

Case Study

Transforming Wastewater Aeration Efficiency at a Leading Metal & Mining Company



Overview

A leading Indian metal & mining company operating a sewage treatment plant (STP) sought to improve aeration efficiency, enhance dissolved oxygen (DO) levels, and reduce overall energy consumption within its wastewater treatment process. The existing treatment environment exhibited oxygen-deficient conditions, impacting process efficiency and operational performance.

To address these challenges, NICO deployed its VARUNA 10 Nanobubble System integrated with oxygen and ozone delivery technology. The project was commissioned and validated under actual operating conditions to evaluate improvements in oxygen transfer, oxidation performance, and energy efficiency.

Project Details

- **Client:** Leading Indian metal & mining company
- **Application:** Sewage treatment plant (STP)
- **Objective:** To improve aeration efficiency, enhance DO levels, and reduce overall energy consumption
- **Technology:** NICO VARUNA 10
- **System Capacity:** 10 m³/hr
- **Commissioning Period:** 09–16 March 2026



Pre-Implementation Challenges

Before the deployment of the NICO VARUNA system, the treatment plant faced several operational challenges that affected treatment efficiency and process stability.

Key observations included:

- Dissolved Oxygen (DO) levels as low as 0.25–0.30 mg/L.
- Highly negative Oxidation Reduction Potential (ORP) values ranging from -290 mV to -300 mV.
- Oxygen-deficient conditions impacting biological treatment performance.
- Need for improved aeration efficiency and oxidation capability.
- High operational energy demand associated with maintaining treatment performance.

These conditions highlighted the requirement for a more efficient oxygen transfer solution capable of improving treatment performance while reducing energy consumption.

NICO Nanobubble Solution

NICO installed the VARUNA 10 Nanobubble System with integrated oxygen and ozone delivery to enhance oxygen transfer and oxidation performance within the STP.

The system was commissioned between 09–16 March 2026 and evaluated under real plant operating conditions. Through nanobubble generation technology, the system was designed to maximize gas dissolution, improve dissolved oxygen availability, and create favorable oxidation conditions for wastewater treatment.



Comparison: Initial vs Final
(Post 10-Minute Circulation with NICO Varuna 10)

Performance Outcomes

Parameter	Unit	Competitor Nanobubble System	NICO Nanobubble System
DO (mg/L)	0.25-0.30	7.3-10.5	10.7-12.1
ORP (mV)	-300	-100 to -200	> -200

The NICO Nanobubble System delivered significantly higher dissolved oxygen levels while simultaneously improving oxidation conditions within the treatment process.

Additional recirculation trials demonstrated dissolved oxygen levels of approximately **30 mg/L within 20 minutes**, indicating oxygen supersaturation levels that are difficult to achieve using conventional aeration approaches.

Energy Consumption Comparison

System	Power Consumption (kW)
Other Nanobubble System	88.7
NICO Nanobubble System	20.4
Power Saving	68.3

Annual Energy & Cost Savings

Parameter	Value
Daily Energy Saving	1,093 kWh/day
Annual Energy Saving	398,872 kWh/year
Electricity Tariff	₹10/unit
Annual Cost Saving	₹39.88 Lakhs

The deployment resulted in approximately **77% reduction in energy consumption**, delivering substantial operational savings and improving overall treatment economics.

Impact Analysis

The implementation of NICO Nanobubble Technology generated measurable improvements across operational and economic parameters:

- **Significant increase in dissolved oxygen concentration.**
- **Improved oxidation environment through enhanced ORP levels.**
- **Oxygen supersaturation capability up to approximately 30 mg/L.**
- **Approximately 77% reduction in power consumption.**
- **Annual energy savings of nearly 398,872 kWh.**
- **Annual operating cost savings of approximately ₹39.88 Lakhs.**
- **Enhanced treatment efficiency under actual plant operating conditions.**
- **Improved process stability with lower energy requirements.**
- **Compact and efficient solution suitable for industrial wastewater treatment applications.**

Conclusion

The deployment of the NICO VARUNA 10 Nanobubble System at a leading Indian metal & mining company successfully enhanced wastewater aeration performance while significantly reducing operational energy consumption. The system demonstrated remarkable improvements in dissolved oxygen levels, oxidation conditions, and treatment efficiency under real operating conditions.

By achieving dissolved oxygen levels exceeding 10 mg/L during single-pass operation and delivering approximately 77% energy savings, the project validated the effectiveness of nanobubble technology as an advanced and energy-efficient solution for modern wastewater treatment facilities. The results demonstrate its potential to support sustainable operations, lower treatment costs, and improved process performance across industrial wastewater applications.