SANKO GEOTHERMAL POWER PROJECT

HAZARDOUS CHEMICALS MANAGEMENT PLAN

Version	Revision	Date	Prepared by	Checked by	Approved by
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SANKO ENERJİ

1. INTRODUCTION

1.1. PURPOSE

The purpose of Hazardous Chemicals Management Plan (HCMP) is to outline aspects associated with the management of chemicals at Sanko Geothermal Power Plant Project area. This includes purchasing, safe use, storage, management, transportation and disposal of chemicals.

The chemicals covered by HCMP are used by the following activities:

- Drilling activities,
- Operation activities.

1.2. AIM

The aim of this document is to outline Sanko Geothermal Power Plant Project's process and expectations for managing chemicals and their associated risks to ensure:

- That arrangements are in place to minimize the risk of adverse health effects and protect the safety of staff and contractors,
- The mitigation of adverse environmental impacts; and
- Compliance with Turkish and World Bank Regulations.

1.3. SCOPE

This document applies to all Project activities by staff and contractors who are required to use chemicals and/or controlled substances within the scope of their duties.

The Chemical Management System is intended for the use of chemicals such as, but not limited to, hazardous substances/chemicals, dangerous goods and otherwise controlled substances.

This document should be used in conjunction with other ESIA and sub-plans prepared for Sanko Geothermal Power Plant Project. This document has been developed in line with Turkish and World Bank Regulations.

This management plan outlines appropriate hazardous chemicals methodologies for:

- Storage;
- Handling;
- Transport; and
- Disposal.

Through the management of these aspects potential health and safety effects will be minimized and environmental risks will be reduced. This plan also guarantees that the chemicals will be managed in a proper manner.

2. ENVIRONMENTAL ASPECTS

The storage and use of hazardous chemicals within the Project footprint presents a number of potential environmental risks including discharge to the environment, impacts on human health, fire and explosion.

Adverse effects resulting from poor management practices associated with hazardous substances can include:

- The contamination of surface and groundwater, soils and air;
- Damage to the environment and ecosystems that can be short term or long term in nature; and
- Damage to human health and wellbeing (short term and long term).

3. HAZARDOUS CHEMICALS MANAGEMENT LEGISLATION

The elements of the Turkish legislation referred to below closely relate to management of chemicals which would occur during the project drilling, well testing and operation and this legislation must be complied with strictly.

Legislation	Official Gazette Date	Official Gazette Issue	Implications for the Project Stages
Waste Management Regulation	02.04.2015 23.03.2017	29314 30016	• Storage and Dispose of chemicals generated during drilling and operation of power plant
Hazardous Chemicals Regulation	18.01.2008	26760	• Storage and Dispose of chemicals generated during drilling and operation of power plant
Water Pollution Control Regulation	31.12.2004 10.01.2016	25687 29589	• Storage and Dispose of chemicals generated during drilling and operation of power plant
Regulation on the Control of Odorous Emissions	19.07.2013	28712	• Odorous emissions generated during the operation stage
Regulation on Soil Pollution Control and Point Source Polluted Areas	08.06.2010 11.07.2013	27605 28704	• Risks of soil contamination at construction and operation stages
Law on Occupational Health and Safety (6331) (as amended with the Law numbered 7033)	01.07.2017	28339	• Health and safety measures to be taken during construction and operation stages
Regulation on Monitoring of Surface water and Groundwater	11.02.2014	28910	• Control of disposal
Regulation on Monitoring of Groundwater Against Pollution and Deterioration	07.04.2012	28257	• Control of chemicals to protect groundwater

4. APPLICABLE POLICIES AND STANDARDS

4.1. ENVIRONMENTAL POLICIES OF SANKO

A number of policies have been identified by Sanko to provide guidance over any operations carried out. The Declaration of Policy provided below covers the policy underlying the environmental operations:

- Sanko Geothermal Power Plant Project is a scheme attaching priority to the preservation of environment.
- Sanko is responsible for elimination or proper minimization of all the potential adverse effects of the project on environment during implementation of good environmental administrative methods.

The storage, use and management of hazardous chemicals within the Project footprint are subject to the following environmental standards:

- Regulations issued by Turkish Official Gazette related to;
  - Storage, Use and Disposal,
  - Appropriate design to prevent / reduce the potential for any accidental spillage or leak of hazardous substances,
  - Containers are appropriately labelled to identify potential hazards.
- Transportation of hazardous substances must be performed in accordance with the Related Regulation,
  - Ensure the Emergency Response Plan is in place to provide the framework to manage any incidents involving hazardous substances.
- Training systems implemented to provide appropriate training on the handling, storage and use of hazardous substances.

The use, storage, transportation and disposal of hazardous chemicals are managed under the control of Sanko. The Act for hazardous chemicals of Sanko deals with the safe management of all hazardous substances. Hazardous substances are substances that are explosive, flammable, oxidizing, toxic, corrosive, or harmful to the environment.

Accordingly, all the works will be carried out in compliance with applicable environmental laws and regulations as well as with international engineering approaches and standards in general such that environment is preserved and its quality enhanced. In order to attain this goal, Sanko will:

- conduct top management reviews and inspections on an annual basis as a minimum for the purpose of achieving conformity to any established policies, procedures and applicable environmental laws and regulations,

- maintain a commitment to pollution prevention, and shall incorporate such principles in any definitions of project conditions and performance of project operations,
- define, evaluate and manage any environmental risks, exerting its best efforts to determine and review objectives and targets for operation thereof and minimize the risks of occurrence of any adverse environmental effects,
- be committed to building relationships with authorities, the scientific community and the public to promote the development and communication of innovative, cost effective solutions to environmental problems;
- Ensure a commitment to the continuous improvement of the Environmental Management System wherever possible and sustainable.

All Project personnel shall be individually and collectively responsible for adherence to, and effective application of the policies and principles contained in this environmental policy statement.

5. MANAGEMENT HIERARCHY OF HAZARDOUS CHEMICALS

The management of hazardous chemicals at Project is undertaken in general accordance with the hierarchy of control. The hierarchy of control for hazardous substances is as follows:

- Elimination and removal

Eliminating either the substance or the activity which gives rise to the risk is the most effective

- Form of risk reduction.
- Substitution

Substituting high risk products or activities with alternative lower risk products or activities will reduce overall risk exposure.

- Isolation, enclosure or sealing Hazards may be isolated by distance or barriers or a combination of both.
- Engineering controls

Engineering controls involve making engineering changes to a process or piece of equipment used to store or handle hazardous substances.

- Safe work practices (administrative controls)

Administration controls consist of properly designed and implemented work practices and procedures.

- Personal protective equipment (least preferred)

PPE is considered the last line of defense against hazardous substances. Material Safety Data Sheets (MSDS) normally contain recommendations on the selection and use of PPE for the particular materials being used.

6. CHEMICALS USED FOR PROJECT

Chemicals used for the Project during Drilling, construction and operation phases are listed below. Table includes Producers, name and Globally Harmonized System (GHS) codes of chemicals.

PRODUCER	NAME OF CHEMICALS	GHS CODE
Merck	Sulfuric acid for 1000 ml, c(H_2SO_4) = 0.005 mol/l (0.01 N) Titrisol®	
Hach Lange	Iron Reagent Powder Pillows, 0.02-3.00 mg/L Fe	GHS-05, GHS-07, GHS-08
Tekkim	Phenolphthalein indicator	GHS-08
Tekkim	Potassium Chromate Extra Pure	GHS-08, GHS-07, GHS-09
Tekkim	Metil Oranj	GHS-06
Hach Lange	Buffer solution Hardness 1 pH 10.1 ± 0,1	GHS-07
Hach Lange	Acid Reagent	GHS-05, GHS-07
Hach Lange	ManVer 2 Hardness Indicator	GHS-08, GHS-07
Hach Lange	Molybdate Reagent	-
Hach Lange	Citric Acid	GHS-07
Norateks kimya	6M NaOH (Sodium Hydroxide)	GHS-05
Merck	Hydrochloric acid c(HCl) = 1 mol/l (1 N) Titripur® Reag. Ph Eur,Reag. USP	GHS-05
Merck	c(NaOH) = 1 mol/l (1 N) Titripur®	GHS-05
Merck	0,01N Titriplex III Solution	
	Silica Gel	
Hach Lange	Sulfate, SülfaVer Reagent	GHS-07
Hach Lange	Ammonium cuvette test 2.0-47.0 mg/L NH4-N	GHS-05, GHS-07, GHS-09
Merck	%65 HNO_3	GHS-03, GHS-05
Hach Lange	Sulphide cuvette test 0.1-2.0 mg/L S2-	GHS-05
Hach Lange	1,600N Sulfuric Acid	GHS-05
Hach Lange	3,636N Sodium Hydroxide	GHS-05
Merck	Silver nitrate solution for 1000 ml, c($AgNO_3$) = 0.1 mol/l (0.1 N) Titrisol®	GHS-05, GHS-09
Hach Lange	Phenolphthalein indicator	GHS-08
Hach Lange	Bromkrezol Yeşili-Mtil kırmızı Indicator	
Hach Lange	0,3636N Sodium Hydroxide	GHS-05
Hach Lange	0,1600N Sulfuric Acid	GHS-05
	%96 Pure Ethyl Alcohol	GHS-02
WTW	Ph-Meter ph:7.00 calibration solution	
WTW	Ph-Meter ph:10.00 calibration solution	
WTW	Ph-Meter ph:4.01 calibration solution	
WTW	Conduct meter calibration solution 0,01 mol/l KCl	
WTW	ph probe electrolyte solution 3mol/l KCl çözeltisi	
Merck	ph probe electrolyte solution 3mol/l KCl çözeltisi	

7. LABELLING, MONITORING AND INCIDENT NOTIFICATION

7.1. LABELLING

Hazardous substances will be labelled including the following information:

- Product identified and chemical ingredients;
- Name, address and business telephone number (manufacturer or importer);
- Hazard pictograms;
- Hazard statement;
- Hazard, first aid and emergency procedures; and
- Expiry date (if applicable).

7.2. HAZARD PICTOGRAMS

The hazard pictograms in relation to the hazardous substances shows potential impact to physical, heath and/or the environment. Hazard pictogram will be located on all hazardous substance containers. A summary of hazardous pictograms and associated dangerous goods class labels are provided in Table below.

HAZARD PICTOGRAMS	SYMBOL AND GHS CODE	HAZARD
	Exploding Bomb (GHS-01)	▪ Explosives ▪ Self-Reactives ▪ Organic Peroxides
	Flame (GHS-02)	▪ Flammables ▪ Pyrophorics ▪ Self-Heating ▪ Emits Flammable Gas ▪ Self-Reactives ▪ Organic Peroxides
	Flame Over Circle (GHS-03)	▪ Oxidizers

	Gas Cylinder (GHS-04)	▪ Gases Under Pressure
	Corrosion (GHS-05)	▪ Skin Corrosion/Burns ▪ Eye Damage ▪ Corrosive to Metals
	Skull and Crossbones (GHS-06)	▪ Acute Toxicity (fatal or toxic)
	Exclamation mark (GHS-07)	▪ Irritant (skin and eye) ▪ Skin Sensitizer ▪ Acute Toxicity (harmful) ▪ Narcotic Effects ▪ Respiratory Tract Irritant ▪ Hazardous to Ozone Layer (Non-Mandatory)
	Health Hazard (GHS-08)	▪ Carcinogen ▪ Mutagenicity ▪ Reproductive Toxicity ▪ Respiratory Sensitizer ▪ Target Organ Toxicity ▪ Aspiration Toxicity
	Environment (Non-Mandatory) (GHS-09)	▪ Aquatic Toxicity

8. MONITORING

8.1. HAZARDOUS SUBSTANCES INVENTORY

Data Collected

The inventory includes the following information:

- Site and location;
- Name, position and date;
- Commercial Name;
- Chemical Composition;
- Volume (L / kg / m3);
- State (solid, liquid or gas);
- Safe fill volume (L / kg / m3);
- Maximum capacity (L / kg / m3);
- Container type; and
- Hazardous substance / dangerous goods classification.

Frequency

Hazardous substance inventories will be updated frequently and when new substances not previously listed within the inventory are brought onto site.

8.2. MATERIAL SAFETY DATA SHEETS REGISTER

In addition to hazardous substance inventories, all product Material Safety Data Sheets (MSDSs) will be maintained at both storage locations and the Site Office.

The MSDS register will be updated as new hazardous substances are brought to site.

8.3. LEAKAGE OR LOSS IDENTIFIED

Should a chemical leak, spill or other cause of discrepancy be detected the following will be undertaken:

- If required, take action as soon as practicable to prevent any further release of product or used chemicals into the environment;
- Identify and mitigate any fire, explosion or vapor hazards;
- Take all reasonable steps to prevent migration of product that has leaked or spilled;
- Take all reasonable steps to recover or remove product that has leaked or spilled so that the site does not pose any threat to the environment or human health and safety; and
- Remove or, where practical to do so, repair any leaking components of the storage container.

9. HAZARDOUS CHEMICALS MANAGEMENT

Hazardous chemicals management will be undertaken in accordance with this plan.

Management of hazardous substances risk is structured below as follows:

- Key Activities, Risks and Impacts: A summary of the key activities being undertaken during the management period. The potential environmental impacts and residual risk levels are identified for each environmental aspect.
- Objective: The guiding environmental management objective(s) and activities that apply to the element.
- Mitigation Measures: The procedures to be employed to ensure that the relevant objectives are met.
- Responsibility: Nominates the responsible position for implementing actions and monitoring.
- Trigger, Action, Response: The actions to be implemented in the case of noncompliance. This includes strategies of remediation and the person(s) responsible for the actions.

9.1. KEY ACTIVITIES, RISKS AND IMPACTS

The key activities and potential environmental impacts have been identified for hazardous substances are listed in Table below.

Activity	Potential Environmental Impact	Residual Risk Level		
		Consequence	Likelyhood	Risk
Uncontrolled release, spill or passive discharge of chemicals, including through inappropriate storage and handling.	Contaminant to ground resulting in contamination of soils and groundwater resource.	Minor	Unlikely	Low
Personnel impacted by fire or explosion. This includes equipment and substance fire and explosions. This may occur during construction or operations. Personnel exposed to hazardous materials via all means e.g. ingestion, inhalation or skin contact.	Personnel fatality or injury.	Catastrophic	Rare	Medium
Unauthorised site access / security breach during construction and operation.	Personnel or third party fatality or injury.	Major	Rare	Medium

The hazardous substances management objectives have been established and are detailed in Table below.

OBJECTIVE	TARGET	INDICATOR
Protection of the surrounding environment from hazardous substances.	No long term impact and/or environmental harm occurring from the release of hazardous substances.	Number of incidents reported leading to potential long term impact and/or environmental harm.
	Hazardous Substances to be stored appropriately and in accordance with legislative standards.	Number of hazardous substance non compliance breaches of legislative standards.

9.2. MITIGATION MEASURES

Mitigation measures have been developed to minimize potential impacts associated with hazardous chemicals. The mitigation measures, timing and responsibilities are provided in Table below.

MITIGATION MEASURE	TIMING	RESPONSIBILITY
SITE INDUCTION		
Site induction includes the following components for hazardous chemicals: • Summary of hazardous substance at the project and associated locations; • Summary of hazardous pictograms and dangerous goods code class labels and what they mean; • Requirements for handling and utilizing fuel infrastructure; • No hot works or naked flames allowed within 20 m of flammable substances; and • Procedure for reporting and/or managing a spill.	Site Induction	All personnel
GENERAL		
Management of hazardous substances in accordance with Turkish Standards.	Drilling, Construction and Operation	Operation Manager / Company Man
Hazardous chemicals to be stored in Chemical Storage Shed with internal bunding to collect spills and ventilation to prevent the buildup of fumes.	Drilling, Construction and Operation	Operation Manager / Company Man
Waste oil and oil filters are to be stored in appropriately labelled Intermediate Bulk Containers (IBC). All IBCs labelled and hazard it poses listed on container. The IBC are to be removed from site by a suitably licenced contractor and delivered to a licenced depot.	Construction and Operation	All personnel
Storage of IBCs will not exceed capacity of secondary containment volume.	Drilling, Construction and Operation	All personnel
Fuel (diesel) storage tanks will meet environmental guidelines for the safe storage.	Drilling, Construction and Operation	Operation Manager / Company Man
Fire extinguishers fitted in site vehicles.	Drilling, Construction and Operation	Operation Manager / Company Man
In general, hazardous substances are to be stored a minimum of 10 m from surface water and 50 m from groundwater wells.	Drilling, Construction and Operation	Operation Manager / Company Man
Storage of flammable and combustible materials will be in accordance with the Hazardous Chemicals Management Plan.	Drilling, Construction and Operation	Operation Manager / Company Man

Open flame or other ignition sources are prohibited within 20 m of bulk flammable storage areas, fuel dispensing vehicles or refueling operations and activities in hazardous atmospheres.		
SPILL MANAGEMENT		
Spill kits are located at all hazardous substance storage locations.	Drilling, Construction and Operation	Operation Manager / Company Man
Monthly inspections of hazardous substance storage locations to ensure facilities meet HSE requirements and spill kits are present/contain sufficient materials for potential spillages.	Monthly	Environmental manager
In the event of a spill follow the spill management procedure within the Emergency Response Plan.	At all times	All personnel
INSPECTION AND MONITORING		
The inspection is to update the hazardous substances inventory. In addition, any new hazardous substances will be included when they are brought to site.	Monthly /As required	All personnel
Safety Data Sheets (SDSs) register will be maintained at storage locations and the Site Office. The register will be supplemented when new hazardous substances are brought to site.	As required	Area Supervisors
Spill kits to be inspected on a monthly basis to ensure kits contain adequate equipment.	Monthly	Safety Officer Environmental Manager Area Supervisors
If any leaks, spills or other cause of loss is identified the following will be undertaken: • Take action as soon as practicable to prevent any further release of product or used oil into the environment; • Identify and mitigate any fire, explosion or vapor hazards; • Take all reasonable steps to prevent migration of product or used oil that has leaked or spilled; • Take all reasonable steps to recover or remove product or used oil that has leaked or spilled so that the site does not pose any threat to the environment or human health and safety; and • Remove or, where practical to do so, repair any leaking components.	As required	All personnel
Annual Hazardous Chemical Management Plan performance review.	Annually	Environmental Manager / Adviser