QUALITATIVE RISK ASSESSMENT IN AUTOMOBILE INDUSTRIES

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ABSTRACT

A risk assessment is involves identifying the hazards present in any working environment or arising out of commercial & work activities, and evaluating the extent of the risks involved, taking into account existing precautions & their effectiveness. Hazards Identification and Risk Management is a structured technique in which a multi-discipline team performs a systematic study of a process to minimize risk level. An unsafe condition action or situation. Risk is the probability of frequency of hazards during a certain period (e.g. 2 explosions per year, 20 fires per year, 5 accidents per month, 200 fatalities per year, 1 disaster per 10 years etc.) Therefore if hazard is identified and removed first, risk is automatically reduced. in automobile industries melting of alloys is very hazards process. All experts of departments studying in group discussion for to identified hazards as risk of process with work activity with required documents such MSDS,P&ID, accident date, process flow diagram etc. The benefits of risk assessment to prevention of accidents, incidents, ill health & their associated costs. Legal compliance. Reduction in claims & complaints. Reduced insurance premiums. Allows financial planning of progressive risk reduction measures. Involvement of staff in process encourages consultation, increases hazard awareness and ownership & contributes to positive H&S culture. May also increase quality standards, efficiency & productivity.

Keyword: *Hazard identification and risk assessment (QRA)*

1. INTRODUCTION

SSWL are based at Mehsana in designs & manufacture automotive alloy steel wheels since 1991. The State of Art facilities of SSWL cater to widest range of Domestic & Global Automobile customers' demands with highest quality standards benchmarks. SSWL are leading supplier to Indian & Global Automobile Manufacturers for Steel wheels of two and three Wheelers, Passenger cars, Multi utility vehicles, Tractors, Trucks & OTR Vehicles. The company complies with all relevant international quality and product safety standards and maintains ISO/TS 16949 - for design, manufacturing and marketing of automotive and non-automotive steel wheel. With regard to Environmental, Health and Safety as well as Social Management, the integral management systems are certified in accordance with ISO 14001, OHSAS 18001. The companies apply Total Quality Management principles across the organization and have adopted the best business practices. SSWL are focused on and are committed to achieve Total Customer Satisfaction by providing products and services which meet and exceed the customer expectations.

2. RISK ASSESSMENT OF PROCESS AND WORK ACTIVITY

A risk assessment involves identifying the hazards present in any working environment or arising out of commercial & work activities, and evaluating the extent of the risks involved, taking into account existing precautions & their effectiveness.

3. LITERATURE REVIEW

Quantitative Risk Assessment (QRA) is the means by which "Risk" for a hazard can be expressed as a scalar value that is a function of that hazard's frequency and consequence. In other words, the product of frequency and consequence is used to generate a numerical value for risk from a particular hazard that can be compared to other risks from other hazards that are calculated in the same manner. Quantitative risk assessment allows for the comparison of risk reduction options for a particular hazard on an equivalent basis, as well as allowing for the comparison of risks that are generated from separate and unique hazards (i.e. fire and explosion risks versus transport accidents).

Because quantitative risk assessment represents risk as scalar values, standard mathematic functions can also be applied to the results of the quantification. The sum of all risks for all hazards at a facility gives an indication of the overall risk for that facility, while the sum of all risks in each particular area of the facility give an indication as to which locations or equipment sections are the most hazardous.

4. PROBLEM FORMULATION

Several accidents are occurs inside the industries and the owner of the factory face many problem like loss of the trained worker, loss of production, loss of materials. There are various challenges in the heavy industry. In field of industry every day an accident is occurred due to unawareness, lack training, absence of personal protective equipment etc. The manufacturing industry involves complex and dynamic work environments that present new hazards to workers on a daily, or even hourly, basis. As a result of the complicated and constantly changing nature of lifting operations, the manufacturing industry has very high injury and fatality rates compared to other industries. According to Director industrial safety & health of government of Gujarat data for 2014, in that year, there were 259 fatal recorded which is high compared by 2013. These all industries if effectively indentified hazards of process and activity hence such types of accident may preventable.

5. METHODLOGY

Regardless of the type of hazard being evaluated, quantitative risk assessment always includes the same general steps.

1. Hazard Identification
2. Consequence Assessment
3. Frequency Assessment
4. Risk Characterization

Depending on the area of risk, the second and third steps may be identified slightly differently (for example in a chemical exposure QRA, the steps are called toxicity assessment and exposure assessment), but they still deal with consequence and frequency of occurrence.

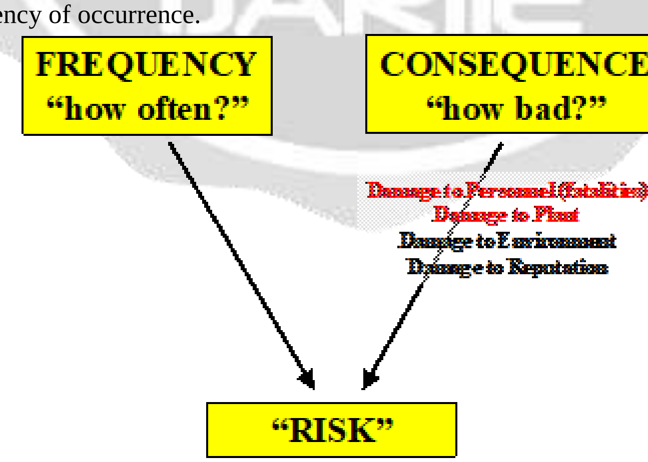
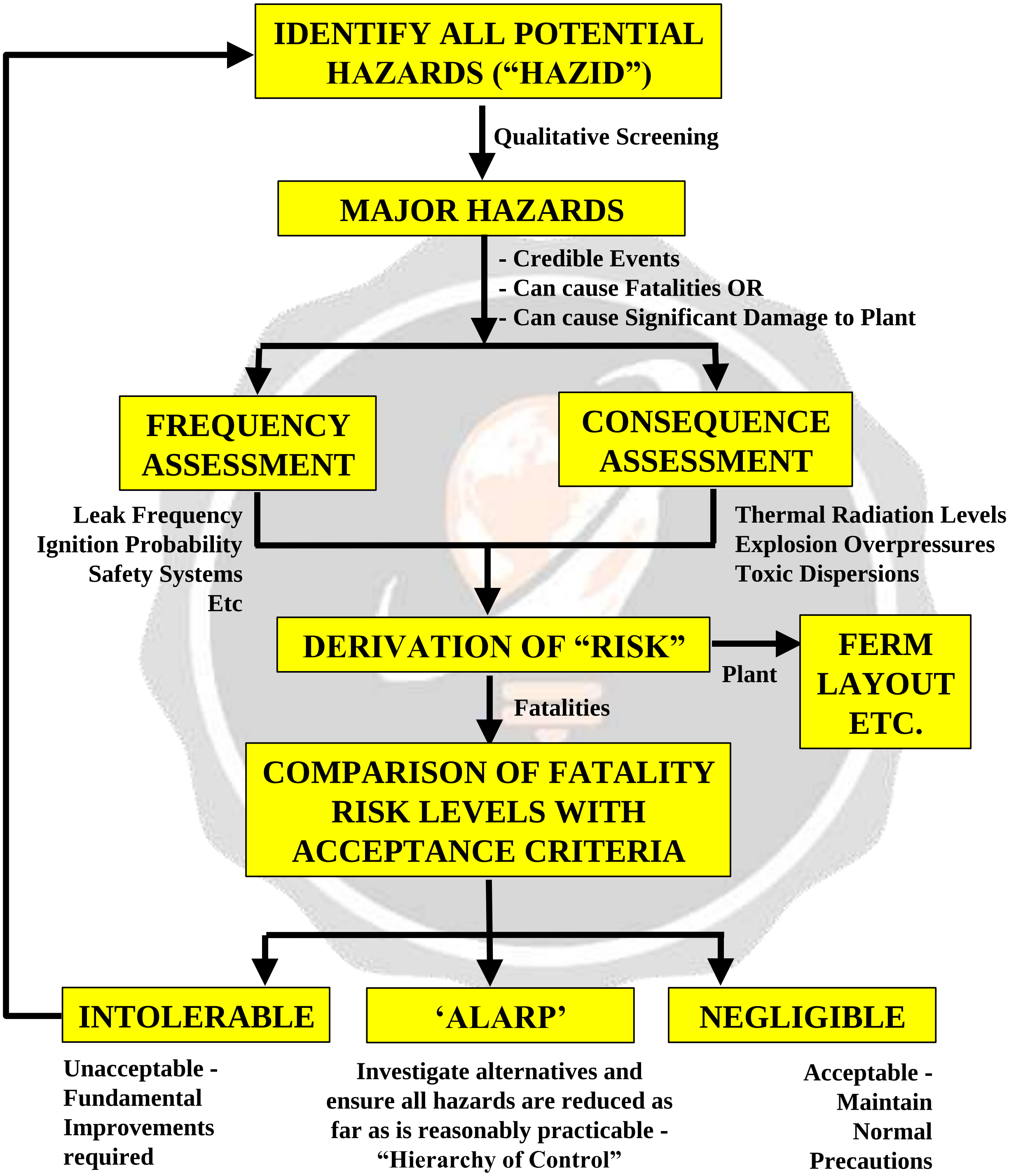


Fig. 1: Bar graph of Average of all Responses

A graphical representation of the QRA process is presented in the following figure.



5.1 General Methodology

QRAs are concerned with actual and potential major incidents only, which in many cases can be defined in terms of fatalities or major plant damage. Hazards are therefore to be screened using qualitative methods first so that the number of hazards that require quantitative assessment can be reduced in number. The steps to be carried out for completion of a QRA are described broadly as follows. Specific guidance and examples can be found in the appendices to this document where indicated, and in the reference documents of this specification.

1. Hazard identification

Formal approaches exist to identify hazards and top events including Hazard Identification (HAZID), Hazard and Operability studies (HAZOP), and Failure Mode and Effect Analysis (FMEA). The most powerful tools for identification of events that may create incidents are imagination combined with experience. For this reason, a brainstorming session with those personnel involved in the design and operation of a process is often effective in determining a list of top events. In this identification step it is important to list all hazardous events and not start rejecting them on the basis of their rare occurrence or small effects.

2. Reduction of top events

Once the hazardous top events have been identified, attempts should be made to immediately eliminate them if at all possible, rather than continue on with the process of evaluating those that can be avoided.

3. Develop incident scenarios

Events should be developed into incidents through the use of Event Tree analysis. Additional information on the use of Event Trees and examples are provided in Appendix B.

4. Estimate the likelihood of events

The estimation of frequencies and probabilities of events in Event Trees is based either directly on statistical analysis of historical data, or derived from the use of Fault Trees. When historical data is not available, or only available for facilities operating in different circumstances, it is necessary to rely on the opinion of experts to interpret data for comparable equipment in order to make the best estimate. Additional information on event frequencies is available in Appendix B.

5. Assess consequences

An assessment of the consequences is required for the scenarios in which the failure of the safety systems and the absence of mitigating factors leads to an escalation of the hazardous event. Physical effects from the release of hydrocarbons or toxic material such as dispersion, explosion over-pressures and heat radiation have to be calculated to assess whether escalation is a realistic possibility and the extent of the damage following the escalation. Important factors such as leakage rate and time dependence need to be calculated during consequence assessment prior to the determination of actual damages to people, assets and the environment.

6. Calculate potential loss

Once the frequency and consequence for each scenario are determined as statistical quantities, potential loss for each scenario can be calculated as the product of the frequency and consequence values. Total potential loss can also be determined as the sum of the potential loss for each discreet scenario.

7. Determine risk to personnel

Risk to people is typically expressed as a rate of injury or fatality (such as the fatal accident rate, FAR) on an hourly exposure basis. If this type of value is required, the rate of loss per hours of exposure to any particular hazard can be determined, and the overall rate can be determined from the total potential loss per overall exposure time.

The statistic potential loss of life (PLL) is often calculated for the evaluation of small work-related incidents and transport accidents. The PLL is determined by summing the product of the fatal accident rate and the exposure hours for any number of incidents that could occur in a typical operation. The PLL statistic is typically determined to show the potential in lives lost for specific operations that may include a number of hazardous events (such as drilling a well).

6. FORMAT FOR IDENTIFICATION OF OHS HAZARDS AND RISK / RISK ASSESSMENT/ RISK MANAGEMENT MEASURE.

Risk Identification								Risk Assessment				Over riding factor (LC/ DC/ Any other)	Risk Control Measure and Ref. Document (if any)
Activity	Hazard	Condition			Adequacy of Measure		Risk	Severity S = L x C		Total	Risk Classification		
		D/I	R/NR	N/A N/E	Existing	Gaps, if any	Nature of Possible Consequence	Likelihood L	Level of Consequence C				

- Likelihood includes Probability of Hazardous Event Occurring / may occur.
- Risk Control Measures Examples: (Technology / Physical improvement / Management Programs /Operational control or procedure/ Training/ Supervision or monitoring / usage of PPE / Competence / Strengthening of Contract Documents / others including emergency preparedness).

6.1 CRITERIA FOR QUALITATIVE AND QUANTITATIVE RISK ASSESSMENT

RISK IDENTIFICATION								RISK ASSESSMENT				OVERRIDING FACTOR (LC/ DC/ ANY OTHER)	RISK CONTROL MEASURE	REF DOC.
ACTIVITY	HAZARD	CONDITION			ADEQUACY OF MEASURE		RISK	SEVERITY S = LXC		TOTAL	RISK CLASSIFICATION			
		D/I	R/NR	N/AN/E	EXISTING	GAPS, IF ANY	POSSIBLE CONSEQUENCE	LIKELI-HOOD (L)	LEVEL OF CONSEQUENCE (C)					
								HUL (1)	SH (2)					
								UL (2)	Harmful (4)					
								Likely (3)	Very Harmful (6)					
								Very Likely (4)	EH (8)					

- **Likelihood** – Possibility of occurrence of risks based on present gaps (technological / operational / competence measurement and monitoring);

- **Level of consequence** – Refer Guidance criteria for this i.e. possible degree of damage; **LC** – Legal Concern - if identified OHS hazards are risks is governed by Indian OHS Legislation, **DC** – Domino Concern – Source or Situation can Trigger of Chain of Accidents, Non-Tolerable OHS Risks Measures -The Substantial and Intolerable risks shall be treated as non-tolerable OHS risks, requiring risk control measures (Management Programme / OCP / Both / Emergency preparedness plan / obvious improvement / training OR competence development)

6.2 DETERMINING RISK LIKELIHOOD – GUIDANCE CRITERIA

LIKELIHOOD	CRITERIA
Highly Unlikely (1)	If almost no gap exists in control of the identified OHS hazard as technology, operational control, competence, measurement monitoring in place
Unlikely (2)	If there is any minor gap / weakness in control of the identified OHS hazard
Likely (3)	There are unreasonable / major gaps in control of the identified OHS hazard with respect to adoption of technology, operational control, measurement monitoring and competence
Very Likely (4)	There are almost no control in place in controlling the identified OHS hazard

6.3 DETERMINING RISK CONSEQUENCY LEVEL – GUIDANCE CRITERIA

LEVEL OF HARM	HUMAN	PROPERTY	EXPOSURE LEVEL
Slightly Harmful (2)	Momentary Discomfort	No action required	Below / equal to prescribed TLV (8 hrs)
Harmful (4)	Minor injuries (Non reportable) requires fast-aid	Minor damages	Above than prescribed TLV (8 hrs); however < 20%
Very Harmful (6)	Major injuries, absence from the work ≥ 48 hrs / temporary disability	Severe damages	Above than prescribed TLV (8 hrs); however within 20% - 40%
Extremely Harmful (8)	Fatal / Permanent Disability. Major incidents involving large number of people	Annihilation (complete destruction)	Above than prescribed TLV (8 hrs); AND > 40%

6.4 RISK CLASSIFICATION INDICATOR

Consequence → Likelihood ↓	SLIGHTLY HARMFUL (2)	HARMFUL (4)	VERY HARMFUL (6)	EXTREMELY HARMFUL (8)
Highly Unlikely (1)	Trivial (2)	Tolerable (4)	Moderate (6)	Moderate (8)
Unlikely (2)	Tolerable (4)	Moderate (8)	Substantial (12)	Substantial (16)
Likely (3)	Moderate (6)	Substantial (12)	Substantial (18)	Intolerable (24)
Very Likely (4)	Moderate (8)	Substantial (16)	Intolerable (24)	Intolerable (32)

A.5 DEFINITION OF LEVEL OF RISKS (REFERENCE IS 15001:2000)

RISK LEVEL	ACTION AND TIME SCALE
Trivial	No action is required and no documentary record needs to be kept.
Tolerable	No additional controls are required. Consideration may be given to a more cost-effective solution or improvement that imposes no additional cost burden. Monitoring is required to ensure that the controls are maintained.
Moderate	Efforts should be made to reduce the risk, but the cost of prevention should be carefully measured and limited. Risk reduction measures should be implemented.
Substantial	Work should not be started until the risk has been reduced. Considerable resources may have to be allocated to reduce the risk where the risk involves work in progress, urgent action should be taken.
Intolerable	Work should not be started or continued until the risk has been reduced. If it is not possible to reduce risk even with unlimited resources, work has to remain prohibited.

CONCLUSION

This project has provided an excellent opportunity and experience in making safety measures for task like material handling, Machine operation, Maintenance of an typical industrial machinery, loading, unloading and housekeeping in welding and assembly machinery shop. The first step for emergency preparedness and maintaining a safe workplace is defining and analyzing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time. Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be avoid. The recommendations are provided to avoid the occurrence of such hazards. Safety instructions, extract of risk rating matrix and safe operating procedures were updated.

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