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Safety Analysis in Kudankulam Nuclear Power Plant L&T Heavy Civil Infrastructure

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ABSTRACT: *This internship is L&T Heavy civil infrastructure, Kudankulam was a great exposure as this is a core industry (Kudankulam nuclear powerplant). The major learning, which I got, is that how to establish a relationship with the client and internal stakeholders to implement safety aspects and complete the project with HSE requirements, how machineries are used in this industry with safety precautions and had a hands-on experience with the cutting-edge technologies with safe manner. I get to know more about nuclear technology its operation and maintenance, advantages which out beats the stick-built methods. I had the opportunity to witness nuclear power project, kudankulam which will be the world's second largest nuclear power plant with the production capacity of 10,000 mega watts power. I have learned to work in a corporate space, which not only enriched me professionally but also helped me grow personally as well. I get to know how each department and how they are coordinate together to complete a project successfully. Getting to know the involvement of each department helped to initialize the safety requirements. I felt that it was the right time at KKNPP3&4 as I witnessed the thermal powerplant in Chennai and Kalpakkam atomic power plant. The career path I would be selecting for myself is quite influenced from my internship as I have had a great opportunity to practically see how power plant sector is working and involving in safety. I went to the site for visual observation and assessment of risks associated with all kinds of activities at site. Visual observation helped me to point the flaws in managing health and safety. I interviewed workers, operators, and area supervisors to discuss the issues associated with their activities and to gather information about previous accidents. I used different hazard identification methods like Task analysis, referring the User manual and MSDS provided by the manufacturer to identify the hazards and risks associated with the machineries and hazardous substances used in the workplace.*
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I. INTRODUCTION:

The passive safety features used by the Kudankulam reactors include the Passive Decay Heat Removal System, an extra system for core passive flooding, Passive Filtering Systems, etc. A task team set up by NPCIL after Fukushima to assess safety discovered that the KKNPP design was secure. However, the task committee made 17 suggestions, all of which have been put into practice, to raise the degree of safety even further. These actions are the most recent and have already strengthened the safety mechanisms. Workers identify, on average, just 53% of workplace fatalities, and human actions and interventions might contribute errors through heterogeneity in hazard identification and assessment within dynamic construction contexts. Critical Controls (CCs) are specialized safety measures that (i) directly prevent the unanticipated energy release that results in large accident events, (ii) directly prevent the escalation of event consequences, or (iii) are special controls along a particular event pathway. Critical Control Risk Management (CCRM), a process used in the mining industry, has been used to implement the safety barrier concept. Using the principles of high-reliability organizations, CCRM focuses on risk treatment by defining and confirming the application and efficacy of important controls (barriers) in a model that addresses organizational and inborn human variables. In order to determine the dependability of four worldwide construction companies' Critical Controls (CCs) and to identify the variables influencing CC dependability, this study analyzed ten years' worth of serious and fatal incident investigation reports from those four companies. According to the findings, just 42% of CCs were reliably implemented and effectively. The identification of human performance components that affect the reliability of CCs included risk identification, decision-making, and competency in addition to supervision, work planning, communication, and organizational aspects [1]. The reliability of computer-based systems is investigated using a thorough literature review of the various approaches and models. In order to analyze the limitations of these models with regard to their applicability in SC systems, a case study of a nuclear power plant system was used[2]. This study examines the ways in which important safety management variables might gauge the qualities of high reliability organizations (HROs) operating in the Australian state of New South Wales' construction sector[3]. This case study offers real-world examples of how to apply EVM in building projects and while using computer applications. The article's innovation comes from the incorporation of extra sensitivity analysis that shows the effects of variables like cost growth or altered delivery dates on the trajectory of deviation curves [4]. The analysis combines theoretical and empirical data, highlighting the benefits and drawbacks of the existing literature and pointing to future directions for research. To better comprehend the current state of research, research problems, and research prospects, HRA in CPIs is compared with nuclear power plants (NPPs) [5]. This essay is based on an analysis of key works on risk management in construction. Suitable Procedures Model for evaluating building risks abroad [6].

II. RISK MANAGEMENT IN CONSTRUCTION SITE

One of the nine knowledge areas promoted by the Project Management Institute is risk management. Additionally, risk management in the context of construction project management is a thorough and organized method of finding, evaluating, and dealing with risks in order to meet the project's goals. The identification and analysis of risks, as well as the enhancement of the processes for managing building projects and the efficient use of resources, are all advantages of the risk management process.

- **Analysis of Safety in Construction:**

One of the nine knowledge areas promoted by the Project Management Institute (PMI) is risk management. The nine knowledge areas recognized by the PMBOK Guide are common to practically all projects.

- **Risk Management Area in Constructional:**

Each PMI knowledge area in itself contains some or all of the project management processes. Risk management planning; Risk identification; Qualitative risk analysis; Quantitative risk analysis; Risk response planning; Risk monitoring and control, Risk management is probably the most difficult aspect of project management.

- **Risk Analysis and Management Techniques:**

Numerous authors have provided in-depth descriptions of the risk analysis and management methods. The major steps in a typical risk management approach are as follows: Identification, evaluation, mitigation, and monitoring of risks. The first and possibly most crucial step in the risk management process is risk identification, which aims to pinpoint the origin and nature of threats.

- **Major Risk Analysis Technique:**

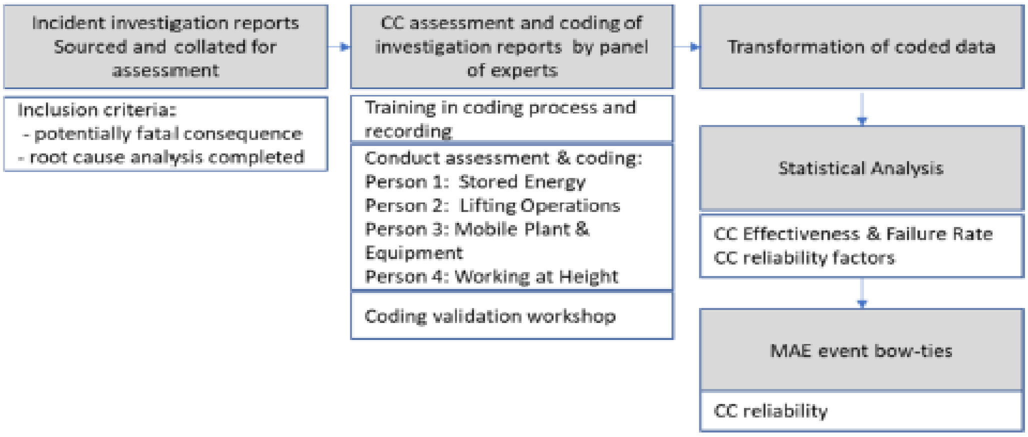
In the literature on risk assessment, qualitative and quantitative analyses are typically split into two major groups. It is possible to identify the main risk factors by a qualitative investigation. By evaluating the possibility and impact of the risks that have been found, qualitative risk analysis creates prioritized lists of the hazards that can be further examined or directly mitigated. A formal approach for qualitative risk assessment, the hierarchical risk breakdown structure (HRBS), was developed by Carr and Tah.

III. MATERIALS AND METHODS FOR CRITICAL CONTROLS IN CONSTRUCTION PROJECTS

The incidents had to have potentially lethal outcomes in order to be considered for the study, and a root cause analysis inquiry had been conducted. It is difficult to obtain genuine, potentially lethal consequence investigation reports from construction firms since they are highly confidential and frequently covered by legal privilege. The research was made possible given the sensitivity of the events and causal factors by the value of the study to the participating organizations and the aggregation of data across numerous enterprises. The researcher compiled the incident investigation papers for focus group examination by a panel of four HSE experts. The quality of the incident investigation reports was evaluated to see if it was sufficiently detailed to identify Major Accident Event ('MAE') hazards, appropriate controls, and cause elements. The reports were categorized into 11 event categories, such as Working at Height. The HSE experts evaluated all incident events from all four organizations that fell under the applicable MAE category after receiving their assigned MAE category. In order to assure alignment and consistency of assessment and coding of the events, the focus group members underwent training in the assessment technique using worked examples with a follow-up session after each member had completed five incident event evaluations.

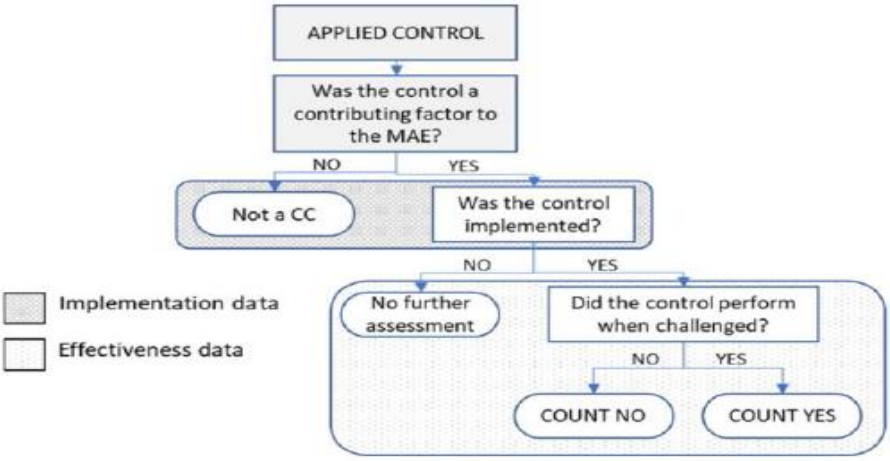
- **Research workflow:**

The research process included gathering event investigation reports for prospective accidents, coding the information, and CC reliability analysis.



➢ **Critical Control Categorization and Assessment:**

Every investigation report underwent an evaluation to identify the mechanism(s) of failure to match the event to the MAE hazard (threat), and then controls detailed in the investigation were compared to known Critical Controls (CC) defined in the Major Accident Prevention (MAP) model event classification method). Each relevant CC was evaluated to: Determine if the CC was a contributing factor in the event (yes/no). 2. Determine if CC had been implemented.3. Had the CC performed as required, i.e., was it adequate to prevent events using a rating of good, needs improvement or inadequate? 4. What was the mechanism of the injury? (List) 5. Were improvements in the of CCs required? 6. Were any improvements in CC specification or additional CCs required.



➢ **Calculating Control Reliability:**

Implementation ratio (%)=(number of times the CC was implemented /number of occasions the control was challenged)X100

CC effectiveness (%)=(number of times the CC was rated adequate (i.e., good)/number of occasions the control was challenged)X100

CC Reliability (%) = (Implementation ratio /CC effectiveness ratio)X100

Critical control reliability percentages were mapped against the MAE hazard Bowtie.

➢ **Failure Rate by CC Hierarchy of Control Type:**

For each MAE category, CC reliability ratings were compared by hierarchy of control type in order to assess CC type reliability. The participating organizations received observations on significant control gaps and improvements once they had been compiled.

➢ **Human Ethics Statement:**

A statement of ethics describes how your research will be done while respecting the rights, dignity, and welfare of your participants and other stakeholders. No harm has resulted from the focus group process or the analysis of the reports.

IV. CONCLUSION

Through the management of energies related to high-risk construction operations, the study demonstrated the validity of the controls defined for the four MAE hazard categories (Lifting Operations, Mobile Plant and Equipment, Stored Energy, and Working at Heights) as CCs. A CCRM's implementation and upkeep need a large investment of time, money, and resources—all of which are severely limited in the construction industry. Senior managers demand proof that their investment in CCRM improves safety, which is difficult to measure in the absence of events. Participants in the research from the construction industry questioned the efficacy of CCRM in preventing potentially catastrophic accidents, specifically how the organization determines that effort is being put into the "right" CCs The study was able to validate the CCs for the four MAE dangers assessed and identify any gaps in the safety management system (s)'s CC criteria, which the organizations were able to address. By comparing incident root causes to CCs and creating targeted improvement actions, the CCRM incident analysis methodology provides a framework for improving incident investigation root cause analysis. The study also point out the need for additional research on how to gauge the effectiveness of CCRM in averting serious accidents during building projects. The study shed light on the personal and institutional variables that may affect the accuracy of CCs. In the inquiry reports that were evaluated, prevalent results included human performance aspects like hazard identification, personal decision making, and competency. The inability of the worker to assess, adapt, and apply CCs to the task at hand was blamed on their lack of experience, training, or competency.

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