

PROCEDURE: APPROVAL FOR RISK ASSESSMENT (RA) STUDIES

1. PURPOSE:

The development of projects under the jurisdiction of Trakhees-EHS, that possess a significant risk of Environment, Health & Safety and Health issues due to the nature of activity, shall necessitate a Risk Assessment (RA) study as per the EHS: RA guidelines. This needs to be carried out by an EHS Pre-qualified third party (Refer Prequalification Procedure) to ensure that all potential EHS/Fire risks are mitigated to acceptable level.

2. SCOPE:

This procedure is applicable to all clients in the areas under Trakhees-EHS jurisdiction.

3. PROCEDURE:

3.1 Identification of RA need: During the initial project review, i.e. License application stage, the respective EHS officers shall evaluate the project for its potential impacts and identify the need for Risk Assessment Study, which shall be communicated to the client.

The need for RA Study can also be communicated to the client during the drawing review stage while reviewing the project's criticality. Furthermore, it may also be communicated during Building completion inspection, Operational Fitness Inspection and / or Random inspections and shall be communicated to the client for conducting the RA study. The client shall select one of the Trakhees registered RA Consultant to carry out the RA study and submit it to EHS through EHS Online system for approval.

3.2 Approval of Scope of Work (SOW)/ CVs: The RA Consultant selected by the client shall first submit the "Scope of Work" (SOW) of the RA Study, CVs of personnel carrying out the RA study as per EHS RA Guidelines, along with Client's covering letter. The SOW document shall be submitted to EHS through EHS online system.

On review of the same (within a maximum period of 5 working days), EHS Permit Section shall communicate its approval; rejection or request for resubmission of the Scope of Work to the RA consultant. The RA consultant shall then resubmit the SOW document after incorporating necessary changes as advised by EHS. Upon satisfactory review of such submissions, EHS: Permit Section shall issue approval letter signed by the manager, with or without comments to the consultant to carry out the detailed RA study.

Link to EHS Online system: <http://trakhees.ae/en/Pages/list-of-eservices.aspx>

3.3 Review/Approval of RA Study: Prior to any approval of project drawings the client shall ensure that RA study is approved by EHS-Permit Section. The RA Consultant shall submit the RA study documents to EHS office through Trakhees online system. After review of the same, EHS Permit Section may approve/reject or approve with comments the submitted RA report (within a maximum period of 10 working days). Resubmission of revised RA study shall be done after incorporating necessary EHS comments /requirements. EHS Permit Section shall issue approval letter signed by the manager with necessary recommendations/comments for client adherence during the

construction/operations of the project on receipt of the final RA report incorporating all EHS requirements, The design/ construction related recommendations of the RA study shall be shared with the Engineering consultant officially by client (copy to EHS) to ensure that comments are incorporated during design / construction.

3.4 Payment:

First Submission for RA-SOW is AED 500/-.
(No Resubmission charges for RA-SOW)

First Submission for RA Study Report is AED 10,000/-.
AED 2,000/- will be charged from Second Resubmission onwards.

A Payment advice will be generated automatically through EHS Online System when the consultant submits the documents.

This shall be paid in cheque at Trakhees cashiers office or through Trakhees online system

3.5 Final Inspection:

It remains the client's responsibility to ensure that all RA recommendations are fully incorporated in their project.

RA Consultants is responsible to check for the compliance of their recommendations during the Building Completion stage of the project. After verification a confirmation letter for the same shall be sent to EHS contacts seen below.

4. ATTACHMENTS:

- A) RA Guidelines

5. APPLICABLE REGULATIONS:

- A) Environmental Control Rules & Regulations & Guidelines
B) Health, Safety & Fire Protection Regulations, Standards & Guidelines
C) FZ/DM/Local/Federal Rules & protocols (Where applicable)

6. EHS CONTACTS:

- A) Mr. Shivakumar Bhajantri, EHS Officer, Tel: 04-8068852 Fax: 04-8817023
E-Mail: shivakumar.bhajantri@trk.pcfc.ae
B) Mr. Cyrus F. Shastri; Sr. EHS Officer, Tel: 04-8068824 Fax: 04-8817023
E-Mail: cyrus.shastri@trk.pcfc.ae
C) Mr. G. K. Singh ; Manager-Facility Permit : Tel: 8068805 Fax: 04-8817023
E-Mail: Gurkripal.Singh@trk.pcfc.ae

7. DEFINITIONS:

- 7.1 Risk Assessment (RA):
Health, Safety, Environment & Fire risk assessment of the project; could include HAZOP

(Hazard & Operability Study) and / or HAZAN (Hazard Analysis). It also includes both Quantitative and Qualitative Risk assessment techniques and differs from traditional Risk assessment. It covers all risks that need to be mitigated and control measures to be incorporated in the design, from the new project before design / construction. A traditional Risk assessment is a General Compliance risk assessment report as part of Organization's HSE / Safety Management System or used for compliance to OHSAS 18001 requirements and doesn't cover Consequence analysis and modeling techniques.

7.2 Risk Consultants:

These are the consultants/companies registered for Risk Assessment studies (RAs) in regards to Life Safety, Occupational Health, Storage/ Use of Dangerous Goods, Construction Safety and Public Safety.

LIST OF REGISTERED RISK ASSESSMENT (RA) CONSULTANTS

Preamble:

The list of RA Consultants, who are approved by Trakhees-EHS, is displayed on the Trakhees website under "Environment Health & Safety Services-Department-Permit Section-Third Party Agencies. The clients can approach these RA consultants and select any one to carry out the Risk Assessment of their project.

In the registration of these consultants, Trakhees-EHS does not assume any responsibility for their services or actions and the client should ensure that the chosen consultant has the requisite expertise to carry out the study. However, we welcome feedback on the consultant services for necessary action.

This list would be updated on a regular basis. The companies seeking the services of these consultants should get the latest/updated List from EHS Website. The list is always updated on the website from time to time and as required.

Notes:

- 1) **RA Consultants** are required to first submit "scope of work" for EHS Permit Section approval. It should include project summary methodology, project data collection, baseline data monitoring, project plan, deliverables/ reporting and preparation of draft report (in accordance with EHS RA Guidelines). CVs of staff and similar projects' past experience to be included.
- 2) Once SOW is approved the Consultant should submit the detailed RA Study Report to EHS for review and comments. RA Study should be completed before the project execution, to enable incorporation of RA recommendations in design/construction.
- 3) It is the consultant's responsibility to act as a third party and give independent and professional opinion and input through their submitted RA reports.
- 4) Clients to follow-up with their consultants for timely reports submission as per agreed plan.
- 5) The Submission of RA-SOW and RA-Study Report should be submitted to EHS by the RA consultant through Trakhees online system

GUIDELINES FOR CONDUCTING RISK ASSESSMENT (RA) STUDIES

Risk Analysis should be based on the various hazard assessment methods outlined in Table 1 (or any other approved method) and should include (but not limited to) the following:

1. As a first step in Risk Assessment, PHA (Preliminary Hazard Analysis) should be carried out followed by detailed examination by other known hazard analysis method such as HAZOP studies. The Risk Assessment Study should evaluate all possible risks arising within the premises/operations and/or off-site due to the operations and recommend necessary mitigation measures.
2. A detailed evaluation of regular/irregular operations, activities, tasks and main installations, including physical-chemical characteristics of materials being stored/handled/processed, quantitative data on amounts, volumes, production/storage conditions etc. should be carried out.
3. Site suitability with regard to wind, flooding etc.
4. FAULT TREE and EVENT TREE analysis should be carried out to provide a graphic description of the accident sequences associated with plant operations and storage.
5. Evaluate/Clarify risks (Frequency, Severity and Probability) using accepted Risk Assessment Technique and Criteria leading to determination of risks to be eliminated or controlled.
6. Accident Consequence Analysis and its effects on human, environment and nearby installations and site should be analyzed.
7. Provide ratings for identified risks and suggest control and mitigating measures for eliminating the risks or controlling the risk to acceptable level.
8. Evaluate Explosion hazard using F & EI Index.
9. Evaluate Ventilation system.
10. Hazardous materials classification based on Internationally accepted standards such as NFPA , U.N. or IMDG code, etc
11. Hazardous Area Classification and identification with mapping of the proposed facility.
12. Effects of emergency situations/major environmental events such as lightning, flooding, and acts of mischief or sabotage should be analyzed.
13. Evaluate occupational health hazards & environmental risks involved in process and operations.
14. For all of the above, measures should be developed and recommended for technical and organizational protection to bring down risks AS LOW AS REASONABLY PRACTICABLE.

15. Develop ON SITE & OFF SITE emergency action plan in co-ordination with Trakhees – EHS Fire Dept.
16. Wherever a risk rating cannot be brought down to the acceptable limit, it shall be the duty of the consultant to highlight the same in the report.

OUTLINE OF RISK ASSESSMENT STUDY REPORT

Risk (incorporating Health, Safety & Environment risks) Assessment study report should contain the following information as a minimum. In practice, the depth of the information required on each guideline topic given below depends on each individual project / facility e.g. Size & Nature of operation , Identified Hazards, Accident History ,etc, will vary according to the circumstance of the individual facility.

- ✓ Background and objective that includes a full description of the proposed project
- ✓ Process Description of the Proposed Project i.e. Basic Operations, Physical and Chemical reactions, Operational Storage, etc.
- ✓ Information on the installation (e.g. location, plot plan, process flow diagram(PFDs), PID's, personnel on site, local land used and population distribution, etc.)
- ✓ Information on details of the plant and machinery including sketches (sectional view) of machinery and schematic of the process involved.
- ✓ Information on hazardous substances (e.g. substance name, monitoring method, hazards, composition of process, MSDS, List of Chemicals, etc.)
- ✓ Information required on management system (e.g. responsible person and Quality Control for safety training etc.).
- ✓ Information on major accidents (identification of potential major hazard events, process flow diagram, prevention and control systems, emergency procedure meteorological conditions, numbers at risk etc.).
- ✓ Information on possible accidents, i.e. Assessment of the possible release of hazardous substances or of energy, Possible dispersion of released substances, Assessment of the effects of the release(Size of affected area, health effects, property damage, etc) ,etc
- ✓ Documentation and summary of Codes, Standards and Recommended Practices which have been consulted during the design stage of the project.
- ✓ Recommendations and Mitigation measures based on risk evaluation
- ✓ Prior to final approval of the Risk Assessment Study report, a technical presentation to EHS Management should be carried out if required / asked by EHS Permit Section.

It is important that:

- 1) The names of personnel who conducted the RA study to be mentioned in the report.
- 2) Report to be submitted by RA Consultant with their cover letter.
- 3) After completion of the project, Risk Assessment constant shall conduct site visit to verify compliance/ implementation of RA recommendations and accordingly submit the Statement of Compliance to EHS Permit Section.

TABLE 1
WORKING METHODS FOR HAZARD ASSESSMENT

METHOD	PURPOSE	AIM	WORKING PRINCIPLE
1) Preliminary hazard analysis 2) Matrix diagrams of Interactions 3) Use of checklist	1. Identification of hazards	1. Completeness of safety concept	1. Use of “thinking aids”
4) Failure effect analysis 5) Hazard & operability study			2. Use of “searching aids” in schematic documents
6) Accident sequence analysis (inductive) 7) Fault tree analysis (deductive)	2. Assessment of hazards according to their occurrence frequency	2. Optimization of reliability and availability of safety systems	3. Graphic description of failure sequences and mathematical calculation of probabilities
8) Accident Consequence analysis	3. Assessment of accident consequences	3. Mitigation of consequences and development of optimum emergency plans	4. Mathematical modelling of physical and chemical process

SPECIFIC REQUIREMENTS TO BE ADDRESSED

- i. Flammability Hazard identification.
- ii. Severity analysis Explosion Index (F & EI) and Toxicity Index (TI). (Refer to TABLE 2)
- iii. Mapping areas of risk / risk contours
- iv. Direct comparison with actuarial data and other risk criteria.
- v. Criteria for assessing maximum release quantity and separation distances / quantifying dispersion.
- vi. Scenario development.
- vii. Probability analysis / the chances of fire and explosion.

- viii. Risk monitoring (if the risk is acceptable).
- ix. Identification of environmental problems that are related to fire protection.
- x. Risk reduction analysis (if the risk is not acceptable) systems & methods and recommendations to prevent and/or reduce them to the acceptable level(s).
- xi. Hazard and Operability Study (HAZOP)
- xii. Event trees
- xiii. Case histories where appropriate
- xiv. Compliance with codes, procedures and regulations including manufacturing requirement & management under ASME code for boilers & pressure vessels.
- xv. Toxicity relationships
- xvi. Damage from fire and radiant heat
- xvii. The TNT equivalence
- xviii. Primary and secondary blasts relationships
- xix. Top event frequency estimation
- xx. Design & construction procedures
- xxi. Maintenance Operations
- xxii. Education & Training of staff
- xxiii. Emergency / Evacuation Plans (on site & off site plans)

Guideline notes:

- a) The scale that measures severity such as death, injuries, property damage, and areas reached by flames shall be specified.
- b) Calculations specifying the severity measure used for a particular fire shall be included.
- c) The consultants shall be solely subject to the laws of the UAE for losses or damages in terms of life and property stemming from design errors, implementation errors, deficiencies of inspections, failure to construct in compliance with the required standards, failure to comply with rules of Professional ethics, failure to use knowledge and experience to the contracting entity, and similar reasons; and successively (severally) liable with the contractors where the consultants have undertaken control and inspection services on works. The consultants shall be caused to complete and compensate for any such losses or damages pursuant to the laws of the UAE.
- d) Trakhees EHS Dept. or any other departments of PCFC and their directors, officers and other concerned personnel shall not be held responsible or liable for any such losses or damages, errors, deficiencies and failures on the part of the consultants.

TABLE 2**FIRE & EXPLOSION INDEX (F&EI) SYSTEM****MATERIAL FACTOR (MF)**

The Material Factor (MF) is derived from the following table:-

	$N_r = 0$	$N_r = 1$	$N_r = 2$	$N_r = 3$	$N_r = 4$
$N_r = 0$	1	14	24	29	40
$N_r = 1$	4	14	24	29	40
$N_r = 2$	10	14	24	29	40
$N_r = 3$	16	16	24	29	40
$N_r = 4$	21	21	24	29	40

The MF for Combustible Dusts; Combustible Solids; Warehousing/Storage of Goods; Manufacturing, Construction and Other Occupancies are derived from separate tables.

GENERAL HAZARDS (GH)

General process Hazards are factors that play a primary role in determining the magnitude of a loss incident. The items viz. (i) Chemical Processes (ii) Storage, Handling, Transfer and Manufacturing (iii) Confinement (iv) Access (v) Drainage (vi) Total General Hazards Factor are investigated as contributing hazards.

SPECIFIC HAZARDS (SH)

The items viz. (i) Quantities of Materials Involved (ii) Pressure Conditions (iii) Toxic Materials Involved (iv) Explosion Potential/ Flammable Range & (v) Total Specific Hazards Factor that indicate existence of specific conditions as a major contributing factor in fire and explosion incidents are investigated.

FIRE AND EXPLOSION INDEX (F&EI)

The F&EI calculation is calculated by giving credit for both general and specific hazards to the materials involved. The formula used is:

$$F\&EI = MF \times (1 + GH) \times (1 + SH)$$

The resulting F&EI values are ranked into four categories:

- 1 - 45 Light Hazard
- 46 - 60 Moderate Hazard
- 61 - 95 High Hazard
- 96 - up Severe Hazard

TOXICITY NUMBER: The toxicity number (Th) is derived from the NFPA health factor Nh (NFPA 704, 325M or 49). Nh is an integer number ranging from 0 to 4. The five degrees of hazards are related to the protective equipment normally available to fire fighters.

Nh	Th
0	0
1	50
2	125
3	250
4	325

PENALTY FACTOR: The Penalty Factor (Ts) is the second toxicity parameter used to determine the TI. The Ts value is derived from the 'Threshold Limit Values (TLV)'.

The TLV-values are drawn up by the American Conference of Governmental Industrial Hygienists. TLV represents a time weighted average (TWA) air concentration to which workers can be exposed during a normal working week without ill effects. TLV is often indicated as a TWA-value, both are the same. The penalty factor is determined from the table below:

Threshold Limit Values (TLVs)	Penalty Factor (Ts)
< 5	125
5-50	75
> 50	50

TOXICITY INDEX (TI)

The Toxicity Index is then calculated from Th and Ts plus the hazard factors of Fire & Explosion Index (F&EI). The TI is found from the following formula:

$$TI: \frac{Th + Ts}{100} (1 + GH + SH)$$

The resulting TI values are ranked into three categories:

- 1-5 Light
- 6-9 Moderate
- 10-up High