APPENDIX 5

Risk Assessment Matrix Specification

Purpose

To establish a consistent process for assessing Risks to people, assets, environment, reputation and community.

Who is this for?

- *Managers*;
- Staff who are in *HSE Critical Positions* or who are required to implement *Controls*;
- *Technical Authorities*;
- *Site Controllers*, *Area Authorities*, *Performing Authorities*, *Isolating Authorities*;
- *Maintenance Planners*;
- *Employees*.

What situations are covered?

This document applies to all *Sakhalin Energy Assets*, *Facilities*, operations, *Projects* and activities, including activities undertaken by contractors on behalf of the Company. In particular, this document is applicable in Managing Risk, classification of *Incidents* and *Audit Findings*, and as the Maintenance Prioritization Tool.

Requirements

Managers are *Accountable* for implementing requirements 1 to 2:

1. Use the *Risk Assessment Matrix* (*RAM*), see Sakhalin Energy Risk Assessment Matrix below, for performing HSE *Risk Assessments*.
   a. In reporting to Lenders, use the RAM specified in the Methodology for Classifying and Remediating Incidents and Breaches that additionally includes a Social consequences column.
2. Assure the competence of people applying the RAM to HSE management processes.

Sakhalin Energy Risk Assessment Matrix Structure & Description

The RAM is a 6 by 5 matrix that is used for qualitative assessments of HSE & SP Risk and, where considered appropriate, for prioritization of activities and resources. It is based on the concept of applying experience of events or incidents in the past to provide insight in how these risks can be managed into the future. The RAM is also used for incident classification and reporting.

SEVERITY	CONSEQUENCES				INCREASING LIKELIHOOD				
					A	B	C	D	E
	People	Asset	Community	Environment	Never heard of in the Industry	Heard of in the Industry	Has happened in Sakhalin Energy or more than once per year in the Industry	Has happened at the site or more than once per year in Sakhalin Energy	Has happened more than once per year at the site
0	No injury or health effect	No damage	No Effect	No Impact					
1	Slight injury or health effect	Slight damage	Slight Effect	Slight Impact					
2	Minor injury or health effect	Minor damage	Minor Effect	Minor Effect					
3	Major injury or health effect	Moderate damage	Moderate Effect	Moderate Effect					
4	PTD* or up to3 fatalities	Major damage	Major Effect	Major Effect					
5	More than 3 fatalities	Massive damage	Massive Effect	Massive Effect					

* Permanent Total Disability

- The vertical axis represents increasing Consequences (Severity levels 0 to 5) in terms of harm to people, damage to assets, impact on Community/Reputation and effect on the environment (PACE categories).
- The horizontal axis represents increasing Likelihood (levels A to E) of the Consequence under consideration.
- Boxes in the matrix represent levels of Risk, increasing from top left to bottom right corners of the matrix.
- The matrix is divided into light blue, blue, yellow and red areas to illustrate the increasing level of Risk.
- The Consequence Severity (0-5) scales in categories People, Assets, Community/Reputation and Environment.
- The Likelihood levels A to E are self-explanatory.

Definitions

HAZARD – agent with the potential to cause harm to People, Assets, Community/Reputation or Environment (e.g. explosive material, high or low temperature of media in a process, pressure in a piping, heavy object on height etc.).

CONTROLS (BARRIERS) – measures put in place to prevent hazard from releasing and causing harm.

RELEASE OF HAZARD – A situation when CONTROLS didn't work and incident happened (e.g. gas leaked through untightened bolt, tool left on the roof fell down etc.).

PEOPLE – refers to employee and contractor health and safety impacts and community safety (e.g. road traffic collisions involving 3d parties, or third party fatalities or injuries as a result of operational incidents).

ASSETS – refers to damage to Sakhalin Energy assets without consideration of Consequential Business Losses (i.e. does not include loss of business, loss of product or resulting revenue, and inability to do other work which has associated costs or loss of revenue).

ENVIRONMENT – refers to people, resources and assets impacted outside of the facility.

COMMUNITY – all social and reputational aspects including but not limited to public and indigenous people livelihood, social and cultural assets, community security and health.

CONSEQUENCES – effect on People, Asset, Community (prior Reputation) and Environment as a result of the Hazard being released. Consequences Categories and Severities are described in the tables below:

People

Level	Definition
0	No injury or health effect
1	**Slight injury or health effect** • No Treatment Case or First Aid Case • Illnesses that result in noticeable discomfort, minor irritation or transient effects that are reversible after exposure stops
2	**Minor injury or health effect** • Medical Treatment Case • Lost Workday Case or Restricted Work Case, where either has a duration of up to and including 5 days • Illnesses with reversible health effects such as food poisoning and dermatitis
3	**Major injury or health effect** • Lost Workday Case or Restricted Work Case, where either has a duration exceeding 5 days • Illnesses with irreversible health effects such as sensitisation, noise induced hearing loss, chronic back disorders or repetitive strain injury • Mental illness due to stress with reversible health effects
4	**Permanent total disability or up to three fatalities** • Illnesses with irreversible health effects such as corrosive burns, asbestosis and silicosis • Cancer • Mental illness due to stress with irreversible health effects
5	**More than three fatalities** • Illnesses with irreversible health effects such as multiple asbestosis cases traced to a single exposure situation • Cancer in a large exposed population

Assets

Level	Definition
0	No damage
1	Slight damage Costs less than US $100,000
2	Minor damage Costs between US $100,000 and US $1 million
3	Moderate damage Costs between US $1 million and US $10 million
4	Major damage Costs between US $10 million and US $100 million
5	Massive damage Costs in excess of US $100 million

When assessing RAM asset consequence, include only direct damage to assets; do not include Consequential Business Loss (CBL). CBL is the indirect loss due to asset damage, environmental impact or impact on the community. It comprises losses such as lost production (expressed as profit margin), process unit downtime, product quality costs, cost of environmental clean-up, cost of recovery/disposal of waste and cost of reprocessing off-grade material.
Example: Naphtha is being stored in a tank. There is a risk of fire leading to the loss of the tank (Impact to Assets). In this case the Asset is the tank. The loss of the stored product is not considered when using the HSSE RAM.
Example: Propane is produced in a Hydrocracking operation. There is a Risk of fire and explosion associated with the Propane. Such an event would obviously impact the Hydrocracking unit resulting in a loss of production. This loss of production is not considered when assessing the Consequence to Assets and does not factor in to the damage estimate.
Do not consider damage to 3rd party assets. These consequences are covered under the Community severity column.

Community

Level	**Definition**	**Additional lenders requirements as per HSE SAP**
0	No effect	No effect
1	**Slight effect** on **Community** indicated by • Infrequent slight nuisance. (Nuisance to include interference with reasonable comforts and enjoyments of life, general inconvenience relating to day to day activities or enjoyment of land). • No observable adverse or perceived effect on livelihood, social and cultural assets, community security, community health, vulnerable or Indigenous People. **Reputation:** Limited public awareness on local level but not discernable concern; no media coverage.	Slight adverse impact to one or more people or their assets which results in no measurable adverse impact on their living standards or livelihood.

2	**Minor effect** on **Community** indicated by: • Limited short-term nuisance • Limited effects on livelihood and/or social or cultural assets, community health. • No observable adverse effect on community security, vulnerable or Indigenous Peoples. **Reputation**: Local public concern/media coverage.	Minor adverse impact on one or more people or on their assets which can be readily identified, is contained within a limited geographical area, and results in a reduction in the living standards or livelihoods of those affected5 • Loss of opportunity for affected persons to derive legitimate material benefits from the Project or to participate in Project public consultation or grievance process. • Damage that is able to be remedied to amenities or objects of cultural importance to the extent this has not been the subject of prior adequate compensation.
3	**Moderate effect** on **Community** indicated by: • Persistent nuisance. • Effects on livelihood and/or social and cultural assets, community health. • Limited observable effects on community security, vulnerable or Indigenous Peoples. **Reputation:** high local public concern; extending to the level of Sakhalin region; media coverage on regional level.	Considerable adverse impact on one or more people or on their assets which can be readily identified, is contained within a limited geographical area, and results in varied primary and secondary impacts on the living standards or livelihoods of those affected6. The determination of an appropriate response, such as compensation, will require focused studies. Destruction of a site or major object or amenity of local or regional cultural importance, or national objects that are not under legislative protection, to the extent this has not already been the subject of prior adequate compensation. Considerable discontent in groups within the labour force and/or community in relation to practices attributable to the construction and/or operation of the Project. Acts of petty violence or other criminal acts by or against Project workers capable of resulting in serious injury or localised civil unrest.
4	**Major effect** on **Community** indicated by: • Persistent effects on livelihood and/or social and cultural assets, community health. • Effects on community security, vulnerable or Indigenous Peoples and/or human rights infringements, that are serious and/or at a community level. • Mitigation is complex or protracted. • National public concern. • Impact on local and national stakeholder relations. • National government and/or NGO involvement with potential for international NGO action. **Reputation**: Likely to escalate and affect reputation on the Company, Shareholders and/or Lenders; national attention, extensive	Major adverse impact on many people or their assets which cannot be readily identified and/or is over a widespread area, and results in long-term varied impacts including secondary impacts on their living standards or livelihoods. Extensive studies required to identify potential compensation measures; full compensation unlikely to be possible. Destruction of a site or major object or amenity of national cultural importance which is under legislative protection. Serious social conflict involving a significant number of members of the community or labour force in relation to practices attributable to the construction and/or operation of the Project. Acts of organised crime (including violence) or other serious

	media coverage on national level, some international.	crimes by or against Project workers capable of resulting in severe injuries to people or civil unrest at multiple locations.
5	**Massive effect** on **Community** indicated by • Persistent, severe impact on livelihood, social and cultural assets, community security, community health, vulnerable or Indigenous Peoples and/or human rights infringements. • Impact may affect a large geographic area or population. • Mitigation is complex or protracted, and of limited effectiveness. • International public concern. • High level of concern and action(s) by governments and/or by international NGOs. **Reputation:** severe impact on reputation of the Company, Shareholders and/or Lenders, international public/media attention; NGO action, high level of concern amongst governments.	Massive adverse impact on extensive populations or on their assets, resulting in varied and probably irreversible impacts on their living standards or livelihoods7. Destruction of a site or major amenity of international cultural importance which is under legislative protection. Massive social conflict resulting in widespread rioting, widespread life threatening violence against Project entities or Project workers, or by or against communities affected by the Project in relation to practices attributable to the construction and/or operation of the Project.

Note: The RAM consequence scale for Community is to a large extent qualitative and not quantitative. Use competent professionals in Social Performance and in External Affairs to perform risk assessment. These practitioners will have a good overview of the impact of Sakhalin Energy activities on the surrounding communities and the Company's reputation. They will be able to combine this with a good understanding of relevant stakeholder perceptions.

The Community column contains generic descriptors, and in relation to Consequences, the Community context within which the risk is being evaluated will vary with each project and asset.

Environment

Level	Definition
0	No Effect No Impact to the Environment
1	Slight Effect • Slight environmental damage contained within the premises. • Examples include but are not limited to: • A small spill in a process area or tank farm area that readily evaporates.
2	Minor Effect • Minor environmental damage, but no lasting effect. • Examples include but are not limited to: • A small on-site spill with potential to harm the environment that has no off-site impact. • On-site groundwater contamination with no potential for off-site contamination. • A single exceedance of statutory or other prescribed limit.
3	Moderate Effect • Limited environmental damage that will persist or require cleaning up. Examples include but are not limited to: • A spill with potential to harm the environment that requires removal and disposal of over

	100 m3 of impacted soil/sand. • A spill with potential to harm the environment which reaches surface water off-site. • Off-site groundwater contamination. • Off-site habitat and/or ecology effects or damage, e.g. fish kill or damaged vegetation. • Repeated exceedance of statutory or other prescribed emission limit for longer than 3 months and/or, with potential long-term effect.
4	Major Effect • Severe environmental damage that will require extensive measures to restore beneficial uses of the environment. Examples include but are not limited to: • A spill to water with potential to reach a shore and cause harm to the environment. Off-site contamination of surface or groundwater over an extensive area. • Requirement for Tier 2 oil spill emergency response. • Off-site habitat and/or ecology effects or damage for greater than 1 year. • Extended exceedances of statutory or other prescribed emission limits for greater than 1 year and/or with potential long-term effect.
5	Massive Effect • Persistent severe environmental damage that will lead to loss of natural resources over a wide area. Examples include but are not limited to: • A spill resulting in pollution of a large tract of wetlands, ocean, part of a river estuary or • beach/coastal habitat. • Requirement for Tier 3 oil spill emergency response. • Persistent off-site habitat and/or ecology effects or damage with proven long-term effect.

Note: "The RAM consequence scale for Environment is to a large extent qualitative and not quantitative. Use environmental professionals competent in their respective discipline areas for assessing severities who have a good overview of local, national and regional environmental issues, regulations and focus areas including a good overview of sensitive areas, habitats and species combined with a good understanding of relevant stakeholder and NGO perceptions of environmental consequences and impacts.
The consequence severities should not be interpreted as being limited to spills and should also be used to assess other examples of consequences in an area including but not limited to overuse/overexploitation of water, operational discharges/emissions to sea and air, chronical leakages from waste sites and damage to flora and fauna from construction activities.
When assessing Environment RAM consequence for repeated exceedances of statutory or other prescribed limits between the quantitative criteria windows defined for minor, moderate and major effects also take into account other factors like regulatory policy, focus and feedback, mediation/frequency of the emission/discharge limit and to what extent the exceedance(s) represent and actual impact on the environment.
For Environmental Consequences not covered by this RAM, such as business-time loss costs associated with onsite and/or off-site clean up, here it is necessary to communicate these consequences and associated Risks to the Business. In these cases a Subject Matter Experts should be consulted".

Likelihood Scale

The scale of increasing Likelihood is intended to represent a range from highly unlikely to frequent. It is expressed in terms of frequency of historical events per period per Industry, Organisation or Location. These descriptions are used in every application of the RAM so as to promote consistent assessment of Risk.

Increasing Likelihood				
A	**B**	**C**	**D**	**E**
Never heard of in the Industry	Heard of in the Industry	Has happened in the Organisation or more than once per year in the Industry	Has happened at the Location or more than once per year in the Organisation	Has happened more than once per year in the Location

The four colors in the application of the RAM mean the following:

	Managing Risk	Incidents
	Manage for continuous improvement, although Businesses may set lower priority for further Risk reduction.	Low Risk Incident
	Manage for continuous improvement through the effective implementation of the HSSE Management System.	
	Identify and implement Controls and Recovery Measures to reduce Risk to As Low As Reasonably Practicable (ALARP).	Medium Risk Incident
	Identify and implement Controls and Recovery Measures to reduce the Risk to ALARP and provide a Documented Demonstration Of ALARP by a Bow-Tie or equivalent methodology.	High Risk Incident
Actual Severity 4 or 5	Identify and implement Controls and Recovery Measures to reduce the Risk to ALARP and provide a Documented Demonstration Of ALARP by a Bow-Tie or equivalent methodology.	Significant Incident
Potential Severity 4 or 5 A-E	Identify and implement Controls and Recovery Measures to reduce Risk to As Low As Reasonably Practicable (ALARP).	**High Potential Incident**

Sakhalin Energy Risk Assessment Matrix in Use

The starting point for a RAM assessment is identifying the hazards with an understanding of the context (hazard release scenario, activity, location etc.), or a description of the particular incident being considered with an understanding of the actual and potential consequences. The RAM assessment then consists of the following steps.

Step 1 Identify potential Consequences

Identify the “worst case credible” Consequences that could develop from a release of the hazard under the prevailing conditions. Ask the question ‘What could happen if the Controls don’t work or they fail?’

Example, the operation of a pump in crude oil service involves the potential for a release of crude oil in the event of a pump seal failure. Potential Consequences:

a) Leak of crude oil into the drain system and then into the sea in a busy fishing area: Community and Environment

b) Ignition of the crude oil resulting in a small fire around the pump: Assets, Environment

c) Worst Case Credible: Escalation of the fire to the point where other process equipment fails and a major fire and explosion occurs: People, Assets, Community and Environment.

Step 2 Estimate the Severity of each worst case credible potential Consequence

For each of the identified Consequences assess the Severity (0 - 5) in the four Consequence categories - people, assets, community & reputation, environment.

Example: In the crude oil pump example above, for the Worst Case Credible Consequences: “Escalation of the fire to the point where other process equipment fails and a major fire and explosion occurs”, here are potential severities:

- People: 4-5 as People may be injured or killed by a Major fire or the explosion. The number of people impacted is based on the possible number of people that could be affected not the number of people that are normally in the affected area. Consider people who may not normally work in an area such as maintenance staff or specialty contractors. Also consider Emergency Response or other people who may enter an area in response to the incident which may put them at Risk of harm.

- Asset: 3-4 as the location of the pump will have an effect on the outcome. The pump is in a remote location or the pump is very near other process equipment.

- Environment: 3-4 depending on volume of spill, ecology effects, potential persistence of impact and requirements for clean-up. More severe impacts requiring extensive measures will typically be 4.
- Community 3-4, proximity to local rural subsistence community increases severity with potential effects on community livelihoods (fishing), community health (drinking, bathing, diet (fish), fear of health effects), concern likely to be limited to local community and local government.

Step 3 Estimate the Likelihood

For each of the 'worst case credible' potential Consequences make an estimate of the Likelihood of the Consequence in terms of the Likelihood levels A to E.

The Likelihood level is judged from past experience, by asking the question ”How often in the past has a hazard release resulted in a Consequence similar to the one that we are considering?". The approach is one of referring to history to determine what actions can or should be taken to manage the risk into the future.

The estimate of Likelihood is based on the Likelihood that the particular Consequence under consideration occurred, not on the Likelihood of the Hazard being released. For incidents this means that when assessing Worst Credible Consequence the Likelihood of the Consequence is what is considered, not the Likelihood of the initial incident occurring.

For the example above, an estimate is made of the Likelihood of the Consequences, e.g. the likelihood that fishing livelihoods will be materially impacted, not the Likelihood that the pump seal will leak.
Refer to Appendix 3, for an example of estimating Likelihood.

The reliability of the Likelihood estimate, and therefore of the RAM assessment, depends to a large extent on the availability of data on previous incidents and on the knowledge and experience of the assessors. It is therefore important to maintain databases of previous incidents and make them available to people making RAM assessments and to have competent people in attendance that are able to cover the range of potential Consequences for the specific categories (SMEs can provide data on historical consequences from releases). The team assigned for estimating likelihood should also have competency in using the RAM.

The hazard release scenario or the incident under consideration will often not be identical to the previous incidents that are being used to determine Likelihood. Also, detailed information on previous incidents outside the Organisation, or even outside the Location, may not be readily available. Therefore, a combination of available information and judgment from experience has to be applied to make a best estimate of the Likelihood level A to E.

Step 4 Estimate the Risk rating

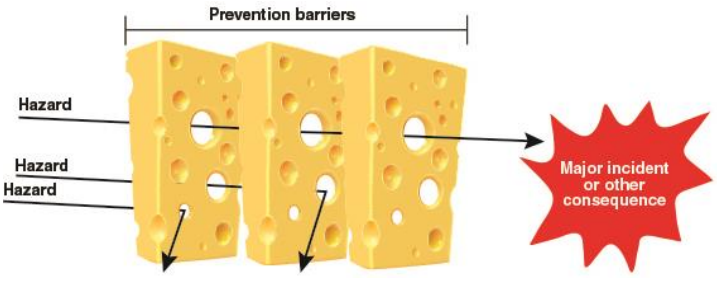
For each potential Consequence determine the RAM risk rating for each of the applicable People, Asset, Community & Reputation, Environment categories in terms of the product of the consequence severity and the likelihood. The risk ratings (up to 5 for each potential consequence) can be plotted on the matrix to provide a visual representation of the risk profile of the hazard release scenario under consideration.

The convention for expressing RAM severity rating (actual consequence) is in the form of “People 2” or “Community 4” and the convention for expressing RAM risk ratings (potential consequence) is in the form of “People 2B“ or “Community 4C“.

Note: while estimating the Risk rating for Community and Reputation choose the most severe rating when both consequences on community and reputation are released.

Considerations to be taken into account:

- Assuming that other barriers prevent the major accident from being released. The phrase "that cannot happen here" can be translated to "accidents happen to other people, not me". "Double jeopardy" similarly means two or more barriers have failed simultaneously. Multiple barrier failures have caused major accidents in industry.



- Everyone has a different perception of risk. That is why a team approach with relevant expertise is needed to judge the credible worst case outcomes and knowledge of industry accidents to judge likelihood. Use your Process Safety and HSE expertise in Sakhalin Energy to make an informed judgment.
- Don’t assess actual outcome likelihood of the event in RAM. Assess worst case credible consequences and their likelihood. See Process Safety example 1.
- Industry's consequential business loss in RAM assessments can result in favor of production over safety. For Asset damage incidents, consequential business loss shall be excluded when assigning

the RAM rating. Only direct damage sustained by the asset should be estimated. Drilling downtime, production shutdown shall be excluded when assigning the RAM rating.