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A Review of Optimization of On-Site Emergency Plan in Industries-Strategies for Environment Protection & Crisis Response

Saniya Mansoori[1], AK Dwivedi[2]

[1]Research Scholar, Department of Chemical Engineering, Ujjain Engineering College, Ujjain

[2]Professor, Department of Chemical Engineering, Ujjain Engineering College, Ujjain

[3]Assistant Professor, Department of Chemical Engineering, Ujjain Engineering College, Ujjain

Abstract: ***This study focuses on evaluating and optimizing the On-Site Emergency Plan at IPCA Laboratories Ltd., Ratlam, a major pharmaceutical manufacturing unit. The handling, storage, and processing of hazardous substances create a high probability of accidents such as fires, explosions, toxic releases, and chemical spills, which, if not managed effectively, may escalate into large-scale industrial disasters. In this context, the On-Site Emergency Plan (OSEP) plays a critical role in safeguarding human life, minimizing damage to property, and protecting the surrounding environment. This thesis, titled Optimization of On-Site Emergency Plan in Industries – Strategies for Environment Protection & Crisis Response, undertakes a comprehensive evaluation of the existing emergency preparedness framework at IPCA Laboratories Ltd., Ratlam, a leading pharmaceutical manufacturing unit. Through a comprehensive evaluation of existing preparedness mechanisms, hazard identification procedures, emergency drills, and personnel responsibilities, the research highlights both the strengths and gaps in current practices.***

Keywords: Safety, On-site emergency plan, Indian pharmaceutical combined association, EHS

1. Introduction

A quick and effective response during an Emergency can have tremendous significance on whether the situation is controlled with little loss or it turns into a Major Emergency. Therefore, purpose an emergency plan is to provide basic guidance to the personnel for effectively combating such situations to minimize loss of life, damage to property and loss of property Industries that deal with hazardous materials are highly susceptible to emergencies, which can arise unexpectedly and escalate quickly. The consequences of such emergencies may range from minor injuries and equipment loss to large-scale disasters involving human fatalities and environmental degradation. To address this, industries are mandated to establish a comprehensive On-Site Emergency Plan (OSEP) that outlines the procedures, resources, and responsibilities required to handle emergencies efficiently**.** This project report, centered around IPCA Laboratories Ltd., Ratlam, investigates the structure and implementation of the company's emergency preparedness system. It also proposes improvements based on real-time observations and best practices recommended by regulatory bodies such as the Ministry of Environment, Forest and Climate Change (MoEFCC)**,** Factory Act, 1948**,** and the National Disaster Management Authority (NDMA)**.** The increasing complexity of industrial operations has amplified the risk of accidents and environmental hazards. Emergency planning has become an integral part of industrial safety, especially in chemical and pharmaceutical sectors.

A clear organizational structure is essential to define the chain of command during an emergency. This includes the appointment of a Site Main Controller, Incident Controllers, departmental heads, and supporting staff who are responsible for specific duties such as fire control, rescue operations, medical aid, and communication. The availability and accessibility of facilities such as fire hydrants, extinguishers, sprinklers, SCBA sets, first-aid centers, assembly points, wind socks, and emergency transport vehicles form the backbone of any OSEP. These facilities must be strategically located, regularly inspected, and maintained in ready-to-use condition. Advanced systems like alarm sirens, control rooms, and water storage tanks also form part of the emergency infrastructure.

1.1 Objective of Onsite Emergency Plan-

An objective of Emergency Planning is to maximize the resource utilization and combined efforts towards emergency operations are as follows.

1.1.1 During an Emergency-

a) To increase thinking accuracy and to reduce thinking time.
b) To localize the emergency and if possible eliminates it.
c) To minimize the effects of accident on people and property.
d) To take correct remedial measures in the quickest time possible to contain the incident and control it with minimum damage.
e) To prevent spreading of the damage in the other sections.
f) To mobilize the internal resources and utilize them in the most effective way.
g) To arrange rescue and treatment of causalities.

1.2.2 During Normal Time-

a) To keep the required emergency equipment in stock at right places and ensure the working condition.
b) To keep the concerned personnel fully trained in the use

of emergency equipment.

c) To give immediate warning tooth surrounding localities in case of an emergency situation arising.
d) To mobilize transport and medical treatment of the injured.
e) To get help from the local community and government officials to supplement manpower and resources.
f) To provide information to media & Government agencies, Preserving records, evidence of situation for subsequent emergency etc.

2. Literature Review

Emergency preparedness in industrial settings has evolved significantly due to increased environmental awareness and regulatory enforcement. The literature reviewed for this study spans government regulations, case studies, safety manuals, and scholarly research in the field of industrial risk management.

Studies have consistently highlighted the importance of structured emergency planning. According to Ndma, a well-prepared emergency plan can reduce response time by up to 40%. & emphasize the role of periodic mock drills in maintaining emergency readiness. Real-time hazard identification and digital monitoring tools enhance crisis response efficiency. Indian regulations like the Factories Act (1948) and Msihc Rules (1989) mandate OSEPs for hazardous industries, reinforcing their necessity. ISO 45001 is an international standard for occupational health and safety (OH&S) management systems. It provides a framework for organizations to manage risks and improve workplace safety, health, and well-being and can be Integrated with other management systems such as ISO 9001 (quality) and ISO 14001 (environment).

2.1 Practices in Other Industries

Many companies include mutual aid agreements with nearby industries, so resources like fire tenders, ambulances, and trained manpower can be shared in case of a major incident. Emergency drills are designed to be scenario-based, for example simulating a solvent spill or ammonia leak, and are carried out with participation from local authorities. Pharma industries also maintain detailed Material Safety Data Sheets (MSDS) at every unit for quick reference during emergencies. A strong focus is given to medical preparedness—many companies run Occupational Health Centres with doctors on duty and tie-ups with multi-specialty hospitals. Some industries also prepare evacuation maps for workers and nearby residents, display emergency signage across plants, and ensure that contractors and visitors are trained in basic safety procedures.

2.2 Legal Frameworks

- The Factories Act, 1948 and the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (amended 2000) mandate occupiers to prepare and implement an On-Site Emergency Plan.
- Rule 13 of the MSIHC Rules, 1989 requires industries handling hazardous substances to conduct a systematic hazard analysis and develop a site-specific emergency response plan.

NDMA Guidelines (National Disaster Management Authority, 2007):

- Emphasize the importance of community awareness, periodic mock drills, and inter-agency coordination.
- Stress proactive planning and response hierarchy.

International Benchmarks:

- OSHA (Occupational Safety and Health Administration, USA) provides frameworks for Emergency Action Plans (EAP) that includes evacuation, incident communication, and chain of command during crises.
- The ILO (International Labor Organization) emphasizes participatory risk assessment and site-specific hazard mapping.

Previous Industrial Accidents:

- The Bhopal Gas Tragedy (1984) remains a reference point for why preemptive disaster planning is essential.
- The Jaipur IOC Depot Fire (2009) also showed the importance of evacuation plans, inter-agency drills, and public warning systems.
- Multiple Fires and Explosions (2010s-2020s): Numerous incidents, such as a fire in a Kolkata chemical warehouse (2018), a chemical factory fire in Thane (11 deaths), and fires in Ghaziabad and Surat, highlight ongoing risks.

Recent Incidents (2024-2025)

- Telangana Chemical Plant Explosion (June 2025)**:** A reactor explosion at a chemical plant in Telangana's Sangareddy district killed 46 people, injured eight, and left eight missing, making it the state's worst industrial mishap.

- Maharashtra Chemical Factory Fire (June 2025): A deadly fire at a chemical factory in the MIDC area near Pune, Maharashtra, charred 18 workers, many of whom were unaware they were handling hazardous chemicals.

3. Methodology

The methodology adopted in this study was designed to systematically analyze, evaluate, and optimize the existing On-Site Emergency Plan (OSEP). Subsequently, detailed process mapping of the emergency response system was undertaken, which included evaluating the availability and readiness of emergency facilities (firefighting systems, PPEs, emergency control centers, and medical facilities) and assessing their accessibility during different scenarios. Primary data collected through site visits, structured interviews, and interactions with plant personnel, EHS managers, and emergency coordinators**.** Secondary data included company records, safety manuals, incident reports, and past drill evaluations. Special emphasis was placed on the observation of mock drills of varying intensity (low, medium, and high emergency) to assess real-time response effectiveness, communication efficiency, and coordination among departments. The methodology also included a gap analysis where strengths of the current system were benchmarked against best practices, and weaknesses such as

limited digital monitoring, inadequate community coordination, or redundant documentation were identified.

4. Conclusion

While IPCA's safety culture is strong, the evolving industrial landscape demands a transition from reactive to predictive emergency management**.** Introducing AI-driven gas detectors, remote siren triggers, cloud-based SOP updates, and integration with Sdma/Ndma platforms can optimize response time and accountability. The findings of this study highlight that the On-Site Emergency Plan (OSEP) implemented at IPCA Laboratories Ltd., Ratlam, demonstrates a robust safety framework, but at the same time reveals opportunities for modernization and integration with emerging industrial risk management practices. This project confirms the importance of OSEPs in industrial safety management. The case study demonstrates that while traditional systems offer basic resilience, optimization through digital technology and regular training can significantly enhance performance. A proactive, well-communicated plan ensures reduced environmental damage and improved personnel safety. The evaluation of the On-Site Emergency Plan at IPCA Laboratories Ltd. underscores the organization's proactive approach toward industrial safety. With extensive infrastructure, trained personnel, and a well-documented strategy, IPCA is largely compliant with national standards such as the Factories Act and MSIHC Rules. However, to further enhance safety, modernization and digitization of emergency systems are recommended. Crisis situations demand not only response but also foresight—and this project provides a roadmap to optimize preparedness, improve environmental protection, and reinforce community resilience. By addressing identified gaps, IPCA can become a model pharmaceutical unit in industrial disaster preparedness.

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