Chapter 10 Solid Waste Management

10.1 INTRODUCTION

A variety of wastes will be generated during the construction and operation phases of the Sakhalin II Project. This Chapter of the EIA Addendum (EIA-A) provides further information relating to SEIC's Solid Waste Management Strategy (SWMS), its environmental implications and the status of its implementation. It updates the outline descriptions initially provided in Section 6.2, Volume 1 of the international-style EIA, including the evaluation of available waste management (e.g. disposal) options.

This Chapter does not aim to be a self-contained analysis of SEIC's SWMS and its implications but provides information to address questions raised by stakeholders during the review of the aforementioned EIA report. Cross references are made to relevant material in other key documents commissioned by SEIC, such as:

- Solid Waste Management Plan (IT Russia Services Dec. 2002a);
- Waste Stream Identification and Quantification (IT Russia Services for SEIC Feb. 2003);
- Waste Management Feasibility Study Report (IT Russia Services Aug. 2004);
- Hazardous Waste Management Plan (IT Russia Services for SEIC, May 2004).

The remainder of this Chapter is structured to include the following items:

Section 10.2 *Waste classifications;*

Section 10.3 *Waste generation volumes;*

Section 10.4 *Basis of the SEIC waste management policy*: outlines the main parameters that have determined the selected strategy proposed;

Section 10.5 *The process of developing the Solid Waste Management Plan (SWMP)*: briefly outlines the key steps through which the approaches to waste was developed;

Section 10.6 *SEIC Waste Management Strategy*: outlines the overall and sub-strategies SEIC has chosen for the management of identified waste streams;

Section 10.7 *Implementation of the Waste Management Strategy*: identifies how the strategy is being implemented, the components involved and progress being made;

Section 10.8 *Environmental overview and discussion of issues*: summarises the basic rational and general environment impacts of the SWMP and its implementation;

Section 10.9 *Conclusions*: contains final conclusions on the approach of SEIC to waste management;

Appendix 1 Waste inventory tables;

Appendix 2 Cross-section of impermeable composite landfill twin-liner.

10.2 WASTE CLASSIFICATIONS

It is useful to define the categories of waste referred to in this chapter.

As required under Russian Federation regulations, wastes must be assessed and classified according to different hazard classes. The rules concerning the classification include dividing wastes into five hazard classes, whereby Hazard Class I wastes are the most hazardous and Hazard Class 5 wastes are considered to be non-hazardous. Table 10.1 presents some examples of waste streams for different Hazard Classes in accordance with the Federal Waste Classification Catalogue, approved by RF MNR Order No. 786 of 12/2/2002, and the Attachment to RF MNR Order No. 663 of 7/30/2003, "*Amendment to the Federal Waste Classification Catalogue*" (FWCC).

Table 10.1 Russian Waste Classification System

Hazard Class	Hazard Description	Waste Stream Project Examples	International Definition
1	Extremely hazardous	Mercury containing fluorescent lights, activated carbon contaminated with mercury sulphide.	
2	High hazard	Concentrated acids, alkalines, halogenated solvents, lead acid batteries, dry batteries, etc.	Hazardous
3	Moderate hazard	Used lubrication oil, oily sludge, oily rags, used oil filters, non-halogenated solvents, paint wastes, etc.	
4	Low hazard	Domestic trash, non ferrous metal scrap, some chemicals, some construction waste, treated sewage sludge, treated medical wastes, water based drilling mud, etc.	Non-hazardous
5	Practically non-hazardous	Inert wastes: plastic, ferrous metal scrap, inert construction wastes, food waste, brush wood, non-treated wood waste.	

This classification system is somewhat different to those applied in other countries, such as member states of the European Union, where it is often the case that wastes are simply classified into two groups: "hazardous" or "non-hazardous". SEIC generally considers all Hazard Class 5 wastes under the Russian system to be "non-hazardous". It is also recognised that most Hazard Class 4, and some Hazard Class 3 wastes, would be considered to be "non-hazardous" in the EU and OECD Member States. Russian Federation regulations permit the disposal of some Hazard Class 3 and all Hazard Class 4 (with a few exceptions) wastes into municipal solid waste landfills. This is subject to an application and permission procedure whereby the waste generator must substantiate the approach taken for disposal.

For the purposes of differentiating between waste management options and diversion to recycling, reuse or resource recovery, SEIC is using the Russian Hazard Class 1 to 5 classification system. Hazardous wastes, as described in international regulations, are defined in the SEIC Waste Management and Minimisation Standard as:

- Hazard Class I, II and III wastes under prevailing Russian Federation regulations, excluding any Hazard Class III waste for which disposal in municipal landfill facilities is permitted (under special conditions and limits defined in Russian Federation regulations);

- It must be noted that under current RF waste management regulations ("Amendment to the FWCC") some oily waste, having less then 15% hydrocarbons of the total mass are considered to be Hazard Class 4 wastes. In accordance with international practice, SEIC will consider oily wastes as hazardous and will not dispose untreated oily waste at municipal landfills.

10.3 WASTE GENERATION VOLUMES

Based on a waste generation assessment (IT Russia Services 2004), Table 10.2 presents overall waste generation volumes for the construction and operation stages of Sakhalin 2 Project Phase II.

A number of SEIC assessments on waste generation were carried out between 2003-2004 (IT Russia Services). The most recent data are provided in Appendix 1. This up-to-date information reflects changes in the Russian classification system for wastes, which includes:

- The implementation of a 13-digits waste code (in line with the amendment to the FWCC);
- Changes in the assignation of Hazard Classes to some waste streams.

The recent prediction of waste generation volumes are generally in accordance with data that have been submitted before in Project documentation. It should be noted that this assessment is rather conservative (i.e. describes "upper limits") and factual data that will be obtained during construction and operation of the Project Assets may be less than the estimated volumes.

Table 10.2 Assessment of Waste Generation Volumes for Construction and Operation Stages of Sakhalin II Project Phase 2

Hazard Class	Waste Generation	
	Construction Total (Tonnes for three years)	Operation (Tonnes/year)
1-2	32	32
3	4,790	1,200*
4-5	98,000	2,600

* oily sludges comprise 987 metric tonnes (MT) a year

For comparison, the Yuzhno-Sakhalinsk landfill receives about 200,000 metric tonnes (MT) of municipal waste (Hazard Class 4) per annum for disposal (i.e. 600 tonnes a day).

10.4 BASIS OF SEIC's WASTE MANAGEMENT POLICY

The basic principles underlying SEIC's approach to waste management embody the following:

- To minimise the amounts of wastes produced;
- To manage waste material as close to the source of its generation as is practicable;
- To maximise the amount of waste that is reused or recycled;

- Dispose of that waste (not otherwise managed) in an environmentally sound manner.

The overall objective is to minimise the potential negative impact on community health and the environment resulting from waste generation. To achieve this, SEIC is committed to managing the wastes for which it is responsible, at a high standard of environmental and economic efficiency. As such, it shall comply with:

- Applicable Russian Federation laws and regulations;
- SEIC HSE-MS Standard "Waste Management and Minimisation" Document # 0000-S-90-04-0-0258-00 (SEIC July 2003);
- Shell EP Minimum Environmental Standards (March 2003);
- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989 and as amended);
- The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).

In addition, SEIC has also chosen to implement its approach to waste management on a cooperative basis with the Sakhalin Oblast Administration and local governments. The objective of this is to support the progressive improvement of waste management capacity for the broader community and thus inherently contribute to sustainable development.

This arrangement has been formalised in a "*Framework Agreement on Waste Management Cooperation*" between the Sakhalin Oblast Administration and SEIC. As elaborated upon in the following sections of this Chapter, the initiatives of cooperation between the parties include:

- Waste minimisation projects;
- Upgrading of three strategically located municipal landfill facilities for disposal of Hazard Class 4 and 5 wastes;
- Planning and SEIC Technical Support for an Integrated Waste Management Facility (IWMF) for adjacent SEIC and Oblast facilities;
- Planning of the long-term development of communal waste management infrastructure within the Oblast.

As bulleted above, SEIC will seek full compliance with standards and jurisdiction of the Russian Federation. SEIC also recognises that the adoption of a strict compliance objective with standards in OECD[1] countries, and particularly those adopted by the European Commission (EC), would potentially diminish SEIC's objective to use the Project and its approach to waste management as a sustainable development tool to assist the local community to incrementally improve communal waste management capacity. In this regard, SEIC believes that its overall approach and particularly that applied to upgrading Hazard Class 4 and 5 waste landfills is consistent with that adopted by the World Bank in developing improved waste management infrastructure. This is to be undertaken through the progressive upgrading of existing infrastructure rather than immediately adopting design and operating standards for communal facilities that would not be sustainable.

[1] OECD: Organisation for Economic Co-operation and Development

In all its waste management activities and facilities, SEIC seeks to achieve a level of environmental performance that is equivalent to international best practice. SEIC will benchmark its waste management plans and practices against the standards and guidelines set by the World Bank and EC as a basis for assessment and ongoing improvement.

Information Box 10.1

Key Elements of SEIC Waste Management Strategy
• Comprehensive waste minimisation and diversion programme; • Temporary storage of Hazard Class 1 to 3 wastes, pending recycling or treatment, at dedicated, equipped and approved sites; • Bio-treatment of Hazard Class 3 oily wastes; • Reuse and recycling of Hazard Class 4 to 5 wastes; • Upgrading of three municipal landfills to international best practice and disposal of Hazard Class 4 to 5 wastes at the upgraded municipal landfills; • Waste tracking system and control of SEIC generated wastes at disposal sites used on Sakhalin; • Waste co-operation, strategy and programmes in conjunction with Sakhalin Oblast Administration.

10.5 THE SOLID WASTE MANAGEMENT PLAN DEVELOPMENT PROCESS

SEIC's Solid Waste Management Plan (SWMP) is based on information collected from a number of studies covering items such as:

- An inventory of the predicted amounts of waste generated during construction and operation;
- An assessment of treatment options, including re-use and recycling and final disposal;
- Surveys of existing landfills;
- Development of a waste tracking system.

The various studies are referenced in the following sections.

10.5.1 Development of Solid Waste Inventory

A key step in progressing a waste management strategy and plan is the development of a waste generation estimate (i.e. an inventory) that identifies, characterises and quantifies anticipated wastes to be generated. The results of this work and the methodology used have been presented in a report entitled *"Waste Stream Identification and Quantification"* (IT Russia Services Feb. 2003).

The anticipated volumes of waste generated from the construction and operation phases are summarised in Appendix 1. The overall conclusions drawn from this are:

- SEIC's total waste volumes for any waste type, during any particular period, are small in comparison to the overall waste generated by municipalities and other industries on Sakhalin Island;

- The largest volumes of waste will be generated during the construction phase and this is predominantly:
  - Hazard Class 4 and 5 wastes from land clearing, civil construction and installation activities;
  - Industrial packaging;
  - Domestic solid waste from construction camp accommodation.
- Construction-related waste will be generated at various locations throughout Sakhalin but with some larger volumes requiring management in the southern part of the Island (e.g. at the LNG/OET asset construction sites) and where waste from offshore platforms and offshore pipelines – transported by returning supply boats – will be landed;
- Waste generation will be significantly lower during the operational phase. The waste will largely comprise recyclable ferrous metal scrap and Hazard Class 4 and 5 domestic solid wastes mainly concentrated towards the southern part of the Island. SEIC's operational and support assets and servicing of offshore operations are concentrated here;
- The overall volume of waste classed as having significant environmental risk and which would be considered hazardous for the purposes of its management (see Table 10.1) is small relative to Hazard Class 4 and 5 wastes;
- For Hazard Class 1 to 3 wastes having relatively high environmental risks, the greater proportion comprises waste oil and lead-acid batteries that can be diverted for recycling or resource recovery.

10.5.2 Waste Management Options and Feasibility Analysis

Based upon estimates of wastes to be generated, various waste management approaches together with generic technology options were identified and evaluated by SEIC. A "*Waste Management Feasibility Study*" was prepared (IT Russia Services Aug. 2004) which not only covered the construction and operational phases but placed an emphasis on waste minimisation and diversion for recycling or resource recovery. The main conclusions of this work were:

- Waste should be selectively segregated at source to optimise opportunities for recycling, reuse and resource recovery;
- Segregated waste streams can be directed to recycling/re-use opportunities (including resource recovery) subject to availability, economic sustainability and appropriate due diligence assessment. Building on an existing base of local service providers, this would apply to waste streams such as used lead batteries, ferrous and non-ferrous metals, waste oils, some plastics and potentially paper and glass;
- For the construction period – where the higher but transient waste volumes would be generated – the need for the following generic facilities was identified:
  - Secure storage for Hazard Class 1 to 3 wastes and appropriate storage for bulked Hazard Class 4 and 5 wastes at the source or at centralised locations;

  - Appropriately located Hazard Class 4 and 5 wastes landfill capacity sufficient to accommodate the transient volumes generated by construction activities;
- For the operational period, the need for the following facilities was identified:
  - Centralised secure storage for Hazard Class 1 to 3 wastes operated by a third party and appropriate storage for bulked Hazard Class 4 and 5 wastes along with size reduction and compaction equipment;
  - A bioremediation facility for hydrocarbon-contaminated soil;
  - Small-scale disposal or long-term secure storage facilities for Hazard Class 3 waste operated by a third party;
  - Modest Hazard Class 4 and 5 wastes landfill capacity;
  - Contingency storage area for waste serving emergency response requirements (including oil spill response).

Based on this, the primary generic technologies and techniques appropriate to the requirements of the SEIC Sakhalin II Project were identified as those providing for:

- Source separation and handling of waste streams that have the potential for recycling and reuse;
- Secure storage of Hazard Class 1 to 2 and some Hazard Class 3 wastes pending availability of treatment and disposal facilities on or off Sakhalin Island;
- Environmentally sound and separate land disposal of Hazard Class 4 and 5 waste streams, respectively.

Waste treatment would be mainly limited to bioremediation of hydrocarbon-contaminated soils. The general application of incineration technology for either Hazard Class 2 to 3 wastes or Hazard Class 4 and 5 wastes in the near-term was not considered supportable for the requirements of the Project. This conclusion was based on the combined impact of a range of factors including:

- The small amount of SEIC-related wastes for which incineration might be required and/or is practical;
- Conflict with SEIC's overall policy in that prioritising waste minimisation would negate the diversion of higher calorific value waste streams needed to support incineration;
- The potential to reduce SEIC's flexibility to work in cooperation with the Oblast Administration and other waste generators in planning and implementing improved waste management infrastructure in the near and longer-term;
- Uncertainty about environmental performance and risks associated with available technologies;
- High initial capital, maintenance and operating costs;
- Potential limitations on operational and technological sustainability;
- Potential long mobilisation, construction, testing and commissioning periods for permanent incineration facilities;
- Longer and potentially complicated approvals processes;

- Adverse public, local governmental and international perceptions;
- Requirement for supplementary fuel and delivery infrastructure;
- Low Russian content (i.e. technology needs to be imported);
- Limited potential to utilise thermal output for other uses;

The use of small (non-EC Directive compliant) incinerators will not be allowed by SEIC for waste generated during construction and operation with the exception of small capacity batch incinerators, not exceeding 25kg per hour. Small incinerators may be used for the disposal of the selected waste streams such as oily rags, for which no feasible management option currently exists on Sakhalin. The contractor must provide to SEIC, all necessary information concerning the incinerator and to receive SEIC's approval prior to using it. SEIC would carry out a compliance audit (to RF standards) for any incinerator used.

A limit of 40 tonnes per year will be set on the total waste that may be disposed of to such incinerators. Such activities will be limited to SEIC operations, controlled and performed by trained personnel. Construction contractors will use third party services and dispose of oily rags via co-combustion in coal boilers and local power stations.

If any incinerators other than the above are used to incinerate waste from the project in the future, the contractor must demonstrate that it is compliant with appropriate EU directives (e.g. EC Directive on Incineration of Waste 2000/76/EC; Incineration of Hazardous Waste 94/67/EC; New Incineration Plants 89/369/EEC).

10.5.3 The Solid Waste Management Plan

SEIC's Solid Waste Management Plan (IT Russia Services 2002) was developed on the basis of waste inventory estimates, the waste management option work described above and in consultation with stakeholders, particularly the Sakhalin Oblast Administration. The SWMP formally documented SEIC's strategy for solid waste management and developed the framework of an integrated waste management system for the project. This covers on-site waste management and the various stages of off-site waste management including transportation and (off-site) management of Hazard Class 4 to 5 wastes.

10.6 SEIC's WASTE MANAGEMENT STRATEGY

The overall waste management strategy set out in the SWMP is aligned with SEIC's *"Corporate Waste Management and Minimisation Standard"*, (see section 6.1, Volume 1 of the EIA). As a result, this Standard states a number of minimum requirements, as follows:

- The impact of waste management activities from existing and planned onshore and offshore facilities and construction projects shall be minimised to a level that conforms with applicable regulations of the RF and company standards and commitments, and is "as low as reasonably practicable" (ALARP) with acceptable residual risks;
- Engineering design requirements for process equipment that generates waste and for waste handling equipment shall meet the requirements of RF law unless otherwise exempted;
- SEIC shall promote co-operation and mutually beneficial waste management solutions with local administrations and shall be responsible for the waste that it generates until it is transferred contractually to appropriate parties for reuse or recycling, or to licensed waste management facility operators for treatment and/or disposal;
- Wastes generated by, or under the control of, SEIC and its subcontractors shall be managed in accordance with the requirements specified in the SEIC Solid Waste Management Plan. This plan governs the waste management activities of SEIC;
- SEIC Staff and contractors shall refrain from engaging in waste management activities that could result in the unintended acquisition of risk or liability for SEIC;
- Each engineering, procurement and construction (EPC) contractor shall prepare and implement its own Waste Management Plan for the design and construction activities included in its scope of work;
- Required licences/permits for waste management activities shall be obtained from the appropriate regulatory authorities. Waste shall not be generated, transported, treated, stored, or disposed prior to the issuing of these licences/permits;
- Prior to making any significant changes in the operation of waste generating facilities or before generating new waste sources at existing facilities, potentially affected waste licences/permits shall be reviewed to ensure the basis upon which they were issued, has not changed. If required, appropriate applications shall be resubmitted for licence/permit renewal or modification.

SEIC uses a "hierarchical approach" to select appropriate waste management solutions. This prioritises waste minimisation and is consistent with RF and international best practice. This hierarchy is illustrated in Figure 10.1 and gives highest priority to avoidance and minimisation, followed by reuse, recycling and recovery. Finally, unavoidable wastes, which cannot be reused, recovered or recycled will be treated and/or disposed of correctly.

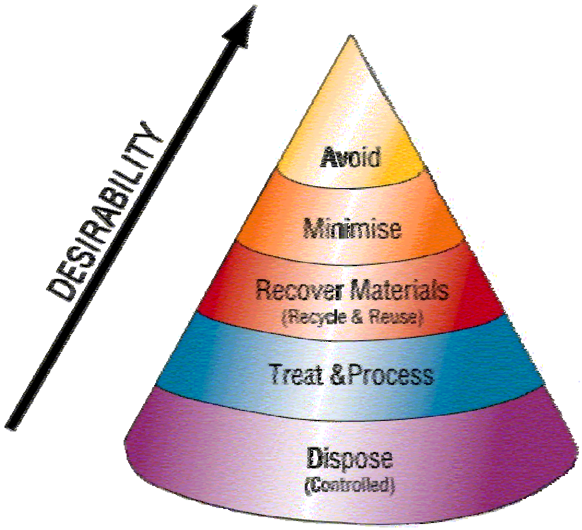

Figure 10.1 Waste Management Hierarchy

SEIC utilises "storage" of wastes (short-term and medium-term) in order to maximise the potential for moving wastes up the waste management hierarchy and to ensure that care and custody of the small quantity of higher environmental risk waste streams (with no immediate treatment and disposal options) are available.

As stated above, waste minimisation is a primary task of SEIC and its contractors. However with respect to the other waste management solutions, it should be noted that waste management is not a core activity of SEIC and, in common with standard industry practice, SEIC prefers to secure waste management services from qualified third party companies whose core business is waste management.

10.7 IMPLEMENTATION OF WASTE MANAGEMENT STRATEGY

In this section, the implementation of SEIC's waste management strategy is discussed in more detail and the progress to date in implementing these activities is outlined.

10.7.1 Waste Avoidance and Minimisation, Including Re-use and Recycling

SEIC's strategy includes a strong focus on "waste avoidance and minimisation" in accordance with the accepted waste management hierarchy. This entails a focus on avoiding waste generation wherever practicable and, where waste is generated, on avoiding/minimising high hazard class waste generation, for example by substitution of hazardous materials used with non-hazardous/low-hazard materials.

Specifically, SEIC intends to implement waste avoidance and minimisation by:

- Appropriate selection of technology, design and installation procedures for each of the facilities;
- Contractual management to ensure that certain residual materials will be removed and recycled, when they might otherwise become wastes for which SEIC is responsible. This would cover contaminated LNG plant filtration equipment that would be returned to technology suppliers and Non-Destructive Testing consumables such as

radiographic film and developing chemicals that will be recycled/treated locally;

- Selection of appropriate materials and management procedures for construction and operation;
- Promotion of low waste generation practices related to packaging and resource utilisation among contractors and service providers as well as SEIC operations.

In order to maximise the diversion of wastes with potential for recycling, reuse and resource recovery, SEIC has initiated a Waste Minimisation Plan; this will have both an internal and external focus with the objective to facilitate an integrated alternative waste management option for the disposal of such waste streams. Key Performance Indicators of waste diversion will be set out in this SEIC Waste Minimisation Plan.

The internal focus will be directed to ensure the implementation of the above principles back to the source of generation. The process of establishing and implementing asset-specific Waste Management Plans (WMP) with EPC contractors and operating assets is the basic tool in establishing source-based management consistent with the strategy. This is in place for EPC contractors and the process of formalising similar plans for SEIC's current operating assets is also underway.

Externally, SEIC is working with the Sakhalin Oblast Administration, other project developers and private sector business on Sakhalin Island to expand the local capacity to receive, process and market diverted waste materials. SEIC will act as a proactive partner in such initiatives and has earmarked financial resources within the Framework Agreement on Waste Management Cooperation with the Sakhalin Oblast Administration for this purpose. In doing this, SEIC believes that, ultimately, the future capacity to handle such diverted waste streams in a sustainable manner will depend on the much larger volumes generated by the community at large. SEIC also recognises that such growth will be progressive, as the regulatory and economic instruments necessary to sustain such initiatives are developed within local institutions, as is the case in other OECD member states. In the longer term, SEIC sees this process as a key component in its ability to pursue the Company's goal of continuous improvement of environmental performance.

There are currently a number of companies on Sakhalin Island and the Russian Far East that provide waste recycling and recovery services and which are anticipated to be the nucleus for the future expansion of waste recycling, resource recovery and potentially re-processing capacity. Current capacity for the viable recycling of materials includes:

- Ferrous and non-ferrous-metals;
- Construction and packaging wood;
- Lead acid batteries;
- Used oil;
- Selected plastics;
- Fluorescent lighting tubes (mercury recovery).

The potential exists to expand this to paper, wood, additional plastics and glass. Some opportunities for the recycling of food wastes may be available on local pig farms.

SEIC will qualify all waste management service providers through audits and, following appointment, carry out due diligence tracking of waste materials taken by them to ensure that the operation of facilities and onward disposition of wastes are in accordance with Russian regulations, as well as SEIC's own policies, standards and plans.

10.7.2 On-Site Waste Management

As noted previously, SEIC's waste strategy prioritises waste minimisation and diversion at source, making on-site waste management practices and capacity at the asset sites (during both construction and operation) a major focus of the SWMPs implementation. The basis for this is the asset-specific Waste Management Plans.

During the construction period, EPC contracts are contractually bound to adhere to SEIC's standard for waste management and minimisation as set out in the framework provided by the SWMP. Each of the appointed EPC-Contractors will prepare its own WMP for the facility within their scope of work. This will cover all solid waste management aspects including temporary storage, transport and minimisation of waste. The latter will be linked to the availability on the island of economically viable waste recycling, re-use and resource recovery outlets qualified by SEIC.

Within the site, the WMP will also include provision for correct and proper documentation and tracking of waste from source and at the point of exit, a link to the overall SEIC Waste Tracking and Documentation System (see Section 10.7.5). It will also require the development and operation of dedicated on-site waste storage and handling facilities at asset sites by the EPC contractors during the construction period up to the handover of commissioned assets to SEIC. These facilities will typically include:

- A dedicated and appropriately located waste management site within the asset designed with suitable security and environmental protection measures such as runoff and access controls;
- Secure and segregated containerised storage of all wastes (Hazard Class 1, 2 and 3 and selected Class 4) inclusive of spill containment for liquid wastes (e.g. oil and chemicals) until they can be transferred to off-site resource recovery, recycling, or treatment;
- Dry storage of segregated recyclable materials pending transfer off-site to appropriate facilities for reprocessing and/or sale;
- Direct provision of and/or an operating area for waste handling, packaging and size reduction equipment such as balers and shredders.

The standards applicable to these facilities will firstly have to meet Russian regulatory standards, for instance those applied to on-site waste storage generally. In addition, the secure storage for Hazard Class I to 3 wastes will have to meet international best practice applicable to hazardous waste transfer stations and/or dangerous goods storage. This will involve primary containment by separating waste types in labelled containers constructed of compatible materials (typically barrels or recovery drums). Such containers must be stored inside a secure building with fire protection and self-contained spill containment (Note: this does not apply to hydrocarbon-contaminated soils and waste oils where larger volumes are involved).

Containers will be stored such that each can be visually inspected for damage and leakage.

Hydrocarbon-contaminated soils may be stored as above where volumes are small or in bulk containers outside with weatherproof covers in locations with suitable run-off capture. Waste oil will be stored by type in suitably sized bulk hydrocarbon storage tanks, similarly located with suitable volume containment and run-off capture.

SEIC has completed the process of reviewing and finalising construction phase asset-specific WMPs with EPC contractors as they mobilise and initiate work. This process also includes the development of formal waste disposal documentation by the contractors as part of their contractual responsibility to obtain the necessary Russian regulatory approvals, as required under their contracts with SEIC. The Russian regulations contain an extensive system for permitting for waste disposal and reporting on it. In accordance with the RF legislation requirements, each company/facility must prepare a Waste Disposal Limit Report. This document will form the basis to approve waste limits and obtain the Waste Disposal Permit from the authorities. The document must be updated at least once every five years (its validity is also five years) unless a change in waste management takes place at an earlier stage, in which case it must then be updated.

The report shall, as a minimum, contain the following information:

- The company's details and background;
- Description of production processes and sources of wastes;
- Hazardous wastes passport with code as per Russian Federal Classifier of wastes;
- List of, composition and properties of wastes;
- Calculations and basis for rates and volume of wastes;
- Wastes' stream plan;
- Description of waste storage, basis for storage volumes and frequency of shipments;
- Description of units and technologies for recycling and decontamination;
- Description of landfills owned by the enterprise;
- Description of environmental monitoring measures at the landfills owned by the enterprise;
- Contingency actions;
- Mitigation measures;
- Waste disposal limits proposals;
- Other attachments (e.g. waste disposal contracts, licenses and Contractors' permits).

This process will also provide an updated database on waste generation and will be used to adjust scaling and distribution of selected waste solutions. This will be monitored against a system of waste generation and disposition reporting required by both SEIC and Russian authorities involving:

- Waste generation report prepared quarterly on the actual amount of waste generated; this forms the basis for the calculation of the "pollution fees". This report is issued to the local Ministry of Natural Resources Committee for approval;

- Annual Statistics Report in accordance with Waste Statistical Reporting Guidance;
- Monthly reporting of actual waste generation, storage inventories, shipments and treatment/disposal destinations to SEIC.

This reporting will also allow SEIC to monitor waste generation and its management for the purposes of pursuing ongoing continuous improvement initiatives as well as external reporting to stakeholders and shareholders.

A similar process of formalising asset specific WMPs is also being pursued by SEIC for its current operating assets and will be implemented as new assets are commissioned and turned over for operation.

10.7.3 Waste Transportation

As a general principle, SEIC requires that all wastes leaving an asset site do so within its overall supervision, including specific pre-approved destinations. These are covered by the standard waste tracking documents (i.e. waste manifest) defined by SEIC's Waste Tracking and Documentation System and only by qualified and licensed transporters (i.e. firms and operators).

For offshore asset construction, a major portion of the offshore construction activity will be remote from Sakhalin Island but waste generation will occur during final installation operations, for example, from the accommodation modules and during offshore pipeline installation. After storage at dedicated areas onboard modules or lay barges, wastes will be transported to shore via supply vessels in purpose-built waste containers. Waste will then be landed at SEIC's shore-based facilities. Upon arrival, the waste will be transferred to secure local on-site storage locations at the landing support asset, prior to transport to a final destination. Alternatively, it will be directly transferred to the final destination upon unloading. These will be primarily recycling, reuse or resource recovery destinations or the designated upgraded landfills (see Section 10.7.4) for Hazard Class 4 and 5 wastes. The primary location for landing this waste will be Kholmsk during the construction phase. During the operations stage, this approach is anticipated to continue.

Transportation from both offshore supply bases and onshore construction and operating assets to the final destinations will be undertaken by specialist service providers. During construction, the responsibility for this transportation will be contractually placed with EPC contractors and specialised service providers with whom they sub-contract. SEIC's operating asset management will assume this responsibility after the assets are commissioned. All transport, whether undertaken or contracted by EPC-contractors or SEIC, will be required to comply with minimum standards of operation conforming to the Shell Global "*Land Transportation Standard*". Within this, there is a wide range of detailed individual standards (e.g. "*Road Transportation HSE*" standard (ref: EP2005 Volume 2); "*Vehicle Specifications*" (EP2005 Volume 2); other topics covered include driver management; safe journey management etc.) that will similarly apply to SEIC and contractors. Additional waste-specific requirements are as follows:

- Use of a duly completed waste transport manifest as defined by the SEIC Waste Tracking and Document System, which as a minimum will include details of:
    - The nature, characteristics and volume/weight of waste material;
    - The source of the waste;

  - Place of last storage;
  - Proposed shipment destination;
  - Full details of waste transporter and transport route.
- Compliance with vehicle load limits;
- Standards for not transporting mutually reactive wastes in a single vehicle;
- Containment and labelling for waste during transportation (including the provision of covers for open trucks);
- Vehicle operators training, qualifications and licensing.

Waste transport routes will be subject to planning and regular review in order to establish preferred waste haulage routes designed to minimise environmental risk, public inconvenience and high traffic densities.

10.7.4 Waste Treatment and Disposal and Facilities Development

The process of selecting and developing SEIC's waste management facility development options evolved through the stages of preparing and developing the SWMP in consultation with the Oblast Administration. Whilst SEIC could have elected to pursue the development of independent facilities, it was apparent that the net benefit from its efforts would be greater if it proceeded in cooperation with the Oblast Administration, building on existing infrastructure and plans for its improvement. Within the basic constraints of needing to ensure that off-site disposal facilities used by the project meet accepted environmental standards and would be available to meet project schedules, SEIC has pursued options that best deliver broader benefits to the overall population and support the long-term development of Sakhalin Island's overall waste management capability, as endorsed by the Oblast Administration. This philosophy has been formalised in the Framework Agreement on Waste Management Cooperation signed with the Sakhalin Oblast Administration (SEIC Feb. 2003).

The result of this process is the selection of three municipal landfill facilities, which have been upgraded for Hazard Class 4 and 5 wastes.

Under the terms of the Framework Agreement, SEIC has undertaken the technical siting studies for possible sites for an IWMF for this and has progressed through the examination of eight possible sites through out the island (SEIC Design Institute IT Russia Services 2003). A preferred site at Ilyinsky in the south central part of Sakhalin Island (Tomarinsky district) had been identified, which regrettably failed to meet the necessary geotechnical requirements.

An alternative IWMF site at the Nogliki district was rejected by public hearing. The failure to be able to construct an Integrated Waste Management Facility (IWMF) has meant a revision to the original IWMF concept and SEIC constructing facilities for SEIC use alone.

(i) Hazard Class 4 and 5 Waste Management Facilities

SEIC has selected and committed to using three main existing landfills located at Nogliki in the north, Korsakov in the south and Smirnykh in the central part of the island. In 2004, Exxon Neftegaz Limited (ENL) will join SEIC in providing a co-financing initiative of the Nogliki landfill upgrade Project to allow for the disposal of ENL Hazard Class 4 to 5 wastes.

These three landfills are upgraded to meet Russian regulatory standards and in line with international best practice of environmental performance. In this respect, the basic environmental performance objective, is to ensure that no significant or damaging environmental contaminants originating from SEIC's waste are released into the general environment. This will be achieved through implementing technical control measures, primarily:

- Strict limitation of wastes going into the landfill as being "Hazard Class 4 and 5" from sources other than SEIC. The Landfill Code of Conduct, approved by SakhSanEpid and implemented at the Upgraded landfills will stipulate non-acceptance of Hazard Class 1 to 3 wastes coming from non-SEIC sources at the landfills. SEIC will provide PPE and appropriate training to Landfill operator's personnel to ensure no Hazard Class 1 to 3 wastes are disposed of in the landfill cells;
- Implementation of SEIC Waste Tracking System through a Waste Manifest;
- Collection of leachate accumulating in the landfill;
- Operating practices in line with the approved operating procedures involving compaction and covering of deposited waste with soil;
- Passive gas ventilation (in each layer) of the landfills will be introduced during operations to meet international best practice (e.g. using gravel lined trenches);
- The Landfills will be capped with the best material as appropriate to both site conditions and material availability in order to permanently cover waste deposited. Revegetation will be initiated. The sealing of the landfill cell will be important to reduce infiltration and reduce the ongoing leachate management costs. The final design for the cover will depend on the availability of low permeability soil. Drainage will be constructed to ensure the infiltration is minimised (information also contained in SEIC's Draft Landfill Operators' Code of Conduct and Landfill Operating Manuals). These design amendments will be issued on site and verified by test results/membrane CQA system;
- Resistivity testing was completed successfully at Korsakov, Nogliki and Smirnyk landfills in 2005. The testing ascertained the integrity of the HDPE liners.

Selection of Landfill Sites

The selection of the landfills chosen for upgrading was arrived at through a series of logical decision-making steps. The first of these involved the preparation of an inventory of existing municipal facilities and undertaking a general assessment of their potential (SEIC Nov. 2002). The conclusion of this work was that no facilities were suitable in terms of present support infrastructure, operating practices and environmental performance. However, a number of them had the potential to be upgraded or offered adjacent site space where new facilities could be developed either independently or in association with local administrations.

A more detailed field assessment was undertaken on nine of these facilities and sites (Extended Field Surveys on selected existing Waste Management Facilities – Approved May 2003). This was followed by work to develop conceptual designs and cost estimates on these sites and an assessment of where and how many Hazard Class 4 and 5 wastes landfill facilities would be required (SEIC Feb. 2004). This was based on the geographical location of on-land waste generation (i.e. the landing sites), timing of generation and transportation costs versus upgrade costs.

The results of this indicated that the optimum number of waste collection points during the construction period would be three: two in reasonable proximity to the OPF and LNG facilities, respectively, and a third located between these points to serve pipeline construction. This would offer some reduction in travel distances and convenience for this largely distributed construction activity.

During operations, access to these three landfill facilities will also be required: one in the south was found to be necessary at Korsakov, covering waste from the LNG; the other is in the north at Nogliki, covering the OPF, Nogliki airport and supervisory camp, which will be cost-shared with ENL, and another one at Smirnykh will be used for the disposal of minor volumes of Hazard Class 4-5 waste from Booster Station 2 and pipeline maintenance camps.

The decision to select existing rather than new sites was made in consultation with the Sakhalin Oblast Administration and local regulatory authorities on the basis that it best served the broader interests of the community. This option was not possible at Smirnykh so a new site was developed. In terms of interests to the community, these include the improvement of local facilities and offering increased capacity for general use. SEIC accepted this option rather than pursuing the development of new sites for its independent use, recognising that the selection of an existing site would be conditional on the following factors:

Upgraded facilities being used only for Hazard Class 4 and 5 wastes;

- Non-SEIC waste should be examined by landfill operator to make sure no Hazard Class 1, 2 and 3 wastes (e.g. acid batteries, used lube oil) are being disposed of at the upgraded landfills. Hazard Classes 1 to 3 waste should be segregated;
- Facilities being subject to the requisite operating standards/controls;
- Facilities to meet current Russian and international operating practices.

In terms of hydrogeology, there are no potable water wells or intakes within two kilometres of any of the three landfill sites. Written correspondence from the three Administrations to SEIC confirms this.

The adoption of a Landfill Code of Conduct applicable to the operators of the upgraded facilities (within the structure of the Framework Agreement) provided SEIC with assurance that both current Russian and international landfill operating practice guidelines will be implemented.

The general design of all landfills involves development of a multi-phase upgrade plan based on two or three discrete landfill cells being constructed independently of the existing landfill. The first phase or cell in each case will be financed by SEIC (excepting Nogliki where the cost will be shared with ENL) under the Framework Agreement and provide co-disposal to capacity for both the community and SEIC.

The design of barriers for each facility is described below. Cells will be equipped for leachate extraction, storage and recirculation. The upgrade will also provide for improved road access, fencing, lighting reception and staff facilities, groundwater monitoring wells and planting of trees for the main purpose of providing a visual barrier.

Korsakov: this landfill site has been commissioned and will be operated from October 2005 for SEIC waste after the Landfill Operator training programme has been implemented.

The initial cell was developed in 2004; this incorporates a landfill liner comprising of an impermeable composite twin liner system including a double layer of an impermeable 1.5mm high-density polyethylene (HDPE) produced in Canada. The specification is beyond the requirements of Russian standards and complies with the EU Council Directive 1999/31/EC pertaining to landfills. Protection is provided by a 200mm sand layer under the bottom liner, 400mm sand layer between the two liners for drainage, a 300mm sand layer above the top liner protected by 200mm of natural soil (shown in cross-section in Appendix 2).

To verify that the works have been constructed in accordance with the specification, a construction quality assurance (CQA) scheme has been implemented. All HDPE liner joints have been air tested this and all of the relevant test data has been retained within the CQA documentation. The quality assurance process on site includes the implementation of additional measures provided by authors and technical supervision from specialists during SEIC site visits and is tracked using a documented variation order record system.

Its construction includes an intermediate drainage layer to allow leachate collection and drainage. The capacity, based on a compaction factor of four, will be 70,200m^3 for 4.4 years. Clean-up and improved operating practice on the existing site has been initiated.

For managing leachate control, a pit has been constructed with a special tanker provided to collect and spread the leachate generated over the waste deposited (e.g. via spreader bar and pump system). This has been shown to accelerate the stabilisation of the landfilled waste. If during seasons of high levels of precipitation the leachate is excessive, it will be processed through the town's sewage treatment plant.

It is not intended to provide a landfill gas extraction and flaring equipment; instead a risk assessment justified that a passive venting system would be provided where required. Gravel, rather than sand, and conduits will be used for passive venting.

Lastly, in terms of abandonment, SEIC will close the site once the landfill is no longer utilised by SEIC – unless the Raion administration requests otherwise – and carry out topographic surveying to document final levels. Closure will be in accordance with Russian Federation legislation.

Nogliki: The landfill was commissioned in November 2005. The operator has a permit. A twin HDPE liner to the same specification as that of Korsakov was put in place in early 2005.

The new cell has been developed within the existing active landfill area and current land allocation. This involved the relocation of 22,000m^3 of existing waste and construction of a 250mm compacted clay layer that will provide a hydraulic conductivity below the waste of 1×10^{-9} m/s.

Nogliki Landfill (August 2005)

A CQA has also been implemented here to verify the works have been constructed in accordance with the specification. All HDPE liner joints have been air tested this and the all of the relevant test data has been retained within the CQA documentation. As in the Korsakov case, the quality assurance process on site includes the implementation of additional measures provided by authors and technical supervision from specialists during SEIC site visits and is tracked using a documented variation order record system.

A suitably protected drainage layer for leachate collection is also provided. The overall site includes surface water drainage to divert run-off from existing active areas with particular attention to segregating and capturing historical contamination. An extension to the existing municipal sewage plant is also being financed, which will ensure that disposal of sewage at the landfill is discontinued. The design has been completed. It should be noted that ENL is making a cost-sharing capital contribution to this upgrade that has allowed more extensive upgrading in the form of a dedicated ENL leachate pit and discrete landfill cell (see also below).

The overall design, based on a compaction factor of four, will have a capacity of 98,000m^3 for ten years.

As at Korsakov, leachate control will be undertaken using leachate pits with the leachate generated being collected and spread the over the waste deposited by a tanker specially provided. This has been shown to accelerate the stabilisation of the landfilled waste. If during seasons of high levels of precipitation the leachate is excessive, it will be processed through the town's sewage treatment plant.

It is not intended to provide a landfill gas extraction and flaring equipment instead a risk assessment justified passive venting system would be provided where required.

The landfill upgrade at Nogliki will be completed in October 2005 and has been operated from January 2004 on a temporary works basis as a controlled landfill (e.g. no fire, daily soil cover and strict waste acceptance control).

Smirnykh: This upgraded landfill site has been commissioned and has been operating for SEIC waste from September 2005, in line with its permit.

Smirnykh Landfill (August 2005)

This is effectively a new site that utilises a quarry/borrow pit near the pipeline right of way. It will be used by SEIC mostly during construction after which that portion used by SEIC will be closed, leaving the remaining capacity for local use and to serve minor Hazard Class 4-5 waste disposal from Booster Station 2 and pipeline maintenance camps. It was developed, initially in 2004, in accordance with Russian standards, through the application of a single impermeable 1.5mm HDPE liner complete with 200mm thick protection /drainage layer and 500mm of clean soil to protect geomembrane during the interim works. In 2005, a second HDPE liner was installed after the clean soil has been removed and the full 400mm thick leachate monitoring layer constructed as indicated on the cross-section in Appendix 2. The capacity, based on a compaction factor of four will be 40,000 cubic metres) for five years.

A CQA scheme is also implemented with the same parameters and specifications, as mentioned above.

As at the other two sites, leachate control will be undertaken using a pit with the leachate generated being collected and spread over an active waste cell. This has been shown to accelerate the stabilisation of the landfilled waste.

It is not intended to provide a landfill gas extraction and flaring equipment as a risk assessment justified the provision of a passive venting system, where required.

The necessary agreements for upgrading are in place. Detailed design work is complete. Approvals for the design and construction are also in place and the 2004 construction programme is staggered to be complete in August 2005. The Korsakov and Smirnykh sites were commissioned in December 2004. The construction status is as follows:

Korsakov – the twin liner system has been constructed and the upgraded landfill is operational. The landfill operator is awaiting the operating licence, and in the meantime the authorities (RTN) have permitted its utilisation..

Smirnyhk – – the twin liner system has been constructed, the second drainage layer (with protection) placed and the landfill is operational.

Nogliki – the twin-liner system has been installed, and all earthworks are completed. The extension to the STP is ongoing. The landfill was commissioned in November 2005. Winter works are also envisaged such as placing the 3.2km power line to the landfill, which traverses swamps and can only be a winter construction.

SEIC may further develop the upgraded cells at Korsakov, Nogliki, and Smirnykh landfills to increase the capacity in order to allow for the disposal of Hazard Class 4 to 5 wastes during the future operation phase of the Project.

Environmental Monitoring at Upgraded Landfills

An environmental monitoring strategy for the upgraded landfill sites, based upon the reference data and conceptual site model for the landfill has been developed and implemented (SEIC Oct. 2004). In a two-staged approach SEIC has outlined a “Site Environmental Monitoring Plan” to collect reference (background) data. The primary purpose is to detect any significant leakage or overspill of leachate. Secondly, an “Environmental Monitoring Programme” has been developed based on the reference data and conceptual site model for the landfill. The programme is used to collate data from the surface water and groundwater environment during the construction, operation and aftercare of the landfill site. The results of routine monitoring will be collated and available in a monitoring report for inspection by the local authorities.

A local hydrogeologist specialist contractor has been commissioned by SEIC to install monitoring infrastructure, take samples, test and report the results in a predefined format. This data will be used to check compliance of the landfill sites as well as provide data to refine the risk assessment model during the construction and aftercare phases of the work.

Other Landfill Sites

Due to delays in upgrading of Nogliki, Korsakov and Smirnykh landfills and with the aim of reducing distances to transport waste, the onshore pipeline contractor has been allowed to use some local municipal landfills for the disposal of Hazard Class 4 to 5 construction and domestic wastes.

Landfills that have been used by the onshore pipeline contractors are Val, Molodeznoye, Makarov, Tymovsk, Yasnoye, Onor, existing Smirnyhk, Novoye, Vizmore, and Dolinsk. The use of the Makarov, Novoye and Vizmore landfills have been discontinued as of Q4 2005. Waste from Yuzhno facilities currently goes to Yuzhno landfill site.

Disposal of waste at these existing facilities was in accordance with RF requirements, for example, contracts with landfill operators were put in place, a waste-disposal fee paid, wastes properly documented, and no disposal of Hazard Class 1 to 3 wastes was allowed.

SEIC will implement a three phase plan to eliminate the use of these non-upgraded landfill sites:

1. Makarov landfill site will not be used by SEIC contractors from 15th September 2005 (SEIC contract with the Landfill Operator ceases with effect from 30th September 2005);
2. Waste disposal by pipelines will be restricted to the three upgraded landfills, plus the landfills at Val, Tymovsk, Yasnoye, Novoye, Vizmore and Dolinsk. This system will be in place from the 15th September 2005 to the 15th March 2005. (Note SEIC Facilities will retain the use of the Yuzhno landfill during this period);
3. Within Q2 2006, SEIC will enact a central waste transportation and compaction contract, which will centralise the collection of all waste from SEIC construction activities and ensure the disposal of this waste at the three upgraded landfills only. Once this centralised system has been established, the use of all non-upgraded landfills will cease.

Offsets

SEIC has budgeted USD 450,000 to provide for environmental improvements to the following seven landfills. Approximately USD 50,000 of this amount will be allocated to each:

- Val
- Molodeznoye
- Tymovsk
- Onor
- Yasnoye
- Makarov
- Novoye
- Vizmore
- Dolinsk

The local administrations, in conjunction with SEIC, will determine how the funding is utilised. Part of the investment will be spent on improvement of waste management practice and rectifying environmental impact of SEIC waste disposal.

SEIC has also budgeted USD 350,000 for the provision of technical and engineering support for the new Yuzhno landfill.

Wastes Generated Offshore

Offshore wastes (Hazard Classes 1 to 5) are transported by vessel to Kholmsk where part is directed for recycling and the remainder of Hazard Class 4 to 5 wastes are disposed of to the Korsakov landfill site.

(ii) Waste Management Facilities for Hazard Class 1 to 3 Wastes

In view of difficulties in selecting a site for the IWMF, SEIC has developed an updated Waste Management Strategy (SEIC 2005) with regard to Hazard Class 1-3 waste. The updated Strategy includes two basic features of IWMF, in particular:

- Medium/long term storage facilities;
- Oily waste holding areas with the possibility for bioremediation.

These are described in more detail below.

(a) Secure medium/long-term storage of Hazard Class 1 to 3 wastes

This component provides for temporary storage facilities for Hazard Class 1 to 3 wastes at site (except for oily wastes, that have to be bio-treated and disposed of and used lube oils that have to be blended with crude or used for heat recovery) that have been accumulated in the on-site secure storage locations during construction and as generated during operation. Subsequently the hazard classes 1 to 3 wastes will be transported to secure third party storage. This storage will be used until suitable treatment and disposal facilities are available locally or sufficient quantities are accumulated to allow economical export to suitable treatment and disposal facilities elsewhere in the Russian Federation or other countries. In the latter case, this export would be undertaken in full compliance with Directive 93/98/EEC on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (Basel Convention) and the Russian Federation’s regulations pertaining to it and international obligations under it.

The facility will consist of an enclosed building or incrementally developed modular units, preferably self-contained as typically used for hazardous waste and dangerous goods storage. These should incorporate spill containment, locked access and a fire protection system.

The estimated overall capacity required for the lifetime of the Sakhalin II Project is 100 metric tonnes (MT) in the absence of periodic shipments out of the storage facility. It would be located on a dry pad with any active waste handling area being underlain by an impermeable barrier with run-off collection features. Wastes contained in the storage facility will be segregated by type and stored in sealed multi-layer containers (i.e. barrels or purpose-made hazardous materials containers), suitably labelled and individually accessible for retrieval and inspection. The facility would also be equipped with contaminated container-cleaning capacity as required. Applicable reference standards will be those typically associated with hazardous waste transfer stations and long-term storage facilities in OECD countries, as described in the World Bank Pollution Prevention and Abatement Handbook (1998 and amended).

(b) Hydrocarbon contaminated oily waste holding areas

This component will provide for storage and bioremediation of soil and similar material that has been contaminated by hydrocarbons arising from accidental spillage of products during construction and operations. The anticipated quantities received on a routine basis are estimated to be small but a contingency will be built into the design to accommodate a more significant (but not major scale) oil spill event, in the form of capacity for secure short-term storage of material pending treatment. The sites will also provide a secure area separate from the active bioremediation cells for secure containment of up to 15,000 MT of contaminated soil that could result from a larger spill (i.e. it could support emergency situations and specifically oil spill response requirements).

No untreated oily waste or oily soil will be placed in landfill sites.

The most suitable technology to be employed at the oily waste holding areas (that will meet SEIC and Russian legal requirements) is expected to be “bioremediation”, which is also widely accepted internationally. This involves cultivating a layer of soil containing a combination of hydrocarbon-contaminated soil, bulk filler and organic matter or nutrients, in order to accelerate natural oil biodegradation processes. Over time the material is rendered suitable for permanent disposal either by landfill or for use as fill material. The key design features will include:

- Secure bonded and impermeably surfaced areas for the storage of wastes with a high oil content;
- An open area for land farming operations with self-contained surface run-off drainage, to contain oil contaminated run-off;
- Agricultural and irrigation equipment for land farming works;
- Surface water run-off containment and primary oil water separation.

The oily waste storage facilities will be allocated at the third party sites in association with the Oblast Authorities. Currently, Hazard Class 1 to 3 wastes will be temporarily stored on the construction sites in secure storage facilities described in *Section 11.7.2* above or transferred to licensed and approved by SEIC waste processors and treatment facilities, where available (and depending on economic volumes being available for recycling/treatment).

Dedicated Hazard Class 3 waste disposal cell was originally considered by the SWMP to be the solution for the modest quantities of Hazard Class 3 waste streams not otherwise managed at source or through recycling/reuse /resource recovery. The SEIC SWM strategy review proposes storage onsite prior to recycling with a view to managing waste such that the dedicated Hazard Class 3 waste disposal cell will not be required.

At this stage, SEIC will not consider design and construction of a dedicated disposal cell for Hazard Class 3 wastes. However, as the project develops, SEIC may revisit the IWMF issue in future and include a facility option in the Waste Management Plan. Table 10.3 presents a comparison of currently considered options and waste management solutions originally provided in SWMP.

Consequently, SEIC is discussing its strategy with the Oblast Administration to achieve the optimum solution as per the requirements of the Framework Agreement.

Table 10.3 Comparative Analysis of Waste Management Options

Waste Streams	Management Option as per SEIC SWMP (2002)	Revised Management Options
Hazard Class 1 to 2 Hazard Class 3, recyclable or recoverable wastes	Construction: Collection, temporary storage at the construction sites, shipping to third party for recycling, recovery or treatment.	Same as SWMP.
	Operation: Collection, transportation to SEIC IWMF, temporary storage at the SEIC IWMF, shipping to third party for recycling, recovery, or treatment.	Collection, temporary storage at the shipping to third party for recycling, recovery, or treatment.
Hazard Class 3, oily wastes, non-recyclable and non-recoverable wastes	Construction: Collection, temporary storage at the construction sites, pending transportation to bioremediation facility.	Same as SWMP.
	Operation: Collection, transportation to SEIC IWMF, temporary storage at the SEIC IWMF and biotreatment to Hazard Class 4 to –5 wastes, disposal at SEIC IWMF or beneficial reuse for landscaping or site reclamation.	Collection, transportation to bioremediation facilities, biotreatment to Hazard Class 4 to 5, disposal at the upgraded municipal landfills or beneficial reuse for landscaping or site reclamation.
Hazard Class 3, non-recyclable, non-oily wastes	Construction: Collection, temporary storage at the construction sites, pending disposal at dedicated landfill.	Collection, transportation to third party for treatment, recycling and recovery. Some temporary storage at the construction sites, pending shipment to the recycling outlets.
	Operation: Collection, transportation to SEIC IWMF, disposal at SEIC IWMF.	Collection, transportation to third party for treatment, recycling and recovery.
Hazard Class 4 to 5 recyclable waste	Construction: Collection, reuse onsite, temporary storage at the construction sites, shipping to third party for recycling and recovery.	Same as SWMP.
	Operation: Collection, reuse onsite, temporary storage at the assets, shipping to third party for recycling and recovery.	Same as SWMP.
Hazard Class 4-5 Non-recyclable waste	Construction: Collection, some temporary storage at the construction sites, disposal at the upgraded municipal landfills.	Same as SWMP.
	Operation: Collection, some temporary storage at the assets, transportation and disposal to SEIC IWMF.	Collection, some temporary storage at the assets, disposal at the upgraded municipal landfills.

(iii) Vessel Wastes

The MARPOL 73/78 Convention[2], to which Russia is a signatory, places duties on port operators and vessel operators concerning the management of certain wastes from ships. SEIC will directly operate the marine facilities at Prigorodnoye. SEIC, as operator, is charged with providing facilities (e.g. segregated skips) for the collection of normal vessel waste. Furthermore, SEIC's contractors are required to have a shipping agent in the port. One of the agent's tasks will be to ensure that waste is handled appropriately and in accordance with MARPOL/Russian Federation legislation.

SEIC will audit all vessels to ensure that facilities are in place to manage waste in accordance with MARPOL. Finally, SEIC will monitor Contractor performance against the commitments set out in the HSESAP with regard to waste management.

The upgraded landfill facilities will be a potential additional resource for the management of some Hazard Class 4 and 5 wastes from ships on a contingency basis.

(iv) Medical Wastes

The volumes of medical waste generated by SEIC and its contractors will be small, involving an estimated 13 MT during the construction period and 43 MT over the entire operating life of the project. Medical waste of concern is essentially waste components containing blood-borne pathogens, in particular needles. This is generated mainly in the assets' clinics and first aid facilities and largely confined to blood-contaminated consumables such as dressing materials and needles.

It is, however, important to put this in context in that there are already a number of controls and sub-controls in place to minimise the risks and likelihood of medical impacts and the potential for contamination. For instance, strict "fitness standards" in the recruitment of staff and regular medical examinations during employment of staff. Another example is that sharps such as surgical blades are rarely used.

Some additional general medical waste may be generated as a result of use of public medical facilities by SEIC and contractor personnel but the numbers are small relative in comparison with the overall volume generated by the community as a whole.

The management of medical waste directly generated by SEIC at its assets involves immediate segregation in secure containers upon its generation. The containers are securely stored on-site in the asset waste management facility. Further disposal is carried out in accordance with Russian regulations and directed by qualified medical practitioners based on their assessment of any risks that may be involved.

Where disposal to landfill is the preferred option, medical waste derived from the Project will not be disposed of in an uncontrolled landfill. In accordance with RF regulations as a minimum, SEIC will ensure that all medical waste is encapsulated prior to disposal on landfills, and either buried at a recorded location in the landfill, or within a segregated cell. As a minimum this will include the use of a proprietary container. Encapsulation will involve the treatment of sharps type waste using a material such as Plaster of Paris (or a

[2] International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

commercial product such as Isolyser) which when fully reacted, will encase the waste in a solid protective matrix. The encapsulating agent will completely fill the container. The container and solidified contents must withstand an applied pressure of 40 psi without disintegration.

Medical waste that is blood-contaminated is disinfected; antiseptics containing "Alaminol" (5%) and "Lizoformin - 3000" (2%) are used. Waste products are immersed in solutions of antiseptic tanks for 15-30 minutes, then packed into polyethylene bags, and destroyed by incineration in hospitals.

SEIC is currently considering an option for the disposal of liquid sterilisation by-products. The proposed option is to mix sterilizing liquid with cement (for stabilisation) and disposal of cement blocks in a dedicated cell at the landfill site.

Contracted health care service providers have contracts in place with nearby hospitals, which dispose of the medical waste in line with the existing regulations.

These practices are (along with supporting procedures for secure segregation at source and pre-treatment) consistent with guidance documents published by the World Health Organisation (WHO 1999) and World Bank (WB 1999 and 2000). The overall approach to the generation, handling, transfer, treatment, control and disposal of medical waste is considered to be ALARP.

Under the SEIC-funded Health Infrastructure Upgrade (HIU) programme, the Company is presently working to upgrade medical facilities jointly with the Sakhalin Health Authority and local hospitals, with the objective of imparting higher standards than currently exist. The improvement of medical waste management practices in accordance with Russian and applicable international standards are part of this scope and may include upgrading of on-site waste management facilities. In this context, SEIC is aware of reservations in the international community with respect to the use of combustion technologies for waste management in medical facilities and notes similar concerns expressed by Russian regulatory authorities.

SEIC is developing appropriate measures to mitigate the potential risks relating to the disposal of medical waste and to identify the deficits in the current systems used by the hospitals to dispose of infective medical waste, in order to bring them up to Russian and those international standards noted above. SEIC's strategy therefore includes waste prevention and options for safe treatment and/or disposal.

Current targets for the HIU programme are to have completed the Yuzhno-Sakhalinsk hospital upgrade by October 2005 with Poronaysk and Nogliki commissioned by November 2005. It is noted that the speed of execution of the programme depends greatly on the approval and agreement processes within the Sakhalin Health Authorities.

From a more strategic perspective, SEIC is addressing its concerns on "public health" issues by engaging in consultation and liaising with local authorities and communities. SEIC is involved in the Joint Health Advisory Committee, a control mechanism between SEIC and the Oblast Authority. The Committee, which was established in December 2003 in following the recommendations of the Health Impact Assessment, meets four times a year and establishes sub-committees for giving advice on specific matters.

10.7.5 Waste Tracking and Documentation System

As documented in detail in the SWMP Appendix 4 (Dec. 2002), SEIC has developed and is implementing a system to track and document the generation, Duty of Care, storage, transfer and disposal of wastes resulting from the construction and operations' activities of SEIC and its contractors. This includes shipments of waste from the platforms to shore.

This system is based on the "care and custody" principle embodied in most systems employed in OECD countries by regulatory authorities in tracking hazardous waste and is extended to include all SEIC waste. It is based on three principal standard control documents:

- *Waste Generation Ledger* – records waste generation at source, movement details and describes management on-site up to the point of removal from site;
- *Waste Manifest (Waste Transfer Form)* – multiple-copy tracking document that remains with the waste to point of disposal as parts are completed by responsible parties (i.e. generator, transporter and receiver);
- *Waste Management Activity Report* – monthly management report prepared by waste generators for SEIC regarding the generation and disposition of all waste as tracked in the Waste Generation Ledger and Waste Manifests.

The SWMP Appendix 4 assigns specific responsibilities to the various parties involved. It also provides detailed guidance on the preparation of required documentation, actions required under assigned responsibilities, appropriate responses in exceptional and non-compliance situations, labelling and reporting. Documentation and labelling will be completed in both Russian and English languages. SEIC will ensure that staff are trained to ensure the system is used correctly and kept up-to-date.

10.8 ENVIRONMENTAL ISSUES OVERVIEW

The basis of SEIC's approach to waste management is to balance the parallel priorities of:

- Ensuring a high level of environmental performance in relation to Russian and international best practice;
- Providing for the extension of environmental benefits to the broader community through the project's development;
- Supporting the schedule and budget requirements for the project's successful execution.

SEIC believes that its overall approach effectively balances these priorities with a significant net benefit in terms of both positive environmental impact and enhancement of opportunities at the local level. In this regard, the following is noted:

- The emphasis on source-based waste minimisation and diversion of waste having potential resource value provides the most fundamental environmental benefit through the principles of "prevention and reduction" (i.e. compared to more traditional waste disposal approaches);

- Environmentally sound landfill disposal for Hazard Class 4 and 5 wastes has been selected instead of pursuing the development of thermal treatment facilities. Meeting Russian standards and approaching international standards is seen as a more environmentally advantageous option given the uncertainties associated with sustained performance of available incineration technology, the need to support such facilities with both landfills and supplementary hydrocarbon fuels, and the negative impact this would have on stimulation of waste diversion for resource recovery and recycling. Furthermore, an incineration option also has significant cost, regulatory, schedule, local benefit, and reputation-risk implications. SEIC considers these facts provide sufficient justification to not warrant a prolonged, more detailed analysis given that the environmental impact of the chosen option does not have significant direct environmental impacts and has positive indirect impacts;
- The selection to dispose of the remaining Hazard Class 4 and 5 wastes in upgraded municipal landfills represents the best trade-off against options involving the development of brand new landfill facilities. Recognising that the three upgraded facilities will meet Russian standards and that they will be benchmarked against international standards for relatively low environmental risk waste streams, several communities on Sakhalin Island will gain the benefit of a much higher standard of waste disposal than currently provided. This represents a significant net environmental benefit. SEIC would acknowledge that development of new Hazard Classes 4 and 5 waste landfills for its own requirements might, in theory, produce marginally better environmental performance but this would be offset by not taking the opportunity to substantially improve facilities serving a larger user base;
- The selection of secure storage (until high quality treatment and disposal is available) for the small amount of non-recyclable and non-bio-treatable Hazard Class 3 waste represents an optimum environmental solution. The potential for direct contamination is prevented and liabilities associated with such materials are fully defined and demonstrably managed until they can be eliminated;
- The selection of a biological treatment cell for hydrocarbon contaminated soils alongside the diversion of waste oil to viable resource recovery have minimal direct environmental impact and thus represent an acceptable solution in waste management terms. This is balanced by indirect environmental benefits. Lastly, the approach is also cost-effective and prudent from a liability perspective;
- EU Directive 99/31/EC has been updated with an EU Council Decision 03/33/EC which establishes criteria and procedures for the acceptance of waste at landfills. A principal requirement is that for all classes of site, a risk assessment should be carried out, taking account of the site engineering and leachate and gas management measures (if present) to demonstrate that the acceptance of a waste would meet the following criteria in both the short and long term (post closure);
    - There are no unacceptable emissions to groundwater and surface water and the surrounding environment;
    - The environmental protection systems such as liners, leachate and gas collection and treatment systems at the site are not jeopardised;

  - Waste-stabilisation processes such as degradation or wash out within the landfill are protected;
  - There is no unacceptable risk to human health.

- Under the RF regulations, risk assessment is not required as part of the formal design approval procedure, however, to check the environmental impact of the proposed landfill upgrades a robust and auditable risk assessment has been carried out for each Hazard Class 4 and 5 landfill sites. This has been undertaken using the UK Environment Agency approved LandSim2.5 "Landfill Performance Simulation by Monte Carlo Method". The original site conditions were modelled and the model generated was validated using the existing site reconnaissance contamination data. This model was then re-run incorporating the landfill upgrade design features. The predicted results show that there will be an improvement to existing environmental conditions with a marked reduction of levels of contamination expected to be encountered in watercourses adjacent to the sites;
- The implementation of Environmental Monitoring Plans to assess the performance of the off site waste management and the facilities developed.

10.9 SUMMARY

SEIC believes that the strategy and framework SWMP is sound from both an environmental and sustainability perspective of widely recognised waste management principles. The SWMP is a framework plan within which asset-specific plans are to be prepared. SEIC is committed to ensuring that the asset-specific WMPs contain the level of detail necessary to appropriately manage the risks associated with waste management.

The chosen strategy whereby SEIC facilitates the upgrading of existing landfills provides for environmentally sound management of SEIC Hazard Class 4 and 5 wastes and results in upgraded waste management facilities for the benefit of the Oblast Administration.

The facilities for management of Hazard Class 1 to 3 wastes have yet to be finally identified and are likely to be a combination of local facilities (based on SEIC assets), Russian mainland facilities and international facilities. These options include the design, permitting, and construction of oily waste holding areas (with bioremediation) at third party sites in association with the Oblast authorities and development of a comprehensive recycling and diversion programme for Hazard Class 1 to 3 wastes.

SEIC is satisfied that the approach is both feasible and practicable.

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APPENDIX 1 WASTE INVENTORY

Projected Waste Generation (Construction Period) – tonnes

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (including TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipelines	NKS-2	GDT		
HAZARD CLASS I										
353 301 00 13 01 1	Spent mercury-containing lamps and luminescent bulbs	0.005	0.005	1.3	n/g	0.5	n/g	n/g	4.1	0.2
	Total:	**0.005**	**0.005**	**1.3**	**0**	**0.5**	**0**	**0**	**4.1**	**0.2**
HAZARD CLASS II										
N/A	Spent consumer batteries and chargeable cells	0.004	0.004	0.59	0.18	0.04	1.07	0.07	1.56	0.13
521 001 01 02 01 2	Spent sulphuric acid from lead acid cells	0.05	0.05	1.90	0.61	5.53	0.07	0.17	13.00	1.50
	Total:	**0.1**	**0.1**	**2.5**	**0.8**	**5.6**	**1.1**	**0.2**	**14.6**	**1.6**
HAZARD CLASS III										
N/A	Spent developing solution used for X-ray photographs	0.2	0.2	7.7	1.7	44.0	2.9	0.3	6.3	5.5
541 002 01 02 03 3	Waste motor oil	2.0	2.0	327.0	64.9	99.4	5.7	2.1	2250.0	28.0
541 002 06 02 03 3	Waste transmission oil	10.0	10.0	21.0	4.2	6.4	0.4	0.1	145.0	1.8
541 002 13 02 03 3	Waste hydraulic oil, free of halogens	n/g	n/g	143.0	30.3	45.5	2.0	1.0	984.0	13.0
N/A	Waste fuel and oil filters	0.2	0.2	22.9	4.5	7.0	0.4	0.1	157.5	2.0
546 002 00 06 03 3	Floating film from oil traps	n/g	n/g	0.5	n/g	3.0	1.0	n/g	4.0	0.2
553 004 01 02 07 3	Waste (mono) ethylene glycol	n/g	n/g	4.7	1.6	16.9	0.2	0.3	32.0	2.8
921 101 02 13 01 3	Spent lead acid cells, not disassembled, free of acid	0.2	0.2	8.7	2.9	26.1	0.3	0.8	68.0	7.4
N/A	Paintwork waste, adhesive sealant	0.5	0.5	5.2	n/g	4.75	1.09	0.36	30.0	10.0
353 103 01 01 01 3	Copper scrap, non-graded	0.3	0.3	11.4	1.8	47	3.1	0.3	22.5	4.5
553 001 01 02 07	Waste acetone	0.01	0.01	0.01	0.2	n/g	0.5	0.2	n/g	1.5

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (including TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipelines	NKS-2	GDT		
3										
	Total:	**13.4**	**13.4**	**552.1**	**112.1**	**300.1**	**17.6**	**5.5**	**3699.3**	**76.7**
HAZARD CLASS IV										
571 015 00 01 00 4	Waste photographic, cinema and X-ray film	0.5	0.5	19.3	4.1	110	7.2	0.7	158.1	13.8
314 023 03 01 03 4	Oiled sand (the oil content less than 15%)	n/g	n/g	3.8	1.3	13.6	0.2	0.2	26.0	2.2
549 027 01 01 03 4	Oily rugs (the oil content less than 15%)	2.0	2.0	29.0	5.7	8.8	0.5	0.2	35.0	2.3
314 016 01 01 00 4	Waste slag wool	n/g	n/g	10.0	n/g	n/g	0.41	0.07	30.0	5.0
187 204 01 01 01 4	Ruberoid wastes	n/g	n/g	5.0	n/g	37.3	0.01	n/g	20.0	5.0
549 012 00 01 00 4	Bitumen, hard pavement materials	n/g	n/g	6.4	n/g	9.8	0.5	0.1	45.0	18.0
N/A	Waste and trash after domestic wastewater separation through grates and screen plates	0.3	0.3	14.1	2.4	64.1	4.2	0.4	93.8	7.5
N/A	Sludge from treated domestic wastewater	0.5	0.5	25.6	4.4	117	7, 7	0.8	171.2	13.7
N/A	Excessive biological mass after biological wastewater treatment	2.5	2.5	136.7	23.4	623.7	40.9	4.0	913.2	73.0
575 002 03 13 00 4 575 002 04 13 00 4 575 002 01 13 00 4	Spent tires with textile cord, Spent tires with metal cord Spent air bladders	n/g	n/g	204.0	40.4	62.1	3.7	1.3	1400.0	22.0
314 002 00 08 00 4	Waste sand from treatment and sand-blast facilities	3.0	3.0	112.0	24.0	640.0	42.0	4.0	920.0	80.0
314 003 00 11 00 4	Abrasive dust and waste powder generated during grinding of ferrous metals (with the metal content less than 50%)	0.01	0.01	1.5	0.5	5.0	0.5	n/g	10.0	2.0
911 004 00 01 00 4 912 004 00 01 00	Domestic trash, non-separated (excluding large-sized trash)	6.4	6.4	351.2	60.1	1602.0	105.0	10.4	2345.4	187.5

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (including TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipelines	NKS-2	GDT		
4										
N/A	Sludge from treated industrial wastewater, treated storm water, and treated wastewater generated after washing of vehicles.	n/g	n/g	21.0	n/g	100.0	35.0	n/g	140	7
	Total:	**15.2**	**15.2**	**939.6**	**166.3**	**3393.4**	**240.1**	**22.1**	**6307.7**	**439.0**
HAZARD CLASS V										
314 700 00 00 00 0	Spent filtered and absorptive pastes, not contaminated with harmful substances	n/g	n/g	3.0	n/g	8.0	n/g	n/g	7.0	n/g
351 301 00 01 99 5	Ferrous metal scrap, non-graded	140.0	140.0	150.0	158.0	2502.0	59.0	4.0	1140.0	210.0
351 303 01 13 99 5	Waste steel drums	5.0	5.0	20.0	n/g	40.0	10.0	n/g	80.0	20.0
351 201 20 01 99 5	Uncontaminated steel cuttings	n/g	n/g	10	n/g	n/g	25	n/g	40	10
353 101 01 01 99 5	Aluminum scrap, non-graded	0.5	0.5	19.0	3.0	79.0	5.2	0.5	37.5	7.5
923 600 00 13 00 5	Waste insulated wires and cables	0.2	0.2	7.6	1.2	31.5	2.1	0.2	15	3
351 216 01 01 99 5	Welding waste	0.5	0.5	16.5	2.45	39.75	0.48	0.01	40	10
575 001 01 13 00 5	All-rubber scrap, not contaminated	n/g	n/g	5.0	1.0	10.0	0.5	0.1	10.0	2.0
314 027 02 01 99 5	Concrete product breakages, waste concrete flinders	0.5	0.5	683.0	883.0	840.0	202.0	127.0	4000.0	1080.0
571 029 02 01 99 5	Waste polyethylene	20.5	20.5	128.0	20.0	60.0	10.0	2.0	250.0	50.0
351 505 00 01 99 5	Spent brake blocks (linings)	n/g	n/g	6.8	2.3	24.6	0.3	0.4	47.0	4.0
314 055 02 01 99 5	Waste cement in pieces	0.1	0.1	102.0	4.0	1.0	21.6	1.8	320	215
912 010 01 00 00 5	Food waste from canteens, not separated	1.3	1.3	70.2	12.0	320.4	21	2.1	469.1	37.5
173 001 01 01 00	Timber spoil	n/g	n/g	281.0	n/g	40847.0	215.0	79.0	n/g	n/g

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (including TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipelines	NKS-2	GDT		
5										
173 001 02 01 00 5	Timber spoil and stumps	n/g	n/g	140.0	n/g	19121.0	65.0	26.0	n/g	n/g
171 105 03 13 00 5	Waste carpentry	3.5	3.5	210.0	n/g	8088.2	6.7	0.3	400	100
187 102 02 01 00 5	Waste cardboard package, uncontaminated	24.0	24.0	110.0	9.0	270.0	18.0	3.0	760.0	140.0
187 103 00 01 00 5	Waste paper and cardboard from offices	0.2	0.2	0.5	0.1	2.5	0.2	0	7.6	0.5
581 011 00 01 00 0	Waste fabric and clothes	0.3	0.3	17.0	3.0	77.0	5.0	0.5	113.0	9.0
314 008 02 01 99 5	Uncontaminated cullet (broken glass), excluding broken electron-beam tubes and luminescent bulbs	n/g	n/g	40.0	n/g	20.0	5.0	n/g	80.0	5.0
	Total:	**196.6**	**196.6**	**2019.6**	**1099.1**	**72382.0**	**672.1**	**246.9**	**7816.2**	**1903.5**
	Total waste of hazard class I-V:	**225.3**	**225.2**	**3515.1**	**1378.2**	**76081.6**	**931.0**	**274.8**	**17841.9**	**2421.0**

Medical waste

N/A	Medical waste Class A (non-hazardous)	0.004	0.004	0.153	0.033	0.890	0.058	0.006	1.303	0.104
N/A	Medical waste Class B (high-risk)	0.004	0.004	0.153	0.033	0.890	0.058	0.006	1.303	0.104

NOTES

* n/g - waste is not generated

Waste Generation during Sakhalin II Project Development (Operation Stage, tonnes/per year)

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (including TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipelines	NKS-2	GDT		
HAZARD CLASS I										
353 301 00 13 01 1	Spent mercury-containing lamps and luminescent bulbs	0.005	0.005	0.56	n/g	0.005	0.1	n/g	0.76	0.04
314 801 00 00 00 0	Waste activated carbon contaminated with harmful substances (mercury sulphide)	n/g	n/g	n/g	n/g	n/g	n/g	n/g	22.0	n/g
	Total:	**0.005**	**0.005**	**0.56**	**0**	**0.005**	**0.1**	**0**	**22.76**	**0.04**
HAZARD CLASS II										
N/A	Spent dry-charged batteries	0.05	0.05	0.1	n/g	0.4	0.1	n/g	0.5	0.1
N/A	Spent consumer batteries and chargeable cells	0.014	0.014	0.006	n/g	0.01	0.003	n/g	0.003	0.001
521 001 01 02 01 2	Spent sulphuric acid from lead acid cells.	0.1	0.1	0.09	n/g	0.05	0.08	n/g	0.2	n/g
N/A	Waste chemicals	n/g	n/g	2.65	n/g	n/g	n/g	n/g	3.98	n/g
	Total:	**0.2**	**0.2**	**2.8**	**0.0**	**0.5**	**0.2**	**0.0**	**4.7**	**0.1**
HAZARD CLASS III										
541 002 01 02 03 3	Waste motor oil	10.0	10.0	1.5	n/g	1.0	0.5	n/g	5.6	n/g
541 002 06 02 03 3	Waste transmission oil	10.0	10.0	0.1	n/g	0.07	0.03	n/g	0.40	n/g
541 002 11 02 03 3	Waste compressor oil	10.0	10.0	5.0	n/g	n/g	4.0	n/g	n/g	n/g
541 002 12 02 03 3	Waste turbine oil	n/g	n/g	10.0	n/g	n/g	10.0	n/g	27.0	n/g
541 002 13 02 03 3	Waste hydraulic oil, free of halogens	0.5	0.5	0.10	n/g	0.07	0.03	n/g	0.4	n/g
541 002 07 02 03 3	Waste transformer oil, free of halogens, polychlorinated biphenyls, and terphenyls	n/g	n/g	n/g	n/g	n/g	n/g	n/g	5.0	n/g
N/A	Waste fuel and oil filters	0.5	0.5	0.11	n/g	n/g	0.07	n/g	0.39	n/g

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (includin g TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipeline s	NKS-2	GDT		
546 015 01 04 03 3	Sludge from cleaning of oil pipelines and oil storage reservoirs (drums, containers, tanks)	2.0	2.0	10.0	n/g	15	n/g	n/g	n/g	987.0
546 002 00 06 03 3	Floating film from oil traps	n/g	n/g	n/g	n/g	n/g	17.0	n/g	n/g	15.0
553 004 01 02 07 3	Waste (mono) ethylene glycol	n/g	n/g	2.2	n/g	n/g	0.2	n/g	0.6	n/g
921 101 02 13 01 3	Spent lead acid cells, not disassembled, free of acid	0.5	0.5	0.4	n/g	0.23	0.08	n/g	0.9	n/g
N/A	Paintwork waste, adhesive sealant	0.05	0.05	0.2	n/g	0.04	0.01	n/g	0.8	0.2
N/A	Dust and sludge from gas-treatment facilities	n/g	n/g	n/g	n/g	n/g	n/g	n/g	1.0	n/g
353 103 01 01 01 3	Copper scrap, non-graded	0.01	0.01	0.2	n/g	0.5	0.2	n/g	1.5	n/g
553 001 01 02 07 3	Waste acetone	n/g	n/g	3.0	n/g	n/g	1.0	n/g	3.0	n/g
	Total:	**33.6**	**33.6**	**32.8**	**0.0**	**16.9**	**33.1**	**0.0**	**46.6**	**1002.2**
HAZARD CLASS IV										
314 023 03 01 03 4	Oiled sand (the oil content less than 15%)	n/g	n/g	0.2	n/g	n/g	0.1	n/g	0.4	n/g
549 027 01 01 03 4	Oily rugs (the oil content less than 15%)	5.0	5.0	3.0	n/g	1.0	1.0	n/g	5	0.5
N/A	Waste and trash after domestic wastewater separation through grates and screen plates	0.8	0.8	0.4	n/g	0.6	n/g	n/g	0.2	0.1
N/A	Sludge from treated domestic wastewater	1.5	1.5	0.7	n/g	1.1	0.3	n/g	0.3	0.1
N/A	Excessive biological mass after biological wastewater treatment	8.2	8.2	3.5	n/g	5.8	1.5	n/g	1.5	0.6
314 037 03 01 01 4	Waste asbestos	0.01	0.01	0.05	n/g	n/g	0.01	n/g	0.2	0.05
575 002 03 13 00 4 575 002 04 13 00 4 575 002 01 13 00 4	Spent tires with textile cord, Spent tires with metal cord Spent air bladders	n/g	n/g	1.2	n/g	1.0	0.5	n/g	5.0	n/g

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (includin g TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipeline s	NKS-2	GDT		
314 003 00 11 00 4	Abrasive dust and waste powder generated during grinding of ferrous metals (with the metal content less than 50%)	0.1	0.1	0.5	n/g	n/g	0.2	n/g	3.0	n/g
911 004 00 01 00 4 912 004 00 01 00 4	Domestic trash, non-separated (excluding large-sized trash)	210.0	210.0	90.0	n/g	150.0	39.0	0.0	37.5	16.5
N/A	Sludge from treated industrial wastewater, treated storm water, and treated wastewater generated after washing of vehicles	n/g	n/g	42.0	n/g	n/g	35.1	n/g	n/g	325.0
	Total:	**225.6**	**225.6**	**141.4**	**0.0**	**159.5**	**77.6**	**0.0**	**52.7**	**342.9**
HAZARD CLASS V										
314 007 03 01 99 5	Waste ceramic products	n/g	n/g	n/g	n/g	n/g	n/g	n/g	0.54	n/g
314 700 00 00 00 0	Spent filtered and absorptive pastes, not contaminated with harmful substances	n/g	n/g	1.6	n/g	n/g	0.2	n/g	3.3	n/g
314 705 01 01 99 5	Waste silica gel filters after gas and air dewatering	n/g	n/g	n/g	n/g	n/g	n/g	n/g	6.2	n/g
314 703 01 01 99 5	Waste zeolite after gas and air dewatering	n/g	n/g	n/g	n/g	n/g	n/g	n/g	39.5	n/g
351 301 00 01 99 5	Ferrous metal scrap, non-graded	300.0	300.0	50.0	n/g	120.0	30.0	n/g	80.0	n/g
351 303 01 13 99 5	Waste steel drums	1.0	1.0	3.0	n/g	n/g	2.0	n/g	5.0	n/g
351 201 20 01 99 5	Uncontaminated steel cuttings	0.5	0.5	1	0.5	2.0	n/g	n/g	3.0	n/g
353 101 01 01 99 5	Aluminium scrap, non-graded	0.1	0.1	0.3	n/g	0.8	0.3	0.0	5.0	n/g
923 600 00 13 00 5	Waste insulated wires and cables	0.01	0.01	0.1	n/g	0.3	0.1	n/g	1	n/g
351 216 01 01 99 5	Welding waste	n/g	n/g	0.2	n/g	n/g	0.1	n/g	0.4	0.1

FWCC Code	Waste type	Platforms		OPF	Pipeline system				LNG Plant	OET (includin g TLU)
		PA-B	Lun-A		Offshore pipelines	Onshore pipeline s	NKS-2	GDT		
575 001 01 13 00 5	All-rubber scrap, not contaminated	n/g	n/g	1.0	n/g	0.5	n/g	n/g	3.0	n/g
314 027 02 01 99 5	Concrete product breakages, waste concrete flinders	n/g	n/g	25	n/g	n/g	n/g	n/g	20.0	5.0
571 029 02 01 99 5	Waste polyethylene	53.0	53.0	6.0	n/g	n/g	n/g	n/g	8.0	2.0
351 505 00 01 99 5	Spent brake blocks (linings)	n/g	n/g	0.3	n/g	0.1	0.5	n/g	0.4	n/g
314 055 02 01 99 5	Waste cement in pieces	n/g	n/g	n/g	n/g	n/g	n/g	n/g	n/g	n/g
912 010 01 00 00 5	Food waste from canteens, not separated	4.2	4.2	1.8	n/g	3	0.8	n/g	0.8	0.3
173 001 01 01 00 5	Timber spoil	n/g	n/g	n/g	n/g	n/g	n/g	n/g	n/g	n/g
173 001 02 01 00 5	Timber spoil and stumps	n/g	n/g	n/g	n/g	n/g	n/g	n/g	n/g	n/g
171 105 03 13 00 5	Waste carpentry	30.0	30.0	30.0	n/g	n/g	n/g	n/g	24.0	6.0
187 102 02 01 00 5	Waste cardboard package, uncontaminated	30.0	30.0	18.0	n/g	n/g	10.0	n/g	20.0	n/g
187 103 00 01 00 5	Waste paper and cardboard from offices	0.3	0.3	0.2	n/g	n/g	0.1	n/g	0.2	n/g
581 011 00 01 00 0	Waste fabric and clothes	1.0	1.0	0.4	n/g	0.7	0.2	0.0	0.2	0.1
314 008 02 01 99 5	Uncontaminated cullet (broken glass), excluding broken electron-beam tubes and luminescent bulbs	n/g	n/g	0.5	n/g	n/g	0.2	n/g	2.0	0.2
	Total:	**420.1**	**420.1**	**139.4**	**0.5**	**127.4**	**44.5**	**0.0**	**222.5**	**13.7**
	Total waste of hazardous class I-V:	**679.4**	**679.4**	**317.0**	**0.5**	**304.3**	**155.5**	**0.0**	**349.3**	**1358.9**

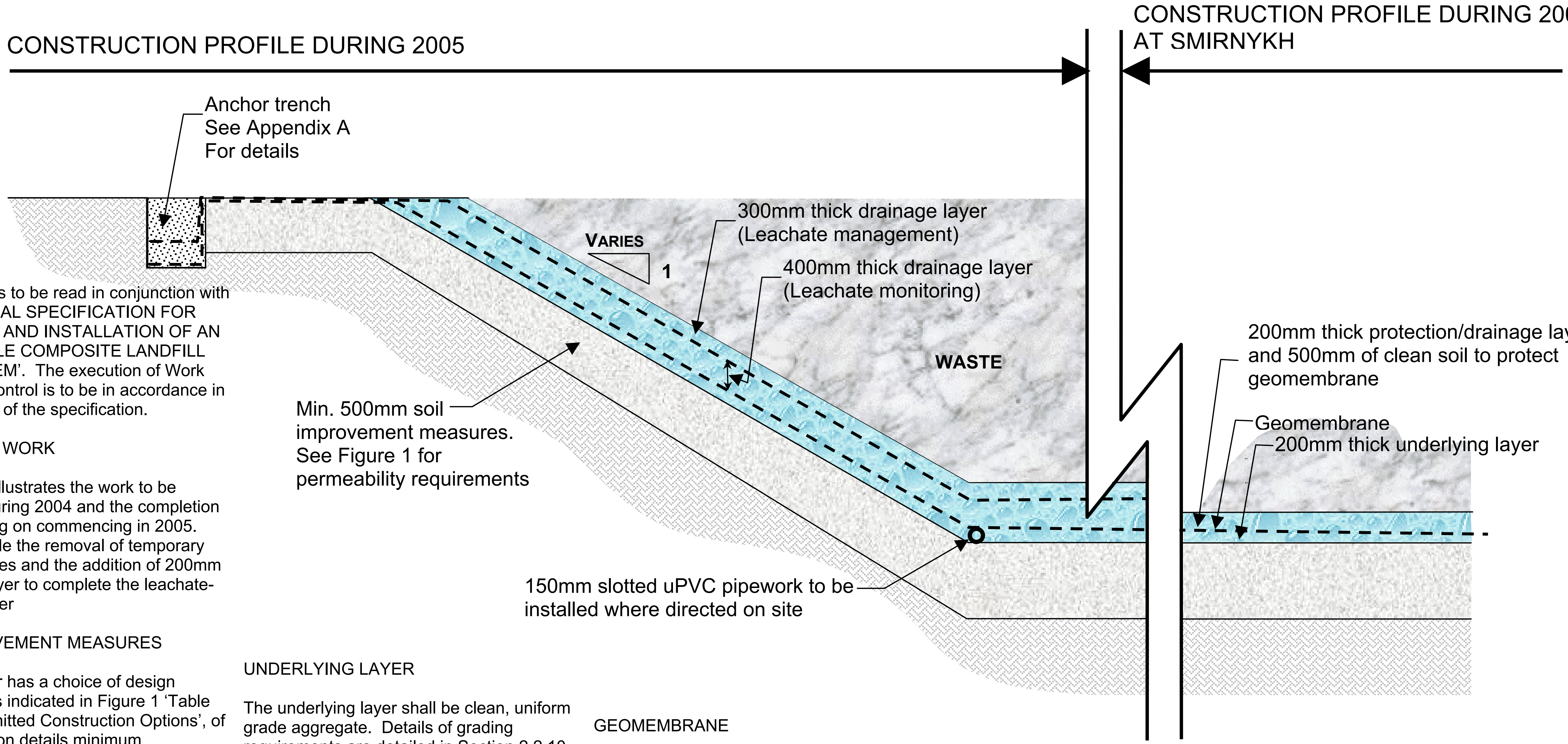
Medical waste

N/A	Medical waste Class A (non-hazardous)	0.012	0.012	0.005	n/g	n/g	n/g	n/g	0.002	0.001
N/A	Medical waste Class B (high-risk)	0.012	0.012	0.005	n/g	n/g	n/g	n/g	0.002	0.001

NOTES: * n/g - waste is not generated

APPENDIX 2 IMPERMEABLE COMPOSITE LANDFILL TWIN – LINER SYSTEM DETAIL

IMPERMEABLE COMPOSITE LANDFILL TWIN – LINER SYSTEM DETAIL



NOTES

This drawing is to be read in conjunction with the 'TECHNICAL SPECIFICATION FOR THE SUPPLY AND INSTALLATION OF AN IMPERMEABLE COMPOSITE LANDFILL LINER SYSTEM'. The execution of Work and Quality Control is to be in accordance in with Section 3 of the specification.

PHASING OF WORK

This drawing illustrates the work to be undertaken during 2004 and the completion works following on commencing in 2005. This will include the removal of temporary waste stockpiles and the addition of 200mm of drainage layer to complete the leachate-monitoring layer

SOIL IMPROVEMENT MEASURES

The contractor has a choice of design alternatives as indicated in Figure 1 'Table Showing Permitted Construction Options', of the specification details minimum requirements for soil improvement. Alternatively the compaction of the in-situ soils to maximum dry density to achieve minimum permeability may be permitted dependent on existing ground conditions.

The contractor will produce a risk-based assessment of the local conditions using an internationally recognised risk assessment method, which assesses the Source-Pathway-Receptor characteristics of the local environment.

The contractor will undertake full scale field trials of the soil improvement technology proposed and the achieved soil permeability results used in the risk assessment to validate that the technology/methodology chosen reduces the risks to significant receptors below accepted toxicological risk-based standards.

UNDERLYING LAYER

The underlying layer shall be clean, uniform grade aggregate. Details of grading requirements are detailed in Section 2.2.10 Table 4 'Table indicating the grading requirements of the imported clean uniform grade aggregate forming the Underlying and Protective layers', of the specification. Alternative grading may be allowable subject to prior approval by SEIC.

Supply and quality control of the materials shall be as detailed in Sections 2.4 and 2.5 of the specification.

Construction of the underlying layer shall be as detailed in Section 3.4 of the specification.

ALTERNATIVE PERMITTED CONSTRUCTION METHODS

The contractor may propose the use of alternative construction/compaction methods or materials, which will subject to prior approval by SEIC.

GEOMEMBRANE

Low density polyethylene (LDPE) or high density polyethylene (HDPE) geomembrane may be used. Minimum thickness of geomembrane should be not less than 1.5mm + 0.15mm. Section 2 of the specification, details the minimum material requirements for the geomembrane.

Installation and quality control of the geomembrane will be by the Main Contractor or approved sub contractor, in accordance with the details set out in Section 2.9 of the specification.

Welding of geomembrane strips shall be in accordance with Section 2.10 and Appendix A of the above document.

Quality control of weld joints shall be monitored in accordance with section 2.11 of the specification.

PROTECTIVE/DRAINAGE LAYER

The protective layer (and drainage layer) shall be clean, uniform grade aggregate. Details of grading requirement are set out in Section 2.2.10 Table 4 'Table indicating the grading requirements of the imported clean uniform grade aggregate forming the Underlying and Protective layers', of the specification. Alternative grading may be allowable subject to prior approval by SEIC.

Supply and quality control of the materials shall be as detailed in Sections 2.4 and 2.5 of the specification.

Construction of the protective/drainage layer shall be as detailed in Section 3.4 of specification.

DRAINAGE LAYER PIPEWORK

Pipework shall be installed at low-points so as to direct the leachate or groundwater to collection or monitoring/discharge points respectively.

One	2 Sept 2004	
Client	SAKHALIN ENERGY AND INVESTMENT COMPANY	
Project	Landfill Upgrade - Nogliki, Korsakov and Smirnykh	
Drawing Title	IMPERMABLE COMPOSITE LANDFILL TWIN - LINER SYSTEM DETAIL	
Date	AUG 2004	Drawing No. 2
Scale	1 : 50 @ A3	