WHY THE GRADE SHORTFALL?

The situation
A team comprising the grade control geologist, the blasting and mining engineers, the drilling and mining foremen and the surveyor is assembled to investigate the cause of the recurrent grade shortfall.

Root-cause analysis: approach and findings
The team generates a large number of ideas regarding the potential causes of the grade shortfall, produces 6 groups of issues and creates a header for each grouping. Then the team lays out the headers in a circular pattern and completes an Interrelationship Digraph that identifies cause-and-effect relationships between nodes (Figure 1). An arrow points to the node that is the effect. Then the number of arrows going “in” and going “out” is tallied at each node. A high number of outgoing arrows indicates a node that is a driver or a possible root cause. A high number of incoming arrows indicates a node that is an outcome. In this example, weights are used to emphasize the strength of the relationship.

Findings: poor Drill-Blast practices (node E) appear to be the driver or root cause of the problem and unplanned dilution (node F) is the likely outcome. Clearly, improving D&B practices should result in a lower unplanned dilution and contribute to solving the grade shortfall.

Gaining further insight
The team then decides to collect data in order to further explore the relationships at, and between, the D, E and F nodes (Table 1).

Poor supervision of drilling and blasting are two of the issues involved at node E.

The horizontal movement of the ore after blasting is a key issue at node D. Where large it is likely to result in inaccurate ore / waste mark-up.

Figure 2 below confirms that poor D&B practices have a strong effect on dilution and the horizontal blast movement. Interestingly, the plots show also a significant interaction between drilling and blasting.

Table 1

<table>
<thead>
<tr>
<th>Drilling supervision</th>
<th>Blasting supervision</th>
<th>Hor. Blast movement</th>
<th>Unplan’d dilution</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>G</td>
<td>1m</td>
<td>3%</td>
</tr>
<tr>
<td>G</td>
<td>P</td>
<td>5m</td>
<td>15%</td>
</tr>
<tr>
<td>G = good</td>
<td>P</td>
<td>3.5m</td>
<td>8%</td>
</tr>
<tr>
<td>P = poor</td>
<td>P</td>
<td>9m</td>
<td>30%</td>
</tr>
</tbody>
</table>

Figure 1

- Weight
  - 1
  - 3
  - 9

- Unplanned dilution
- Poor geological interpretation
- Poor D&B practices
- Inaccurate O / W mark-up

- A
- B
- C
- D

- NODE OUT IN
  - A 3 1
  - B 4 1
  - C 1 4
  - D 3 5
  - E 13 0
  - F 0 13

- Driver (root cause)
- Outcome (to use as a KPI)

Copyright © 2012 Omega Geo-Consulting Pty Ltd
PO Box 7646 - Cloisters Square - WA 6850 - Australia - ☏ +61 8 9367 8770 - www.OmegaGeo.com – March 2012