A STUDY ON ASSESSING THE RISK INVOLVED IN FIRE HAZARDS

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Abstract - *The Study investigated to acquire an overall idea about risk and its consequences in construction field and the process required for its management in India. The effect of risk on assessment of a project is discussed along with the tools and methods adopted to manage risk in industry. Based on the review, underlying cause of current limitations in fire protection measures is identified as lack of a holistic framework to mitigate fire hazard. The present study develops an approach to integrate fire safety assessment and decision making using the Relative important index (RII) and Cronbach's Alpha Value (C.A.V.) method. Strategies utilized incorporates; actual perceptions, report survey and poll interviews. The study finding shows at solving fire protection measures of high-rise residential building and other and provide some practical value, assessment of fire safety and establishment of precautionary emergency program. The methodology can be utilized to assist with diminishing the likelihood of fire event and seriousness of potential outcomes during the fire risk. The investigation provides the application of Delphi method for determining the 20 factors causes of fire and 20 factors fire protection measures ranking by Relative important index (RII) method for causes of fire along with Cronbach's Alpha (C.A.V.) method for fire protection measures.*

Key Words: Fire Protection, short circuits, Detonation, Gas and Chemical Explosion, RII method and CAV method.

I. INTRODUCTION

A fire can happen at any time at any place irrespective of its occupancy status. You can expect a fire at any structure, may be at your home or at your workplace or in a hospital or in public places like theatres, malls, etc. Fire in any occupancy has the potential to cause harm to its occupants and severe damage to property. Fire plays a significant part role in society from the viewpoints of human safety and economics, and it has become an important aspect of human civilization. With the rapid development of India's national economy, fire constitutes a major threat to life and property in urban and rural areas. There are various models that compute the fire chances in structures. RII and CRONBACH ALPHA method are used to calculate the expected fire risk expectation. However, these methods represent fire factors. The goal of this paper is to utilize statistics to collect information and gain an understanding of elements affecting fire risk. Fire risks in residential buildings can be predicted based on fire statistics to better respond to fire incidents factors. Additionally, fire measurements information offer an amazing method to gain from genuine occasions, and the chance to investigate expected ways to deal with fire misfortune decrease. Fire Safety Audit is found to be an effective tool for assessing fire Safety standards of an organization or occupancy. All in all, it is meant to survey the structure for consistence with the National Building Code of India, pertinent Indian Standards and the enactments instituted by State Governments and Local Bodies, on fire prevention, fire protection and life safety measures. A small fire in a residential building may be spread very fast and within a few minutes it can reach a stage beyond the control of its occupants and ultimately seek the help of fire brigade to carry out a major firefighting operation. During the last one decade there was a vibrant growth in the constructions activities in India, especially in High Rise buildings. Thousands of High Rise buildings have already constructed in metros and major cities in India, and thousands are under construction. On account of its exceptional nature, fire in private structures specifically, tall structures become more mind boggling and the rescuing tasks become more troublesome and once in a while in any event, coming about in many deaths and huge property losses.

II. OBJECTIVE

To identify the factor that influence fire hazards.

To develop a survey instrument measuring the importance of factor influencing fire safety.

To develop conclusions for improvement of fire safety management

III. LITERATURE REVIEW

Literature review: general literature review is done for carrying out the project. The details of the various references and the interferences from those references are discussed in below.

Noah Akhimien, Adamolekun M.O. (2017) the point of this investigation was to look at fire wellbeing measures and their suitability in structures, the necessary measures are innovation based. Structures ought to be planned so that inhabitants can escape without anyone else if there should be an occurrence of fire. In any case, contextual analyses shows that tenant frequently are found unfit to escape on schedule and customarily sabotage safeguard measures needed to stay away from or get away from fire. The investigation system depended on episode assessments and genuine analyses, for example, unannounced departure drills. The prospects of computer generated reality for considering human conduct in flames are so far scarcely embraced by scientists. In any case, since in virtual conditions test people can be confronted with the marvel of fire in a protected manner, Data was additionally gathered from books, magazines, diaries and related articles, the utilization of a conduct appraisal and examination instrument in computer generated simulation is relied upon to be an important enhancement on the current exploration techniques. Overall little data is thought about real human conduct in an occasion of fire flare-up.

Mr. C. Ravi Kumar and Mr. A. Varadharaj (2018) Different angles introduced by different creators on work wellbeing in development were examined and broke down. Itemized examination of information gives the reasons for fatalities in development industry. Falls are the absolute most normal reason, trailed by struck-by-occurrences, trapped/in the middle of cases and electric shock. A few examinations notice issues like low quality work, risky working conditions, and absence of natural control can be improved by receiving security rules and guidelines. Significant reasons for word related and security disappointments were insufficient wellbeing training, deficient guidance, helpless housekeeping and 'wilful offense'. In one examination, it is referenced that all building destinations have special parts of wellbeing to be thought of**.**

N Rodhi, N Anwar, I P A Wiguna (2018) Oil and gas projects are in danger because of the monstrous capital venture, the contribution of numerous gatherings, the utilization of complex innovation, just as the high ecological and social effects. The danger is the chance of the event of some dubious, unforeseen, and surprisingly undesirable occasions, which will change the likelihood prospect of a given venture. Notwithstanding the intricate dangers, perils conceivably lead to catastrophes in the oil and gas projects. These dangers can unquestionably be expected with the utilization of hazard the executives, however an unsystematic and insufficient execution of hazard the board will in any case bring unfriendly effects.

As per the eleven danger the board standards in ISO 31000:2009, the use of hazard the executives should focus on all angles, both inside and outside factors. Subsequently, this paper means to distinguish factors that could influence the fiasco moderation endeavors of oil and gas projects. This examination started with writing study to decide the issues of hazard the board in oil and gas projects, so the influencing factors as the investigation destinations can be indicated consequently dependent on the writing audit also. The factors that should be considered in the endeavors of catastrophe hazard relief of oil and gas project are the danger elements and manageability viewpoint.

Ramaswamy S.N., Nampoothiri N.V.N. furthermore, Sekar T. (2019) Accidental blasts causing artificial catastrophes are accounted for consistently during the assembling of fireworks and wellbeing matches in Sivakasi district of Tamil Nadu in South India. Sivakasi is notable as "Scaled down Japan‖ (or — Kutty Japan‖) and is well known for the production of fireworks and security matches. Mud block workmanship is utilized for the development of modern constructions for the assembling of firecrackers and match work items which don't consolidate any blast opposing highlights. Artificial fiascos because of unplanned blasts while fabricating fireworks are accounted for frequently in India. These inadvertent catastrophes additionally cause breakdown of block brick work structures prompting loss of living souls and foundation consistently. The investigations were led utilizing ANSYS programming. In view of the limit worth of avoidance as one 10th of divider thickness of block brick work, a gauge of the amount of synthetic compounds that can be utilized in an assembling shed, for different blast opposing highlights is proposed so that breakdown of designs causing catastrophes can be limited.

Ji-Myong Kim, Taehui Kim, Junseo Bae, Kiyoung Son & Sungjin Ahn (2019) There are numerous dangers and vulnerabilities in plant development projects, on account of their intricacy, trouble in misfortune forecast and size of development being enormous. The danger the executives of plant development undertakings ought not be depended entirely on encounters and instinct of the project workers or the development directors as it has been before. Accordingly, another quantitative and experimental danger investigation is needed, all together for the advancement of a danger appraisal utilizing hazard pointers for the plant development projects. This exploration utilized the protection payout record from a worldwide insurance agency to mirror the genuine quantitative misfortune in the danger appraisal model for plant development project. The analysts embraced the geographic data just as development data (development

stage and dispatching stage, plan rate, absolute length), as the autonomous factors, which discovered to be genuinely huge in the examination in this investigation. It was tracked down that the connection between harm proportion and the substantial factors was measurably critical, and along these lines, the harm model is additionally genuinely huge. This examination proposes that the relapse model containing such substantial free factors could be helpful as far as giving basic rules to the plant development project hazard investigation.

Brian Meacham and Margaret McNamee (2020) The Fire Protection Research Foundation (FPRF) upheld a writing survey identified with fire wellbeing difficulties of 'green' (supportable) building materials, frameworks (advances) and highlights. The points of that work were to: distinguish reported fire episodes in 'green' structures; characterize a particular arrangement of components in 'green' building configuration, including setup and materials, which, without relieving techniques, increment fire hazard, decline security or reduction building execution in correlation with 'conventional' development; recognize and sum up existing best practice contextual investigations in which the danger presented by explicit 'green' building plan components has been unequivocally tended to; and aggregate examination contemplates identified with consolidating building wellbeing, life security and fire security as an express component in 'green' building files, distinguishing holes and explicit required exploration regions.

IV. RESEARCH METHODOLOGY

The quantitative research method adopts a deductive and objective view, which is characterized by tangible data such as counts, weight, mass, and other physical measures. Quantitative research is generally based on two research methods namely survey and experimentation. A survey involves either interviewing or administering questionnaires to a sample of research respondents. In experimentation, observations of the phenomenon of interest occur under deliberately controlled conditions produced by the researcher. The advantage of the quantitative approach is that it measures the reactions of a great many people to a limited set of questions, thus facilitating comparisons and statistical aggregation of the data, and so the results can be generalized.

AIMS AND OBJCETIVES OF RSEARCH

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LITERATURE REVIEW

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QUESTIONNAIRE SURVEY

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DATA COLLECTION

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DATA ANALYSIS

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RESULT AND DISCUSSION

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CONCLUSION AND RECOMMENDATIONS

METHODOLOGY FLOW CHART

V. QUESTIONNAIRE DESIGN

In this research, quantitative research was adopted by using questionnaires to collect the sufficient data due to the consideration for time constrain. The data has been collected by using survey approach. The survey questionnaires have been distributed to the fire engineer, fire safety inspector and peoples firm by online is demographics information which is intended to solicit respondent's information and such information will be used to determine the profile of respondents. Along with various type of approach has been adopted for the following questions in the survey research. And asked to give rating on the scale of 1 to 5 for each risk. Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.

VI. DATA COLLECTION

A scaled item type questionnaire was used following a format designed to facilitate an optimal response rate questions. The fixed alternative type of question was included in the questionnaire to allow respondents to answer factual questions such as, most preferred method of fire risk management, factors which are responsible for fire generation, which could then be statistically analysed.

VII. DATA ANALYSIS

Once the data had successfully collected, the researcher sorted the same and coded it appropriately for

determination work. In this research progressed work SSP and Excel software have used to determine and analyze the statistical data which had collected by the questionnaire survey that's why as to carry out the data analysis in this research.

A. **Relative Important Index method-** Data of all these tables was analyzed by RII method was calculated for each type of claims as follows;

$$RII = \frac{\sum W}{AXN}$$

WHERE,'W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 this case), and N is the total number of respondents.

Table-1 Relative Important Index method

Sr. No.	Questions	RII by Civilians	RII by Fire Safety Engineers	Average Of RII	RANK
1	Overloaded circuits/short circuit	0.846	0.886	0.866	1
2	Flammable gases and liquids	0.86	0.826	0.843	3
3	Cooking gas Cylinder/Stove	0.866	0.866	0.866	1
4	Fire risks involving chemical oxidizers	0.866	0.853	0.859	2
5	Hot working	0.833	0.833	0.833	5
6	Arson	0.84	0.846	0.843	3
7	Temporary lighting and lamps	0.78	0.733	0.756	15
8	Portable heaters	0.813	0.813	0.813	6
9	Plugging too many things in same extension cord	0.773	0.800	0.786	8
10	Fire retardant scaffold and temporary covering materials	0.84	0.833	0.836	4
11	Old/ defective wiring	0.766	0.840	0.803	7
12	Overloaded outlets	0.733	0.780	0.756	15
13	Loose connections	0.733	0.780	0.756	15
14	Faulty fuses	0.74	0.793	0.766	12
15	Compressed gases	0.733	0.766	0.749	
16	Poor inspection	0.76	0.766	0.763	13
17	Less hydrant system equipment (sprinkler & extinguisher)	0.793	0.726	0.759	14

18	Not properly assign instruction of sign board and equipment	0.8	0.760	0.78	11
19	Mean of egress (escape routes)	0.826	0.733	0.779	10
20	Fire doors/ exit closer	0.813	0.753	0.783	9

B. **Data analysis by SPSS Software-** after the collecting, cronbach's alpha value was found out by using SPSS software to check the Reliability of the survey.

Cronbach's alpha	Internal consistency
α ≥ 0.9	Excellent
0.9 > α ≥ 0.8	Good
0.8 > α ≥ 0.7	Acceptable
0.7 > α ≥ 0.6	Questionable
0.6 > α ≥ 0.5	Poor
0.5 > α	Unacceptable

❖ **Reliability of data by Civilians**

Reliability of data by Civilians

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.851	.855	20

Table-2 Item-Total Statistics (Cronbach's Alpha if Item Deleted)

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Overloaded circuits/short circuit	75.5172	70.473	.459	.721	.844
Flammable gases and liquids	75.4483	71.399	.348	.709	.848
Cooking gas Cylinder/Stove	75.3793	69.672	.545	.758	.842
Fire risks involving chemical oxidizers	75.3793	65.530	.676	.893	.834
Hot working	75.5517	70.256	.409	.758	.845
Arson	75.5172	72.116	.298	.818	.849
Temporary lighting and lamps	76.1034	68.167	.446	.595	.844
Portable heaters	75.6897	72.150	.238	.611	.851

Plugging too many things in same extension cord	75.9655	69.892	.322	.690	.849
Fire retardant scaffold and temporary covering materials	75.4828	71.187	.250	.611	.852
Old/ defective wiring	75.8966	67.239	.413	.835	.846
Overloaded outlets	76.1034	67.096	.473	.669	.843
Loose connections	76.0690	65.138	.636	.892	.835
Faulty fuses	75.8276	66.005	.637	.864	.836
Compressed gases	76.0690	71.067	.265	.764	.851
Poor inspection	75.9310	64.567	.530	.814	.840
Less hydrant system equipment (sprinkler & extinguisher)	75.7931	66.884	.584	.788	.838
Not properly assign instruction of sign board and equipment	75.7586	68.261	.566	.761	.840
Mean of egress (escape routes)	75.5862	71.180	.208	.654	.855
Fire doors/ exit closer	75.6897	67.650	.508	.709	.841

Cronbach's alpha value of Civilians has found to be 0.851, as the value is within .7 to 1 that's why data is reliable.

❖ **Reliability of data by fire safety engineers**

Reliability of data by fire safety engineers

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.914	.925	20

Table-3 Item-Total Statistics (Cronbach's Alpha if Item Deleted)

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Overloaded circuits/short circuit	75.5333	111.637	.605	.	.910
Flammable gases and liquids	75.8333	107.385	.749	.	.906
Cooking gas Cylinder/Stove	75.6333	109.275	.819	.	.906
Fire risks involving chemical oxidizers	75.7000	108.493	.835	.	.906
Hot working	75.8000	106.648	.780	.	.905
Arson	75.7333	107.789	.836	.	.905
Temporary lighting and lamps	76.3000	110.493	.448	.	.913
Portable heaters	75.9000	110.507	.435	.	.913

Plugging too many things in same extension cord	75.9667	113.551	.375	.	.914
Fire retardant scaffold and temporary covering materials	75.8000	106.648	.780	.	.905
Old/ defective wiring	75.7667	107.289	.827	.	.905
Overloaded outlets	76.0667	111.237	.454	.	.912
Loose connections	76.0667	111.237	.454	.	.912
Faulty fuses	76.0000	106.138	.602	.	.909
Compressed gases	76.1333	104.189	.620	.	.909
Poor inspection	76.1333	104.120	.689	.	.906
Less hydrant system equipment (sprinkler & extinguisher)	76.3333	110.092	.426	.	.913
Not properly assign instruction of sign board and equipment	76.1667	104.489	.583	.	.910
Mean of egress (escape routes)	76.3000	121.321	-.108	.	.924
Fire doors/ exit closer	76.2000	103.890	.588	.	.910

Cronbach's alpha value of Civilians has found to be 0.914, as the value is within .7 to 1 that's why data is reliable.

VIII. CONCLUSIONS

Cronbach's alpha value of Civilians has found to be 0.851, as the value is within .7 to 1 that's why data is reliable.

Cronbach's alpha value of Civilians has found to be 0.914, as the value is within .7 to 1 that's why data is reliable. So all factor are play a vital role.

It was found according to civilians and fire safety engineers, Overloaded circuits/short circuit and Cooking gas Cylinder/Stove are major reason for fire accident.

Based on above literature review and the directed study it could be concluded that the assessing the risk involved in fire risk management. This paper presented a detailed review on the history of design, research and education of fire safety engineering. An effectively implemented fire safety management ensures total safety to buildings. Private offices are known to be high-hazard sort of structures to fire event. Fire safety in residential facilities should be maintained in an appropriate level to safeguard the life of occupants and protect properties. This paper assists with evaluating the arrangement of fire insurance measures for alleviation the danger of instances of fire. The study concludes with the development of risk analysis checklist and protection measures checklist which includes 20 factors causes of fire and 20 factors fire protection measures which is verified as acceptable or adequate by field survey of firefighters. The specific

findings of research study shows that satisfy overall fire safety for this case study. It was found that the development of fire safety engineering was significantly driven by big city fires at the early stage, industry revolution and government regulation and international/national organizations. The education in fire safety engineering should pay more attention on fundamental knowledge on fire science and performance based fire safety techniques.

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