	Asset Integrity and Process Safety Standard	Rev. 03
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APPENDIX 7

Loss Prevention in Design and Construction

Purpose

To manage *Risks*¹ due to leaks or spills, including Risks to people, assets, air, water, soil and groundwater.

Who is this for?

- *Project Managers, Contract Holders and Contractors* with work scope including facilities design and construction.

To be clear, this specification is only applicable for design and construction phases of projects and project expansions.


Requirements

In addition to all requirements of [Soil & Groundwater Standard Overview](#)² 0000-S-90-04-O-0018-00, the following requirements apply to design and construction activities.

1. **Design considerations - All activities** [EIA V1: 6-28]. Management of potential hydrocarbon spills shall be an integral part of the detailed design of all facilities, which shall incorporate measures to minimise the likelihood and severity of a spill. Mitigation measures shall include:
 - a. Secure storage;
 - b. Secondary containment;
 - c. Closed circuit drainage;
 - d. High level alarm and trip system;
 - e. OET tanks shall have an internal floating roof to minimise the risk of explosion;
 - f. LNG diesel storage tank shall have a nitrogen blanket in the headspace of the tank to prevent degradation during long-term diesel storage.
2. **Spill containment – Onshore** [EIA V1: 6-33, 6-34].
 - a. To minimise the possibility that oil spills could spread beyond the facility area, bunds shall be constructed around hydrocarbon storage tanks to provide spill containment of 110% of the largest stored vessel.
 - This requirement includes but is not limited to: product storage tanks, product transfer areas, fueling areas, waste storage areas, and wastewater treatment facilities.
 - b. To maintain stability, bunds shall be constructed using onsite or imported soil, with a maximum slope of 1 vertical unit to three horizontal units. Bunds shall contain a liner for secondary containment.
 - c. Oil tanks situated within the OET are provided with secondary containment. Tertiary emergency containment pond shall also be provided.
 - d. LNG tanks have a concrete outer tank that shall act like a full container. The perimeter road at the LNG site shall act as a dam in the Southwest part of the site to prevent oil ingress into the Mereya River in the case of a catastrophic failure of oil tanks and bunds.
3. **Spill containment - Platforms, LNG and OPF**. Interceptors shall be installed on all drainage facilities prior to any discharge of runoff water into a watercourse or marine environment.
4. **Facility integrity (Seismicity & Geohazards) - Facility construction, commissioning and operation** [EIA V1: 6-27, V2: 3-35; EIA Addendum on Oil Spill Response]. Onshore and offshore pipelines shall be

¹ Italicized terms in this document are included in the Sakhalin Energy HSE Glossary.

² Underlined items in this document refer to Sakhalin Energy Controlled Documents.

	Asset Integrity and Process Safety Standard	Rev. 03
---	--	----------------

designed to withstand, without rupturing, earthquake, strong ground motion and related permanent ground deformation.

- a. Strong ground motion: offshore pipelines designed for return periods of 1 in 2,000; onshore pipelines designed for return periods of 1 in 1,000 years.
- b. Permanent ground deformation: the pipelines shall be designed to accommodate ground displacements from characteristic earthquakes associated with Holocene active faults.
- c. OPF has been designed to withstand ground motions with return periods of 1 in 475 years, with only minor damage to the facility such that it can be put back into operation after normal commissioning checks and minor repairs.
- d. LNG / OET facilities have been designed using two levels of ground motion: The Safe Shutdown Earthquake (SSE) and Operating Base Earthquake (OBE). LNG tanks and safety related facilities are designed to withstand an SSE with a return period of 1 in 10,000 years. These are also designed for an OBE with a return period of 475 years. The other facilities and the OET are designed for the same OBE.
- e. Offshore platforms are designed for two levels of strong ground motion. Ductility Level Earthquake (DLE) design is to a 1 in 3000-year event, and Serviceability Level Earthquake (SLE) design is to a 1 in 200-year event.

5. Pipeline integrity (Seismicity & Geohazards) - Onshore pipelines.

- a. The design for onshore pipeline/fault crossings shall incorporate a widened trench with flat side slopes, special trench backfilling, and optimised pipe class to reduce the impact of ground displacement. At other sensitive locations, such as rivers, wetlands, roads and railways, and in the vicinity of settlements, the thickness of the pipeline wall shall also be increased, as prescribed by the SNiP.
- b. Onshore pipelines shall be designed to withstand, without rupturing, areas of slope instability, liquefaction, and lateral spread. Areas of slope instability will be avoided or hazard will be mitigated. Areas of liquefaction and lateral spread shall be designed for buoyancy control and to withstand estimated ground deformation.
- c. Coastal facilities shall be designed to withstand tsunami inundation.
- d. Install and maintain block valves along the onshore pipeline. These shall be placed at maximum intervals of 30km to minimise loss of oil (or gas) in the event of a rupture. Oil and gas pipeline block valves shall also be located on both sides of high-risk seismic faults or groups of faults to assist control of pipeline inventory in the event of increased seismic load. Oil pipeline block valves shall be strategically placed to minimise the effect of an oil spill on medium and high sensitivity rivers in case of a rupture. The system shall be continuously monitored and the pipeline shall be closed immediately in case of a leak or the detection of a trigger-event level earthquake.

6. Pipeline integrity (Ice damage) - Offshore pipelines.


- a. All pipelines shall be protected from physical damage at shore approach from trawling or ice keels by rock/concrete backfill and burial below seabed. Burial depths will vary according the depth of water, but will comply with relevant RF regulations and applicable good international practice.

7. Pipeline inspections – Pipelines.

- a. Prior to pipeline operation, X-ray or ultrasonic inspection shall be undertaken on all pipeline welds to assure their quality.
- b. Prior to operation, the pipeline systems shall be hydraulically pressure tested to at least the equivalent of 125% of the design pressure. The testing shall be supervised by the RF Technical Supervisory Board. Undertake routine site audits to ensure compliance. Retain inspection records/certificates. Conduct Pre-Operational Audit.

8. Pipeline integrity (Anti corrosion) – Pipelines.

- a. Onshore pipelines shall have anti-corrosion measures including epoxy coating and cathodic protection.
- b. Offshore pipelines shall have asphalt enamel under a concrete weight coating for the 14" and 30" pipelines; polyethylene 3 layer for the 4.5" pipeline; and in the PA-A risers in the J-tubes Fusion Bonded Epoxy Coating shall be used.

	Asset Integrity and Process Safety Standard	Rev. 03
---	--	----------------

9. **Loss of well control during drilling operations - Offshore drilling** [EIA V2-3: 3-35, V2: 3-9]. Shallow gas surveys shall be carried out prior to any drilling operations (Shallow gas survey programme). The risk of loss of well control shall be reduced using:
 - a. Well design drilling programme and drilling fluid make up;
 - b. Well monitoring programme;
 - c. Well control training;
 - d. Emergency drills.
10. **Blow-out preventers - Offshore drilling** [EIA V2-3: 3-35]. Blow out preventers (BOPs) shall be fitted on all wells that are being drilled and checked by regular audits.
11. **Fuel management, Refueling, and Parking of equipment adjacent to watercourses and wetlands** – refer to [Soil and Groundwater Operational Controls specification 0000-S-90-04-O-0018-00](#).
12. **Water supply wells** shall be located and constructed to prevent contamination of groundwater and subsurface soils. For example, water wells should not be located near hazardous materials storage or waste disposal areas and well casings should be appropriately sealed to prevent downhole migration of contaminants.
13. **Conduct routine site audits** to ensure compliance with all above.