NET VALUE CALCULATION

- **The size and the shape of the pit depends upon economic factor & design/production constraints**
- **With an increase in price the pit would expand in size assuming all other factors remained constant**
- **The pit existing at the end of mining is called the ‘final’ or ‘ultimate pit’**
- **Within the pit are found materials of different value. Economic criteria are applied to assign destinations for these materials based on their value (mill, waste dump, stock pile, etc)**
NET VALUE CALCULATION

• **The simplest case would be that in which there are two destinations:**
  - The mill for further processing, or
  - Waste dump

• **One cut of grade is needed**

• **Cut of grade:** The grade at which the mineral resource can no longer be processed at a profit

• **That grade for which the net value is zero is called the breakeven cutoff grade.**
NET VALUE CALCULATION - EXAMPLE

• **Ore containing 0.55% copper**
• **Mill recovery rate = 80%**
• **Mill concentrate grade = 20%**
• **Smelting loss = 4.5 kg per tonne of concentrate**
• **Refining loss = 2.3 kg per tonne of blister copper**
• **All the costs and revenues will be calculated with respect to one tonne of ore**
NET VALUE CALCULATION - EXAMPLE

Step 1: Compute the amount of saleable copper

- **CONTAINED COPPER (CC)**
  
  \[
  CC = 0.55\% \times 1000 = 5.5 \text{ KG PER TONNE OF ORE}
  \]

- **COPPER RECOVERED BY MILL (RM)**
  
  \[
  RM = 5.5 \text{ KG} \times 80\% = 4.4 \text{ KG PER TONNE OF ORE}
  \]
NET VALUE CALCULATION - EXAMPLE

Step 1: Compute the amount of saleable copper

• **Concentration ratio (R)**

\[ R = \frac{\text{kg of Cu per tonne of concentrate}}{\text{kg of Cu recovered per tonne of ore}} = \frac{0.2 \times 1000}{4.40} = 45.45 \]

• **This means that 45.45 tonnes of ore running 0.55% copper are required to produce 1 tonne of concentrate running 20% of Cu**
NET VALUE CALCULATION - EXAMPLE

Step 1: Compute the amount of saleable copper

- COPPER RECOVERED BY SMELTER (RS)
  - SINCE THE SMELTING LOSS IS 4.5 KG/TONNE OF CONCENTRATE, THE SMELTING LOSS PER TONNE OF ORE IS:

\[
SL = \frac{4.5 \text{ KG}}{45.45 \text{ KG}} = 0.01 \text{ KG PER TONNE OF ORE}
\]

\[
RS = 4.4 - 0.01 = 4.39 \text{ KG PER TONNE OF ORE}
\]
NET VALUE CALCULATION - EXAMPLE

Step 1: Compute the amount of saleable copper

- Copper recovered by the refinery (RR)
  - The number of tonne of ore required to produce one tonne of blister copper is:
    $$ \frac{1000}{4.39} = 228 \text{ tonnes of ore} $$
  - Since refining losses are 2.3 kg of blister copper, the refining loss (RL) per tonne of ore is:
    $$ RL = \frac{2.3}{228} = 0.01 \text{ kg per tonne of ore} $$
NET VALUE CALCULATION - EXAMPLE

Step 1: Compute the amount of saleable copper

- **Copper recovered by the refinery (RR)**
  - The recovered copper is;
  - \( RR = 4.39 - 0.01 = 4.38 \text{ kg per tonne of ore} \)
  - **Saleable copper = 4.38 kg per tonne of ore**
NET VALUE CALCULATION - EXAMPLE

Step 2: Compute the gross value (GV) for the ore

• **Assume the copper price is $2.00 per kg**

• \[ \text{GV} = 4.38 \times 2 = \$8.76 \ \text{per tonne of ore} \]
NET VALUE CALCULATION - EXAMPLE

Step 3: Compute the total cost

- **Production cost (PC)**
  - **Mining cost = $0.90**
  - **Milling cost = $2.50**
  - **General and Administration = $0.51**
- **Total = $3.91 per tonne of ore**
NET VALUE CALCULATION - EXAMPLE

Step 3 : Compute the total cost

- **Amortization and Depreciation (A & D)**
  - This amount is charged against each tonne of ore to account for capital investment in a mine and mill plant
  - In this case, 20% of the total PC is used:
  - \( A\&D = 0.2 \times \$3.91 = \$0.78 \) per tonne of ore
NET VALUE CALCULATION - EXAMPLE

Step 3 : Compute the total cost

- **Treatment, refining, and smelting costs (TRS)**
  - **Shipment of concentrate to smelter (@$1.5 per tonne of concentrate)**

\[
\frac{1.5}{45.45} = \$0.03 \text{ per tonne of ore}
\]

- **Smelting cost (@$50.00 per tonne of concentrate)**

\[
\frac{50.00}{45.45} = \$1.10 \text{ per tonne of ore}
\]
NET VALUE CALCULATION - EXAMPLE

Step 3 : Compute the total cost

- **TREATMENT, REFINING, AND SMELTING COSTS (TRS)**
  
  - **SHIPMENT OF BLISTER COPPER TO REFINERY (@$40.00 PER TONNE OF BLISTER COPPER)**
    
    \[
    = 40.00 \times \frac{4.39}{1000} = $0.18 \text{ per tonne of ore}
    \]

  - **REFINING COST (@$120.00 PER TONNE OF BLISTER COPPER)**
    
    \[
    = 120.00 \times \frac{4.39}{1000} = $0.53 \text{ per tonne of ore}
    \]
NET VALUE CALCULATION - EXAMPLE

Step 3: Compute the total cost

- **Treatment, Refining, and Smelting Costs (TRS)**
  - **Selling and delivery cost (@$0.01 per kg of copper)**
    - \( 4.38 \times 0.01 = $0.04 \) per tonne of ore
  - **General plant (@$0.05 per kg of copper)**
    - \( 4.38 \times 0.05 = $0.22 \) per tonne of ore
  - **Total TRS = 0.03 + 1.10 + 0.18 + 0.53 + 0.04 + 0.22**
    - = $2.10 per tonne of ore
- **TC = 3.91 + 0.78 + 2.10 = $6.79 per tonne of ore**
NET VALUE CALCULATION - EXAMPLE

Step 4 : Net value (NV) per tonne of ore

• NV = GV – TC = 8.76 – 6.79 = $1.97 PER TONNE OF ORE
NET VALUE CALCULATION - EXAMPLE

Step 5: Compute net value (NV) per tonne of ore for another Cu grade, for example, 30%.

- **FOLLOW STEPS 1 TO 4.**
NET VALUE CALCULATION - EXAMPLE

Step 5 : Compute net value (NV) per tonne of ore for another Cu grade, for example, 30%.

- GV = $4.69
- TC = $5.82
- NV = 4.69 – 5.82 = - $1.13 PER TONNE OF ORE
NET VALUE CALCULATION - EXAMPLE

Step 5: Compute net value (NV) per tonne of ore for another Cu grade, for example, 30%.

Grade = 0.55%  
NV = $1.97

Grade = 0.30%  
NV = - $1.13
Step 6 : Construct a net value – grade curve

- **Point 1**: (0.55, 1.97)
- **Point 2**: (0.30, -1.13)
- **Join two points to form a straight line**
NET VALUE CALCULATION - EXAMPLE

Step 7: Determine breakeven cutoff grade

- Graphically
  - Equation of a straight line