

Report

Industrial Visit to UltraTech Cement Manufacturing Plant, Hirmi

Date of Visit: 21 March 2026

Number of Students: Approximately 45

Organized by: Department of Chemical Engineering, National Institute of Technology (NIT) Raipur

Introduction

An industrial visit to the **UltraTech Cement Manufacturing Plant, Hirmi** was organized by the Department of Chemical Engineering, National Institute of Technology (NIT) Raipur, on **21 March 2026**. The visit aimed to bridge the gap between theoretical knowledge and industrial practices by providing students with exposure to the large-scale manufacturing processes employed in the cement industry. The visit enabled students to understand modern cement production technology, process automation, quality control, environmental management, and industrial safety practices.

Objectives of the Visit

The primary objectives of the industrial visit were:

- To understand the complete manufacturing process of cement.
- To observe the operation of various process equipment used in cement production.
- To gain practical knowledge of raw material handling and processing.
- To learn about quality assurance and quality control techniques adopted in the cement industry.
- To understand pollution control measures and sustainability initiatives implemented by the plant.
- To interact with industry professionals and gain insights into industrial operations and career opportunities.

Overview of UltraTech Cement – Hirmi Cement Works

UltraTech Cement Limited, an Aditya Birla Group company, is India's largest manufacturer of grey cement, ready-mix concrete, and white cement. The **Hirmi Cement Works**, located in Baloda Bazar-Bhatapara district of Chhattisgarh, is one of the company's major integrated cement manufacturing units. The plant is equipped with advanced process control systems, modern production facilities, and environmental management technologies to ensure efficient and sustainable cement production.

Activities During the Visit

Upon arrival at the plant, the students were welcomed by the plant officials and provided with a safety briefing. Personal Protective Equipment (PPE), including helmets and safety instructions, was provided before entering the mining area.

The visit commenced with exposure to mining areas from where calcites are extracted, manufacturing capacity, product portfolio, safety policies, and sustainability initiatives. Following the plant's tour to various sections of the plant under the guidance of experienced engineers, students were gathered in meeting hall where head of the plant, delivered a presentation introducing the company's history, infrastructure growth and development.

Cement Manufacturing Process

During the visit, students observed the major stages involved in cement manufacturing from the control room:

Raw Material Preparation: The primary raw materials limestone, clay, laterite, and iron ore were transported to the plant and stored separately. These materials were crushed using crushers to achieve the desired particle size before being conveyed to the raw mill.

Raw Meal Grinding: The crushed raw materials were finely ground in the raw mill to produce raw meal. Continuous sampling and chemical analysis were carried out to maintain the required composition before feeding the material into the preheater.

Preheating and Calcination: The raw meal passed through a multi-stage cyclone preheater where it was heated using hot exhaust gases from the kiln. Calcination occurred in the calciner, converting calcium carbonate into calcium oxide while releasing carbon dioxide.

Rotary Kiln: The partially calcined material entered the rotary kiln, where temperatures reached approximately **1400°C**. At this stage, clinker minerals such as alite and belite were formed, producing cement clinker.

Clinker Cooling: The hot clinker discharged from the kiln was rapidly cooled using a grate cooler. Heat recovered from the cooling process was recycled back into the system to improve thermal efficiency.

Cement Grinding: The cooled clinker was mixed with gypsum and, depending on the cement grade, supplementary cementitious materials such as fly ash or slag. The mixture was ground in cement mills to obtain the desired fineness.

Storage and Packing: The finished cement was stored in large silos before being packed into bags or transported in bulk through automated packing systems for dispatch to customers.

Quality Control Practices

Students visited the quality control laboratory, where modern analytical instruments were used for testing raw materials, clinker, and finished cement. Important quality tests included:

- Automatic Robo
- X-ray fluorescence (XRF) analysis
- X-ray diffraction (XRD)
- Blaine fineness test
- Setting time determination
- Compressive strength testing
- Soundness test
- Chemical composition analysis

These tests ensured that the cement met relevant Indian Standards (IS) specifications before dispatch.

Automation and Process Control

The plant employed advanced Distributed Control System (DCS) technology for real-time monitoring and control of various process parameters such as:

- Temperature
- Pressure
- Flow rate
- Kiln operation
- Fuel consumption

- Product quality

The central control room enabled operators to monitor the entire manufacturing process using computerized systems, thereby improving production efficiency and minimizing operational deviations.

Environmental Management

The visit highlighted the plant's commitment to environmental sustainability. Several pollution control measures were observed, including:

- Electrostatic precipitators (ESPs) and bag filters for dust collection.
- Continuous emission monitoring systems (CEMS).
- Waste heat recovery for improved energy efficiency.
- Water conservation through recycling and rainwater harvesting.
- Utilization of supplementary cementitious materials such as fly ash to reduce clinker consumption.
- Extensive green belt development around the plant premises.

These initiatives demonstrated the company's efforts to minimize environmental impact while maintaining high production efficiency.

Industrial Safety Practices

Safety was given the highest priority throughout the visit. Students observed several safety measures adopted by the company, including:

- Mandatory use of personal protective equipment.
- Clearly marked emergency exits and evacuation routes.
- Fire protection systems installed throughout the plant.
- Safety signage and hazard identification.
- Regular safety training and emergency preparedness programs.
- Strict adherence to occupational health and safety standards.

Learning Outcomes

The industrial visit significantly enhanced students' understanding of industrial cement manufacturing. Key learning outcomes included:

- Practical understanding of the complete cement manufacturing process.
- Familiarity with industrial equipment and process flow.
- Knowledge of automation and process control systems used in modern industries.
- Understanding of quality assurance techniques in cement production.
- Awareness of environmental protection and sustainable manufacturing practices.
- Appreciation of industrial safety culture and operational discipline.

Conclusion

The industrial visit to **UltraTech Cement Manufacturing Plant, Hirmi**, on **21 March 2026**, was highly informative and educational. It provided valuable practical exposure to large-scale cement manufacturing and enabled students to relate classroom concepts to real industrial operations. The interaction with experienced professionals and observation of advanced manufacturing technologies enriched the students' technical knowledge and broadened their understanding of chemical engineering applications in the cement industry. The visit was an excellent learning experience and contributed significantly to the students' professional and academic development.

Acknowledgement

The students sincerely express their gratitude to the **Department of Chemical Engineering, National Institute of Technology (NIT) Raipur**, for organizing this industrial visit. We are also thankful to the management and technical staff of **UltraTech Cement Manufacturing Plant, Hirmi**, for their warm hospitality, informative presentations, and guidance throughout the visit. Their valuable interactions and demonstrations greatly enhanced our practical understanding of cement manufacturing and industrial operations.

