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An Integrated Approach for Environment Impact Assessment by the Use of Fault Tree Analysis: Literature Review

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Abstract : *The environmental impact assessment (EIA) is the key to robust environmental management of industrial projects. It is used to anticipate, evaluate and reduce the environmental and social risks of a project. This study proposes an integrated methodology of fault tree analysis, which provides means to integrate the qualitative and quantitative information for environment impact assessment for any industry or project. This literature review gives an idea about using of FTA method for environment impact assessment. The research findings illustrates that FTA method can be significantly used for the EIA.*

Key Words: **FAULT TREE ANALYSIS, ENVIRONMENT IMPACT ASSESSMENT, BOOLEAN LOGIC, EIA NORMS.**

1. INTRODUCTION

Environmental Impact Assessment (EIA) is the formal process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior to the decision to move forward with the proposed action. Formal impact assessments may be governed by rules of administrative procedure regarding public participation and documentation of decision making, and may be subject to judicial review.

The environmental impact assessment (EIA) is a procedure for assessing the likely environmental impact of a proposed project or planned development, taking into account the socio-economic, cultural and health effects, depending on each other, both beneficial and negative. There many more definition are given such as by UNEP defines Environmental Impact Assessment (EIA) as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers

EIA is an inherently complex, multi-dimensional process. Maybe because of this complexity,

The implementation of the EIA is not entirely satisfactory

(e.g. Moon, 1998). New innovations and methods may be needed to improve the EIA process.

In fact, the EIA process is evolving Since its adoption to analyze the environmental impact of development projects.

Fault Tree Analysis (FTA) is a top-down deductive failure analysis that analyzes an undesirable state of a system using Boolean logic to combine a series of lower-level events.

FTA follows the concept of Boolean logic, which permits the creation of a series of statements based on True / False.This method also provides valuable troubleshooting information when applied to problem solving and FTA diagram often utilizes failure probabilities at each level, from components and software to the undesirable Top-level event.

This literature review provides a systemic approach for environmental assessment by use FTA diagram and methodology of constructing the FTA diagram.

2. Environment impact assessment EIA

EIA as a mandatory regulatory procedure originated in the early 1970s, with the implementation of the National Environment Policy Act (NEPA) 1969 in the US. A large part of the initial development took place in a few high-income countries, like Canada, Australia, and New Zealand (1973-74)

Environmental impact assessment, or sometimes simply environmental assessment (EA), is recognized in a large number of international conventions, protocols and agreements, including: The Convention on Tran boundary Environmental Impact Assessment; the Convention on Wetlands of International Importance; the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters; the United Nations Framework Convention on Climate Change; the United Nations Convention on the Law of the Sea; the Protocol on Environmental Protection to the Antarctic Treaty.

Current EIA problems: theory, practice and

Efficiency

Ortolano and Shepherd (1995, p. 3) state that they have had "much less influence than their original followers

hoped they would influence the project and the plan Decision making and identification of a number of areas Concern: different views on nature and purpose the EIA and in particular its relationship to decision making Process; Problems of institutional implementation; Problems related to practice, including a limited or non-existent audience Participation; and the limited essential impact of the EIA as Process.

Retief (2010) addresses these concerns Identified the three main topics based on a review of the international literature on environmental assessment:

.Theoretical basics - do we have a clear feeling for it?

The purpose of environmental assessment and what

is it?

.Quality - what are good practices, how to judge?

.Quality, what advice do we give?

.Efficiency - what do we get from it?

.Process?

These three are used in the following discussion of the problems big issues, but replace quality with practice as the key Consideration of the second topic, since it a broader perspective. Public participation is

Priority in practical questions as a topic has evolved significantly over the past 20 years Forms of impact assessment remain the source of many Problems with practical impact assessments.

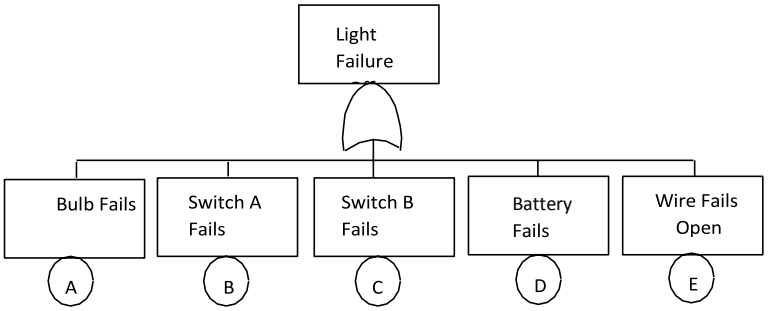
3. FAULT-TREE ANALYSIS

Fault Tree Analysis (FTA) was first introduced by Bell Laboratories and is one of the most commonly used methods for analyzing the reliability, maintainability and security of the system. It is a deductive process that identifies the various combinations of hardware and software errors and human errors that can cause unwanted events (so-called main events) at the system level.

The deductive analysis begins with a general conclusion and then tries to determine the specific causes of the conclusion by creating a logical diagram called the fault tree. This is also known as a top-down approach.

The main goal of fault tree analysis is to identify the potential causes of system failures before they actually occur. It can also be used to assess the likelihood of the highest event using analytical or statistical methods. These calculations include quantitative information about the reliability and maintainability of the system, such as: B. the probability of failure, the failure rate and the repair rate. After signing a free trade agreement, you can focus on improving system security and reliability.

The below figure is an example of fta diagram which shows failure of light which is caused due to failure of subsystem such as failure of bulb, switch, battery, wire.



FTA DIAGRAM

Fault tree construction

To complete a full free trade agreement:

1. Define the error condition and note the top-level error.

2. Use technical information and professional judgment to determine the possible reasons for the error. Remember that these are second level elements as they are just below the top level error in the tree view.

3. Disassemble each element with additional doors on the lower levels. Consider the relationships between the elements to decide to use a logical "and" or "or" port.

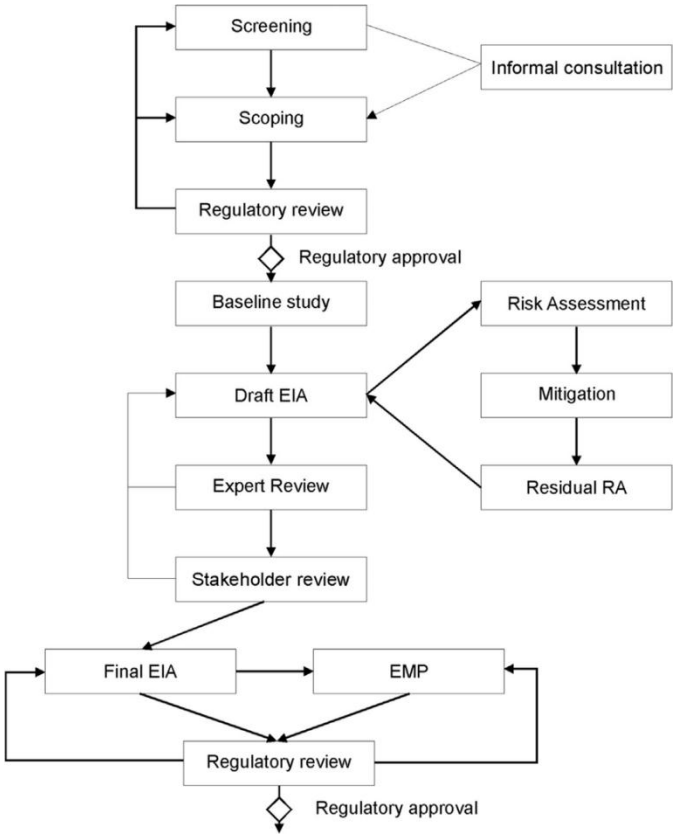
4. Finalize and review the full diagram. The chain can only end with one fundamental error: human, hardware or software.

5. If possible, evaluate the probability of occurrence for each of the lower level elements and calculate the statistical probabilities from bottom to top.

METHODOLOGY:

In this research, an integrated approach of FTA methodology for analyzing and assessing the environment impact due to certain project or plane. As the EIA process contains different stapes such as,

- Screening
- Scoping
- Prediction and Mitigation
- Management and Monitoring
- Audit



Whereas FTA analysis consist of four steps.

1. System definition
2. Fault tree construction
3. Qualitative evaluation
4. Quantitative evaluation

This literature review suggest to combine the FTA methodology to EIA process for any industry or organization to have a

Hence these can be done easily by knowing the FTA diagram for the project or industry. And this knowledge of assessment can help in determining different stages of failure and fault.

3. CONCLUSIONS

This research present a structure framework for understanding and application of fault tree analysis method for environment impact assessment for any organizations i.e. manufacturing industry, power plant building, aeroplane building or any human activity which could harm the environment which subsequently harm the livings.

This present study proposes an operational model for EIA for any project or plane or industry by just constructing the FTA diagram for the project or industry. As by drawing the FTA diagram the critical area or system can be easily understood this can help us in assessing the environment impact of project which helps in reducing the impact or harm on ecosystem or livings.

Nonetheless, the complexity in the selection of criteria and sub-criteria might be the challenge for the prospective of FTA diagram. Additional study has to be done to have a complete synergic study of fault and impact on environment.

Finally, the present study provides an opportunity to the case industry to manage their environment emission and certainly, the finding of this study would significant for enhancing the process of EIA effectively and efficiently.

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