ภาคผนวก 2-15

เอกสารวิเคราะห์ความเสี่ยงการทำงาน (Task Risk Analysis)

PROCEDURE - TASK RISK ANALYSIS		Document No. 3-RM-003	Page 1 of 18
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Revision History

Revision No.	Reason for change (s)	Date
3.0	Update document to the current practice	30 /06/15

1. **Purpose** :

This procedure outlines the process of hazards and effects analysis of each element of task and defining appropriate controls and recovery measures.

2. Scope :

Where and when is TRA Applied?

- Routine tasks that have the potential for serious incidents
- Routines tasks having a history of incidents, including near misses
- New tasks of tasks introducing new work methods
- Routine tasks being carried out in unusual circumstances
- As a verification of the hazards management elements of an established work procedure.
- Any tasks apart from the above which could not be justified whether to conduct TRA or not, the risk matrix is a tool to assess those tasks and if the result from the assessment is **low**. It is no need to conduct TRA for those tasks.

3. Definition :

3.1 Task Risk Analysis (TRA) is the application of the hazards and effects management process at the task level, identifying and assessing the hazards of each element of the task and defining appropriate controls and recovery measures

3.2 Hazard is the potential to cause harm, including ill-health or injury, damage to assets or the environment or company reputation, product losses or other liabilities

3.3 Risk is the product of the probability that a hazard will occur and the severity of the consequences when it does.

4. Reference:

4.1 Job Hazard Analysis (JHA) from Shell International Exploration Product (EP 95-0311)

5. Responsibilities:

5.1 Job owner is responsible for the appointment of TRA meeting and to be a team leader.

5.2 Area owner is responsible for hazard evaluation for responsible area and taking action to reduce and eliminate the hazard finding.

5.3 HSE staff is responsible for supporting the HSE information and advises in HSE matter to reduce and eliminate the hazard finding.

6. Procedure

TRA methodology is derived from the work study technique know as Task Analysis, and is known variously as Task Risk Analysis (TRA), Work Safety and Health Analysis, Activity Risk Assessment (ARA).

6.1 Who Performs TRA?

TRA is normally a team exercise involving three to five people.

The person involved in leading the analysis should have a level of technician competence relevant to the job to be analyzed and be a competent TRA Leader. The composition of the team depends on the individual task being analyzed and front line supervisors and each area of skill should be represented. For simpler tasks, a small team led by the supervisor of the activity should be sufficient. Tasks of greater complexity may involve safety advisers and

area supervisors or the asset owner. Larger teams of TRA exercises conversing a number of tasks may benefit from use of a facilitator (someone holding TRA skills).

If the task is to be carried out in a live production facility a representative of the facility supervision should be in the team or should approved the TRA.

6.2 APPLICATION

6.2.1 Conducting TRAs

TRAs may be conducted on an existing task or prior to a task, during the planning stage. Three principle ways of conducting TRAs are discussed below:

- Direct observation
- Group discussion
- Recall and check

6.2.2 Direct observation

In this method the persons doing the analysis actually observes the job being done. They may observe the process a number of times before they identify the separate steps, estimate the potential accidents and develop controls and recovery measures. In addition they may observe different employees doing the same job to establish variations in job execution.

The advantage of direct observation are three fold;

- Recognition
  Seeing the job being done stimulates recognition of potential accidents more effectively than relying on memory. It also stimulates better solutions

- Experience
  Employees who do a job regularly are a rich source of information about accidents and near accidents associated with their job; they can be a great help with the TRA. In addition, observing the job gives supervisors and excellent opportunity to exchange safety ideas with operative.
- Environment

  The influence of the environment and interface with other work can be more readily appreciated.

  A limitation of the observation method is that it cannot readily apply to new jobs or jobs done infrequently.

  Key points for using the observation method are presented in Appendix I.

6.2.3 **Group discussion**

A group of people familiar with the job, under the guidance of the supervisor, use their collective experience to identify the job steps, the potential accidents in each steps and develop good solutions.

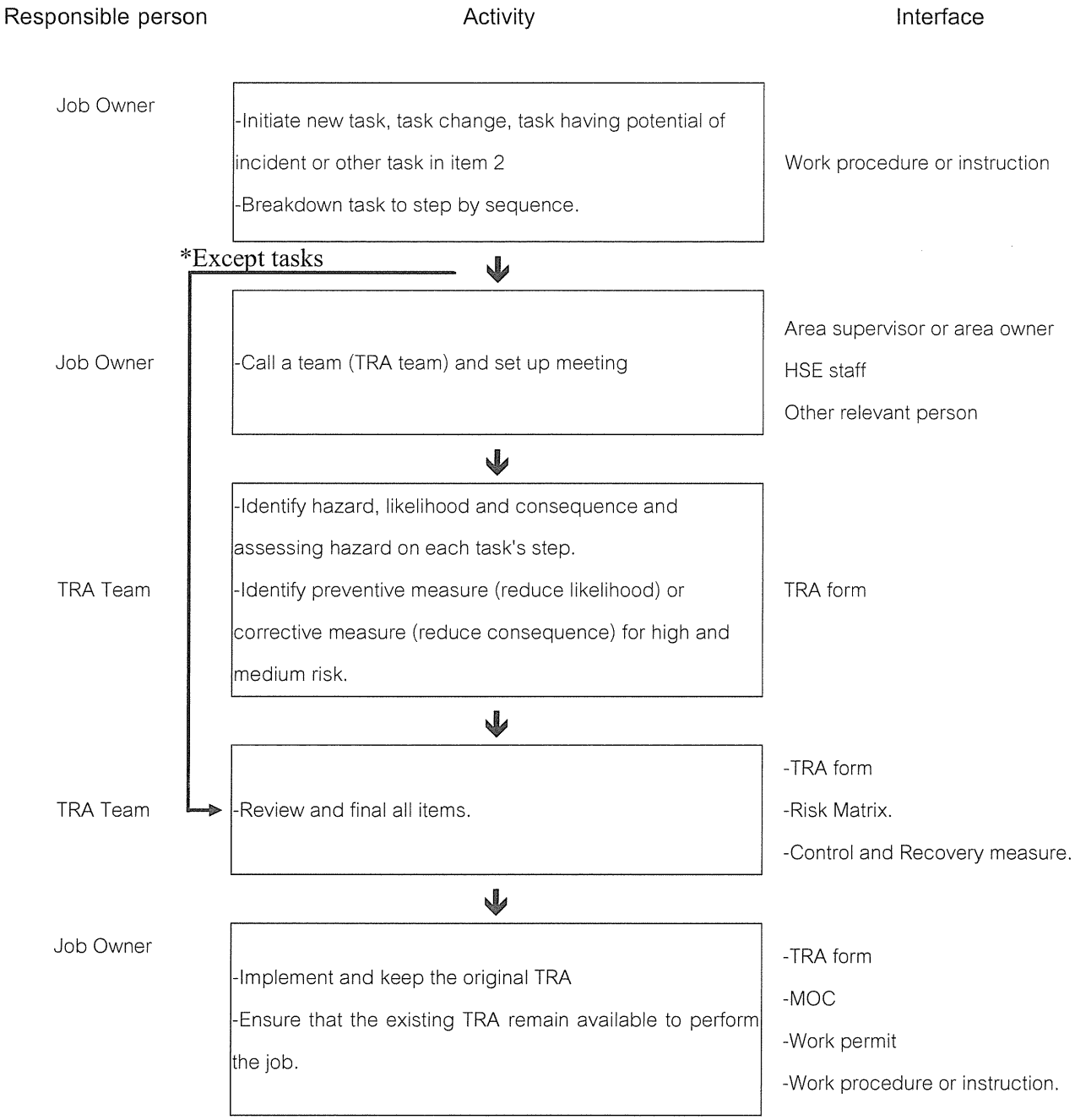
The participants in the discussion should be those with most knowledge about the job. In either case, the supervisor needs to be competent in TRA group discussion techniques. He should be able to stimulate a group to obtain the maximum contribution from each of its members and guide the discussion down the most productive paths.

6.2.4 **Recall and check**

The individual supervisor prepares a preliminary version of the TRA on the basis of recall rather than of direct observation of the job. This preliminary version is checked by discussing it with others or by directly observing parts of the job about which the may be doubts.

6.3 Outline of TRA Process

The TRA flow chart is shown as below. Simplify the timing to conduct TRA is after the task change (MOC) and should be before issuing work permit.



*Except tasks; Safe work, line breaking, nonflammable work, confine space level 1.

6.4 Initiating a TRA

Determine the task to be analyzed, established the scope of work and the objectives of the exercise. Convene and brief the TRA team.
Selection of tasks for TRA can be made on the basis of need as identified in 2.0. HSE Plans may require each department to have TRA done for routine operational or maintenance activities or after the task change (MOC).

The scope of work should include the task to be analyzed and the range of operating environments to be considered. Permit to Work may used to specify that a TRA be carried out as part of work preparation.

6.5 Breaking Down the Task

Break down the task into its basic steps, describing what is to be done, and in what sequence. This information is often available in a work procedure or method statement.

In defining the steps a balance must be made between too much and too little detail. As a general rule, the demarcation between steps will be marked by some change, either in activity or location, which would result in different hazards, or exposure. Experience has shown that most tasks that are subject of TRAs can be broken down into ten steps or less. If more than 15 steps are identified and it is not feasible to merge some steps without losing essential detail, it is recommended that the task itself is split and separate TRAs are conducted for each part.

- Provide a statement of what is to be done, without reference to how it is to be done or who is to do it.
- Begin with an action verb (install, remove, assemble etc.)
- End with the subject being discussed (pump, valve, hoist etc.)
- Omit reference to hazards.

An example is presented in Appendix II.

6.6 Identifying Hazards and Potential Incidents

Examine each basic step for hazards that could be present as a result of the task itself or of the work environment. At the same time, consider the departures from expected circumstances that could release or expose the hazard, and the potential incident that could result.

The observation method described in 6.2.3 provides a good opportunity to assess hazards in the context of the work environment and discuss them with operators.

The key activity in a TRA is to determine the hazards and potential incidents associated with each particular step. TRAs fails or become inefficient when the focus is on overall solutions to the whole job. Structured questions should be applied to each step to stimulated discussion about the various risk factors. Where temporary piping hook-ups are installed the TRA may also include a simple HAZOP. Appendix III presents checklists relating to hazards. Job factors and incident potential.

6.7 Assessing Hazards

In some cases it may be beneficial for the team to assess the risk associated with a hazard or the consequence of a hazardous event and the likelihood of its occurring. Such assessments can be used to set the level of control and recovery, and to priorities actions to be taken.

The assessment is a coarse approximation and should be reached without protracted debate but high risk hazards identified could be the subject of a more detailed assessment later.

A risk assessment matrix is often used to present risk by plotting the probability or likelihood on one axis and the consequences or severity on the other. The risk assessment matrix used in HMC such as the one below. The detail of risk assessment matrix can refer to Hazard identification& risk assessment (3-RM-001).

Risk Assessment Matrix

Severity	Potential Consequence of an Incident				Likelihood (Increasing ProAaAility) →			
					A	B	C	D
Incident Level	People	Assets	Env.	Image	Heard of Incident in Chem. Ind. (1x10-4)	Incident has Occurred in Bompany (1x10-3)	Happens Several Times Per Year in Company	Happens Several Times Per year in Locations
1	Minor Injury	Minor Damage	Minor Impact	Limited Space	1A	1B	1C	1D
2	Major Injury	Local Damage	Localized Impact	Considerable Impact	2A	2B	2C	2D
3	Fatality	Major Damage	Major Impact	Major National Impact	3A	3B	3C	3D
4	Multiple Fatality	Extensive Damage	Massive Impact	Major International Impact	4A	4B	4C	4D

LOW
MEDIUM
MEDIUM
HIGH

6.8 Controls and Recovery Measures

Controls and recovery measures should be developed first of all from an overview of the completed task and the risks involved. If the task as described involves a number of high risks, a change in the entire task may present a better solution than controlling each hazard individually.

If no radical solution presents itself, each hazard and potential incident should be examined and control measures identified. A useful hierarchy of solutions to bear in mind is shown below (ranked broadly in order of effectiveness):

1. Eliminating the hazard (eg buying ready sawn timber rather than using a circular saw)
2. Substitution (using a less hazardous material or process)
3 Reducing the frequency of a hazardous task
4 Enclosing the hazard
5 Guarding/segregating people
6 Additional procedures

7 Additional supervision

8 Additional training

9 Instructions/information (handouts/signs)

10 (Some) personal protective equipment.

6.9 Recording the TRA

Summary information for each TRA should include:

- The scope of work
- Assumptions made
- Position/qualifications of team members
- Abbreviations used. Etc.

Results of the TRA should be tabulated on a form of the type shown in Appendix IV.

A copy of this summary should be available at the workplace for using as a site reference. Where a program of TRAs has been undertaken, the results should be kept at job owner.

6.10 Review and Update of TRAs

If the TRA fails to identify all significant factors or hazards, the way in which the task is done may differ from that identified in the original TRA.

To ensure that the experience and information gained by doing the job remains available to perform the job, the TRA team should complete the each job, review and update the original TRAs.

When reviewing the TRA on completion of the job, the following should be considered:

- Changes to job circumstances

  Change in the environment, specifications, or tools and equipment can cause job steps to be added, deleted or changed. Changes in job steps can introduce new hazards, requiring new solution.

- Unforeseen hazards

  Once a job has commenced additional unforeseen hazards may present themselves so that solutions have to be developed on the job. These job-developed solutions need to be included on the revised TRA.

- External influences and interfaces

When doing a TRA it is often difficult to identify all of the possible external factors that impact on the job and the interface with other jobs and people in the immediate vicinity. Feedback of this type can be invaluable to people planning similar jobs in the future.

APPENDIX I

DIRECT OBSERVATION

Key points in the observation method of TRA are:

- Select the right employee to observe

  When you have more than one person doing the job you plan to analyze, choose the one who will be able to help you most. He should be experienced and co-operative. It is also a good idea to observe more than one employee.

- Explain what you intend to do

  Make sure the employee fully understands the purpose of your observation.
  Emphasize that the study is of the job not of him. The best approach is to invite the employee to share the task with you. "I'll do the writing, and you help me with the ideas."

- Observe to get the step-by-step breakdown

  Keep in mind that you are observing to identify the basic steps. Don't break down the activity into too many steps. On the other hand, don't make the steps so broad that critical aspects are overlooked. If the job is a lengthy one, develop a preliminary breakdown by recall then check it with the employees. Where there is full agreement, there may be no need to observe that task element. Observation can then concentrate on the task elements where there is uncertainty.

- Check your job step break down with the employee

  When you complete your observation, check your breakdown with the employee observed. Get agreement on what is done and in what order, not on how it is done. Don't discuss hazards or precautions at this stage.

- Record the job step breakdown

  After you have checked the job step breakdown with the employee, record the steps (see Appendix II – for relief valve test example). If you have observed one employee, check the breakdown with other experienced employees.

The direct observation method is suitable for repetitive and frequently carried out jobs.

APPENDIX II

BREAKING DOWN THE TASK – EXAMPLE

A step-by-step breakdown for the job of testing a relief valve is:

Step 1 Set up relief valve (RV) on test bench

Step 2 Engage clamp jacks

Step 3 Check lift pressure

Step 4 Reset at correct pressure

Step 5 Fit plug and hose; complete bubble test

Step 6 Remove plug, hose and exhaust valve

Step 7 Release clamps

Step 8 Remove RV from test bench

Stem 9 Certify RV

Note the following:

- Each step tells generally what must be done with no reference to how
- No hazards are mentioned and no safety precautions are prescribed. These come later
- The job steps are described in their normal order of occurrence
- The description of each step starts with an action word, i.e. position, remove, tighten, etc.
- It usually takes only a few words to describe a job step.

Two errors to be avoided in this part of the TRA are:

- Making the job steps too 'fine'

This results in an unnecessarily large number of job steps. For example, in the following 'expansion' of Step 6, the steps are of similar actions, performed at the same time and having similar hazards:

Step 6 Remove plug

Step 7 Remove hose

Step 8 Remove exhaust valve

- Making the job steps too 'board'

For example:

Step 1 Set up relief valve (RV) on test bench

Step 2 Check lift pressure; complete bubble test

Step 3 Remove RV from test bench

These steps are too general and omit activities that could contain potential accidents. When this happens the whole TRA is weakened.

APPENDIX III

HAZARD IDENTIFICATION

3.1 Hazards, Hazardous Conditions and Hazardous Activities

The following is a checklist relating to hazard, based on the Hazards and Effects Hierarchy:

Table 3.1 Hazards, hazardous conditions and hazardous activities

Hazards		Hazardous Conditions	Hazardous Activities
Hydrocarbon liquids/gases	Extreme temperatures	Vibration	Manual handling
Flammable materials	Open flame	Lighting	Use of machinery
Explosives	Electricity	Extreme ambient temperatures	Driving
Material under pressure	Electromagnetic radiation	Temporary facilities	Climbing /working at heights
Differences in elevation	Radioactive	Non-breathable conditions	Confined spaces
Objects under stress	Noise		Stacking
Moving equipment/vehicles	Toxic substances/ chemicals		Excavation work
	Biological conditions		

3.2 Job Factors

Aspects of work environment, the task step itself and the organization that should be considered in the context of the task step, such as:

Table 3.2 Job Factors

Work Environment	Task Factors	Organizational Factors
Access/egress/escape routs • Scaffolds • Suspended access • Mobile platforms • Ladders/lightweight staging **General workplace conditions** • Work space • Light • Heat/cold stress • Noise and vibration • Weather /atmosphere • special workplace conditions • at heights • over water • in excavations • on or near live plant **Plant and equipment** • portable tools • abrasive wheels • cartridge-operated tools • hand tools **Services and consumables** • electricity • consumable (eg LPG, petrol/gasoline, etc) • hazardous substances • process fluids and solids • dusts, mists, smoke and fumes • construction materials chemicals	• Workload • Workplace, effort, exertion • Skill, knowledge and experience • Complexity • Time, timing • Decision making • Repetitiveness	• Training / familiarization • language/communication • supervision • rules and procedures • controls • norms • forms/permits • resource levels

3.3 Key points for Identifying Hazards/Potential Incidents

Each question is in principle, put to each job step. In practice the nature of the job step and the surrounding circumstances may eliminate the need to raise some of them:

- can the employee be **struck by** or **contacted by** anything while doing this job step ?
- can he **strike against** or make **injurious** contact with anything?
- Can he **be caught in, on** or between anything?
- Can the employee **strain** or **overexert**?
- Can the employee **slip** or **trip** on anything. Can he **fall** in any
- Can employee be **exposed to** any **injurious condition** such as gas, heat, fumes, pressure, chemicals, asbestos, etc?
- can the employees injure a fellow employee?
- Can **damage** to **equipment** occur?
- Can **pollution** of the **environment** occur

APPENDIX IV: TRA FORM

Table 4.1 Typical TRA form, showing analysis with risk assessment, are given below

TASK RISK ANALSIS FORM

Task Name: Relief valve testing			Team Composition : Workshop Supervisor, Valve Technician, Impendent Person					Date:
Step No.	Description of Task step	Hazard potential incident	Who or what might Be harmed	Sev-erity	Likeli-hood	Risk	Control measures/ Recovery measures	Action/Responsible Party
1	Set up relief valve (RV) on test bench	Heavy, awkward lift Failure to secure with clamps Gasket failure under test Dirt/particles in lines	Valve Technician Valve Technician Valve Technician Valve Technician	M L M L	M L L L	M L L L	Use lifting beam Inspect clamps-ensure Correct height adjustment Check gasket condition/seating Blow out lines on test bench	
2	Engage clamp jacks	Hydraulic hose failure	Valve Technician	M	L	L	Inspect (pressure test) hose and coupling	
3	Check lift pressure	RV opens violently with noise and sudden discharge of N2 Valve fails to open	Valve Technician/others in vicinity	L M	M L	L L	Restrict access – notify others in Area – confirm exhaust is clear- Wear eye and hearing protection Reaches design limit	
4	Reset at correct pressure	Equipment overpressure (if incorrectly set)	Plant operator (if valve installed with in correct setting)	H	L	M	Confirm pressure against RV schedule Verify Valve Technician competence	
	Fit plug and hose; complete bubble test	Valve remains under pressure –leak may 0ccur	Valve Technician / others in vicinity	L	L	L	Restrict access – notify others in area - wear eye and hearing protection	
6	Remove plug, hose and exhaust valve	Noise and rapid discharge of N2	Valve Technician/others in vicinity	L	L	L	Restrict access – notify others in area - wear eye and hearing protection	
7	Release clamp	Noise RV falls over	Valve Technician	L	L	L	Wear hearing protection Technician steadies RV when releasing	
8	Remove RV from test bench	Lifting hazard	Valve Technician	M	L	L	Use lifting beam	
9	Certify	Valve installed in wrong service	Plant Operator	H	L	M	Inspection section to audit valve certification	

7. Attachment

7.1 TASK RISK ANALYSIS FORM (5-RM-001)