director, July 2021 to present
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  - VALE - Brazil, Resource Geologist, 2012
  - AREVA - France, Resource Geologist, 2008 to 2011
  - BHP BILLITON - Chile, Mine Geologist, 2005 to 2007
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  - NORANDA and others - Chile, Exploration Geologist, 2000 to 2001

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Objectives of this Section

- **To understand** the concepts and key elements involved in a TR NI 43-101.
- **To show** a description of good practice as applied to the Mineral Resources Statement according to NI 43-101 full compliance

Technical Content

- Why do we need a Global standard?
- What is a TR NI 43-101?
- Importance and usefulness of a TR NI 43-101
- QP role
- Mineral Resources in full compliance with a TR NI 43-101

Why a Global Standard…

Atacama Desert - CHILE

Siberia - RUSSIA

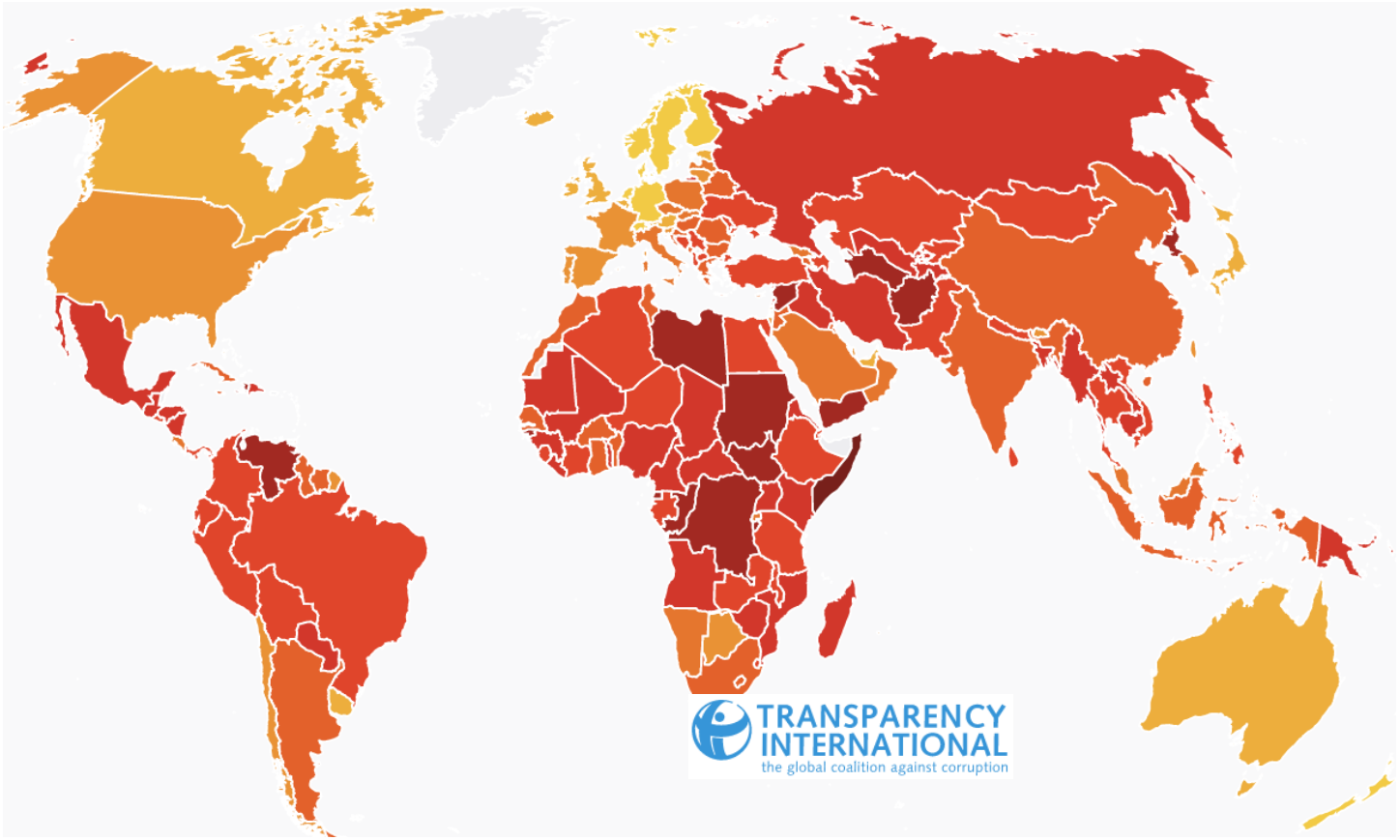
- The mining history of every country is different, but as a result of globalization, mining and exploration companies are operating in a global capital and frequently in a common commodity market.
- You need to compare the value of the mining projects and/or mines from the different jurisdictions…but with similar criteria, if not… How do you compare the stock values in the same Stock Exchange (TSX, LSE, others)?

But another important cause….. FRAUD

Tolerances in Business Practices…

So, ….Limits About What it is Ethically Acceptable…

Corruption Index and Bribes (2020)



Corruption Perception Index (CPI)

90-100	Lowly Corrupt
80-89	
70-79	
60-69	
50-59	
40-49	
30-39	
20-29	
10-19	
0- 9	Highly Corrupt

Interesting Mining Milestone: Bre-X Case:

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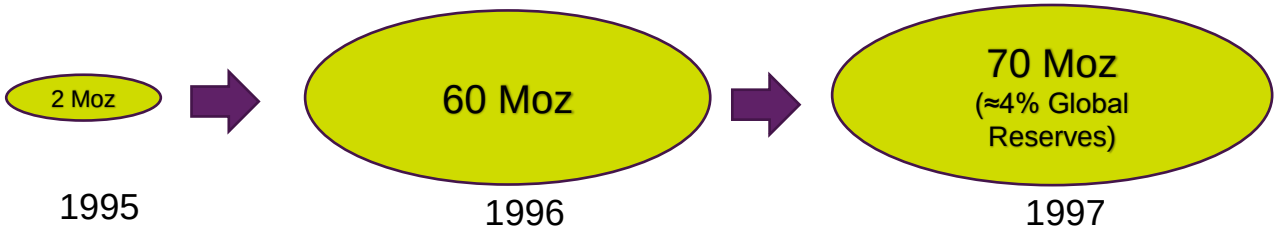
- David Walsh founded Bre-X Minerals in 1989. In 1993, Walsh associated with the geologist John Felderhof, they bought a property in the middle of a jungle near the Busang River (Indonesia), involving a local project manager: (Filipino geologist Michael de Guzman).

- Guzman estimated and declared:



- On the Toronto Stock Exchange, the stock price of Bre-X reached:

Market Capitalization = **US$4.4 billion** (currently 6.6 billion)

- The Indonesian government (Suharto Dictatorship) also got involved. Stating that a small company like Bre-X could not operate the mine by itself, the government forced them to involve a large mining company….Barrick Gold acquired an important part of Bre-X.

Bre-X Case: The Biggest Mining Scandal

- February 1997: Freeport-McMoran is invited to evaluate the future mine. Freeport-McMoran began their own review on site.

- March 1997: Michael de Guzman reportedly (according to the Indonesian government) committed suicide by jumping from a helicopter near the project´s property. Just a week later, Freeport-McMoran announced the review results as: "insignificant amounts of gold".

- Immediately, an independent company, Strathcona Minerals, was brought in to do its own studies. Their results (May 1997): “the Busang ore samples had been salted with gold dust”. The same day, in 10 minutes, Bre-X collapsed and the company filed for bankruptcy protection.

Michael de Guzman (Centre). March 1997. Assoc.Press/Gatra Magazine

- David Walsh and John Felderhof of Bre-X denied any involvement.

Global Standard Becomes URGENT

International Codes: History

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Early stage: since the 1980s….

- Each country has tried to develop their own codes for Reporting of Mineral Resources and Ore Reserves. Example, the 1989 JORC Code from Australia.

Note: JORC (Joint Ore Reserves Committee) was established in 1971.

1994 – South Africa: The Council of Mining and Metallurgical Institutions ('CMMI') was created and established a "**provisional agreement on standard reporting definitions"**, modelled on the JORC Code

- **CMMI Members:**
  - Australia – AusIMM: Australasian Institute of Mining and Metallurgy
  - Canada – CIM: Canadian Institute of Mining, Metallurgy and Petroleum
  - South Africa – SAIMM: South African Institute of Mining and Metallurgy
  - United Kingdom – IMM: Institution of Mining and Metallurgy
  - United States - SME: Society for Mining, Metallurgy and Exploration

International Codes: Global History (cont.)

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After **Bre-X scandal**, the need for more regulations becomes urgent.

October 1997 (USA): in **the Denver Accord**, **CMMI** defined the categories:

Mineral Resources
- **Measured**
- **Indicated**
- **Inferred**

Mineral Reserves
- **Proven**
- **Probable**

2002 (Australia): the CMMI is dissolved and **CRIRSCO** is created:
Combined Reserves International Reporting Standards Committee.

International Codes: CRIRSCO Goals

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- Promoting uniformity, excellence and continuous improvement in national and international reporting standards for Exploration results and MR&MR

- Encouraging the continued development of international reciprocity of CP or QP through nationally-based recognised professional organisations

International Codes:
CRIRSCO

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- Currently, CRIRSCO is composed by professionals from each one of these regions/countries: NROs

NROs: National Reporting Organizations

https://mrmr.cim.org/media/1128/cim-definition-standards_2014.pdf

- **The most common Codes:**
  - JORC (Australia)
  - **NI 43-101 (Canada)**
  - SAMREC (South Africa)
  - SK-1300 (USA)

International Codes Examples:

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- **NI 43-101 (Canadá-1996):** is a national instrument for the Standards of Disclosure for Mineral Projects within Canada. The Instrument **is a codified set of rules and guidelines for reporting and displaying information related to mineral properties** owned by, or explored by, companies which report these results on stock exchanges within Canada. This includes foreign-owned mining entities who trade on stock exchanges overseen by the Canadian Securities Administrators (CSA).

- **CH20235 (Chile-2007):** Este código sintetiza la práctica actual de la industria minera con respecto a **estándares y normas que se aplican para informar sobre los resultados de exploración, recursos minerales y reservas minerales con el propósito de informar públicamente** sobre instrumentos financieros derivados de estos activos mineros en los mercados de capital. La aplicación del Código CH 20235 es mandatoria para emitir documentación preparada con el propósito de informar a los inversionistas o posibles inversionistas y a sus asesores, así como a la autoridad regulatoria y a instituciones gubernamentales.

Principles Governing the Application of the Codes

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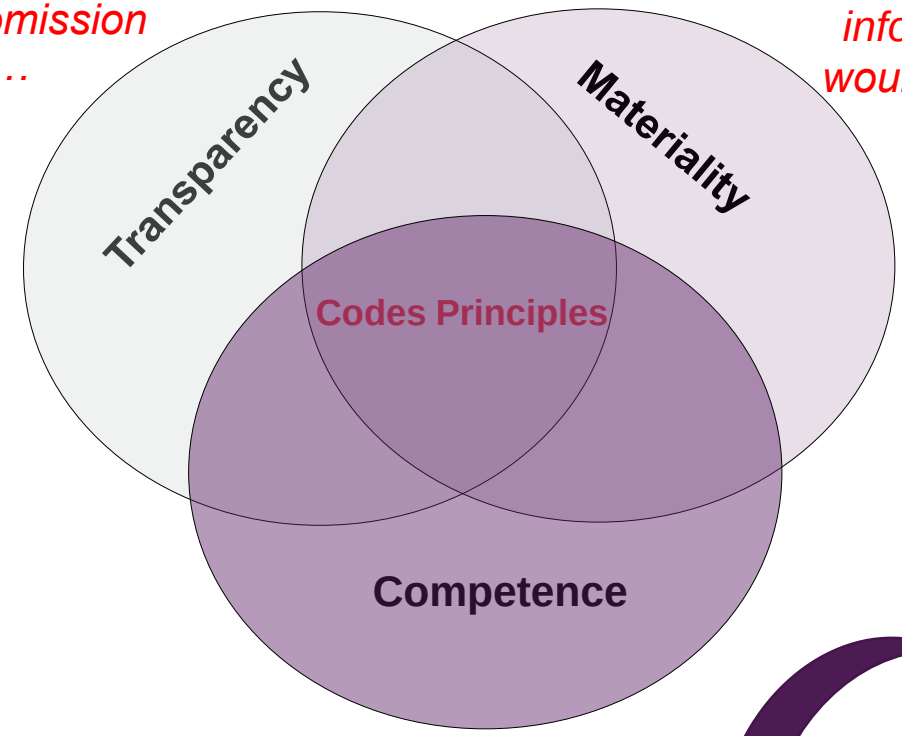
…information must be clear and unambiguous….no omission of information…

…contains all relevant information that investors would reasonably require…



… be based on work that is the responsibility of suitable qualified and experienced persons

Qualified Person (QP)

Qualified Person (QP) Definition

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CIM: Mineral Resource and Mineral Reserve estimates and any supporting technical reports must be prepared by or under the direction of a Qualified Person, as that term is defined in NI 43-101.

TR NI 43-101:

QP means an individual who:

- Is an engineer or geoscientist with a university degree, or equivalent accreditation, in an area of geoscience, or engineering, relating to mineral exploration or mining;
- Has at least five years of experience in mineral exploration, mine development or operation, or mineral project assessment, or any combination of these, that is relevant to his or her professional degree or area of practice; and has experience relevant to the subject matter of the mineral project;
- Does not include engineering and geoscience technicians, engineers and geoscientists in training, and equivalent designations that restrict the individual's scope of practice

Structure and Compliance by NI 43-101

Item 1:	Summary
Item 2:	Introduction
Item 3:	Reliance on Other Experts
Item 4:	Property Description and Location
Item 5:	Accessibility, Climate, Local Resources, Infrastructure and Physiography
Item 6:	History
Item 7:	Geological Setting and Mineralization
Item 8:	Deposit Types
Item 9:	Exploration
Item 10:	Drilling
Item 11:	Sample Preparation, Analyses and Security
Item 12:	Data Verification
Item 13:	Mineral Processing and Metallurgical Testing
Item 14:	Mineral Resource Estimates
Item 15:	Mineral Reserve Estimates
Item 16:	Mining Methods
Item 17:	Recovery Methods
Item 18:	Project Infrastructure
Item 19:	Market Studies and Contracts
Item 20:	Environmental Studies, Permitting and Social or Community Impact
Item 21:	Capital and Operating Costs
Item 22:	Economic Analysis
Item 23:	Adjacent Properties
Item 24:	Other Relevant Data and Information
Item 25:	Interpretation and Conclusions
Item 26:	Recommendations
Item 27:	References

Unfortunately…

REAL WORLD ≠ IDEAL WORLD

Note: everything depends on the QP !!!

Example:
QP Certificate and Report

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- **A technical report must be dated and signed by a QP:**
  - each qualified person who is responsible for preparing or supervising the preparation of all or part of the report

Appendix B
Example of Consent of Qualified Person

[QP's Letterhead] or
[Insert name of QP]
[Insert name of QP's company]
[Insert address of QP or QP's company]

CONSENT of QUALIFIED PERSON

I, [name of QP], consent to the public filing of the technical report titled [insert title of report] and dated [insert date of report] (the "Technical Report") by [insert name of issuer filing the report].

I also consent to any extracts from or a summary of the Technical Report in the [insert date and type of disclosure document (i.e. news release, prospectus, AIF, etc.)] of [insert name of issuer making disclosure].

I certify that I have read [date and type of document (i.e. news release, prospectus, AIF, etc.) that the report supports] being filed by [insert name of issuer] and that it fairly and accurately represents the information in the sections of the technical report for which I am responsible.

Dated this [insert date].

_____ [Seal or Stamp]
Signature of Qualified Person

_____
Print name of Qualified Person

TR NI 43-101 Code

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Accepted Foreign Associations and Membership Designations

Examples:

Foreign Association	Membership Designation
American Institute of Professional Geologists (AIPG)	Certified Professional Geologist (CPG)
The Society for Mining, Metallurgy and Exploration, Inc. (SME)	Registered Member
Mining and Metallurgical Society of America (MMSA)	Qualified Professional (QP)
Any state in the United States of America	Licensed or certified as a professional engineer
European Federation of Geologists (EFG)	European Geologist (EurGeol)
Institute of Geologists of Ireland (IGI)	Professional Member (PGeo)
Institute of Materials, Minerals and Mining (IMMM)	Professional Member (MIMMM), Fellow (FIMMM), Chartered Scientist (CSi MIMMM), or Chartered Engineer (CEng MIMMM)
Geological Society of London (GSL)	Chartered Geologist (CGeol)
Australasian Institute of Mining and Metallurgy (AusIMM)	Fellow (FAusIMM) or Chartered Professional Member or Fellow [MAusIMM (CP), FAusIMM (CP)]
Australian Institute of Geoscientists (AIG)	Member (MAIG), Fellow (FAIG) or Registered Professional Geoscientist Member or Fellow (MAIG RPGeo, FAIG RPGeo)
Southern African Institute of Mining and Metallurgy (SAIMM)	Fellow (FSAIMM)
South African Council for Natural Scientific Professions (SACNASP)	Professional Natural Scientist (Pr.Sci.Nat.)
Engineering Council of South Africa (ECSA)	Professional Engineer (Pr.Eng.) or Professional Certificated Engineer (Pr.Cert.Eng.)
Comisión Calificadora de Competencias en Recursos y Reservas Mineras (Chilean Mining Commission)	Registered Member

Mineral Resources Definition

- **Definition (CIM):**

A "Mineral Resource" is a concentration or occurrence of solid material of economic interest in or on the Earth´s crust in such form, grade (or quality), and quantity that there are reasonable prospects for eventual economic extraction (RPEEE).

The location, quantity, grade, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

RPEEE definition

- The term **RPEEE implies an assessment (albeit preliminary) by the QP in respect to all matters likely to influence the prospect of economic extraction** including the approximate mining parameters.

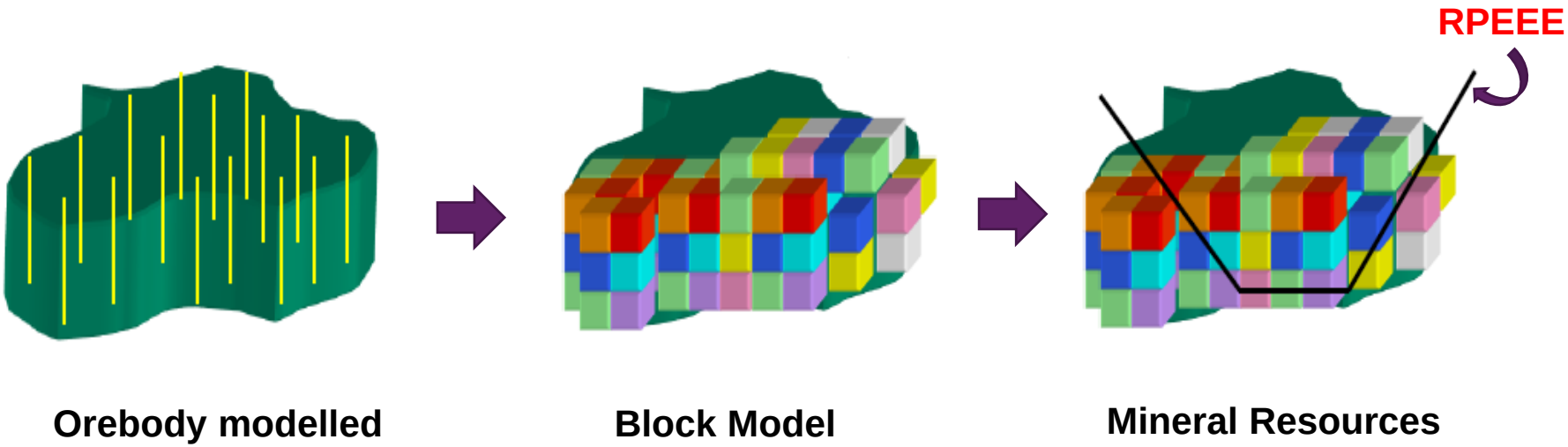
- In other words, **a Mineral Resources is NOT an inventory of all mineralization drilled or sampled,** regardless of cut-off grade, likely mining dimensions location or continuity.

RPEEE definition (cont.)

- Portions of a deposit that do not have RPEEE MUST NOT BE INCLUDED in a Mineral Resource. The basis for the RPEEE is always a material matter, and must be explicitly disclosed and discussed by the QP.

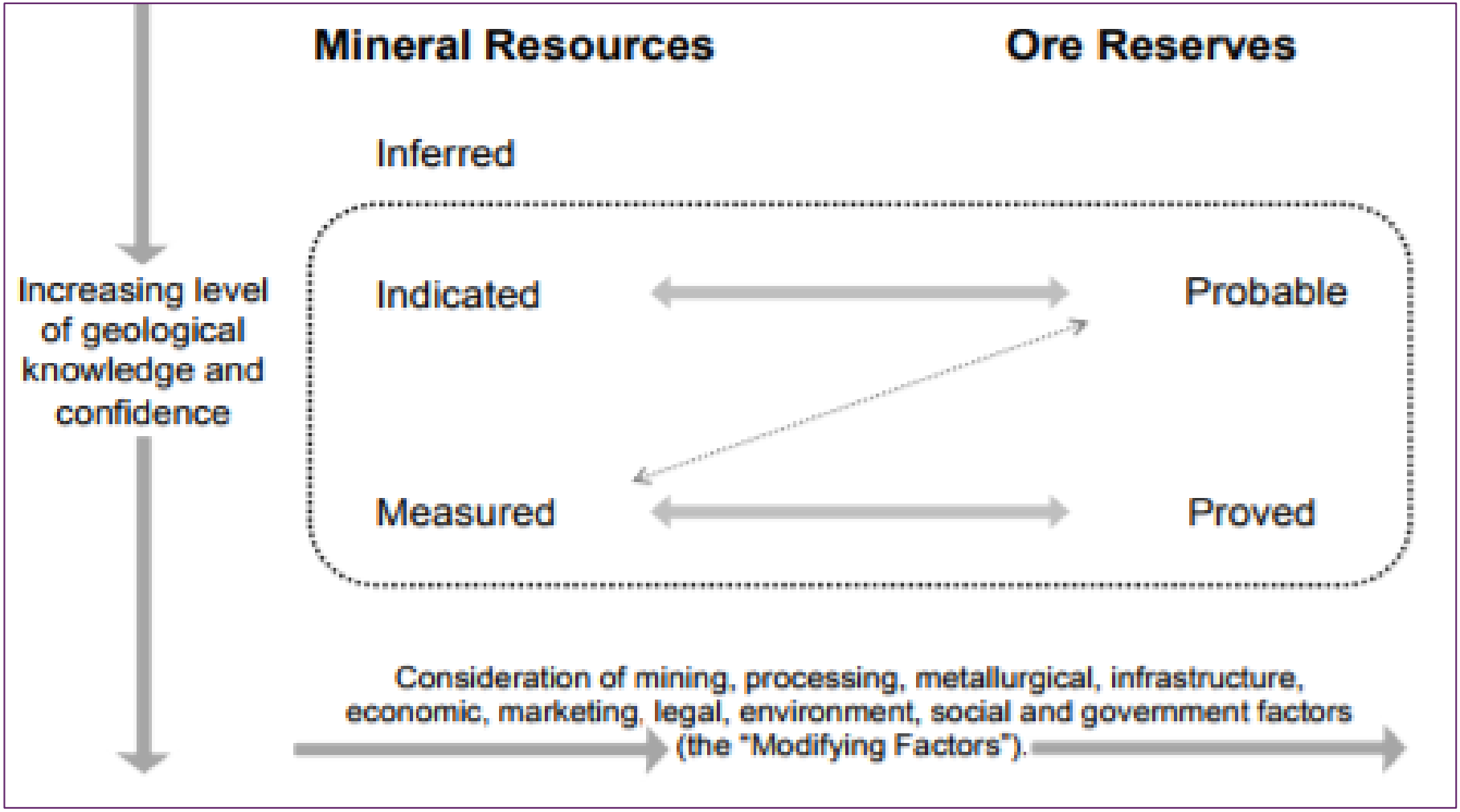
  - Example: Pit as RPEEE

    - Frequently, a technical and economic envelope is used as RPEEE, which include cutoff, cost, price etc. According to the type of mine, there are **pits or stopes** envelopes as part of RPEEE.



MR&MR Classification (CIM)

- **Key definitions in terms of the confidence.**



Measured Mineral Resources (CIM Definition)

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- **Measured:**

A 'Measured Mineral Resource' is that part of a Mineral Resource for which quantity, grade (or quality), densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit.

Geological evidence is derived from detailed and reliable exploration, sampling and testing gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes, and is sufficient to confirm geological and grade (or quality) continuity between points of observation where data and samples are gathered.

Mineralisation may be classified as a Measured Mineral Resource when the nature, quality, amount and distribution of data are such as to leave no reasonable doubt, in the opinion of the Competent Person determining the Mineral Resource, that the tonnage and grade of the mineralisation can be estimated to within close limits, and that any variation from the estimate would be unlikely to significantly affect potential economic viability.

This category requires a high level of confidence in, and understanding of, the geological properties and controls of the mineral deposit.

Indicated and Inferred Mineral Resources (CIM Definitions)

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- **Indicated:**

An 'Indicated Mineral Resource' is that part of a Mineral Resource for which quantity, grade (or quality), densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit.

Mineralisation may be classified as an Indicated Mineral Resource when the nature, quality, amount and distribution of data are such as to allow confident interpretation of the geological framework and to assume continuity of mineralisation.

- **Inferred:**

An 'Inferred Mineral Resource' is that part of a Mineral Resource for which quantity and grade (or quality) are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade (or quality) continuity. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

International Codes: Guidelines or Definitions?

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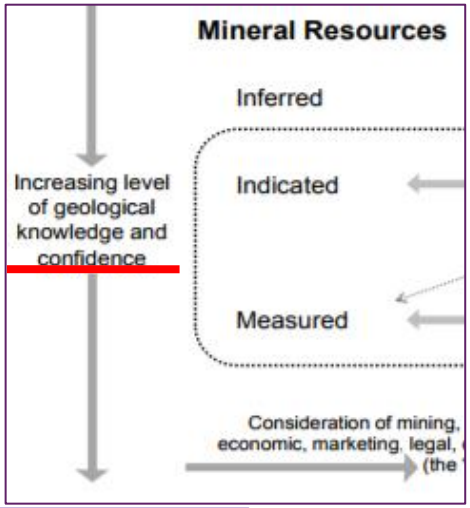
A 'Measured Mineral Resource' is that part of a Mineral Resource for which quantity, grade (or quality), densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit.

A "Mineral Resource" is a concentration or occurrence of solid material of economic interest in or on the Earth´s crust in such form, grade (or quality), and quantity that there are reasonable prospects for eventual economic extraction

and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods



Geological evidence is derived from detailed and reliable exploration, sampling and testing gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings

Mineralisation may be classified as a Measured Mineral Resource when the nature, quality, amount and distribution of data are such as to leave no reasonable doubt, in the opinion of the Competent Person

Mineralisation may be classified as an Indicated Mineral Resource when the nature, quality, amount and distribution of data are such as to allow confident interpretation of the geological framework and to assume continuity of mineralisation.

….A QP/CP must have a minimum of five years relevant experience in the style of mineralization or type of deposit ….

International Codes: Subjective Definitions?

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- **Then, some of the frequent expressions included in the Codes are:**

  - **“…reasonable prospect…”**
  - **“…sufficient confidence…”**
  - **“…no reasonable doubt..”**
  - **“…sufficient to imply…”**
  - **“…appropriate techniques…”**
  - **“…precision…”**
  - **“…quality data …”**
  - **“…confident interpretation…”**
  - **“…relevant experience…”**

what does it mean?

Too subjective?

International Codes (include NI 43-101): Finally

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Current discussions:

"…Yes, globally we have had some advancements… but the questions continue…."

- Are the current codes enough as minimum standards?
- Does everyone understand the rules in the same way? (geologists, miners, managers, companies, banks, universities, etc)
- Can we really compare the MR&MR from different projects in different countries?
- Is it possible to have more objective guidelines?

For the up and coming generation in the mining and financial world…

…this is a challenge FOR ALL OF US !!

Mining Business
Understanding the Mineral Resources

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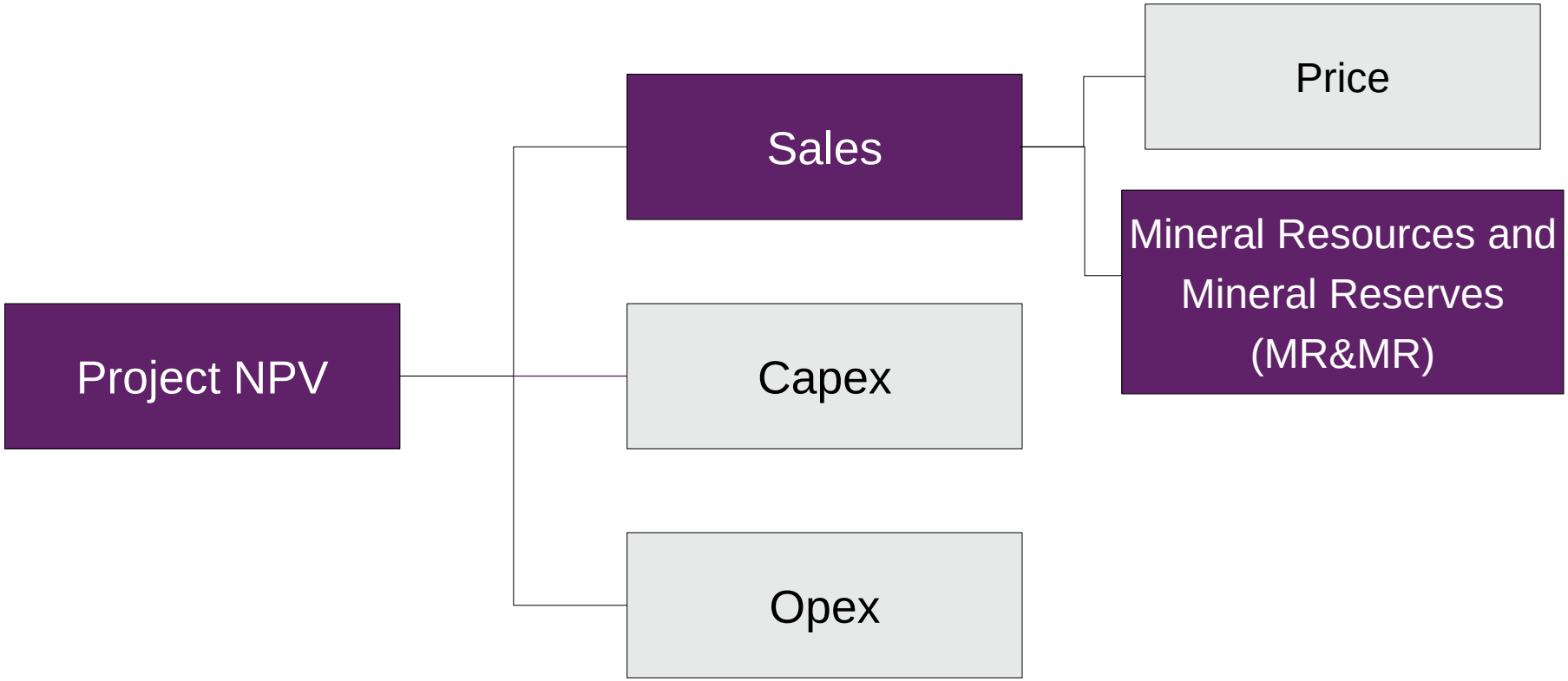
Is it very different from other businesses?



Modern Mining World and Risks Associated

Currently controlled by the complex procedures of the classification and declaration (statement) of the MR&MR.

Example (2015-2022):

- The rapid increase in external audits or «*Due Diligence*», in which the inclusion of Mineral Resources has recently gained greater importance.
- The MR&MR review in order to confirm a TR NI 43-101 full compliance

Control Systems for International Codes Compliance

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Internal Audits
External Audits

Due Diligence

Basically, studies recognized as review processes, in which we need to identify:

Issues (problems), Risks and Opportunities

- **Audits:**

How often? Each year / every 2 years / every 10% increase in drill holes….?
Why? Only when a significant issue has been identified…?
Who? Min. experience requirement applied to consulting companies/QPs…?
Depends on the Study Level…?

Audit and/or Due Diligence Differences

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- **When and why an Audit or a Due Diligence?**

Audit

- Frequently due to:
  - (unfortunately) Big problem
  - Required by the Company (each 2 or 3 years; or ending each level (scoping, PFS, FS)
- Duration: according to (3) types:
  - **High Level Review (HLR)** (1-3 weeks). Focus: To identify the Key Issues.
  - **Full Audit** (4-8 weeks). Focus: To identify the Key and Significant Issues
  - **Endorsement level** (8-12 weeks) Focus: To identify the Key and Significant Issues, then sign off.

Due Diligence

- Frequently due to:
  - New acquisition of a Project or Mine
  - Required by the Bank or Investors (potential new owner)
- Duration: timing is very short (2-4 weeks) and divided in two phases:
  - First stage (large list of the companies, involving 1 week with general information).
  - Second stage (short list, involving 2-3 weeks with a big “dataroom”). Focus: To Identify key issues (“FATAL FLAW”), risks and opportunities for the potential buyer.
  - A sufficient review to support financing.

Audits and Due Diligence
Example of Issues Classification

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- **Key Issue:** corresponds to a lack of critical information, errors, and/or improper methodologies that **have** a material impact on the LOM Plan, Mineral Resources and Mineral Reserves. Material means demonstrated or strongly suspected deviations of several relative percentage points from current stated results. A positive assurance opinion of the resource/reserve statement cannot be given if the issue is not resolved or addressed on a timely basis. Key Issues require immediate corrective action.

- **Significant Issue:** Significant Issues correspond to a lack of information, errors, improper methodologies, lack of validation or source of significant risk that **could have** an adverse impact on the LOM Plan, Mineral Resources and Mineral Reserves.

- **Minor Issue:** Minor Issues reflect better (best) practices or processes that would align more closely with the standards required by securities regulations and/or industry best practices. These issues, when resolved, will make resource estimates better or improve confidence in the estimate, **but may not have a significant impact on the estimate or resource classification if unresolved.**

Audit and/or Due Diligence
Very Common ISSUE: Lack of critical information

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"…When the commodity price is high, no one cares about data quality or traceability…"

Frequent problems:

- Lack of geological logs
- Lack of assay certificates
- Lack of collar certificates
- Lack of downhole survey certificates
- Lack of QA-QC data

These problems are significant in **that any of the deficiencies will produce an unverifiable** and thus suspect database **that is generally unacceptable in today's regulatory environment**

Audit and/or Due Diligence
Recommendation: efforts focused

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Just in a short time!!! You nee to review and validate…

It´s VERY useful to use a check list, summarizing:

Geologists

- Quality of **exploration and geometallurgical data**
- Quality of **geological interpretations** and adequately based on **the original logging**
- **Grades estimated** as key variables (geostat.)
- Support of the **declaration of resources (RPEEE)**

Other Professionals

- Support of the **declaration of reserves (Modifying Factors)**
- **Metallurgical test data** will be checked for suitability of ore types
- **Process design** or existing plant performance will be reviewed
- Life of mine process **production plan, operating costs** and sustaining capital
- **Mine designs** for proper incorporation of cutoff grades, geotechnical and hydrological studies, metallurgical recovery, metal prices, operating costs and royalties
- **Cash flows, financial analysis** and sensitivity studies

But clearly,
all these points
depend on the
Study Level

Mining Study Levels: Prospects and Projects

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First Issue: Different Terms from each Country…

In general we can mention:

PROSPECTS

- Range Analysis or Blue Sky
- Exploration

PROJECTS

- Preliminary Feasibility Study or Scoping Study (SS)
- Pre-Feasibility Study (PFS)
- Feasibility Study (FS)

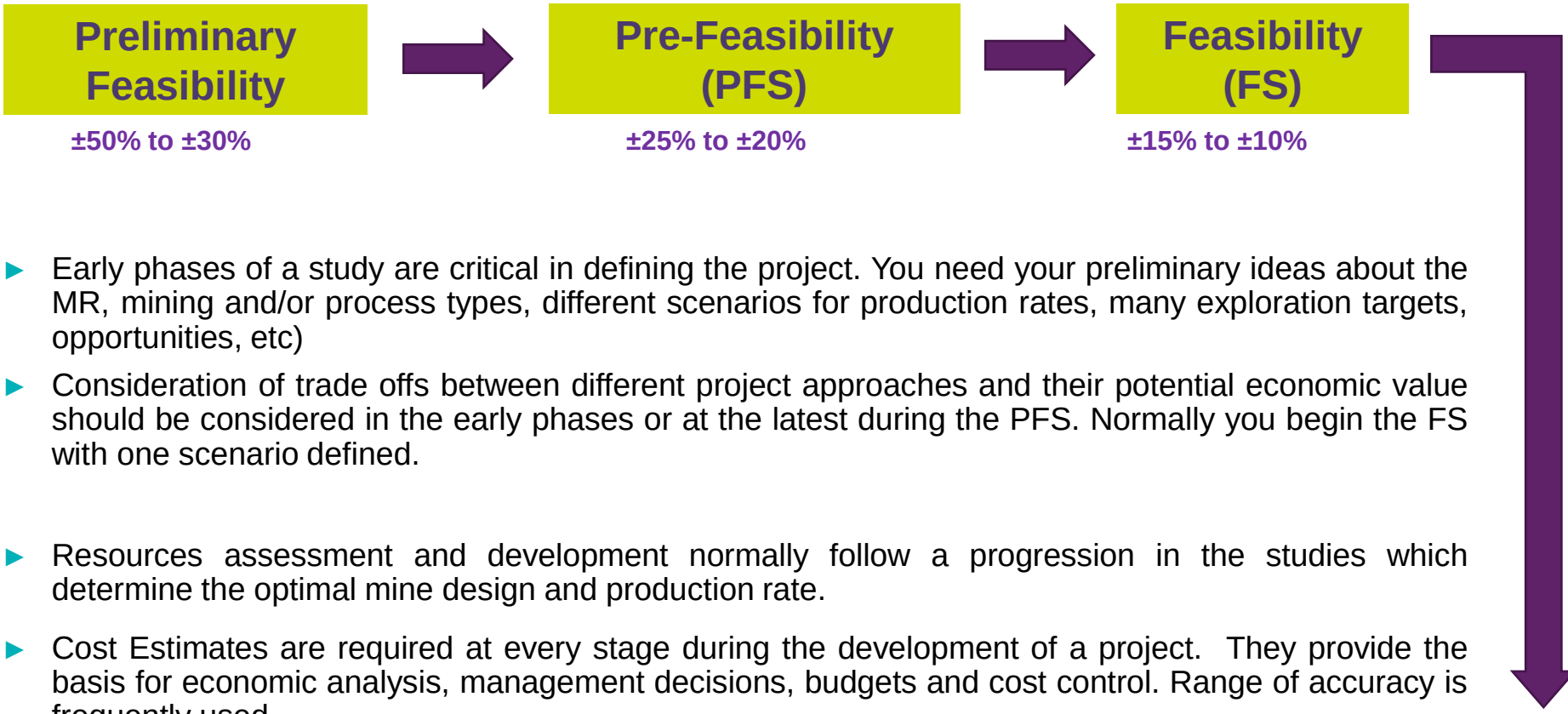
But again, the levels of studies are not standardized around the world.

- **NI 43-101 according to the CIM definitions:**

Preliminary Feasibility, Pre-Feasibility and Feasibility Studies

Three Study Levels of a Mining Project

The level of study varies according to the source of information and risk of capital.



- Early phases of a study are critical in defining the project. You need your preliminary ideas about the MR, mining and/or process types, different scenarios for production rates, many exploration targets, opportunities, etc)
- Consideration of trade offs between different project approaches and their potential economic value should be considered in the early phases or at the latest during the PFS. Normally you begin the FS with one scenario defined.
- Resources assessment and development normally follow a progression in the studies which determine the optimal mine design and production rate.
- Cost Estimates are required at every stage during the development of a project. They provide the basis for economic analysis, management decisions, budgets and cost control. Range of accuracy is frequently used.

The stage of EPCM (Engineering, Procurement and Construction Management) starts when financing has been secured and the authorization expenditure has been made…

Study Levels of a Mining Project Example:

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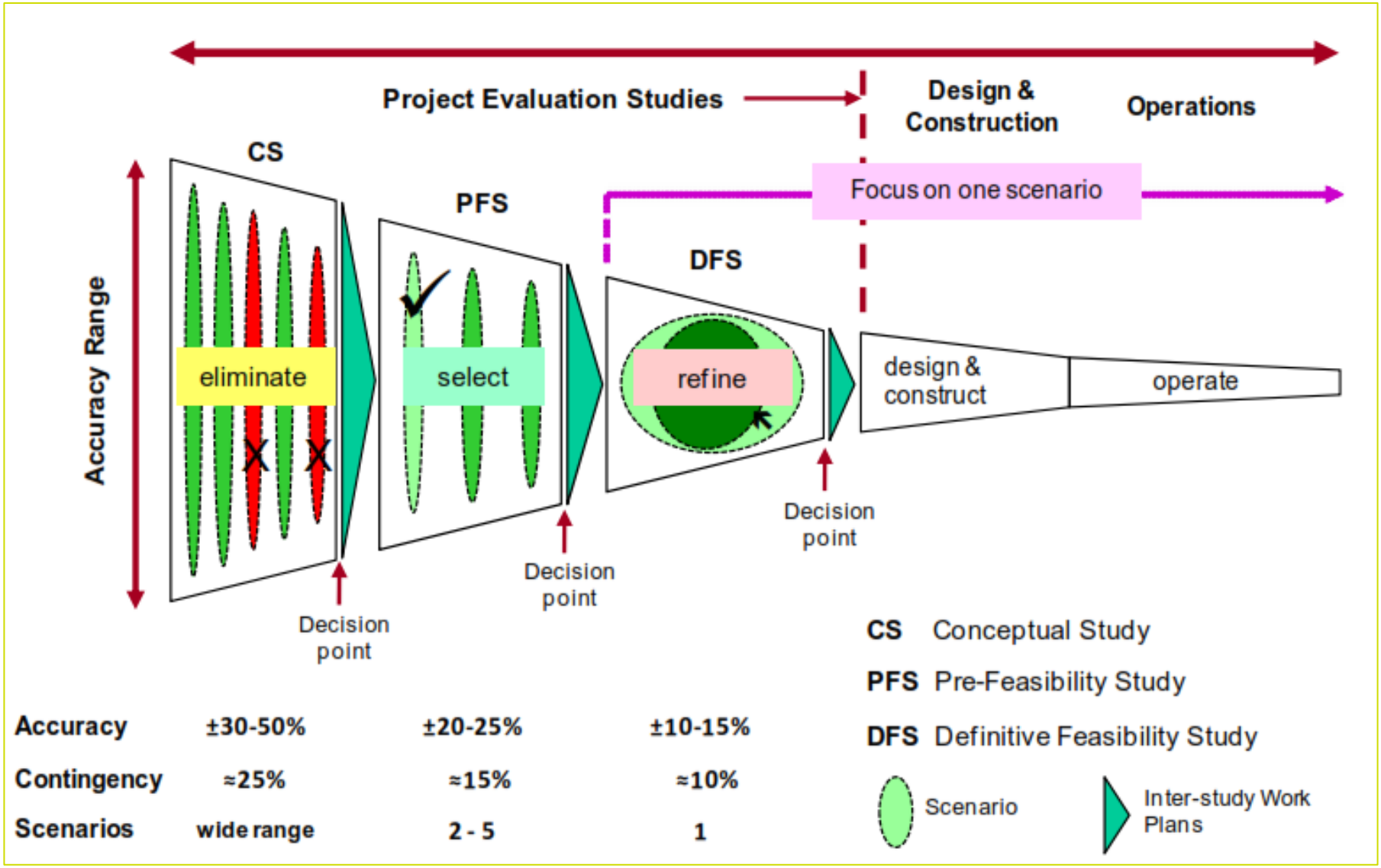

Accuracy	**±30-50%**	**±20-25%**	**±10-15%**
Contingency	**≈25%**	**≈15%**	**≈10%**
Scenarios	**wide range**	**2 - 5**	**1**

Study Levels of a Mining Project Return…

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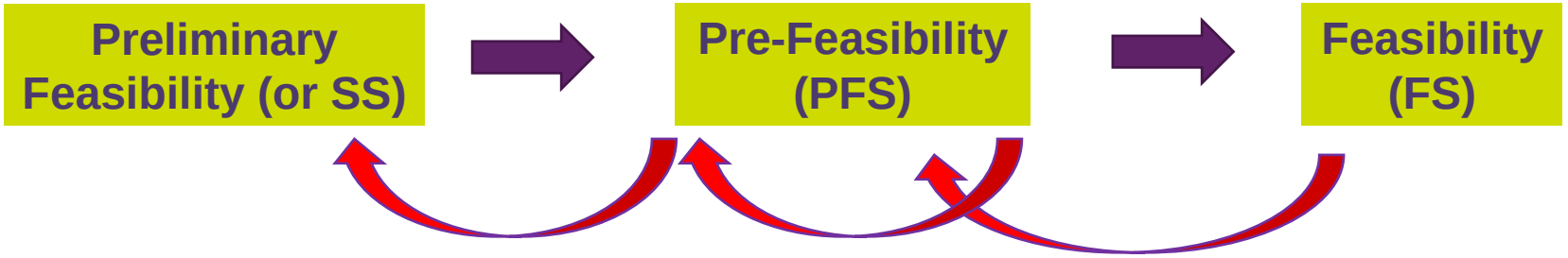
In the Ideal World, we have three sequential levels…



But in the Real World, we have some relevant Issues in MR&MR statement… with a high impact on the study level definition

- The level and timing of the study is varied. But finally, the decision of the study level depends on:

  the bank – the company – the QP ?

- Unfortunately, sometimes the companies decide to move directly from SS to FS level.
- So, the question is: How do you control the study level definition?

Study Levels of a Mining Project

Requirements According to the Best Practices for MR

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Example:

	Scoping	PFS	FS
Project Data	Existing databases checked, identify deficiencies to be fixed	Verify and fix old data. Collect most of the project's detailed data in this stage. Produce error free databases.	Data added to improve confidence in estimates
Topography	Preliminary map 20 ft accuracy	Detailed photogrametry 10 ft accuracy	Detailed photogrammetry 10 ft accuracy
Drilling	First check of drilling procedures and comparison of methods, assessment of data quality	Comprehensive checks on drilling types and biases, sample recovery, drilling conditions, collar and downhole surveys. Assessment of logging. Twin hole confirmation of old drill holes.	Infill drilling and specialized drilling for geotechnical, metallurgy, hydrogeology, sterilization
Sampling/Assaying	Historical sampling and assaying checked with minor validation	Full quality controls on sampling and assaying, checks of biases, validation of historical data, check assays.	Additional sampling and confirmation of historical data as necessary to produce unbiased assay database.
Mineralogy/Metallurgy	Brief mineralogical study for metallurgical use, metallurgical parameters are assumed, some metallurgical tests performed.	Comprehensive mineralogy for ore characteristics. Comprehensive metallurgical tests, may be geometallurgical modeling.	Bulk sampling, pilot tests
Downhole Surveys	Checks for deficiencies	Comprehensive surveying, adjustments for deviations, resurveying of holes.	Complete

Study Levels of a Mining Project

Requirements According to the Best Practices for MR

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	Scoping	PFS	FS
Geological Controls	Preliminary understanding of controls of grade domains.	Detailed studies of ore controls, establish clear domaining of mineralization.	Models refined with additional data.
Geological Mapping	Existing geological mapping or reconnaissance grade mapping	Surface and underground geological mapping reasonably detailed, stratigraphy and structure well defined.	Detailed geological mapping of surface and workings, geological controls well understood.
Mineralogy	Preliminary to define principal rock units and identify minerals of interest.	Full mineralogical studies to characterized ore types and influences of mineralogy on metallurgical characteristics and mill throughput.	Continued studies in support of refining metallurgy.
Database Validation	Checks of available data.	Full validation of available historical data and development of comprehensive, error-free databases for new data.	Complete

Study Levels of a Mining Project

Requirements According to the Best Practices for MR

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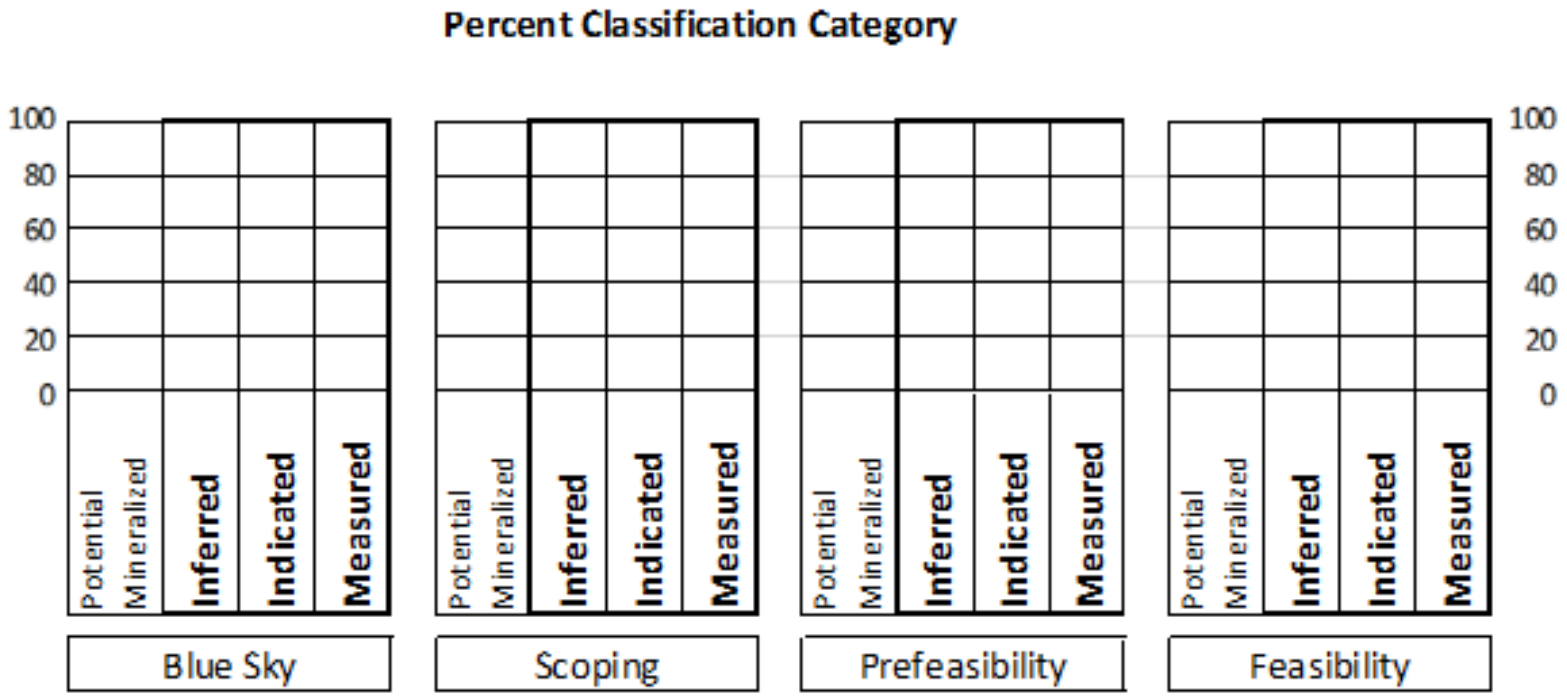
Exercise: In your opinion, the minimum % of the Mineral Resources accepted on the SS , PFS or FS Level Studies are:



Study Levels of a Mining Project
Requirements According to the Best Practices (Cont.)

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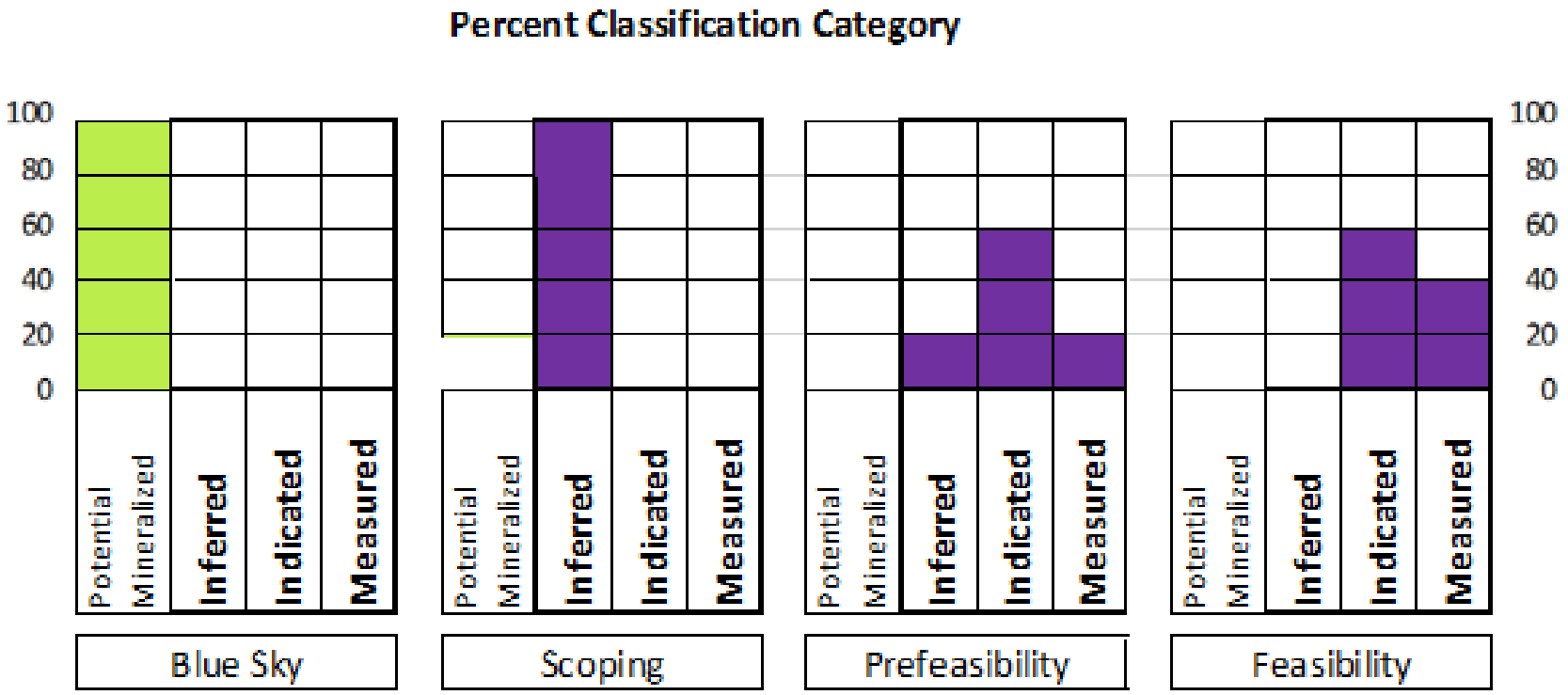
Best Practices….



But finally everything depends on the QP!!!

Pyramid of the Mining Business
Reality vs Ideal World

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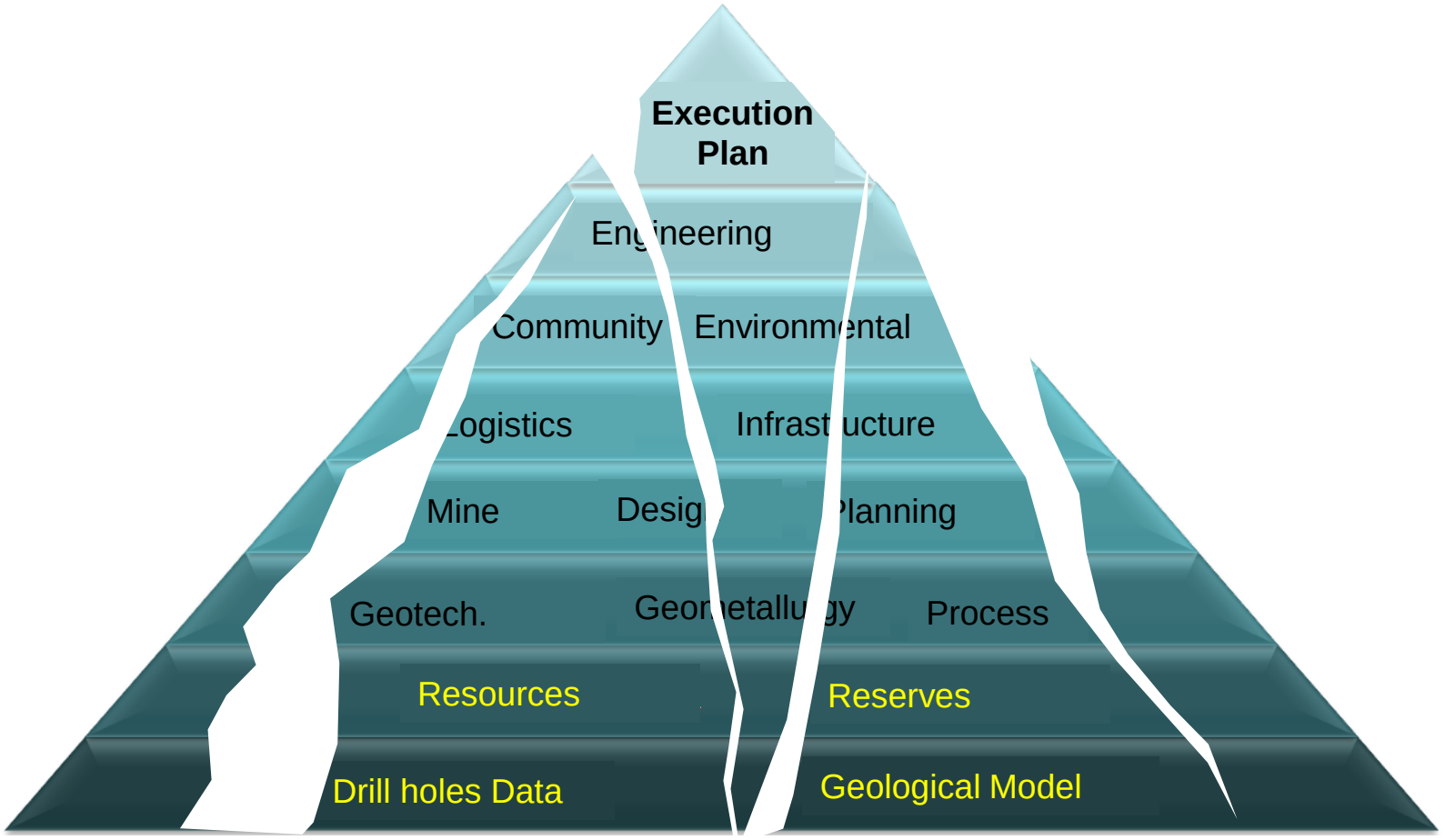
However, the reality



Frequent risk issues in the early stages can lead to instability in the mining business
Risks may increase or decrease in severity depending on actions taken

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CIM: Estimation of Mineral Resources Best Practice Guidelines

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Examples:

6. MINERAL RESOURCE ESTIMATION

6.1. Introduction

This section provides guidelines with respect to data analysis, sample support, model setup, estimation, and model validation. Estimation of Mineral Resources is best achieved by a multi-disciplinary effort that includes consideration of such topics as:

- land title issues,
- surveying,
- exploration techniques,
- geophysics,
- sampling theory,
- sample preparation equipment and methods,
- assaying equipment and methods,
- quality assurance and quality control,
- treatment of outlier values (capping),
- mineralogy,
- comminution characteristics and how they relate to geology,
- processing methods and how they relate to geology,
- deleterious elements or minerals and how they relate to geology,
- acid rock drainage modeling of waste rock,
- hydrogeology,
- effects of weathering,
- geotechnical considerations and mining methods,
- selective mining unit sizes as they relate to geology,
- estimations of mine dilution and mine recovery,
- environmental and social considerations,
- application of cut-off and recovery formulas,
- geostatistical and geological knowledge, and
- grade estimation procedures.

https://mrmr.cim.org/media/1146/cim-mrmr-bp-guidelines_2019_may2022.pdf

CIM: Estimation of Mineral Resources Best Practice Guidelines (cont.)

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- A **multi-disciplinary approach** might involve geologists, metallurgists and mining engineers.

- For example, one person or team may be responsible for collecting the geological data, another person or team may be responsible for the metallurgical testing program, another person or team will deal with environmental issues, another person or team will deal with mining constraints, and another person or team may be responsible for preparing the Mineral Resource estimate.

- As a general principle, **all parts of the Mineral Resource Estimation process should be documented to facilitate peer reviews and reproduction of the results to within reasonable limits.**

https://mrmr.cim.org/media/1146/cim-mrmr-bp-guidelines_2019_may2022.pdf

General Work Flow of Mineral Resources Statement

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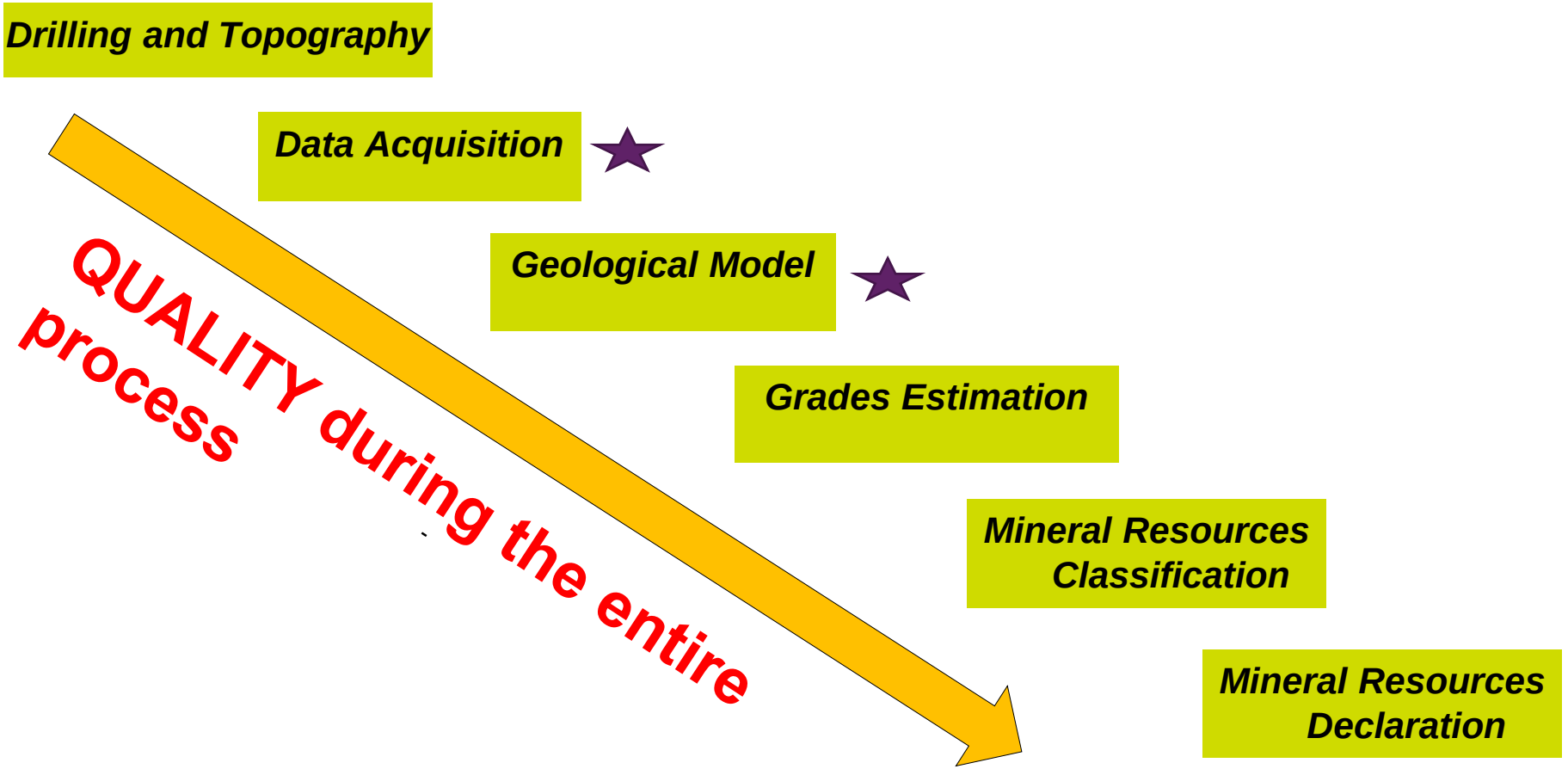

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Potential Consequences of Lack or Poor QAQC

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Real and Current HIGH Impacts are:

Tonnage, and/or

Grade, and /or

Classification, and/or

Study level (PFS to Scoping or FS to PFS)

Grade Model vs Geological Model Comparison

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Envelope of grade	**>>**	***Envelope of Geology + Grade***
Unclear and uncertain geometry	**>>>**	***Control and explanation of the geometry***
Heterogeneous material to plant	**>>>**	***Homogeneous material to plant and optimization costs***
Without development of the geological knowledge	**>>>**	***Important development of the geological knowledge***

Full Compliance with the international codes, including NI 43-101

Geological Model vs Estimation Model
Interaction of the Models

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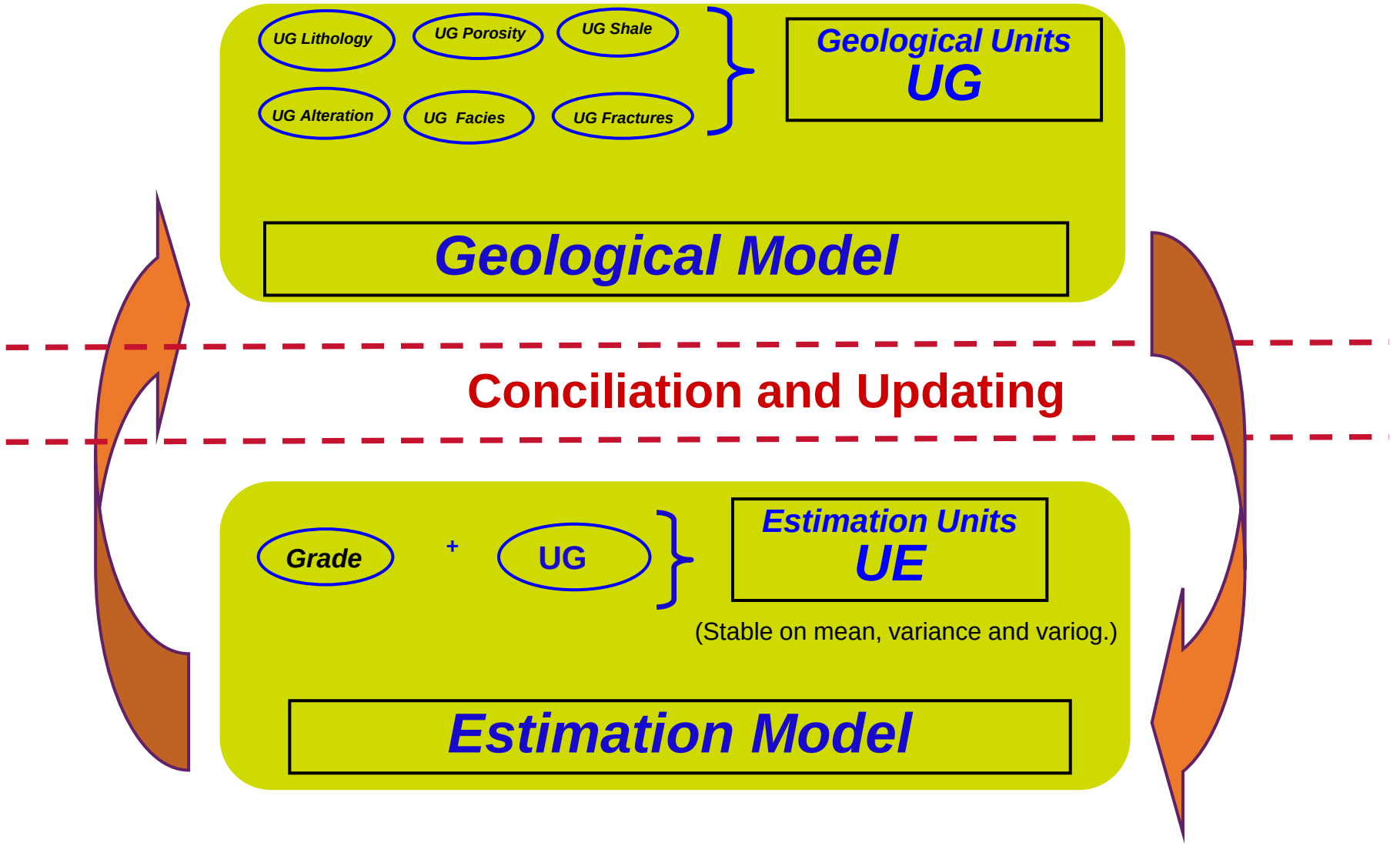

However, currently during the audits…
… frequent surprises!

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Client comments:

"…I don´t understand, for the estimation and classification we applied a good geostatistical techniques in my block model, and I hired reputable a geostatistician….. <u>But now you tell me:</u>"

- **"…your Measured are just Indicated…"**
- **"…you lost 20% of the contained metal…"**
- **"…the sign off from your qualified person (QP) is not available..."**
- **"…You are not in FS level, you are just in PFS level…"**

Note: Just some examples of confidential and real cases, in the last 3 years

New rules? New NI 43-101 version? Or the same three Pillars?

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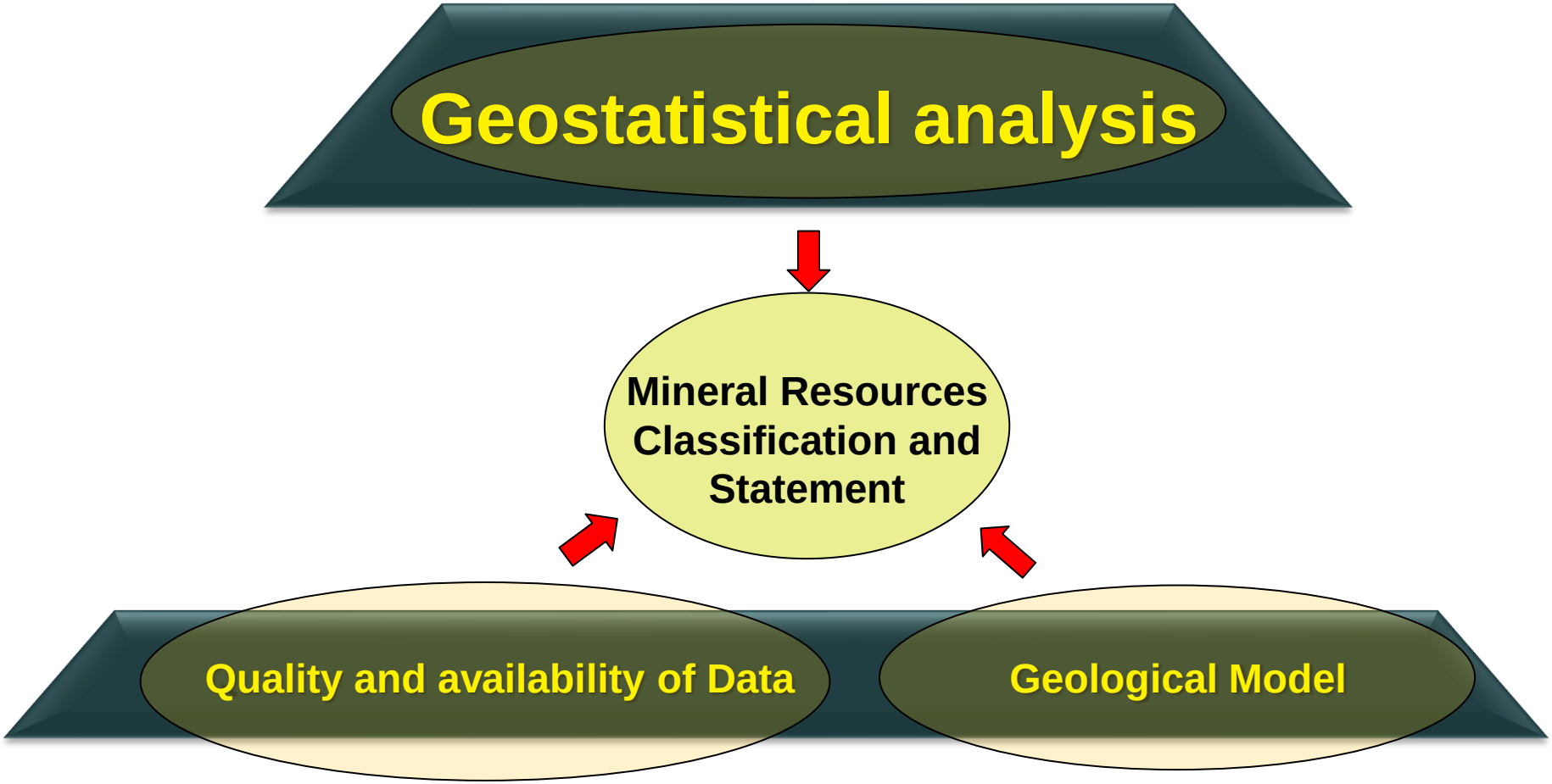

Public Codes (including NI 43-101) and Requirements are Available

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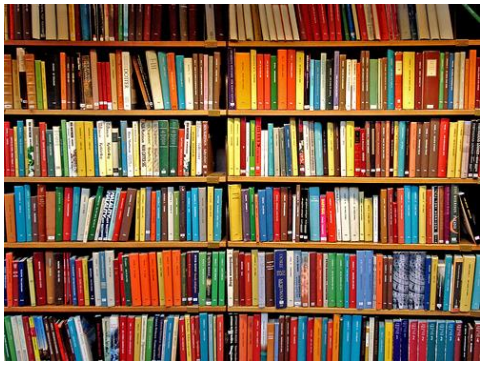
Many public codes regarding to Mineral Resources statement are available, including the quality data and geological requirements BUT…



…same issues in the baseline are frequently encountered around the world...

Therefore, we promote serious and rigorous compliance with international standards such as NI 43-101

Finally,
NI 43-101 and best practices for the Mineral Resources Statement

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Some key concepts and thoughts:

- A TR NI 43-101 **is mandatory for the TSX** and possible for your project
- A TR NI 43-101 **provides a minimum standard** and guideline for your mining project
- The complexity and geological exclusivity of each deposit **does not allow having a single guide (recipe)** to apply to all deposits
- The **Data Quality and the Geological Model are significant pillars for the MR Statement,** clearly exposed in the international codes, including in NI 43-101

Thank you
Dziękuję
Děkuji
شكرا
Merci
Благодаря
Multumesc
Obrigado
Gracias

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