WHAT IS THE PREVALENT REPORTING SYSTEM IN INDIA?
YES, IT IS THE UNFC ?
WHAT DOES UNFC STAND FOR?
IT IS UNITED NATIONS FRAMEWORK CLASSIFICATION AND IN SHORT IT IS CALLED UNFC
United Nation Framework Classification (UNFC)

United Nation Framework Classification (UNFC) is a system classifying the estimations based on three digit codes representing Geological certainty, Feasibility, and Economic viability. It is a globally understandable system.
THREE DIGIT CODE SYSTEM
THREE DIGIT CODE SYSTEM

EFG

Economic Axis

Feasibility Axis

Geological Axis
GEOLOGICAL ASSESSMENT

FOUR CODES

1. DETAILED EXPLORATION
2. GENERAL EXPLORATION
3. PROSPECTING
4. RECONNAISSANCE
FEASIBILITY ASSESSMENT

THREE CODES

1

2

3
ECONOMIC ASSESSMENT
THREE CODES

1

2

3
UNFC SYSTEM

Three digit Code based categories of reserve – Economic (E), Feasibility (F) and Geological (G)

- Economic Axis (E):
  - Economic
  - Potentially Economic
  - Intrinsically Economic

- Feasibility Axis (F):
  - Feasibility Study and Mining Report
  - Pre-Feasibility Study
  - Geological Study

- Geological Axis (G):
  - Detailed Exploration
  - General Exploration
  - Prospecting
  - Reconnaissance
CONCEPT

3 AXES
(I) GEOLOGICAL ASSESSMENT (G)
(II) FEASIBILITY ASSESSMENT (F)
(III) ECONOMIC VIABILITY (E)

GEOLOGICAL ASSESSMENT
Terms used in conventional classification for classes of resources of increasing geological assurance are replaced by activity-related terms. Typical consecutive stages of geological investigation are:
1. RECONNAISSANCE G4
2. PROSPECTING G3
3. GENERAL EXPLORATION G2
4. DETAILED EXPLORATION G1
Reconnaissance study identifies areas of enhanced mineral potential on a regional scale, based primarily on results of regional geological studies, regional geological mapping, airborne and indirect methods, preliminary field inspection, geological inference and extrapolation.

The objective is to identify mineralized areas worthy of further investigation towards deposit identification. Estimates of quantities should only be made if sufficient data are available and when analogy with known deposits of similar geological character is possible.
PROSPECTING (G3)

Prospecting is the systematic process of searching for a mineral deposit by narrowing down areas of promising enhanced mineral potential.

The methods utilized are outcrop identification, geological mapping and indirect methods such as geophysical and geochemical studies. Limited trenching, drilling and sampling may be carried out.

The objective is to identify deposit which will be the target for further exploration.

Estimates of quantities are inferred based on interpretation of geological, geophysical and geochemical results.
GENERAL EXPLORATION (G2)

General exploration involves initial delineation of an identified deposits.

Methods used include surface mapping, widely spaced sampling, trenching and drilling for preliminary evaluation of mineral quantity and quality (including mineralogical test on lab scale if required) and limited interpolation based on indirect methods of investigation.

The objective is to establish main geo features of deposit, giving a reasonable indication of continuity and providing initial estimate of size, shape, structure, and grade. The degree of accuracy should be sufficient for deciding whether pre-feasibility and detailed exploration are warranted.
Detailed exploration involves three dimensional delineation of known deposits, achieved through sampling such as from outcrops, trenches, boreholes, shafts and tunnels. Sampling grids are closely spaced such that size, shape, structure, grade and other relevant characteristics of the deposit are established with a high degree of accuracy.

Processing tests involving bulk sampling may be required. A decision whether to conduct a feasibility study can be made from the information provided by detailed exploration.
## COMPARISON OF DIFFERENT ACTIVITY REQUIREMENTS IN THE 4 GEOLOGICAL AXES

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>ACTIVITIES</th>
<th>G4 RECONNAISSANCE</th>
<th>G3 PROSPECTING</th>
<th>G2 GENERAL EXPLORATION</th>
<th>G1 DETAILED EXPLORATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Geological Surveys</td>
<td>1:50,000</td>
<td>1:50,000 to 1:25,000</td>
<td>1:25,000 to 1:5,000</td>
<td>1:1,000</td>
</tr>
<tr>
<td>2</td>
<td>Trenching</td>
<td>1 or 2</td>
<td>To explore bed rock/mineralized zone</td>
<td>Deciphering the extent of mineralisation</td>
<td>Spacing of 200 to 300m.</td>
</tr>
<tr>
<td>3</td>
<td>Pitting</td>
<td>Upto 5 pits/BH per 100 sq.km. area</td>
<td>BH in 200 to 500 sq.m.grid</td>
<td>BH in 100 to 400 m. grid</td>
<td>Pits 2 to 5 per sq.km Drilling Closer than G2 100 to 50m grid</td>
</tr>
<tr>
<td>4</td>
<td>Sampling</td>
<td>Regional grab/chip sampling</td>
<td>Well defined locations at surface, Pit/Trench/BH/Existing mine openings</td>
<td>Pit/Trench sampling Core Sampling (Check Sampling 10%)</td>
<td>Systematic Pit/Trench Core/Sludge Sampling for lab scale and Bulk sample for pilot plant scale beneficiation</td>
</tr>
<tr>
<td>5</td>
<td>Petrographic/Mineragraphic study</td>
<td>Principal rock type determination, mineral assemblage identification for minerals of interest (Ore &amp; Gangue Minerals)</td>
<td>Petrographic studies of rocks, alterations of the deposit and its surroundings.</td>
<td>Petrographic studies of rocks including grain size and texture etc.</td>
<td>Refining Petrographic studies of rocks including grain size and texture, gangue and its liberation etc.</td>
</tr>
<tr>
<td>6</td>
<td>Geostatistical Analysis</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>BH data, thickness of ore, waste encountered in holes, assay values of samples etc.</td>
</tr>
</tbody>
</table>
FEASIBILITY STUDY (F – AXIS)

Feasibility study assesses in detail technical soundness and economic viability of mining project.

Serves as basis for the investment decision and as a bankable document for project financing.

The study constitutes an audit of all geological engineering, environmental, legal and economic information accumulated on the project.

Cost data must be reasonably accurate (10%) and no further investigations should be necessary to make the investment decision.
METHOD OF INVESTIGATION

FEASIBILITY

* GEOLOGICAL & RELATED STUDY
  - INFRASTRUCTURE, METEOROLOGY, ECOLOGY

* MINING
  - METHODS, RECOVERY, MANPOWER

* ENVIRONMENT
  - BASELINE DATA, IMPACT

* PROCESSING
  - LABORATORY, PILOT PLANT, INDUSTRIAL SCALE STUDIES
METHODS OF INVESTIGATIONS

FEASIBILITY (Contd.)
* INFRASTRUCTURE, CONSTRUCTION & SERVICES

* COSTING
  - CAPITAL, OPERATIVE

* MARKETING
  - DEMAND-SUPPLY RELATION
  - INDUSTRY STRUCTURE

* ECONOMIC VIABILITY
  - CASH-FLOW FORECAST

* OTHER FACTORS AS STATUTORY PROVISIONS
  - LABOUR, LAND, MINING, TAXATION
ECONOMIC VIABILITY (E – AXIS)

The term economic, invariably means that quantities of reserves in economic class are considered to be exploitable at a profit under existing socio-economic conditions and with current mining and processing technology. Consequently quantities which do not meet this requirement at the time of assessment are sub-economic provided they may become economic in future.

Resource estimates undertaken in the course of geological assessment contains preliminary evaluation of economic viability which is normally done by application of meaningful cut-off values from comparable mining operations.
METHODS OF INVESTIGATION

ECONOMIC VIABILITY

* DETAILED GEOLOGICAL KNOWLEDGE

* MINING REPORT/PLAN RESERVES AS PER SPECIFIC END USE GRADE

* FOREST/NON-FOREST & OTHER LAND USE DATA
1. **RECONNAISSANCE MINERAL RESOURCE** *(CODE 334)*

- A reconnaissance mineral resource is based on regional geological studies and mapping, airborne and indirect methods, preliminary field inspection, as well as geological inference and extrapolation.

- The aim is to identify areas of enhanced mineral potential worthy of further investigation towards deposit identification.

- Estimates of quantity based on limited information and analogies with known deposits of similar character may be possible.
2. **INFERRED MINERAL RESOURCE (CODE 333)**

- An inferred mineral resource is that part of mineral resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. It has intrinsic economic interest based on prospecting.
- Estimates of quantities are inferred based on outcrop identification, geological mapping, indirect methods and limited sampling.
3. **INDICATED MINERAL RESOURCE (332)**

- An indicated mineral resource is that part of a mineral resource for which tonnage, densities, shape, physical content can be estimated with a reasonable level of confidence.

- It has intrinsic economic interest based on general exploration establishing the main geological features of a deposit providing an initial estimates of size, shape, structure and grade.

- The level of confidence should be sufficient for deciding whether a preliminary study and detailed exploration are warranted.
• **MEASURED MINERAL RESOURCE (331)**

• A measured mineral resource is that part of a mineral resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence, establishing all relevant characteristics of a deposit with a high degree of accuracy.

• **It is intrinsic economic interest** based on detailed exploration to conduct a feasibility study can be made.
5. **PREFEASIBILITY MINERAL RESOURCE (221 & 222)**

- A pre-feasibility mineral resource is that part of an indicated and in some circumstances measured mineral resource that has not been found economically mine able at the present time.

- The pre-feasibility study will have included consideration of realistically assumed **mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors** to justify that extraction is presently not viable.

- These resources has been identified economically viable subject to changes in technological, economic, environmental and/or other relevant conditions. **Demonstrated** to be potentially economic.

- Pre-feasibility study is usually carried out in areas of detailed exploration and general exploration.
7. **PROVED MINERAL RESERVE** (111)

- A proved mineral reserve is the economically mineable part of a measured mineral resource.

- It includes diluting materials and allowances for losses, which may occur when the material is mined.

- Appropriate assessment which may include feasibility studies have been carried out and include consideration and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors.

- These assessments demonstrate with a high level of confidence at the time of reporting, that extraction is justified.

- Proved mineral reserve may be demonstrated to be economically mineable by a feasibility study or by actual mining activity.
KEY TO THE CLASSIFICATION

Classification will depend on:

a) Geological studies carried out
   1. DETAILED EXPLORATION
   2. GENERAL EXPLORATION
   3. PROSPECTING
   4. RECONNAISSANCE SURVEY.

(b) Studies carried out for Economic Assessment
   1. FEASIBILITY STUDY OR MINING REPORT
   2. PREFEASIBILITY STUDY
   3. GEOLOGICAL STUDY
### TERMS AND CODES IN UNFC

#### 1. RESERVE
- **Proved (111)**
- **Probable (121 & 122)**
- (economically mine able part of measured/indicated mineral resource)

#### 2. Remaining Resource
- **Reconnaissance Mineral Resource (334)**
- **Inferred Mineral Resource (333)**
- **Indicated Mineral Resource (332)**
- **Measured Mineral Resource (331)**

- **Pre-feasibility Mineral Resource (221 & 222)**
- **Feasibility Mineral Resource (211)**

(Intrinsic economic interest, reasonable prospect for eventual economic extraction)
ADVANTAGES OF UNFC

• AN INTERNATIONALLY UNIFORM SYSTEM BASED ON MARKET ECONOMY CRITERIA.
• ENHANCES INTERNATIONAL COMMUNICATIONS.
• SIMPLE, EASY TO USE.
• EASILY UNDERSTANDABLE ACROSS THE GLOBE.
• PROJECTS THE TRUE WORTH OF A RESOURCE ESTIMATE IN A SPECIFIC AND OBJECTIVE MANNER.
• A FLEXIBLE SYSTEM, MEETING THE REQUIREMENTS FOR APPLICATIONS ON NATIONAL, COMPANY OR INSTITUTIONAL LEVEL.
REVISED EDITION OF UNFC IS UNFC-2009
MAJOR CHANGES IN UNFC, 2009

THE 3 AXES HAVE NOW BECOME

E  ECONOMIC AND SOCIAL VIABILITY (E1,E2,E3)

F  FIELD PROJECT STATUS AND FEASIBILITY (F1,F2,F3,F4)

AND

G  GEOLOGICAL KNOWLEDGE (G1,G2,G3,G4)
UNFC, 2009 APPLIES TO FOSSIL ENERGY MINERAL RESERVES AND RESOURCES LOCATED ON OR BELOW THE EARTH SURFACE INCLUDING OIL & GAS, ATOMIC ENERGY MINERALS GEOTHERMAL ENERGY NON CONVENTIONAL ENERGY RESOURCES
TYPE OF PROJECTS

1. COMMERCIAL PROJECTS (111,112,113)
2. POTENTIALLY COMMERCIAL PROJECTS (221,222,223)
3. NON COMMERCIAL PROJECTS (321,322,323)
4. EXPLORATION PROJECTS (334)
5. ADDITIONAL QUANTITIES IN PLACE (341,342,343)
6. OTHER COMBINATIONS
7. EXTRACTED QUANTITIES