



APPENDIX 5

Waste Management Standards Comparison

This document is based on original project data and standards in force at date of signing.

Purpose

This document benchmarks the Company's waste management practices and plans and determines compliance versus international standards and guidelines.

Who is this for?

This document supports the Asset/Activity HSE Managers and Environmental and Waste Management Specialists to benchmark performance, determine compliance, maintain internal standards and specifications, and advise Asset/Activity Managers on relevant requirements.

Ref	Document	Aspect/Relevant issues/Requirements	Project Specification	Comments
1.	Environmental, Health and Safety Guidelines for Waste Management Facilities (IFC, December 2007)	<p>Environmental Health and Safety Guidelines (EHS) covers establishments and assets, dedicated to urban solid and industrial waste management including waste collection and transport, receiving, loading, utilization and storage, waste disposal, physicochemical and biological treatment and incineration.</p> <p>World Bank (WB) policy relates to the following aspects:</p> <ul style="list-style-type: none"> • Impact of industrial activity and its management; • Waste collection and handling; • Receiving, loading, utilization and storage of waste; • Disposal on landfills; • Project siting; • General environmental requirements; • Monitoring; • Work planning for landfills removal and after removal; • Hazards Protection ; 	<p>Company policy and strategy is defined by the following documents:</p> <ul style="list-style-type: none"> • Waste Management Standard 0000-S-90-04-O-0258-00-E, Rev. 06 • Annual HSE Action Plan • Waste Classifier 	<p>Comply.</p> <p>According to Decree by Minprirody of Russia as of 04.03.2016 No. 66: "On the Procedure of monitoring the condition and pollution rate of environment at the waste disposal territories and within the range of waste influence on the environment by the owners of waste disposal assets, as well as by the individuals owing or using waste disposal assets"</p> <p>Requirements to organising and performing monitoring of the environment condition and pollution rate at the waste disposal asset</p>



Waste Management Standard

Rev. 06

Ref	Document	Aspect/Relevant issues/Requirements	Project Specification	Comments
		<ul style="list-style-type: none"> Employee Health & Safety; Training; Record Keeping and Reporting 		<p>territories are set.</p> <p>The document comes into force on 26.06.2016 (except for certain provisions thereof)</p> <p>Appendix B of GOST 56598-2015 about requirements of Environmental Control of Landfills. The document comes into force on 01.07.2016.</p>
2.	IFC Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (April. 2007)	<p>Covers development and production activities, pipeline delivery of products, tanker loading and unloading, ancillary and support operations. The guidelines are intended to be used as a standard in project conception and design whilst project operations may be evaluated against the guidelines.</p> <p>An Environment, Health and Safety Management System (EHSMS) is required for Category A projects.</p> <p>In terms of solid waste, packaging material, containers, discarded and damaged pipe and drill bits, and leftover construction materials are to be taken ashore and appropriately reused, recycled or disposed. Hazardous wastes (e.g. paint residues, solvents, batteries, pig-cleaning sludge, etc) are to be taken ashore to facilities for treatment and disposal with efforts made to eliminate, reduce or recycle hazardous wastes.</p>	<p>Sakhalin Energy uses a “hierarchical approach” to select appropriate waste management solutions. This prioritises waste minimisation and is consistent with RF and international best practice.</p> <p>Sakhalin Energy has a strategy for dealing with all s mentioned in the IFC guidelines, as specified in Waste Management Standard 0000-S-90-04-O-0258-00.</p> <p>Wastes generated offshore including hazardous wastes shall be stored in secure containers on platforms until viable economic quantities are accumulated and then shall be handed over to a licensed contractor for further disposal ashore.</p>	Comply
3.	Directive 2000/59/EC of the European Parliament and of the Council on port reception facilities	<p>Protection of the marine environment can be enhanced by reducing discharges into the sea of ship-generated waste and cargo residues. One way this can be achieved is through improving the availability and use of reception facilities and enforcement.</p>	<p>Licensed landfills included into GRORO (State Register of Waste Disposal Facilities) can receive the Hazard Class 4 and 5 wastes from ships on a contingency basis.</p>	Comply



Ref	Document	Aspect/Relevant issues/Requirements	Project Specification	Comments
	for ship-generated waste and cargo residues (amended by: 2002/84/EC; 2007/71/EC; Regulation (EC) № 1137/2008 of 22 October 2008)			
4.	Directive 2000/76/EC of the European Parliament and of the Council on the incineration of waste (amended by Regulation (EC) № 1137/2008 of 22 October 2008)	<p>This Directive is intended to fill the gaps in existing legislation pertaining to incineration i.e. Directives 89/369/EEC and 89/429/EEC (new and existing municipal waste-incineration plants) and 94/67/EC (incineration of hazardous waste).</p> <p>Repealing of the latter Directives came into force on December 28, 2005.</p> <p>Apart from the incineration of non-toxic municipal waste its scope extends to the incineration of non-toxic non-municipal waste (such as sewage sludge, tyres and hospital waste) and toxic wastes not covered by Directive 94/67/EC (such as waste oils and solvents). It is also intended to incorporate the technical progress made on monitoring incineration-process emissions into the existing legislation.</p>	<p>Small capacity incinerators not exceeding 25kg per hour are used by the Company's contractors for the disposal of selected waste streams such as oily rags, oil filters, oil sludge where no feasible management option currently exists on Sakhalin.</p> <p>A limit of 90 tonnes per year sets on the total waste that may be disposed of to such incinerators during operations phase. Such activities are limited to Sakhalin Energy operations, controlled and performed by trained personnel.</p> <p>Sakhalin Energy carries out a compliance audit (to RF standards e.g., air emissions and waste incineration permits are required) for any such incinerator used by contractor.</p> <p>The company may use its own units complying with the EU requirements for incineration of its own wastes without any limitations</p>	Comply
5.	Council Directive on hazardous waste 91/689/EEC (amended by 94/31/EC; Regulation (EC) №166/2006 of 18 January 2006;	<p>Member States ensure that hazardous waste is recorded and identified; and that different categories of hazardous waste are not mixed and that hazardous waste is not mixed with non-hazardous waste (except where the necessary measures have been taken to safeguard human health and the environment).</p> <p>Any establishment or undertaking which carries out disposal operations must obtain a permit.</p>	<p>Sakhalin Energy record, identify and segregate all hazardous from non-hazardous waste classes.</p> <p>Separation of hazardous and non-hazardous waste is required by effective RF Legislation (GOST R 56598-15).Separate landfills shall be used for hazardous and non-hazardous waste (Class I Landfill for Hazardous and Class II for non-hazardous ones) and it is not allowed to</p>	<p>Sakhalin Energy complies with EU Directive</p> <p>The very recent changes to RF Legislation (namely GOST R 56598-15 came in force on 01.07.2016) set up the same Waste classification as EU</p>



Ref	Document	Aspect/Relevant issues/Requirements	Project Specification	Comments
	2008/98/EC)	<p>Establishments or undertakings which carry out disposal operations or operations which may lead to recovery and producers of hazardous waste are subject to periodic inspections covering in particular the origin and destination of the waste. Transporters, producers, establishments and undertakings keep a record of their activities and make this information available to the competent authorities designated by each State.</p> <p>Does not cover domestic waste.</p>	<p>dispose hazardous waste in the cells designated for non-hazardous waste.</p> <p>Landfill Operator shall dispose in his facility the approved type of waste only, whereas the Waste Owner shall provide to him comprehensive and correct information on the waste composition.</p> <p>Landfill operation is permitted through Russian State environmental expertise, State Construction expertise, waste disposal limits approval and Hazardous waste handling licence to be issued to the landfill operator. The landfill shall be included into GORO.</p> <p>Storage of hazardous wastes shall also meet this standard.</p>	Directive 1999/31/EC of 26 April 1999.
6.	Council Directive concerning urban waste water treatment 91/27/EEC (amended by 98/15/EC);	<p>The objective of the Directive is to protect the environment from the adverse effects of discharges of urban wastewater and of wastewater from the agro-food industry.</p> <p>In terms of SWM, EU states must provide general rules or registration or authorisation for the sustainable disposal of sludge arising from wastewater treatment and phase out dumping or discharge of sewage sludge into surface waters.</p>	Waste and sludge from sewage water treatment generated by the assets operations disposed of to landfills.	Complies with EU Sakhalin Energy complies with the Directive with regard to the urban wastewater discharge
7.	Council Directive on the disposal of waste oils (amended by 87/101/EEC; 91/692/EEC; 2000/76/EC; 2008/98/EC)	<p>These Directives apply to any mineral-based lubrication or industrial oils which have become unfit for the use for which they were originally intended.</p> <p>EU Member States must ensure that waste oils are collected and disposed of (by processing, destruction, storage or tipping above or underground). They must give priority to the processing of waste oils by regeneration i.e., by refining.</p> <p>Where this process is not used, other methods may be considered: combustion, destruction, storage or tipping.</p>	Used oils shall be stored in secure containers on assets sites until viable economic quantities are accumulated and then shall be handed over to the licensed contractor for further disposal (processing).	Comply



Waste Management Standard

Rev. 06

Ref	Document	Aspect/Relevant issues/Requirements	Project Specification	Comments
		The Directives stipulate the conditions under which this must occur; in particular, they allow undertakings to collect and/or dispose of waste oils.		



The opportunity to consider how Russian Federation (RF) standards for landfill design align with those required by the IFC general EHS Guidelines and the requirements of PS3 (Resource Efficiency and Pollution Prevention), EU Landfill Directive and other good practice guidelines.

New RF Standards are consistent with EU

Standards Comparison of the Upgraded Non-Hazardous Waste Landfills (and potential future new facilities) against EC Landfill Directive EC 1999/31/EC (updated 2003/33/EC)				
Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
Article 4	Class of Landfill	Each landfill shall be classified in one of the following classes: - landfill for hazardous waste; - landfill for non-hazardous waste; - landfill for inert waste.	Russian regulations have similar general requirements in this area. GOST R 56598-2015: Respective of the waste composition received, the following classes of the landfills have been established: 1 landfill for hazardous waste; 2 landfill for non-hazardous waste; - Class 3 landfill for inert waste.	Consistent
Article 5 and Annex 2	Waste excluded from Landfill	Promotes the reduction of biological waste deposited in landfills and specifically excludes non-sterilised infectious waste, whole tyres, liquid waste, any waste categorised as hazardous due to properties and environmental contaminant risks as judged by the competent jurisdiction pending adoption of a unified waste classification system in the EU.	Russian regulations have similar general requirements in this area. GOST R 56598-2015: 4.5. The following types of wastes shall not be accepted by the landfill: a) Wastes for which effective methods of extraction of the metals or other substances have been developed (the absence of methods for the use and conversion of the waste must be confirmed in each specific case by the appropriate ministries or departments); b) radioactive wastes; c) petrochemical products that are subject to recovery; d) military wastes. 4.5.1. Measures shall be taken for the following types of wastes not to be	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>accepted by the landfill:</p> <ul style="list-style-type: none"> • liquid wastes: <ul style="list-style-type: none"> - biodegradable municipal wastes, including food wastes; • wastes that, when disposed at the landfill, are explosive, as well as corrosive oxidable, flammable and combustible or other properties specified in Appendix A hereto; - wastes that react with water; - pathological wastes from medical and veterinary institutions; - undamaged used tyres, except for the tyres that are used as technical and constructional material as part of re-cultivation and fragmented tyres (excluding, in both cases, bicycle tyres and tyres with the outside diameter over 1,400 mm); • wastes containing persistent organic pollutants: • pesticides; - wastes that fail to meet the acceptance criteria. <p>4.5.2. Wastes mixing solely for the purpose of meeting the criteria for wastes acceptance by the landfill shall not be allowed.</p> <p>4.6. Normally, measures shall be taken so that only processed wastes should be buried.</p> <p>12, Federal Law No.89-FZ "On production and consumption waste":</p> <p>It is prohibited to bury waste containing recyclable commercial components. It is prohibited to bury waste containing recyclable commercial components. The requirement comes into force starting 1 January 2017.</p>	
Article 6 and Annex 2	Wastes Accepted at Landfills as Non-Hazardous	<p>Requires pre-treatment of all land filled waste except where it is inert or in the absence of pre-treatment shall not compromise an overall object of prevention or reduction in environmental impact to air, surface and ground water or the global environment.</p> <p>Excludes access of hazardous waste and allows access to municipal waste, inert waste and other non-hazardous waste without properties with</p>	<p>As above except.</p> <p>GOST R 56598-2015: Class 2 landfills for non-hazardous wastes can be used for the burial of:</p> <ul style="list-style-type: none"> • municipal wastes; • non-hazardous wastes of any other origin that meet the criteria for waste acceptance by the landfills specified in Appendix B hereto: - long-lived wastes, non-reactive hazardous wastes (for instance, solidified, vitrified) in case of non-hazardous-waste-equivalent leachate generation that meet the criteria for waste acceptance by the landfills . 	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
		hazardous properties and contaminant risk.		
Article 7	Permitting	Requires a formal application for a permit that includes identity of applicant/s, operators, capacities, waste quantities, site description (including geological and hydrogeological setting), pollution control measures, operational plan (e.g. operation, monitoring, control and closure), EIA and financial security provisions.	<p>The Russian development permitting, and state expertise process involves equivalent although not exactly the same requirements as the EU standards.</p> <p>Territorial patterns for waste management, including solid municipal wastes, shall be approved by the authorised agencies as per Federal Law No.89-FZ, and legal entities shall obtain the status of regional operators of solid municipal wastes' management.</p> <p>The regional operator of solid municipal wastes' management (hereinafter also referred to as the "regional operator") is an operator for solid municipal wastes' management – a legal entity that must conclude a contract for solid municipal wastes that are generated and whose collecting points are located within the area of the regional operator's activity.</p> <p>Requirements to the bidders are as follows: Bidder shall meet the following mandatory requirements:</p> <ul style="list-style-type: none"> a) shall have state registration in the territory of the Russian Federation; b) shall have a valid license for collection, transportation, processing, disposal, decontamination and placement of Hazard Class 1-4 wastes, whose management is provided by the bidding documentation, with one or several permitted types of activity carried out by the bidder; <p>The bids' evaluation and benchmarking criteria are as follows:</p> <ul style="list-style-type: none"> a) discounted value of the regional operator service; b) quality of the regional operator services. <p>The quality criteria of the regional operator services are as follows:</p> <ul style="list-style-type: none"> c) reliability criteria – annual rate of permissible breaches of the schedule for removal of solid municipal wastes from the collection and accumulation points; d) promptness criteria – time required for review of the requests coming from consumers of the regional operator services. <p>According to the RF legislation the Scope of work of environmental monitoring is defined by Decree of Minprirody of Russia as of 04.03.2016 No.66 "On the Procedure of monitoring the condition and pollution rate of environment at the waste disposal territories and within the range of waste influence on the environment by the owners of waste disposal assets, as well as by the individuals owing or using waste disposal assets"</p>	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
Article 11	Waste Acceptance Procedures	Requires a formal procedure related to documentation of waste deliveries and its verification	RF requirements (MPR Order #721 that came into force on November, 2011) requires landfill operators, waste producer/collectors to maintain the comprehensive system for waste identification, inspection and registering. According to GOST R 56598-2015, the landfill operator shall comply with the following procedures for waste acceptance: <ul style="list-style-type: none"> • check of the wastes' documentation; • visual examination of wastes at the entrance to the landfill and at the wastes' location point; • verification versus the documentation provided by the wastes' owner; • verification of the wastes' content versus the description of those presented in the wastes' documentation that is provided by the wastes' owner; • maintaining of the register of the quantity and characteristics of the buried wastes with their origin specified, as well as the date of the delivery, name of the manufacturer or collector (in the event of municipal wastes), and in the event of hazardous wastes – precise location of those at the landfill. This information shall be made available to the appropriate authorities for statistics, if this is required for statistical purposes; • dosimetric control of each waste lot shall be exercised to prevent acceptance by the landfill of radioactive substances. 	Consistent
Article 12	Operational Control and Monitoring Procedures	The Landfill Owner shall undertake a monitoring programme in accordance with Annex III, report environmental impacts, provide annual reports on monitoring results and ensure that analysis is undertaken by qualified facilities.	The Landfill Owner shall undertake a monitoring programme in accordance with the RF legislation the Scope of work of environmental monitoring is defined by GOST R 56598-2015 and Decree of Minprirody of Russia as of 04.03.2016 No.66, report environmental impacts, provide annual reports on monitoring results and ensure that analysis is undertaken by qualified facilities. Landfill operator is obligated to: <ul style="list-style-type: none"> • notify relevant government agencies of any material adverse environmental impacts detected through landfill control and monitoring programs: - follow the instructions of a relevant government agency in respect of the remedial actions nature and due dates. 	Consistent
Article 13	Closure and After Care Procedures	Requires the closure of a landfill or part thereof, ongoing monitoring and reporting of results	Requirements to the closure and re-cultivation of the landfills are set forth in Section 7 of GOST R 56598-2015. Russian regulations required equivalent closure and after care procedures as applied to the operator and/or permitted party.	Consistent
Annex I General Requirements for All Classes of Landfills (As Applied to Non-hazardous Waste Landfills)				
Annex I.1	Location	Requires consideration of the following factors in landfill siting:	Russian regulations apply equivalent considerations in selection of landfill sites. According to GOST R 56598-2015, Section 5. Requirements to Landfills Location:	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
		<ul style="list-style-type: none"> • Surrounding land use including residential, recreational and agriculture • Potential receptors (groundwater, waterways, water bodies, coastal waters). • Geological and hydrogeological conditions. • Flooding and land instability risk. • Nature and cultural protection. 	<p>5.1 The plot for the landfill placement shall be selected based on the functional zoning of the area and town-planning solutions.</p> <p>5.2 The landfills are placed outside residential area and at isolated territories with sanitary protection zones to be arranged as per sanitation-and-epidemiological regulations and standards.</p> <p>5.3 The landfills shall not be placed:</p> <ul style="list-style-type: none"> - in the area of Belt 1, 2, and 3 of sanitary protection zones of water sources and mineral springs; - in all the belts of resorts sanitary and protection zone; • in the area of mass out-of-town recreation and treatment/rehabilitation institutions; • in recreation zones; • at locations with aquifer wedging – in: <ul style="list-style-type: none"> • within the boundaries of the established water protective zones of surface water bodies; • in the area with mineral resources occurrence without approval to be obtained from state mining supervision agencies; • in hazardous zones of refuse dumps of coal and schist mines or enriching factories; - in active karst area; - in slide area, mud avalanche, and snow avalanches; • in wetlands; - in swamp and flooded area: <ul style="list-style-type: none"> • in the area of feeding of underground drinking water sources: <ul style="list-style-type: none"> • in urban green belt area; • on lands that are under forests or are intended to be under forests, forest-parks and other green plantations that perform protective and sanitary and hygienic functions and recreation area; • at plots that are organic-and radioactive-waste contaminated before the dates established by sanitary and epidemiological service agencies; • within the settlement boundaries; • at the sites of unorganised stockpiling of solid domestic wastes (unorganised dumps) without activities for special preparation of those or preliminary re-cultivation: <ul style="list-style-type: none"> • in protection zones of the main petroleum products pipelines; • at area that has complex geology and hydro-geological conditions (developed slope processes, under-washed unstable soils: water-logged sites and flooded area, etc.). <p>5.4 The plot for the landfill placement shall be located at a distance of over 2 m</p>	



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>from agricultural lands use for commercial crops that are not used for foodstuff manufacturing.</p> <p>5.5 The plot size shall be determined by the landfill capacity, type and waste hazard class, processing technology, 20-25 years' designed operation period and possibility of subsequent use of the wastes.</p> <p>5.6 Sanitary-protection zone of the landfill</p> <p>5.6.1 The size of the sanitary-protection zone of the landfill shall be no less than 500 m. In the event that the landfill is arranged at the area of depleted pit with its re-cultivation, the size of the sanitary-protection zone shall be no less than 100 m.</p> <p>5.6.2 Sanitary-protection zones shall be established within the boundaries of the water protective zones and coastal protective belts of bodies of water if those are present in the vicinity of the landfills.</p> <p>5.6.3 Development of sanitary –protection zones of the landfills that affect the conditions of bodies of water shall be as per the requirements established in the regulatory documentation for protection of bodies of water and technical specifications for water use.</p>	
Annex I.2	Water Control and Leachate management	<p>Requires provision in design for:</p> <ol style="list-style-type: none"> 1. Control of precipitation entering the landfill. 2. Prevent surface and groundwater entering the landfill 3. Contaminated water and leachate collection 4. Contaminated water and leachate treatment as required 	<p>Russian regulations had absolutely equal to the international ones set up in Landfill Directive EC 1999/31/EC</p> <p>GOST R 56598-2015:</p> <p>Control over water sources' pollution and leachate management:</p> <ul style="list-style-type: none"> - Respective of the characteristics of the landfill and meteorological conditions, appropriate measures shall be taken to: <ul style="list-style-type: none"> • control water income into the landfill body as a result of atmospheric precipitation: <ul style="list-style-type: none"> • prevent income of surface and/or underground water into buried wastes; • collect polluted water and leachate. In the event that the assessment of the landfill and wastes to be received by the landfill establishes that the landfill has no potential hazard for the natural environment, the appropriate authority can prescribe that the following condition shall not be complied with, namely, treatment of the polluted waters from the landfill and leachate to the required standard. <p>Observations over surface waters shall be conducted along the network of the stream stations located at the nearest water courses.</p> <p>Monitoring of surface waters shall be conducted at least at two stations, one of which is located upstream, and, and the other downstream the landfill.</p> <p>Samples shall be taken and leachate volume shall be measured separately at</p>	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>each station of the section where leachate is present.</p> <p>Monitoring of surface water and leachate is conducted with the middle segment of the sample used.</p> <p>Frequency of sampling can be established respective of the morphological composition of the wastes that are buried: layout of wastes placement in the pit (vertical extent), stockpiling in deep pits, etc.</p>	
Annex I.3	Protection of Soil and Water	<p>Requires protection of soil and ground water by natural geological conditions or mineral engineered barriers at the bottom, sides and surface (upon closure).</p> <p>The permeability (K) and bottom barrier thickness (T) requirements for disposal of Non-hazardous waste (as intended by SEIC) are:</p> <p>$K_{nat} < 10^{-9}$ m/sec (for natural barrier)</p> <p>$T_{nat} > 1.0$ m (natural) or</p> <p>$T > 0.5$ m (artificial), with permeability K which ensures the combined effect of the artificial barrier at least equivalent the natural one of aforementioned T_{nat} and K_{nat}.</p> <p>For disposal of Inert waste and Hazardous waste (for reference only, as SEIC is going to dispose in the local landfills neither Inert nor Hazardous waste) the permeability (K) and bottom barrier thickness (T) requirements are respectively as follows:</p>	<p>Russian Technical Standards have the same requirements: both natural (geological) layer and an artificial watertight membrane can be used for the soil and groundwater protection.</p> <p>GOST R 56598-2015:</p> <p>Disposal landfill shall be located and designed to comply with the requirements intended to prevent contamination of soil, underground and surface water, as well as for facilitating effective leachate gathering.</p> <p>6.11 Protection of soil, underground and surface water shall be achieved by the use of a combination of a geological barrier and the landfill underlying stratum (base) during the active/operation stage, and by the use of a combination of a geological barrier and top layer (cover) in the passive stage/landfill closure.</p> <p>6.12 The sealing barrier below and near the landfill location is determined by geological and hydrogeological conditions, which ensure sufficient protection for water and soil against the potential risk of contamination.</p> <p>6.13 The landfill base and walls shall be made of a mineral liner, which shall comply with the permeability and thickness requirements (with a synergetic effect in time) for protection of soil, underground and surface water and which shall be at least equivalent to one of the following requirements:</p> <ul style="list-style-type: none"> Class 1 landfill for disposal of hazardous water: $K \leq 1.0 \times 10^{-9}$ m/s; thickness ≥ 5 m: 	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments									
		<p>landfill for Inert waste: $K_{nat} \leq 10^{-7}$ m/s; thickness $T_{nat} \geq 1$ m</p> <p>landfill for Hazardous waste: $K_{nat} \leq 10^{-9}$ m/s; thickness $T_{nat} \geq 5$ m</p> <p>Alike the "base case" of disposal of Non-hazardous waste, the artificial barrier for these two types of waste shall have $T > 0.5$ m, with permeability K which ensures the combined effect of the artificial barrier at least equivalent the natural one of T_{nat} and K_{nat} for respective waste.</p> <p>A Leachate collection and sealing layer involving an additional artificial sealing barrier and drainage layer > 0.5 m thickness.</p> <p>At the discretion of the competent authority, surface sealing to prevent leachate formation may be required. This shall involve a gas drainage layer, impermeable mineral layer, drainage layer (>0.5 m) and top cover (>1.0 m).</p> <p>The above requirements may be reduced based on a risk assessment.</p>	<ul style="list-style-type: none"> Class 2 landfill for disposal of non-hazardous waste: $K \leq 1.0 \times 10^{-9}$ m/s; thickness ≥ 1 m; Class 3 landfill for disposal of inert waste: $K \leq 1.0 \times 10^{-7}$ m/s; thickness ≥ 1 m. <p>6.14 If the natural geological barrier does not comply with the above requirements, it can be engineered and strengthened by other protective features which can offer equivalent protection. The artificial geological barrier shall be at least 0.5 meters thick.</p> <p>6.15 To prevent ingress of pollutants into the aquifer and soil, the bottom and walls of the landfill floor must be covered by compacted clayey soil-bitumen-concrete, asphalt-concrete, asphalt-polymer-concrete and other materials which have been approved by the sanitary-epidemiological expert review.</p> <p>6.15.1 The design of a landfill may include the use of geotextile and similar material products to support one or several landfill functions, including leachate, segregation, reinforcing and protection. The list of specifications for geotextile and similar material products, used for the purpose of waste disposal, as well as the respective methodology for testing the stability of the specifications is provided in GOST R 56616.</p> <p>Soil and water protection In addition to the geological barrier, the landfill must have a system for leachate collection and landfill base sealing to ensure that the leachate accumulation at the landfill base is sustained at a minimal level.</p> <table border="1"> <thead> <tr> <th>Landfill category</th> <th>For non-hazardous waste</th> <th>For hazardous waste</th> </tr> </thead> <tbody> <tr> <td>Artificial insulating barrier</td> <td>Required</td> <td>Required</td> </tr> <tr> <td>Drainage</td> <td>Required</td> <td>Required</td> </tr> </tbody> </table>	Landfill category	For non-hazardous waste	For hazardous waste	Artificial insulating barrier	Required	Required	Drainage	Required	Required	
Landfill category	For non-hazardous waste	For hazardous waste											
Artificial insulating barrier	Required	Required											
Drainage	Required	Required											



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements			Comments																		
			layer of 0.5m																					
			<p>As per recommendations of Directive 1999/31 /HC of the European Union Council, the measures intended to seal the landfill cover layer include the requirements indicated in the table below:</p>																					
			<table border="1"> <thead> <tr> <th data-bbox="898 552 1048 651">Landfill category</th> <th data-bbox="1048 552 1176 651">For non-hazardous waste</th> <th data-bbox="1176 552 1301 651">For hazardous waste</th> </tr> </thead> <tbody> <tr> <td data-bbox="898 651 1048 748">Gas drainage layer</td> <td data-bbox="1048 651 1176 748">Required</td> <td data-bbox="1176 651 1301 748">Not required</td> </tr> <tr> <td data-bbox="898 748 1048 845">Artificial insulating layer</td> <td data-bbox="1048 748 1176 845">Not required</td> <td data-bbox="1176 748 1301 845">Required</td> </tr> <tr> <td data-bbox="898 845 1048 927">Impermeable mineral layer</td> <td data-bbox="1048 845 1176 927">Required</td> <td data-bbox="1176 845 1301 927">Required</td> </tr> <tr> <td data-bbox="898 927 1048 1024">Drainage layer of > 0.5 m</td> <td data-bbox="1048 927 1176 1024">Required</td> <td data-bbox="1176 927 1301 1024">Required</td> </tr> <tr> <td data-bbox="898 1024 1048 1121">Soil protective layer > 1 m</td> <td data-bbox="1048 1024 1176 1121">Required</td> <td data-bbox="1176 1024 1301 1121">Required</td> </tr> </tbody> </table>			Landfill category	For non-hazardous waste	For hazardous waste	Gas drainage layer	Required	Not required	Artificial insulating layer	Not required	Required	Impermeable mineral layer	Required	Required	Drainage layer of > 0.5 m	Required	Required	Soil protective layer > 1 m	Required	Required	
Landfill category	For non-hazardous waste	For hazardous waste																						
Gas drainage layer	Required	Not required																						
Artificial insulating layer	Not required	Required																						
Impermeable mineral layer	Required	Required																						
Drainage layer of > 0.5 m	Required	Required																						
Soil protective layer > 1 m	Required	Required																						
			<p>In case the relevant state agency decides, on the basis of assumed environmental risks assessment, that there is no need in leachate collection and neutralization, or in case it has been determined that the landfill does not pose any potential threat to soil, underground or surface water, the requirements can be scaled back.</p> <p>The parameters, which are tested in underground water sample, must be dictated by the expected leachate composition and the quality of underground water at the landfill site.</p> <p>The selection of parameters to be tested must take into account the velocity and</p>																					



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>direction of underground water flow.</p> <p>The parameters may include indicative markers, which guarantee early detection of change quality of water.</p>	
Annex I.4	Gas Control	<p>Gas control is mandatory where biodegradable waste is deposited, and must be flared in the absence of capture for fuel use.</p> <p>Gas monitoring (CH₄, CO₂, O₂, H₂S, H₂ etc.) must be representative for each section of the landfill. The gas sampling is to be taken on a monthly basis during Operation Period.</p>	<p>Russian regulations have similar general requirements in this area.</p> <p>GOST R 56598-2015:</p> <p>To prevent generation of greenhouse gases, measured should be taken to reduce methane generation at landfills by way of reducing the quantity of organic waste (kitchen waste, etc.) and biodegradable waste, as well as by establishing requirements for control of landfill gas. The measures taken to reduce methane generation at landfills by reducing the quantity of organic waste (kitchen waste, etc.) and biodegradable waste, must stimulate separate collection of such waste, as well as its segregation and utilization as recoverable resources.</p> <p>6.25 the landfill operator must take measures to reduce the amount of methane, generated by the landfill, by way of reducing the quantity of disposed biodegradable waste and implementation of a system to control and utilize landfill gas.</p> <p>7.3 After the landfill closure, the landfill owner will carry out premises reclamation and monitor emission of landfill gas and leachate formation during the subsequent thirty years in case of Class 1 landfills, twenty years in case of Class 2 landfills, five years in case of Class 3 landfills.</p> <p>7.8.1 the engineering and technical phase of land rehabilitation includes the development of process and construction measures, solutions and designs for installation of protective screens at the top and base of the landfill, biogas capture and utilisation, leachate and surface water run-offs collection and treatment.</p> <p>7.9.2 As long as the landfill poses potential hazard (as seen by relevant state authorities) for the environment, the landfill operator must bear responsibility for the control and analysis of landfill biogas, generated landfill leachate, as well as for the condition of underground water at the landfill site.</p> <p>B.5 Projection of the atmosphere</p> <p>B.5.1 Appropriate measures must be taken to control landfill gas accumulation and travel.</p> <p>B.5.2 Monitoring of generated landfill gas must be carried out in each landfill sector.</p> <p>B.5.3 Landfill gas must be captured, treated and utilized at all landfills which accept biodegradable waste for disposal.</p>	Consistent



Waste Management Standard

Rev. 06

Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>B.6.4 In case the captured landfill gas cannot be used to generate power, it must be flared.</p> <p>B.6.5 Landfill gas capture, treatment and utilization must be implemented via a method, which mitigates environmental damage or the environment quality deterioration, as well as mitigates human health risks</p>	
Annex I.5	Nuisance and Hazards	Requires control measures related to odours, dust, windblown material, birds/vermin/insects, fires, as well as prevention of soil transfer off site	<p>Russian regulations have similar general requirements in this area.</p> <p>GOST R 56598-2015:</p> <p>3 Protective screens at the top and bottom of waste storage maps: main design elements, which ensure implementation of the environmental function of soil, underground and surface water protection against leachate, as well as protection of the atmosphere against generated landfill gas. Dust, odours, and pathogenic germs spread.</p> <p>6.24 Measures must be taken to minimise the risks and hazards generated by the landfill operation, including:</p> <ul style="list-style-type: none"> - emission of odours and dust: • windblown materials: • noise and traffic: • birds, parasite, insects; • strange (unidentified) chemical compounds and aerosols; • fire. 	Consistent
Annex I.6	Stability	<p>Requires that stability of the mass of deposited waste be maintained should the barriers protecting water and soil as well as capturing leachate are damaged or breached</p> <p>The emplacement of waste on the site shall take place in such a way as to ensure stability of the mass of waste and associated structures, particularly in respect of avoidance of</p>	<p>Russian regulations have similar general requirements in this area.</p> <p>GOST R 56598-2015:</p> <p>6.7 Waste burial at a landfill must be carried out in such a way that it guarantees the stability of the waste mass and relevant structures, especially to prevent waste mass shifting.</p> <p>6.7.1 To measure the weight of the accepted waste mass, measuring instruments must be installed at the waste collection stations.</p> <p>6.8 In case of an artificial barrier installation, it must be previously determined that the landfill substratum is morphologically sufficiently stable to prevent soil</p>	Consistent



Waste Management Standard

Rev. 06

Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
		slippages. Where an artificial barrier is established it must be ascertained that the geological substratum, considering the morphology of the landfill, is sufficiently stable to prevent settlement that may cause damage to the barrier.	subsidence, which can cause damage to the installed barrier.	
Annex I.7	Barriers	Requires a fenced and gated site that has access control to prevent illegal dumping.	Russian regulations have similar general requirements in this area. GOST R 56598-2015: 6.16.1 The landfill gates must be locked up all the time except for the working hours. 6.16.2 The access control system must include a range of measures to detect and stall unauthorized operation of engineering facilities.	Consistent
Annex II Waste Acceptance Criteria and Procedures				
Annex II.2	General Principles	In the absence of a unified EU waste classification system, the requirements are that each jurisdiction has such a system and that this dictates the direction of waste to various types of landfills based on properties and environmental risk posed. Furthermore it contemplates that such restrictions be applied on a landfill specific basis.	In advance of EU requirements, Russian regulations apply a hazard class system and catalogue each waste type by class and individual coding. Municipal landfills can accept all Class 5 (practically non-hazardous waste) and Classes 3 and 4 wastes under a site and waste specific exception justified by evaluation of the impacts on the specific location involved. While the specific requirements and methodologies may differ, the general principle is consistent with what the EU is targeting to achieve. GOST R 56598-2015: 6.17 Landfill management shall be carried out by physical or legal entities (operators) with technical vocational education, which have at their disposal all technical facilities required for the landfill operation. 6.18 Waste owners, which delivery their waste to the landfill, must provide to the landfill operator reliable information on waste quality and quantity, which confirms the waste type, as well as copies of hazardous waste certificates in case of	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>hazardous waste delivery.</p> <p>6.19 Landfill operators have the right to accept only such types of waste, which are allowed for burial at their landfill and which the operators are allowed to store in accordance with the permit issued by a relevant government agency.</p>	
Annex II.3	General Procedures for Testing and Acceptance of Waste	Requires a tiered system of waste assessment covering basic characterisation, periodic compliance validation and inspection upon delivery. In fact at this time only on site verification is currently mandatory (Annex II.4) and sampling procedures are yet to be promulgated (Annex II.5).	<p>RF regulations apply analogous requirements with respect to waste characterisation through the unified classification system and catalogue system as well as the establishment of waste limits by waste generators and annual reporting requirements. The main differences lie in the term over which the basic characterisation can apply (up to five years) and requirements for mandatory validation. In practice the Russian requirements exceed EU standards</p> <p>GOST R 56598-2015:</p> <p>6.20 Landfill operator must comply with the following waste acceptance procedures:</p> <ul style="list-style-type: none"> • examination of waste documents; • visual waste inspection at the landfill entrance and at the burial site; • verification of documents provided by the waste owner; • check of waste matching their description in the documents provided by the waste owner; • maintaining a register to record the quantity and characteristics of the buried waste, specifying waste origin, delivery date, waste generator or collector (in case of municipal waste). In case of hazardous waste, the register should specify the exact location of such waste storage at the landfill. This information should be easily accessible for relevant government statistics agencies, if this is required for state statistics purposes; • to exclude delivery of radioactive waste by the landfill, it is necessary to carry out radiation measurements in respect of each accepted waste lot. <p>Note — Appendix Б features waste acceptance criteria and procedures in accordance with [1].</p> <p>6.21 Landfill operator must issue a written confirmation of delivery for each accepted waste lot.</p> <p>6.21.1 If the delivered waste has not been accepted by the landfill, the operator must promptly inform the relevant government agency about its refusal to accept</p>	Exceeds



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>particular (lots of) waste.</p> <p>6.22 Landfill operator must implement control and monitoring programs in accordance with Appendix B.</p> <p>6.22.1 Quality control of testing facilities and control procedures, monitoring and/or testing must be performed by certified laboratories.</p> <p>6.22.2 Landfill operator is obligated to:</p> <ul style="list-style-type: none"> • notify relevant government agencies of any material adverse environmental impacts detected through landfill control and monitoring programs: - follow the instructions of a relevant government agency in respect of the remedial actions nature and due dates. 	
Annex III Control and Monitoring Procedures in Operations and Aftercare Phases				
Annex III.2	Meteorological Data	Requires daily (operations) and periodic (post closure) meteorological data to be collected covering precipitation, wind, humidity and evaporation.	No meteorological data collection requirements are applied under Russian regulations. (However, there is a requirement for monitoring of water balance elements and leachate volume, which has similar purpose to the collection of metrological data that may be used in water balance calculations.)	Not a significant omission
Annex III. 3	Emission Data: Water, Leachate and Gas Control	Requires emission sampling and analysis on a monthly or quarterly basis during operation for surface water and leachate (volume and composition), and potential gas emissions (CH ₄ , CO ₂ , O ₂ , H ₂ S, H ₂)	<p>Russian regulations have similar general requirements in this area.</p> <p>According to the RF legislation the Scope of work of environmental monitoring is defined by Appendix B of GOST R 56598-2015 and Decree of Minprirody of Russia as of 04.03.2016 No.66 "On the Procedure of monitoring the condition and pollution rate of environment at the waste disposal territories and within the range of waste influence on the environment by the owners of waste disposal assets, as well as by the individuals owing or using waste disposal assets"</p> <p>Requirements to organising and performing monitoring of the environment condition and pollution rate at the waste disposal asset territories are set by this Decree</p> <p>The monitoring procedure is intended for the waste disposal assets owners, as well as individuals owing or using waste disposal assets, for Rosprirodnadzor and its territorial bodies, Rosgidromet and its territorial bodies and organisations subject to it, other state authorities, local authorities, individuals and legal bodies interested in receiving data on the environment condition and pollution rate at the locations of waste disposal assets. In particular, the following is stipulated by the Decree:</p> <p>- procedure of developing programme on monitoring the condition and pollution</p>	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>rate of environment at the waste disposal asset territory and within the range of waste influence on the environment;</p> <ul style="list-style-type: none"> - composition and content of the programme on monitoring the condition and pollution rate of environment at the waste disposal asset territories and within the range of waste influence on the environment; - composition and content of the report on the results of monitoring the condition and pollution rate of environment at the waste disposal asset territories and within the range of waste influence on the environment. <p>GOST R 56598-2015:</p> <p>6.23 At regular intervals stipulated by the relevant waste management government agency (at least once a year), landfill operator must (on the basis of summarized data) landfill management must submit to the relevant government agency a report with monitoring findings, which should prove compliance of the landfill operation with the permit terms and conditions and enhance public awareness of the landfill condition.</p> <p>B.1.1 A monitoring program should be developed for the landfill to detail monitoring of underground and surface water, atmosphere, soil, vegetation, noise level, dump-truck and machinery traffic at the landfill and in the area of the landfill potential adverse impact.</p> <p>B.1.2 the monitoring program must cover, inter alia, monitoring of water balance elements, atmosphere, soil, vegetation, as well as standard control over radioactive and mercury contamination.</p>	
Annex III.4	Protection of Groundwater	<p>Groundwater flow requires sampling at a minimum of three points (one upstream and two downstream); at least three samples taken prior to opening of the cell to establish baseline.</p> <p>Level of groundwater is recorded every six months.</p>	<p>As above</p> <p>GOST R 56598-2015:</p> <p>B.2 Geological Environment Monitoring</p> <p>B.2.1 Landfill geological environment monitoring is a system of long-term regular observations. Their findings form basis for the assessment of the geological environment current condition and for the forecast of its changes due to man-induced and industrial impacts. B.2.2 A grid of observation wells is to be drilled at the landfill site for monitoring purposes.</p> <p>6.2.3 Observation wells are to be drilled with due account for the location and</p>	Consistent



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments
			<p>size of pollution sources – waste storage sites, aquifer configuration, natural water flow direction and stream slope.</p> <p>6.2.4 The grid of observation wells must include a baseline well upstream of the landfill and wells within the landfill impact footprint.</p> <p>B.3 Monitoring of water contamination and leachate handling</p> <p>B.3.1 Depending on the landfill specifications and meteorological conditions, appropriate measures must be taken to allow the following:</p> <ul style="list-style-type: none"> • control the flow of water into the landfill body as a result of an atmospheric precipitation; • prevent ingress of surface and/or underground water into buried waste; • collect contaminated water and leachate. In case the evaluation of the risks, based on the landfill location and permitted for acceptance waste, indicates that the landfill will not pose any potential threat to the environment, a relevant government agency may rule that the above requirement is not mandatory: <p>- treat collected contaminated water and leachate to the applicable standard.</p> <p>8.3.2 The above requirements may be eased for inert waste landfills.</p> <p>6.3.3 Monitoring of surface water shall be carried out at monitoring stations located in the closest watercourses.</p> <p>B.3.4 Monitoring of surface water must be carried out at at least two monitoring stations, one of which should be located upstream from the landfill, while the other is to be located downstream of it.</p> <p>B.3.5 Sampling, as well as measurements of leachate volume and composition</p>	



Ref	Design aspect/issue	EU Directive Requirements	RF Standards Requirements	Comments									
			<p>should be carried out separately at each leachate formation sector of the landfill.</p> <p>B.3.6 Monitoring of leachate and surface water should include testing of average composition of samples.</p> <p>6.3.7 Sampling frequency may be established depending on the disposed waste morphological composition (vertical waste containment arrangement, in a pit, in deep pits, etc.).</p>										
Annex III.5	Topography of the Site: Data on the Landfill Body	Requires evaluation of structure/composition of the landfill body and degree of settling on an annual basis during operation.	<p>Russian regulations have similar general requirements in this area.</p> <p>GOST R 56598-2015:</p> <p>8.6 Monitoring of landfill body structure and composition Information regarding monitoring of the landfill body structure and composition is presented in Table 8.3</p> <p>Table 8.3 — Monitoring of landfill body structure and composition</p> <table border="1"> <thead> <tr> <th>Characteristics</th> <th>Landfill operation phase</th> <th>Closed landfill redevelopment phase</th> </tr> </thead> <tbody> <tr> <td>Landfill body structure and composition</td> <td>Yearly</td> <td>—</td> </tr> <tr> <td>Landfill body filling level</td> <td>Yearly</td> <td>Yearly</td> </tr> </tbody> </table> <p>¹ Information for the landfill construction plan: landfill surface filled by waste, waste volume and composition, waste burial methods, waste burial time and duration, landfill ullage calculation (reserve holding capacity).</p>	Characteristics	Landfill operation phase	Closed landfill redevelopment phase	Landfill body structure and composition	Yearly	—	Landfill body filling level	Yearly	Yearly	Consistent
Characteristics	Landfill operation phase	Closed landfill redevelopment phase											
Landfill body structure and composition	Yearly	—											
Landfill body filling level	Yearly	Yearly											