# Red to Green Projects in Alumina Refineries of Hindalco

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**Abstract**

Red mud is a waste generated from alumina refineries that is alkaline in nature and highly unsuitable for any kind of vegetation. Hindalco took the challenge and deployed suitable technology to convert the red dumps to a green land. In 2004, Hindalco Belagavi and Muri plants started experiments to develop greenery over the red mud disposal areas and in turn made an attempt to neutralize red mud spread across 55 acres of land by adding soil and other amenders, in partnership with TERI. They successfully developed a green cover over the abandoned red mud yard. In 2008, Hindalco Renukoot also took the initiative and restored around 12 acres of red mud yard. In Jan-2022, Hindalco Muri again took an initiative and implemented novel ways for neutralizing the red mud soil and growing vegetation in association with TERI. Muri's project covered another 25 acres of red mud yard by Mar-23 and development is in progress.

Muri plant has adopted a combination for rehabilitation of red mud, i.e., Red Mud + 10% Gypsum + 20% FYM + 15% Fly Ash + Mycorrhizae and topography amendments to facilitate the plantation. Indigenous tree saplings and grass species were selected which will survive in local environment and on Red mud heap. Contour terracing along the bench slope was constructed and plantation was done along the benches which will restrict the rainwater flow and mud sliding. Also, the Unit has installed Piezometers and Inclinometers in red mud yard to monitor any underground water accumulation and/or any mud sliding from the heap and analyse the real time online data. This helped in ensuring stability of the red mud disposal area and eco-restoration activities will create environmental synergy.

The expected outcomes of the ongoing 'Red to Green' efforts at Muri are stabilising the pH of surface runoff (pH 6.5 to 8.5) during monsoon and enhancement in red mud dump aesthetics through development of green area.

**Keywords:** The Energy and Resources Institute (TERI), Farmyard Manure (FYM), Red Mud Pond or Disposal Area (RMP), Contour Terracing, Gypsum, Fly Ash, Mycorrhizae, Piezometers, Inclinometers.

## 1. Introduction

Red mud is a waste generated from alumina refineries. It is alkaline in nature and highly unsuitable for any vegetative growth. Hindalco took the challenge and found a suitable process to convert the red mud yards into green land. Red mud in Muri after passing through Filter Press, is stored as dry stacks with handling and storage area management during monsoon require specified standard procedure due to its alkaline nature and generation of fugitive dusts during summer season. Studies have found that such dust contains traces of Sodium Carbonate. Moreover, cracks & erosion are also observed in the red mud yard. Greenbelt development with proper compaction, sloping and benching will restrict the development of cracks, prevent erosion and dust emission in the storage yard. The adopted process is highly significant and effective in the sense that bioremediation by the amenders and subsequent vegetation will continuously reduce alkalinity.

In 2001, Muri and Belagavi units started experiments to develop greeneries over Red Mud storage areas and in turn achieved to neutralize it by mixing soil and other amenders in partnership with TERI (The Energy and Resources Institute) and have successfully built green cover at the abandoned red mud yards.

In Jan-2022, Hindalco Muri again took an initiative to grow vegetation and simultaneously neutralize the red mud soil. This time gypsum, fly ash, vermi-compost /farmyard manure (FYM) and mycorrhizae were used to make the region fertile enough to grow vegetation. The whole process is a combination of mechanical, civil, chemical, microbial and vegetation-based treatment.

## 2. Steps Involved in Converting Red Mud Yards into Green Land.

### Step 1: Levelling and Bench Slope Construction.

As per CMPDI (Central Mine Planning & Design Institute) design, benching and sloping was done at 2:1 ratio with 16-degree angle from the bottom and each bench was 10 m wide and 5 m in height.

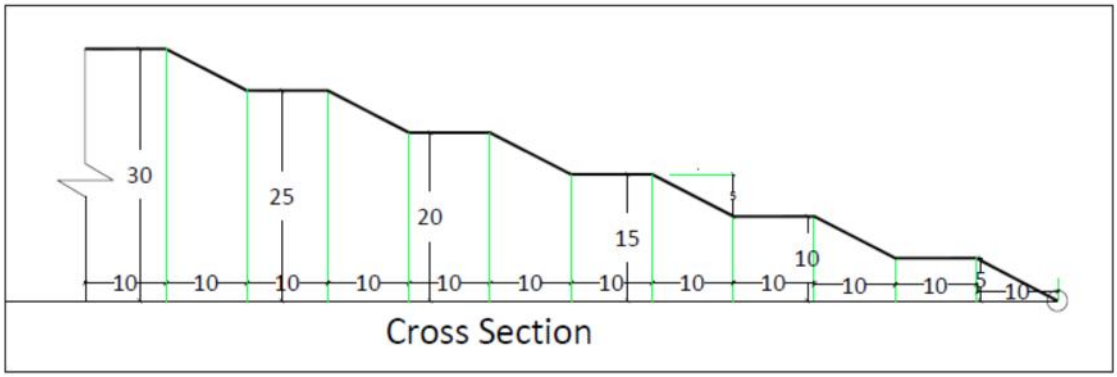


**Figure 1: Red Mud slope and benching**

### 2.1 Risk Mapping and Monitoring of Red Mud heap:

Contour terracing was constructed along the bench slope to reduce surface runoff. Piezometer and Inclinometer were installed in red mud yard to monitor water accumulation. This project also ensured that there was no red mud sliding from the heap.

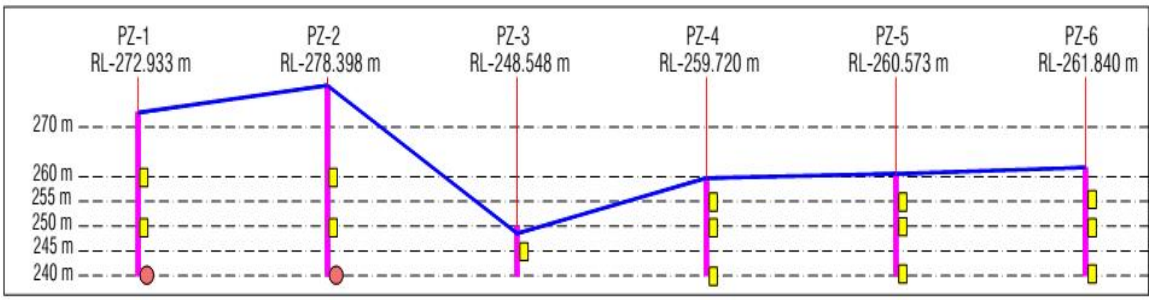


**Figure 2. Realtime Piezometer Reading of Water Level- Water level of red mud heap was monitored through piezometer which is used to monitor and subsequently take actions to restrict percolation of water.**

## 5. Advantages of Red to Green Project

The green vegetation developed in red mud yard in Belagavi and Muri plants had many advantages. The major benefits attributed to the green cover are:

a) Alkalinity of red mud top layers got neutralized.
b) pH of surface runoff became normalized in the range of 6.5 to 8.5.
c) Vegetation growth in red mud areas provided stability to red mud yard and reduced erosion.
d) Green vegetation also reduced the dust emission from red mud yards which used to be a major challenge during summer.
e) The project provided an aesthetically pleasing place for local inhabitants and the erstwhile barren land will be an abode of local biodiversity in future.

## 6. Way Forward

Hindalco Muri, Renukoot and Belagavi plants will convert another **70 acres** of Red Mud yard into green area by 2027.

a) Muri will additionally develop 50 acres of red mud yard by 2027.
b) Renukoot unit will convert another 15 acres of red mud yard into green cover by 2027.
c) Belagavi will develop another 5 acres of red mud yard by 2027.

## 7. References

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