Regulation of Department of Industrial Works
Re: Criteria for hazard identification, risk assessment,
and establishment of risk management plan
B.E. 2543 (2000)

Pursuant to Article 5 and Article 6 of the Ministerial Notification No. 3 (B.E. 2542 (1999)) dated 18th November B.E. 2542 (1999) issued pursuant to the Factory Act B.E. 2535 (1992) regarding safety working measure about establishment of hazard identification, risk assessment, and risk management plan.

It is deemed appropriate to prescribe implementing procedure for hazard identification, risk assessment, and risk management plan as follows:

Chapter 1
General criteria

Article 1 This regulation shall be called "the Regulation of Department of Industrial Works regarding criteria for hazard identification, risk assessment, and establishment of risk management plan B.E.2543 (2000)".

Article 2 In this regulation,

"Risk" shall mean the probability with which a hazardous event occurs and the consequences of the hazardous event.

"Acceptable level of risk" shall mean level of risk judged to be outweighed by corresponding benefits or one that is of such a degree that it is considered to pose minimal potential for adverse effects.

"Hazard" shall mean an agent or event capable of causing injury or illness from working, damage to property, the environment and public, or combination of all these.

"Incident" shall mean an unexpected occurrence that once occurred may result in accident or near miss.

"Near miss" shall mean an unexpected occurrence that once occurred may result in accident.

"Accident" shall mean an unexpected or uncontrolled occurrence, that once occurred may result in injury, illness from working or loss of life, damage to property, the environment or the public.

"Major accident" shall mean fire, explosion, release of chemicals or hazardous substance that adversely affects human health, life, property, community, or the environment.

"Operating procedure" shall mean document describing working procedure or implementation in any matter for safety in workplace or for risk reduction or control.

"Implementation" shall mean design, production process, receiving, storage, transfer, use, transport, raw material, fuel, chemicals or hazardous substances, products and by-products, operating practice, machinery or equipment used in production, and other activities or conditions in a factory.

Article 3 A factory entrepreneur or a person requesting for factory license or extension of factory license shall conduct a report on risk analysis from potential hazards occurred from factory operation by means of studying, analyzing, and reviewing its implementation to identify hazards, to assess risk and to set up risk management plan according to Article 4, Article 5, and Article 6 of this regulation as follows:

3.1 For a factory entrepreneur with an existing factory license or a person requesting for extension of factory license, a study, analysis and review of its implementation to identify hazards and assess risk shall be conducted by personnel of a factory of at least 3 persons with the following qualifications.

3.1.1 Possess knowledge, understanding, and experience in factory operation such as production technology, production process, maintenance, machinery or equipment, raw material, product and by-products, etc.

3.1.2 Possess knowledge, understanding, and experience in safety, occupational health, and working environment.

3.1.3 Possess knowledge and understanding in hazard identification, risk assessment, and risk management plan.

3.2 A person requesting for factory license shall study, analyze, and review its implementation in a factory to identify hazards and assess risk by group of personnel possessing the qualifications prescribed in 3.1.1, 3.1.2, and 3.1.3.

3.3 A report on risk analysis from potential hazards occurred from factory operation shall be conducted as follows:

3.3.1 Study, analyze, and review all implementation in a factory and use such information to establish a list of risk and hazard and potential impact on people, community, property, or the environment using the risk and hazard form as exampled annexed hereto.

3.3.2 Select method of hazard identification in Article 4 that is appropriate for the implementation in order to identify hazard associated with risk and hazard listed in 3.3.1.

3.3.3 Identify hazard associated with risk and hazard in the list under 3.3.1 using the appropriate method by specifying incident, accident, major accident, potential hazard and its consequence.

3.3.4 Assess risk by considering probability and violence that may occur from such listed risk and hazard and occurrence sequence of an event, condition or factor causing the event.

3.3.5 Set level of risk from the listed risk and hazard that may have impact on people, community, property or the environment by following instruction in Article 5.

3.3.6 Set up a risk management plan by setting up a risk reduction plan using Form Plan 1 and a risk control plan using Form Plan 2 by following instruction in Article 6.

3.3.7 Use the results of 3.3.1-3.3.6 to write up a report on risk analysis from potential hazards occurred from factory operation.

3.4 A report on risk analysis from potential hazards occurred from factory operation shall at least consist of the following.

3.4.1 Description of factory operation

3.4.2 List of risk and hazard

3.4.3 Description of hazard identification and risk assessment of risk and hazard

3.4.4 Description of risk management plan

3.4.5 Summary of result from studying, analyzing, and reviewing implementation that have acceptable level of risk, high level of risk, unacceptable level of risk, including a risk reduction and control plan.

Chapter 2
Hazard Identification

Article 4 A factory entrepreneur or a person requesting for factory license or extension of factory license may choose any method or its combination as sees appropriate and suitable for type of factory operation or risk from potential hazard arising form factory operation in identifying hazard as follows:

4.1 Checklist: it is a method in identify hazard by using checklist form to inspect implementation in a factory to search for hazard. A checklist shall consist of topic of question related to implementation to determine whether it has been done according to design standard, operating standard or the law in order to bring the inspection result to identify hazard.

Steps for studying, analyzing, and reviewing implementation of a factory to identify hazard using Checklist method shall be as follows:

4.1.1 Set aspects that will be inspected for safety in implementation.

4.1.2 Outline detail description of such aspect to be inspected by considering operating procedure, legal matter concerning safety and occupational health, and safety standard.

4.1.3 Use the information in 4.1.2 to constitute a checklist for safety inspection.

4.1.4 Check for accuracy and completeness of the checklist and have it rechecked by expertise to assure that the checklist covers all aspects concerning existing safety problems.

4.1.5 Use the checklist to inspect safety in implementation of a factory.

4.1.6 Use the result from inspection in assessing risk in order to prioritize risk associated with potential hazard into Form Hazard Identification and Risk Assessment 1 as exampled annexed hereto.

4.1.8 Establish a risk management plan according to risk level determined from the assessment and fill into Form Plan 1 or Form Plan 2 as exampled annexed hereto.

4.2 What If Analysis: it is a process of studying, analyzing and reviewing in order to identify hazard from factory implementation by asking the question “What if” and find the solution for such problem which substantially will be potential hazard from factory implementation.

Steps for studying, analyzing, and reviewing implementation of a factory to identify hazard using What If Analysis shall be as follows:

4.2.1 Appoint personnel group to study, analyze and review factory implementation in order to identify hazard be means of What If.

4.2.2 Set a scope of what to be studied, analyzed, and reviewed in order to identify hazard, including in a situation of fire, explosion, and release of chemicals or hazardous substance.

4.2.3 Identify prospect of hazard source and affected area, including affected person.

Prospect of hazard source in production process may be,

- Chemicals or hazardous substances
- Machinery or equipment
- Unit of production process
- Operating area
- Utilities
- Neighbored residence

4.2.4 Prepare detail data in every aspect for a group member to review important background information in order to propose a question with hypothesis or variation from normal production period; both normal implementation period, unusual period and case of emergency, including if there is any change in production process. A group leader shall survey hazardous working area in order to understand general condition and related equipment in existing area for efficiency in risk assessment.

4.2.5 Organize the questions and review them by group members. The following aspects shall be considered in constituting the questions.

- Failure of machinery
- Unusual condition of production process due to temperature, pressure, or malfunction of process of feeding raw material to production process
- Malfunction of tools or instruments
- Breakdown of related utilities system
- Human error
- Working by not following procedure during normal operating condition, machinery operation, or machinery termination.
- Maintenance related accident
- Accident in related working area such as transfer area, impact from forklift or accident during transportation
- Overall failure such as failure of several equipment or failure of equipment combined with human error

Set of questions must be constituted in an organized manner by starting from the first step in production process through the final step in production process. Formation of questions can be applied with unusual condition of production process as well.

4.2.6 Study, analyze and review conditions to identify hazard using hazard identification technique of “What If” questions by categorizing all questions into groups according to sequences of production process. Description in each column of hazard identification and risk assessment form shall consist of following.

- "What If" questions
- Arising hazard or consequences
- Measure to reduce impact from hazard
- Recommendations

Reviewing process shall start with each "What If" question by considering hazard or consequences that may arise and measure to reduce impact associated with each question, including recommendation in prevention of hazard. A group leader shall has a duty in completing questions in each set before continuing to the next question and the group shall accept the answer and all consideration which shall be used later on in risk assessment.

4.2.7 Summarize all data obtained from the study, analysis and review of implementation for hazard identification of the group into Form Hazard Identification and Risk Assessment 2 as exampled annexed hereto.

4.2.8 The result of hazard identification shall be used to assess risk and to organize potential risk that may arise in order into Form Hazard Identification and Risk Assessment 2 as exampled annexed hereto.

4.2.9 Establish a risk management plan according to risk level determined from the assessment and fill into Form Plan 1 or Form Plan 2 as exampled annexed hereto.

4.3 Hazard and Operability Study (HAZOP): it is a technique of studying, analyzing and reviewing in order to identify hazard and problems that may arise from factory implementation by analyzing for hazard and problems of systems which may be a result of unintentional incomplete design. This method uses approach of setting hypothetic questions associated with several conditions of production process by using HAZOP Guide Words in Table 1 together with production factor according to the design or operational malfunction such as flow, temperature, pressure, etc. to identify hazard or problems in production process which may cause accident or major accident.

Steps for studying, analyzing, and reviewing implementation of a factory to identify hazard using HAZOP method shall be as follows:

4.3.1 Introduce each member of the personnel group with background information of each person.

4.3.2 A group moderator shall present procedure of HAZOP to the group member to assure their understandings in studying, analyzing, and reviewing implementation of a factory.

4.3.3 Present the group about property of chemicals or acutely hazardous substances to realize toxicity and hazard of such substances.

Table 1: HAZOP Guide Words

HAZOP Guide Words	Operating Deviation
None	• No Flow • Reverse Flow • No Reaction
More	• Increased Flow • Increased Pressure • Increased Temperature • Increased Reaction Rate
Less	• Reduced Flow • Reduced Pressure • Reduced Temperature • Reduced Reaction Rate
Part of, as well as Other	• Change of Ratio of Material Present • Different Material Present • Different Plant Conditions from Normal Operation • Start up • Shutdown • Relief • Instrumentation • Sampling • Utility Failure • Corrosion • Maintenance • Erosion • Grounding/Static

4.3.4 A group member shall identify primary hazard in production process in order to recognize objective of HAZOP procedure and be able to synchronize it implementation.

4.3.5 Specify scope of HAZOP.

4.3.6 A factory survey shall be conducted by the group to understand the operating procedure.

4.3.7 Set up a small group meeting under the scope of HAZOP.

4.3.8 Summarize all data obtained from the study, analysis and review of implementation for hazard identification of the group into Form Hazard Identification and Risk Assessment 3 as exampled annexed hereto.

4.3.9 The result of hazard identification shall be used to assess risk and to organize potential risk that may arise in order into Form Hazard Identification and Risk Assessment 3 as exampled annexed hereto.

4.3.10 Establish a risk management plan according to risk level determined from the assessment and fill into Form Plan 1 or Form Plan 2 as exampled annexed hereto.

4.4 Fault Tree Analysis: it is a technique of hazard identification by emphasizing on accident or major accident that is expected to occur which then will be used to determine cause of such event. The technique uses backward thinking approach by basing on logical principle to identify cause of accident or major accident occurrence. It starts with analyzing of accident or major accident that is expected to occur by determining the first event that will occur. Then such event shall be analyzed for numbers of small event that may be a cause of the event and how they occur. The analysis shall be stopped when it is found that the cause of small event is malfunction of machinery or implementation error.

Steps for studying, analyzing, and reviewing implementation of a factory to identify hazard using Fault Tree Analysis method shall be as follows:

4.4.1 Select the top event that once occurs shall lead to major accident.

4.4.2 Analyze for the cause of the top event that they are from what Fault tree event or intermediate event.

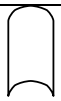
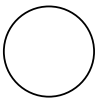
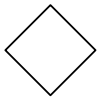
4.4.3 Analyze for the cause of the Fault tree event or intermediate event again until find out that such event is a result of malfunction of machinery, instrument, safety system, human error, and/or management system which are basic event.

4.4.4 Illustrate the result of study, analysis, and review for hazard identification with chart using the symbol in Table 2.

4.4.5 Summarize all data obtained from the study, analysis and review of implementation for hazard identification into Form Hazard Identification and Risk Assessment 4 as exampled annexed hereto.

4.4.6 Establish a risk management plan according to risk level determined from the assessment and fill into Form Plan 1 or Form Plan 2 as exampled annexed hereto.

Table 2: Symbol in Hazard Identification

Symbol	Name	Description
	AND Gate	Event occurs from many cause of fault tree event.
	OR Gate	Event occurs from any cause of fault tree event.
	Basic Event	Normally occurred fault tree event which its cause is clearly known without analyzing for the next cause. It can be recognized as the first cause of the incident.
	Fault Tree Event	Fault tree event that leads to subsequent events resulting in the cause of the incident.
	Undeveloped Event	Fault tree event that do not need analysis for it cause due to lack of supporting data.
	External Event	External event or external factor that is cause of other events.

4.5 Failure Modes and Effects Analysis (FMEA): it is a technique of hazard identification by analysis of failure modes and effects which consists of an inspection of machinery parts of the system followed with the analysis of effect from such machinery failure.

Steps for studying, analyzing, and reviewing implementation of a factory to identify hazard using FMEA method shall be as follows:

4.5.1 Prepare data, documentation and schematic for FMEA as follows:

- Schematic of pipe and equipment system
- Schematic of electrical current circuit and its explanation
- Schematic of system linking between instrument or equipment
- Schematic of electrical line
- Schematic of instrument or equipment in operation
- Other documentation such as training manual, instrument manual and instruction procedure

This documentation shall represent an impact to central system or intermediate system due to potential failure modes and be able to recognize such impact

and dependent relationship between each system. For example, several power distribution systems have connection with equipment controlling air, cooling water or electrical power and failure of electrical system can lead to failure of air compressor. There are also several hidden problems such as failure of electric power that is sent to air pressure control equipment. Consequently, a person who performs the analysis must have sufficient principal background on structure and how to implement such parts in order to realize the connection that can lead to hazard and the connection that deviate from designed system.

4.5.2 Select a group of person to conduct FMEA. The group shall consist of the following expertise.

- Engineer or specialist in operation that has proficiency in factory design and operation.

- Specialist in control of electricity system, machinery, equipment and utilities, especially is proficient in design process.

A group leader shall have the following qualification to ensure the quality and validity of the result of the analysis.

- Has experience in machinery especially in the part that relating to operation, cause and impact of machinery failure.

- Has knowledge in industrial engineering in terms of designing and operational control of machinery or electricity.

The group leader of FMEA shall have comprehensive knowledge and experience because FMEA technique not only analyze for description of role and operation of machinery or systems in a factory but also determine connection between machinery and systems that work and support each other. In case there is no detailed information about any part of analytical technique, it is a responsibility of the group leader and the group to use their expertise in solving such situation. A person selected to be a group member shall have principal and basic knowledge to facilitate each other in conducting the analysis efficiently.

The group of FMEA has to understand not only the direct consequences of the failure of machinery parts or systems but also factors influencing operational condition of such machinery parts or systems. This is due to the fact that a failure in machinery or systems will impact normal function of operation resulting in variation or change in production process and eventually affect and lead to further system failure.

4.5.3 Procedure of FMEA is as follows:

- Set a definition to determine scope of FMEA by organizing factory matters into system. A system means all components of machinery, equipment, pipe and other supporting units such as electricity generator, cooling water, etc. and shall include complete function of each system.

- Illustrate description of major components of systems in a factory because the analysis shall be related to several systems. However, such major components of each system mostly has malfunction from its minor components. The group of FMEA can take such failure of minor components into consideration while doing the analysis if there is a specialist in the group.

- Collect following data.

- Description of machinery part and supporting system

- Select failure scenario and its cause

- Consequence or impact from failure of central system and minor systems

- Determination procedure and analysis for cause of failure

- Substituting function system and operator with explanation

In conducting FMEA, failure of machinery is mainly emphasized because it allows understanding the overall situation. However, other components and their failure shall be considered as well. For instance, consideration of machinery such as pump must also consider other power distribution system such as circuit breaker, connection system from startup to termination of operation, and joint control system. Failure of system mostly is from electricity system and control system.

4.5.4 Data collection shall represent impact of component failure to the system. All failure causing system malfunction shall be considered without stressing on severity of the impact or tendency of such event. Damaged machinery may be a result of failure of supporting system such as a long period of short circuit condition. Therefore, it is responsibility of an analyst to add such topic into data recording to indicate failure that impacts system operation or to explain aspect of impact from the failure with its tendency to cause loss of production or revenue.

4.5.5 A report must present the result of the study and data shall be recorded into Form Hazard Identification and Risk Assessment 5 as exampled annexed hereto which consists of the following data.

- Description of machinery part and supporting system

- Failure, damage or error

- Cause of such failure, damage or error

- Consequence of such failure, damage or error of machinery part and supporting systems

- Preventive, control, and corrective measure

4.5.6 The result of hazard identification shall be used to assess risk and to organize potential risk that may arise in order into Form Hazard Identification and Risk Assessment 5 as exampled annexed hereto.

4.5.7 Establish a risk management plan according to risk level determined from the assessment and fill into Form Plan 1 or Form Plan 2 as exampled annexed hereto.

4.6 Event Tree Analysis: it is a technique of hazard identification to analyze and evaluate a consequence that may occur once the initial event occurs. It is an anticipation to analyze for consequent impact due to machinery malfunction or human error to understand how it happens and its probability. It also an inspection whether or not there is a problem with current safety system.

Steps for studying, analyzing, and reviewing implementation of a factory to identify hazard using Event Tree Analysis shall be as follows:

4.6.1 Consider initiating event that may occur or has already occurred.

4.6.2 Illustrate detail of all safety system currently employed and operating procedure of workers that relates to potential or occurring event.

4.6.3 Draw a chart of Event Tree Analysis by analyzing safety system and/or operator into two cases; one is when safety system or operator works properly and the other is when safety system or operator works improperly.

4.6.4 Explain stage and consequences of the event in sequence.

4.6.5 Summarize all data obtained from the study, analysis and review for hazard identification and risk assessment using Event Tree Analysis into Form Hazard Identification and Risk Assessment 6 as exampled annexed hereto.

4.6.6 Establish a risk management plan according to risk level determined from the assessment and fill into Form Plan 1 or Form Plan 2 as exampled annexed hereto.

4.7 A factory entrepreneur or a person requesting for factory license or extension of factory license may choose other hazard identification methods or other methods approved by Department of Industrial Works such as hazard identification procedure in accordance with the industrial product standard regarding management system for safety and occupational health. The methods shall be submitted to Department of Industrial Works for approval.

Chapter 3

Risk Assessment

Article 5 Risk assessment shall conform to the following criteria or other procedure approved by Department of Industrial Works.

5.1 Consider probability of event to occur by setting probability in to 4 levels as shown in Table 3.

Table 3: Probability level of event

Level	Description
1	Very low probability such as never occur in period of 10 years or more
2	Low probability such as occur once in a period of 5-10 years
3	Medium probability such as occur once in a period of 1-5 years
4	High probability such as occur more than once in a year

5.2 Consider the severity of the event whether or not it will lead to adverse effect to people, community, property or the environment and how severe it will be by classifying level of severity into 4 levels as detailed in Table 4, Table 5, Table 6 and Table 7.

Table 4: Classification of severity level of the event affecting people

Level	Severity	Description
1	Low	Small injury requiring first aid
2	Medium	Injury requiring medical treatment
3	High	Severely injured
4	Extreme	Disabled or dead

Table 5: Classification of severity level of the event affecting community

Level	Severity	Description
1	Low	No impact or small impact to the community nearby a factory
2	Medium	Impact to the community nearby a factory but can correct the situation in a short time
3	High	Impact to the community nearby a factory requiring a length of time to correct situation
4	Extreme	Severely impact to the community in a large area or require the authority to correct the situation

Remark: impact to community means nuisance to community, injury or illness of people, damage to property of community and people.

Table 6: Classification of severity level of the event affecting the environment

Level	Severity	Description
1	Low	Slight impact to the environment, can control or correct the situation
2	Medium	Moderate impact to the environment, can correct the situation in a short time
3	High	Severely impact to the environment, require a length of time to correct the situation
4	Extreme	Extremely impact to the environment, require resources and a great length of time to correct the situation

Remark: impact to the environment means deterioration and damage to the environment such as air, soil, water reservoir, etc.

Table 7: Classification of severity level of the event affecting the property

Level	Severity	Description
1	Low	No damage or slight damage to the property
2	Medium	Moderate damage to the property but can continue the production
3	High	Massive damage to the property and must stop operation in some parts
4	Extreme	Extensive damage and must stop all operation

Remark: A factory can set up a level of damage to the property by considering its capacity.

5.3 Set level of risk by considering the multiplication product between probability level and severity level of the event affecting people, community, property or the environment. If the levels of risk affecting people, community, property or the environment are different, the highest risk level shall be selected as the outcome of risk assessment in such aspect. Risk can be classified into 4 levels as detailed in Table 8.

Table 8: Risk level

Risk Level	Multiplication product	Meaning
1	1-2	Small risk
2	3-6	Acceptable risk, requiring revision of control measure
3	8-9	High risk, requiring action to reduce risk
4	12-16	Unacceptable risk, requiring a cease in operation and immediate corrective action to reduce risk

Chapter 4

Risk Management Plan

Article 6 Risk management plan is risk reduction plan and risk control plan which a factory entrepreneur shall establish to prescribe appropriate and efficient safety measure in reducing and controlling risk from hazard potentially occurred from factory operation as follows:

6.1 If the outcome of risk assessment shows unacceptable risk level, a factory entrepreneur shall cease its operation immediately and implement corrective action to reduce such risk before continue on its operation by establishing risk reduction plan and risk control plan using Form Plan 1 and Form Plan 2, respectively.

6.2 If the outcome of risk assessment shows high risk level, a factory entrepreneur shall establish risk reduction plan and risk control plan using Form Plan 1 and Form Plan 2, respectively.

6.3 If the outcome of risk assessment shows acceptable risk level, a factory entrepreneur shall establish risk control plan using Form Plan 2.

6.4 Risk reduction plan is a corrective action plan in several aspects to reduce the risk to acceptable level which consists of measures or activities of risk reduction. The plan shall specify detail of procedural step, responsible personnel, implementation period, and evaluation as show in Form Plan 1.

6.5 Measures or activities of risk reduction may consist of the following.

6.5.1 Preventive and controlling measure for hazard source namely implementation in any or several matters including control and inspection of such implementation by setting up into procedural step as follows:

6.5.1.1 Reduce or eliminate hazard using engineering practice such as design, construction, machinery installation and installation of safety system, use of standard material by taking the result of hazard identification and risk assessment into account.

6.5.1.2 Prescribe operating procedure.

6.5.1.3 Prescribe testing method, inspection procedure, and maintenance for machinery and safety system.

6.5.1.4 Prescribe process, procedure, or steps for modification of production process, raw material and machinery by revising hazard identification and risk assessment before starting implementation.

6.5.1.5 Arrange for worker training.

6.5.1.6 Arrange for safety evaluation.

6.5.1.7 Prescribe control procedure to ensure that the standard operating procedure has been conformed.

6.5.1.8 Arrange for revision of hazard identification and risk assessment when there is occurrence of major accident.

6.5.1 9 Employ other activities to prevent and control generation of hazard.

6.5.2 Mitigation measure namely;

6.5.2.1 Establish and arrange for practice of emergency plan.

6.5.2.2 Arrange for accident or incident investigation.

6.5.2.3 Arrange for remediation plan for factory, community or the environment by taking the result of hazard identification and risk assessment into account.

6.6 Risk control plan is a plan for controlling and inspecting preventive and controlling measure for hazard source and mitigation measure to ensure efficiency and effectiveness in preventing, reducing, and controlling the risk by controlling and inspecting the implementation to maintain risk at acceptable level at all times. The plan shall consist of measures or activities in reducing risk or risky procedure, responsible personnel, Controlled aspects, standard or criteria used, and inspector as show in Form Plan 2.

Announced on the 17th day of November B.E. 2543 (2000)

(signed) ……

(Miss Kanya Sinsakol)
Director-General of Department of Industrial Works

Risk and Hazard Form
Page ..../.....

List of Risk and Hazard
Factory: .....
Date performing the study, analysis and review of implementation in a factory .....

Factory implementation	Risk and hazard	Potential impact	Remark

Form Hazard identification and Risk Assessment 1
Page ..../.....

The result of the study, analysis and review of factory implementation for hazard identification and risk assessment using Checklist Method.
Area/Machinery/Production process/Operating procedure/Activities ..... Factory .....
According to Document number ..... Date performing the study .....

The result of Checklist	Hazard or consequences	Preventive and Controlling measure for hazard	Recommendation	Risk Assessment			
				Probability	Severity	Multiplication product	Risk level

Form Hazard identification and Risk Assessment 2
Page ..../.....

The result of the study, analysis and review of factory implementation for hazard identification and risk assessment using What If Analysis.
Area/Machinery/Production process/Operating procedure/Activities ..... Factory .....
According to Document number ..... Date performing the study .....

What If Questions	Hazard or consequences	Preventive and Controlling measure for hazard	Recommendation	Risk Assessment			
				Probability	Severity	Multiplication product	Risk level

Form Hazard identification and Risk Assessment 3
Page ..../.....

The result of the study, analysis and review of factory implementation for hazard identification and risk assessment using HAZOP.
Unit ..... Description .....
Production Factor ..... Control Value ..... Plan number.....

Defect	Hypothetical situation	Consequent event	Preventive/Control/ Corrective Measure	Recommendation	Risk Assessment			
					Probability	Severity	Multiplication product	Risk level

Form Hazard identification and Risk Assessment 4
Page ..../.....

The result of the study, analysis and review of factory implementation for hazard identification and risk assessment using Fault TreeAnalysis.
Area/Machinery/Production process/Operating procedure/Activities ..... Factory .....
According to Document number ..... Date performing the study .....

Cause of event that leads to major accident	Hazard or consequences	Preventive and Controlling measure for hazard	Recommendation	Risk Assessment			
				Probability	Severity	Multiplication product	Risk level

Form Hazard identification and Risk Assessment 5
Page ..../.....

The result of the study, analysis and review of factory implementation for hazard identification and risk assessment using FMEA.
Area/Machinery/Production process/Operating procedure/Activities ..... Factory .....
According to Document number ..... Date performing the study .....

Machinery/System	Failure	Cause of failure	Consequences	Preventive/Control/ Corrective Measure	Risk Assessment			
					Probability	Severity	Multiplication product	Risk level

Form Hazard identification and Risk Assessment 6
Page ..../.....

The result of the study, analysis and review of factory implementation for hazard identification and risk assessment using Event TreeAnalysis.
Area/Machinery/Production process/Operating procedure/Activities ..... Factory .....
According to Document number ..... Date performing the study .....
Hypothetical situation .....

Defect in Safety system/Operating procedure	Hazard or consequences	Preventive and Controlling measure for hazard	Recommendation	Risk Assessment			
				Probability	Severity	Multiplication product	Risk level

Form Plan 1
Page .../.....

Risk Management Plan (Risk Reduction Plan)
Unit ..... Description .....
Objective: .....
Goal: .....

No.	Measure/Activity/Implementation in risk reduction	Responsible personnel	Implementation Period	Inspector	Remark

Form Plan 2
Page .../.....

Risk Management Plan (Risk Control Plan)
Unit ..... Description .....
Objective: .....
Goal: .....

No.	Measure/Activity/Implementation in reduction of risk or risky operating procedure	Responsible personnel	Controlled aspect	Criteria or standard used	Inspector