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SAFETY IN HYDROLOGICAL CONDITIONS AND THE ANALYSIS OF RISKS ASSOCIATED WITH HYDROTECHNICAL STRUCTURES

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The problem statement. Safety is paramount in the realm of hydrotechnical structures, where the interplay between hydrological conditions and engineering intricacies demands vigilant risk analysis. This article explores the multifaceted aspects of ensuring safety in hydrotechnical structures and delves into the comprehensive analysis of associated risks. Let's discuss some problems concerning hydrotechnical structures safety.

Research Findings. Importance of Safety in Hydrotechnical Structures: The nexus between hydrological factors and the structural integrity of hydrotechnical facilities underscores the critical need for safety measures. Recognizing the potential risks is pivotal in crafting robust strategies to mitigate adverse outcomes.

Hydrological Conditions and Their Impact: Understanding the dynamics of hydrological conditions is fundamental to assessing risks accurately. Factors such as water flow, sediment transport, and seasonal variations can significantly influence the performance and safety of hydrotechnical structures.

Structural Vulnerabilities and Risk Assessment: Identifying structural vulnerabilities is a crucial step in risk assessment. This involves a meticulous analysis of potential failure points, material fatigue, and the impact of external forces, providing insights into areas that require focused attention.

Compliance with Safety Standards: Adherence to established safety standards is a cornerstone in mitigating risks. The integration of international safety protocols ensures that hydrotechnical structures are designed, constructed, and maintained with the highest level of safety in mind.

Technological Innovations for Risk Mitigation: Embracing technological innovations enhances the safety paradigm. Advanced monitoring systems, real-time data analytics, and state-of-the-art materials contribute to early detection of risks, allowing for timely interventions and preventive measures.

Emergency Preparedness and Response: Developing robust emergency preparedness plans is essential to mitigate the consequences of unforeseen events. Training personnel to respond effectively to emergencies ensures a coordinated and efficient approach, minimizing potential damage.

Environmental Considerations: Beyond structural safety, it is imperative to consider the environmental impact of hydrotechnical projects. Integrating eco-friendly practices ensures sustainable coexistence, addressing concerns related to habitat disruption and water quality.

Case Studies and Lessons Learned: Examining past incidents provides valuable insights into refining safety measures. Case studies serve as a repository of lessons learned, offering tangible examples of successes and failures in the realm of hydrotechnical engineering.

Learning from Past Incidents: Identification of Weaknesses: Case studies allow for a thorough examination of past incidents, helping identify weaknesses and vulnerabilities in hydrotechnical systems.

Root Cause Analysis: Understanding the root causes of failures provides essential knowledge for preventing similar incidents in the future.

Refining Safety Measures: Iterative Improvement: Lessons learned from case studies guide engineers in the iterative improvement of safety measures. This process involves adjusting design parameters, construction practices, and maintenance protocols based on the insights gained [1].

Benchmarking Best Practices: Successful case studies become benchmarks for best practices in safety. They highlight successful strategies that can be replicated in similar projects.

Risk Mitigation Strategies: Tailored Solutions: Case studies offer insights into the effectiveness of different risk mitigation strategies. Engineers can tailor solutions to specific challenges based on the outcomes of past incidents.

Adaptive Planning: The adaptive planning process involves incorporating lessons learned into emergency response plans and continually updating risk assessments.

Training and Education: Educational Resource: Case studies serve as valuable educational resources for training future generations of hydrotechnical engineers. They provide practical, real-world examples that complement theoretical knowledge [2].

Scenario-based Learning: By examining case studies, professionals can engage in scenario-based learning, enhancing their ability to anticipate and address potential challenges.

Improved Decision-Making: Informed Decision-Making: Decision-makers can make more informed choices by drawing on the experiences outlined in case studies. This informed decision-making process helps ensure that projects are executed with safety at the forefront.

Crisis Response and Recovery:

Preparedness Enhancement: Case studies contribute to the enhancement of emergency preparedness. Understanding past incidents prepares response teams for similar scenarios, facilitating a quicker and more effective crisis response [3].

Post-Incident Recovery: The recovery phase is informed by lessons learned, enabling a more efficient recovery process and minimizing the impact of incidents on surrounding communities and ecosystems.

Conclusion. In conclusion, safety in hydrological conditions demands a holistic approach encompassing structural integrity, technological innovation, and environmental stewardship. By diligently assessing risks and leveraging advancements in technology, the field of hydrotechnical engineering can continue to evolve, ensuring the safety and resilience of structures in the face of dynamic hydrological challenges [1–3].

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