

STUDY OF ELECTRICAL MAINTENANCE AND TECHNICAL SUPPORT SERVICES AT CSIR – NATIONAL CHEMICAL LABORATORY

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Abstract

Internship training was conducted at CSIR–National Chemical Laboratory within the Technical Support Service (TSS) department to gain practical exposure to industrial electrical systems, laboratory utility services, maintenance activities, and safety procedures. The training focused on the operation, inspection, and maintenance of electrical systems deployed in research laboratories and technical support facilities. Key activities included inspection of electrical equipment, monitoring of machine parameters, observation of preventive maintenance practices, troubleshooting of electrical faults, and implementation of safety measures. The study also provided knowledge of industrial power distribution systems, equipment handling procedures, and electrical safety standards applicable to laboratory environments. Overall, the internship significantly enhanced practical understanding, technical competence, teamwork, communication skills, and professional knowledge in the areas of electrical engineering and industrial maintenance.

1.INTRODUCTION

CSIR–National Chemical Laboratory (CSIR-NCL) is one of India's premier scientific research institutions, operating under the Council of Scientific and Industrial Research (CSIR). The organization is internationally recognized for its contributions to scientific research, industrial development, technological innovation, and technical support services. Internship training was carried out in the Technical Support Service (TSS) department to gain firsthand understanding of electrical system operations, maintenance workflows, laboratory utility services, and industrial safety procedures in a live research environment.

During the training period, knowledge was acquired regarding electrical maintenance practices, equipment inspection techniques, preventive maintenance strategies, and safe handling of laboratory and industrial electrical systems. The internship provided valuable industrial exposure and contributed to the development of technical skills, practical reasoning, teamwork, professional discipline, and a deeper understanding of electrical engineering applications in an institutional setting.

2.METHODOLOGY

The methodology adopted during the internship involved structured observation, hands-on inspection support, maintenance assistance, and systematic analysis of the electrical systems managed by the TSS department. The training commenced with an orientation to the laboratory environment, existing electrical infrastructure, operational safety protocols, and standard working procedures of the organization.

Activities carried out during the internship included inspection of electrical equipment, monitoring of voltage and current parameters, observation of scheduled preventive maintenance routines, identification of faults in electrical systems, and analysis of utility management operations. All activities were performed in strict adherence to safety precautions and equipment handling guidelines. The internship further encompassed the study of technical support workflows, utility management systems, and best practices in industrial maintenance, thereby enabling a holistic understanding of electrical engineering in an applied context.

3. TECHNICAL SUPPORT AND SYSTEM ANALYSIS

Electrical utility systems within the TSS department were observed and analyzed systematically throughout the internship period. Key systems studied included transformers, uninterruptible power supply (UPS) systems, electrical distribution panels, and safety systems. The analysis encompassed their operational principles, maintenance requirements, and relevance to the functioning of a modern research facility.



Fig -1: Transformer System

The transformer system was examined to understand voltage transformation principles, power distribution architecture, cooling arrangements, and protection mechanisms used in industrial electrical installations. Regular inspection and maintenance activities are conducted to ensure the safe, reliable, and efficient operation of the transformer. Detailed observation of the transformer yard provided practical insights into protection relays, tap changers, and earthing arrangements that are integral to grid-connected industrial system



Fig-2: Ups system

The UPS system provides uninterrupted power supply to critical laboratory and research equipment during grid power failure conditions. The study encompassed observation of battery bank configurations, charge-discharge cycles, power continuity management, operational safety checks, and scheduled maintenance procedures. Understanding the UPS infrastructure highlighted the importance of power reliability for sensitive research instrumentation and data integrity



Fig-3: Electrical Safety System

Electrical safety systems within the facility — including grounding and earthing arrangements, circuit breakers, residual current devices (RCDs), surge protection devices, safety signage, and emergency isolation systems — were examined in detail. Proper safety practices are enforced to prevent electrical accidents and to ensure the safe operation of all laboratory and industrial systems. Observations reinforced the significance of adhering to established safety standards and maintaining a culture of electrical safety in research environments.

4. RESULTS AND DISCUSSION

Through structured observation and maintenance support activities in the TSS department, practical understanding of electrical systems, transformer operation, UPS infrastructure, and technical support workflows was developed. The internship provided a meaningful foundation for interpreting the operational procedures followed in industrial and laboratory electrical environments. Study of the transformer system and associated distribution equipment deepened understanding of power supply management, equipment protection strategies, preventive maintenance planning, and safe electrical system operation. Participation in regular inspection activities also improved familiarity with basic troubleshooting methodologies and condition monitoring practices. Observation of the UPS systems

provided insight into the principles of uninterrupted power delivery, battery management, and the critical role of backup power in safeguarding laboratory equipment and ongoing experiments. The internship additionally strengthened competencies in equipment handling, operational safety, electrical parameter monitoring, and teamwork within a professional industrial environment — all aligned with the safety standards and maintenance protocols maintained by the TSS department.

5. CONCLUSIONS

The internship training at CSIR–National Chemical Laboratory provided comprehensive exposure to industrial electrical systems, transformer operation, UPS infrastructure, preventive maintenance practices, and technical support services within the TSS department. The training facilitated a thorough understanding of industrial working procedures, electrical safety standards, and the operation of utility systems employed in laboratory and research environments. Through observation and hands-on inspection activities, knowledge was gained in equipment handling, fault identification, electrical parameter monitoring, and structured maintenance practices applicable to industrial settings. The internship experience has meaningfully enhanced technical skills, practical reasoning, teamwork abilities, and professional competence in electrical engineering and industrial maintenance — forming a strong foundation for future professional practice

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