“Progress of Mineral Resource Evaluation system at Hindustan Zinc Ltd – A journey towards JORC”

Presented by:
Kuldeep Singh Solanki
AGM (Geology)
Hindustan Zinc Ltd
Core Strengths

Leading the way with fully integrated operations

1. Sustainable Enterprise
   Zero harm to People, Positively Impacting 5 lakh people in nearby communities

2. R&R base 389.9 Mt
   Ensuring mine life of +25 years

3. High Scale of Operation
   11 million+ MT Ore Production Capacity

4. Fully Integrated Operation
   Raw Material & Power - Self sufficiency

5. High Domestic Market Share
   Large Customer Portfolio in India

Among the lowest cost producers of zinc

Source: Wood Mackenzie Research
A world class mining portfolio

**Rampura Agucha Mine**
- Reserves: 51.1mt
- Resources: 52.7mt
- Reserve Grade: Zn 14.0%, Pb 1.8%
- Current Ore Capacity: 4.63 mtpa

**Kayad Mine**
- Reserves: 3.9mt
- Resources: 2.0mt
- Reserve Grade: Zn 13.4%, Pb 1.8%
- Current Ore Capacity: 1.0 mtpa

**Sindesar Khurd Mine**
- Reserves: 33.2mt
- Resources: 76.3mt
- Reserve Grade: Zn 4.7%, Pb 3.2%
- Current Ore Capacity: 4.0 mtpa

**Rajpura Dariba Mine**
- Reserves: 9.3mt
- Resources: 49.4mt
- Reserve Grade: Zn 6.3%, Pb 1.6%
- Current Ore Capacity: 0.84 mtpa

**Zawar Mining Complex**
- Reserves: 9.5mt
- Resources: 82.3mt
- Reserve Grade: Zn 3.4%, Pb 1.7%
- Current Ore Capacity: 1.8 mtpa

**Chanderiya Smelting Complex**
- Pyrometallurgical Lead Zinc Smelter: 105,000 tpa Zinc and 85,000 tpa Lead
- Hydrometallurgical Zinc Smelter: 420,000 tpa Zinc
- Captive Power Plant: 234MW

**Zinc Smelter Debari**
- Hydrometallurgical Zinc Smelter: 88,000 tpa Zinc

**Zawar Mining Complex**
- Hydrometallurgical Zinc Smelter: 210,000 tpa Zinc
- Lead Smelter: 100,000 tpa Lead
- Captive Power Plant: 160MW

**Pantnagar & Haridwar**
- Processing & Refining of Zinc, Lead & Silver
Exploration Success

Strong track record of delivering organic R&R growth.

- Annual Drilling: +1,00,000m
- Ground Penetration: +1,500m
- Exploration Time Gain: +50%
- Annual Spending: Rs. +70 Cr, USS +10.2 M

2002: 154Mt
2009: 272Mt
2016: 390Mt

Sindesar Khurd R&R Growth
Mineral Resource Evaluation

1970
Polygonal Method

1980
Cross-sectional Method

1990
Inverse Distance Weight

1970
Polygonal Method

1980
Cross-sectional Method

1990
Inverse Distance Weight

PLAN VIEW

SECTIONAL VIEW
Resource estimation methodology since 2004

In order to overcome the issues of IDW where in spatial correlation between the samples is not being taken into account. Kriging is adopted for resource estimation.

- Sampling and QAQC
- Data validation
- Development Mineralised Envelop
- Exploratory Data Analysis
- Kriging Neighbourhood Analysis
- Model Compilation
- Reconciliation
Classification of ore reserves – A Journey

1970
- Blocked Ore
- Proven Ore
- Indicated Ore
- Probable ore
- Possible Ore

1980 - 4p classification
- Positive Ore
- Proved Ore
- Probable Ore
- Possible Ore

1990 - Ore Reserve Classification
- Developed Ore Reserves
  - Fully Developed Ore reserves
  - Partly Developed Ore reserves
- Undeveloped Ore Reserves
  - Proved Ore Reserve
  - Probable Ore Reserve
  - Possible Reserves
- Other Ore Reserves
Since after disinvestment and our company got registered at London stock exchange JORC Code was adopted which is internationally accepted reporting standard and which is recognised and adopted worldwide for market-related reporting and financial investment.

- Resource models are compiled by geologist.

- It is depleted against the production stope wireframe.

- Resource numbers (measured, indicated & inferred) are declared on depleted model.

- Life of mine plan (LOMP) is being prepared by mining engineers on depleted model.
Modifying Factors

- Modifying factors are derived based on past reconciliation for dilution and mining recovery.

- The criteria taken to define the factors include
  - Hanging wall Condition
  - Geological complexity of Orebody
  - Mine to metal Reconciliation

- The above criteria are coded into the resource model to derive modifying factors which are then applied to derive the reserves.

```
IF (COMPLEX==1 AND HWCOND==0) PDIL=5.3 UNPDIL=5.5 MRECOV=95
IF (COMPLEX==2 AND HWCOND==0) PDIL=11.1 UNPDIL=5.8 MRECOV=98
IF (COMPLEX==3 AND HWCOND==0) PDIL=17.6 UNPDIL=6.2 MRECOV=98
IF (COMPLEX==1 AND HWCOND==1) PDIL=11.1 UNPDIL=9.7 MRECOV=95
IF (COMPLEX==2 AND HWCOND==1) PDIL=17.6 UNPDIL=13.1 MRECOV=95
IF (COMPLEX==3 AND HWCOND==1) PDIL=33.3 UNPDIL=21.7 MRECOV=90
```
Competent person signoff

- The resource and reserves numbers are validated signed off internally by site geologist and mine planning engineer.

- SRK, UK has been assigned to undertaken Mineral Resource and Ore Reserve audits on an annual basis to review
  - Exploration drilling, sampling and QAQC.
  - Methodologies being used to estimate, classify and report Mineral Resources.
  - Life of Mine Plans (“LoMP”) and schedules.
  - Modifying factors
  - Concentrator and smelter facility capacity.

Mineral resource and Ore reserves of HZL are annually signed off by SRK,UK as competent person.
Way forward towards global best practices

• At group level a “Vedanta R&R Risk Management Committee” is being formed.

• The committee will prepare a company-wide Mineral Resource and Ore Reserve reporting guidelines which is in line with global best practices.

• Conduct internal audit of the whole process and signoff on the R&R numbers.

• A process has been initiated to have JORC compliant competent persons on each site of HZL.

• Independent signoff on JORC complied R&R reports.
Thanks