Waste Management Strategy in West Kuwait Fields of Kuwait Oil Company

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Abstract

Waste generation is an important environmental aspect in West Kuwait (WK) operational area. This strategy is developed considering the requirements of ISO14001: Environment Management Systems especially the 'Plan' part of Plan-Do-Check-Act (PDCA) Cycle in the Continual Improvement Process. KOC's production and associated works have three main streams of waste which are non-hazardous, hazardous and crude oil related wastes. Handling techniques set for each waste type as non-hazardous wastes are handled with the priority to recycle with occasioned disposal to landfills. The purpose of the Waste Management strategy is to ensure that the wastes generated within the KOC's West Kuwait (WK) operational area are handled, monitored and controlled in line with applicable Kuwait Environmental Public Authority (KEPA) legal Regulations, KPC HSSE Policy and relevant KOC HSEMS procedures.

Effective waste management is an ongoing process. The major composition of the waste generated from the operational activity consists of Mixed Garbage, Wooden Pallets/Wood Scrap, Concrete, Empty Metal Drums or Metal Scrap, and Hazardous waste liquid/ expired chemicals. The waste contribution from Paper and Cardboard, Empty Plastic Drums, Glass and Food etc. is very less as compared to the other waste generated. Since these wastes are non-hazardous which are effectively managed by Waste Management Services Contract by sending to recycling companies. Recyclable non-hazardous waste material is bailed and bundled, once the sufficient quantity is accumulated, the material is sending to the appropriated recycling facility. Hazardous waste is handled and shipped as per the KOC applicable regulations. This paper focuses on the strategy of the waste management in west areas and analysis of quantities of wastes and associated generation streams for further scoping of future projects and additional services. Finally, a demonstration of advantages of using such waste management system is highlighted for benefits to KOC, community and over-sighting regulatory bodies.

Keywords: Non-hazardous Waste, Hazardous Waste, Waste Management Hierarchy, Soil Bioremediation, Recycle, KEPA

1. Background

Throughout the years Kuwait Oil Company (KOC) has been and continues to be a vital part of the local economy and is one of the most reputable oil exploration and production companies. Being a leader in such business and with HSE in mind, the company has identified possible improvement points to its waste management techniques throughout studying history of the same and exploring best available options for solutions. KOC is a state owned Company that was established for managing the exploration, production and export of oil and gas with the associated facilities from more than twelve developed oil fields in the state of Kuwait. The oilfields are spread over the State and split off into three main parts of North Field, West Field, South and East Field that are locally administered at the site headquarters. Approximate distances of fields from Ahmadi (the headquarters and executive town of the Company are as follows: North Field is 70 miles (112 Km), West Field is 38 miles (60 Km) and South East Field is 12 miles (20 Km). The Company has established HSE policies, standards and procedures to cope with the speedy development of oil exploration and production operations and its associated complications. Measuring against international highest business standards, the Company issued its HSE Management System (HSEMS) for the first time in 1995, taking the lead in this regard. Currently, the Company has its self-established HSEMS with successful implementation for over 15 years (since the full inception of its refined HSEMS in 2003). With emphasis to environmental protection and adherence to local regulations, the HSE-MS evolved over the years to cope with and support the environmental responsibility that Company has towards the local community and society. Environmental procedures were established with emphasis on Waste Management, Contractors Oversight, Gatch Pit Management and other environmentally related procedures.

Environmental protection and preservation is one of the most major global concerns. In the past, disposal techniques were the only way of dealing with wastes as landfill disposal engineering was about the only field of environmental waste management available. Nowadays, for maximum environmental protection and preservation new approaches and techniques have been applied by international organizations, scientific institutes and governments. Although disposal to landfills is the most economic handling techniques (Al-Yaqout et al. 2001), waste prevention and recycling has been the focus of waste management since then due to the vast great benefits of the same in environmental protection (aside from economic values) (Muzenda et Al., 2012). Such techniques have been proven to conserve energy and reduce green house gases by placing less demand on the methane-producing landfills.

A comprehensive waste management system usually is the cornerstone of every enterprise for managing its wastes in these desired techniques. Benefits of having a waste management system could be summarized as follows:

- Assurance of managing wastes in accordance to local and international laws and standards.
- Minimize waste generation.
- Minimize environmental impacts from waste handling.
- Ensuring that waste handling in general does not interfere with normal operations.
- Maximize reusing and recycling of "wastes" with disposal as the least favored option.
- Assurance of handling techniques and strategies are in line with Company's policies and procedures. The Company thereafter changed its approach from "Management of Waste" to "Waste Management" which includes anticipation and planning of the waste generation process and managing waste in the "cradle to grave" philosophy in accordance to the waste management hierarchy (Muzenda et al., 2012). Therefore, it is of much benefit to an organization to adapt a tailored waste management system for maximum benefit of its business, commitment to local community and related environmental protection/preservation.

2. Waste Management History in KOC

Throughout its development as a company, KOC was coping with the relevant international business standards. Below are discussions of different waste categories in KOC:

2.1 Historical Operational Wastes

Operational waste was dealt with upon occurrence with no clear local national legislations over neither handling and disposal issues nor facilities for handling the same. Some of resulted wastes (e.g. liquid industrial liquids) were stored and exposed to evaporation (via evaporation lined pits/ponds) as an engineering management/disposal method (Alyaqout, 2003). Such techniques were later abandoned due to adaptation of new effluent waste water (high salinity and oily formation water) handling technique in the form of reinjection for oil reservoir pressure maintenance/enhancement. Some of these pits still exist but are decommissioned as other handling means were made available. The same is currently referred to as "Historical Operational Wastes". Resulting "Historical Operational Wastes" are currently being dealt with a mega project for remediation of land and restoration to its original status. This part of the waste management system in KOC will not be covered in this paper due to focus of the same on current operational wastes only.

2.2 Identification of Current Waste Streams and Possible Solutions

After identifying historical operational waste streams, the Company set its efforts towards "Management" of "Operational Wastes" that are resulted from the various aspects of crude oil

exploration, stabilization, production and exporting. Therefore, the process began with identifying different activities within the Company and its related generated wastes streams. These activities are listed, but not limited to, the below list:

List of Operational Waste Generation Activities in KOC:

Laboratory Works	Construction	Crude oil processing	Production chemical storing and utilization
Vessel desludging	Fabrication and workshop works	Office Works	Asbestos (from dismantling of historical construction works).
Exploration Works	Warehouse and storage activities	Mobile Equipment Workshop activities	Overhaul and Preventive Maintenance Works
Oil leaks and spills	Drilling and workover works	Maintenance works	

These identified waste streams were historically handled by separate contracts with emphasis on disposal and temporary storage only. After identifying activities and related wastes the process shifted towards exploring possible treatment options for contaminated soils and sludge/slurry for inclusion in one project for waste management per area wises. Further considerations were being explored for the implementation of a "Management System" for waste elimination, reduction, reuse, recycling and recovery proactively anticipating waste generation processes and applying the same with disposal being the least favored option. The process started by setting physical area boundaries to further aid the required services scoping process. After identifying operational activities, there are different waste streams. General Operational wastes categories were classified as below:

- Liquid hazardous wastes (from expired production chemicals, laboratories …etc,)
- Solid hazardous waste (solidified chemicals, filter material… etc,)
- Recyclable metals (from scrap bulks, maintenance and decommissioned facilities)
- Oily sludge and slurry (vessel maintenance and inspection and leaks)

- Crude contaminated soil (from fresh oil spills)
- Concrete and construction debris (from construction and maintenance)
- Lube oils
- General house hold recyclables (Paper, Plastics, Glass and Aluminum cans)
- Wood waste and wooden pallets (associated with chemical drums).

3. Waste Management Process

- Waste Management involves the following steps in West Kuwait Fields:

  Collection: Hazardous and Non-Hazardous Wastes are collected from all KOC Facilities, Installations, and Operations.

  Segregation: The collected waste from the KOC operational area are segregated into recyclable (Hazardous & Non-hazardous), non-recyclables (Hazardous & Non-hazardous) waste in Segregation area to minimize Environmental impact of KOC Operations.

  Treatment: The treatment of waste refers to the activities carried out to reduce the severity of toxic substances and thereby reducing the environmental hazard. Contaminated soil is treated to recover Crude Oil to reduce Environmental Hazard. Solidification carried out for treatment of hazardous liquids

  Disposal: Transporting wastes to KEPA approved disposal facilities. All hazardous wastes are collected, stored, transported, treated and disposed in a safe and secure manner in compliance with the requirements of Kuwait Environment Public Authority (KEPA). Hazardous wastes are treated On-Site/ Off-Site and/ or disposed at Kuwait Environment Public Authority approved Sites.

  Recycle: Transporting wastes to KEPA approved Recyclers or to KOC's Scrap Yard.

4. Waste Management System in KOC WK Operational Areas (data represents the period from February 2011 to July 2017)

Service contract has been started on February 2011. All Waste materials were subject for reduction, re-use or recycling, recovery or disposal as contract clauses stipulated. This section will illustrate current waste management system specifics in handling each waste stream. Category wise total waste quantity data generated from all the West Kuwait KOC operated facilities, offices, check posts and other locations from the commencement of the waste management contract since February 2011 to July 2017 is summarized in Table (1) & (2) and fig. (1) and fig. (2).

- Table-1 Non-Hazardous Waste

S.NO	DESCRIPTION (Type of Waste)	%
1	MIXED GARBAGE	**46.13**
2	PAPER/CARD	**0.96**
3	PLASTIC	**2.74**
4	GLASS	**0.13**
5	FOOD	**0.17**
6	WOOD/PALLETS	**3.17**
7	CONCRETE	**27.69**
8	METAL	**17.52**
9	ALUMINUM	**0.03**
10	TIRE	**1.47**

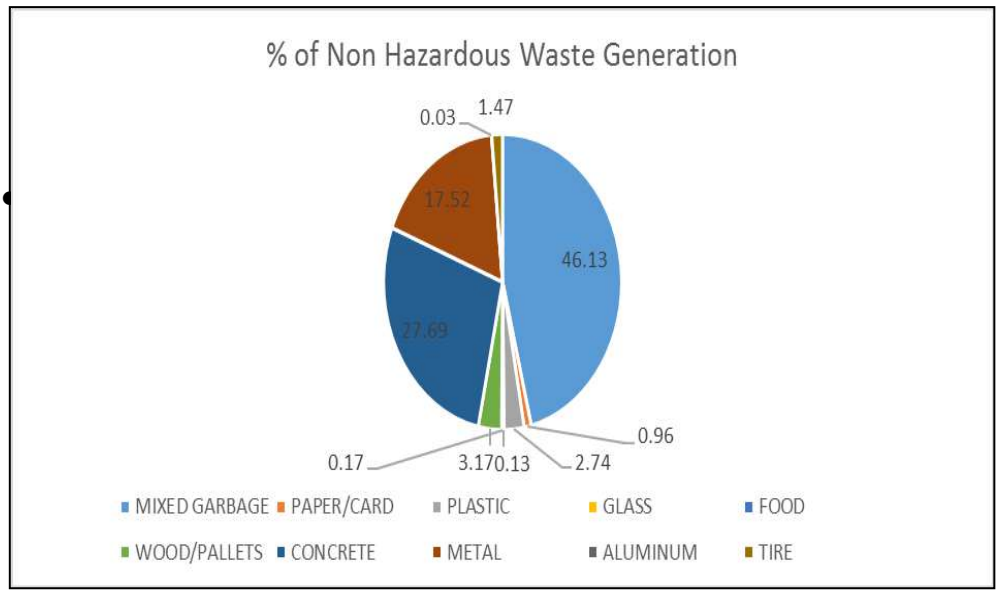

Fig. (1): % of NON Hazardous Waste Generation

Table-2 Hazardous Waste

DESCRIPTION (Type of Waste)	%
USED Lube OIL (m3)	**1.58**
HAZARDOUS WASTE SOLID (Ton)	**14.81**
HAZARDOUS WASTE LIQUID (CHEMICALS, ETC.) (M3)	**1.33**
OIL CONTAMINATED SAND (Ton)	**81.69**
SLUDGE/SLURRY (m3)	**0.60**

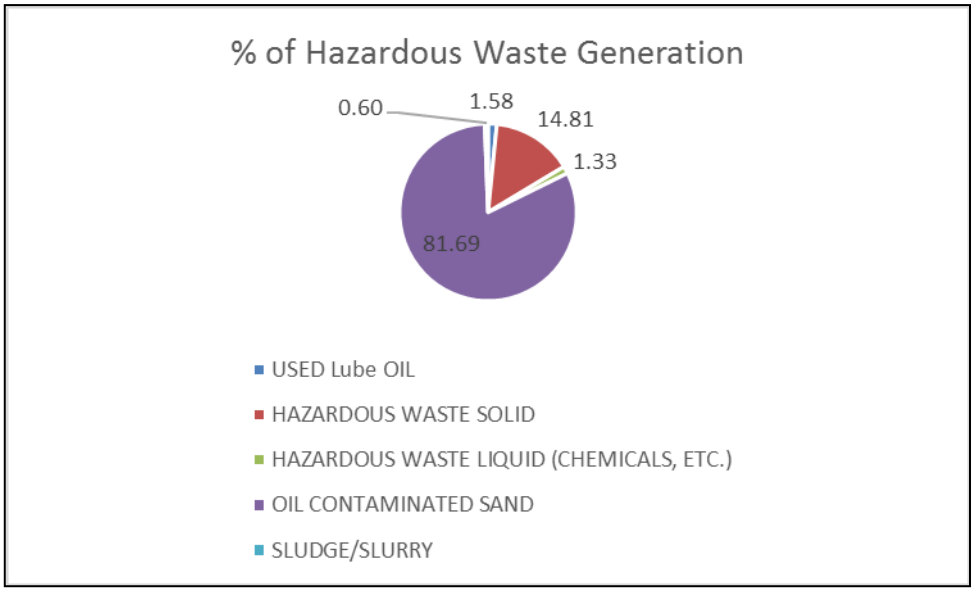

Fig. (2): % Hazardous Waste Generation

The major composition of the waste generated from the operational activity consists of Mixed Garbage, Wooden Pallets/Wood Scrap, Concrete, Empty Metal Drums or Metal Scrap, and Hazardous waste liquid/ expired chemicals. The waste contribution from Paper and Cardboard, Empty Plastic Drums, Glass and Food etc. is very less as compared to the other waste generated. Since these wastes are non-hazardous, they are effectively managed by shipping to recycling companies. Proper awareness is provided to employees to minimize

waste generation at source. Use of electronic media for communication, viz email, DIMS is encouraged.

Chemicals are used in WK Facilities for various processing and lubrication purposes. These chemicals are normally supplied in 208 litre capo. metal/plastic drums or 1000 litre cap. Intermediate Bulk Containers (IBC) (1000 litre). Upon use of these chemicals, these empty containers are handled as recyclable non-hazardous waste (ensuring that residual chemical content is < 1% of container capacity).

All attempt is made to use chemicals which have less environmental footprint. Further, it is ensured that HSE requirements are met for the safe handling, transportation and disposal of hazardous waste material as per HSEMS procedures. Liquid and Solid hazardous waste are shipped to Shuaiba Solid Waste Reception Station for the final disposal to the landfill. Oil contaminated soil and oily sludges are generated as a result of WK operational activities. Oil Contaminated is treated within WK waste processing area (WPA) using bioremediation process.

Waste collection and disposal is closely monitored based on each shipment (incoming and outgoing) using Waste manifest, loading Notes, Weighing ticket the Monthly Summary data. Monthly waste quantity report is generated which summarizes all types waste by category, type is submitted . Additionally data is collected for desert cleaning, gatch pit cleaning, road side cleaning, etc. and the following information is compiled in the monthly reporting format :

- Date collected at source
- Date processed at Waste Processing Areas
- Date sent for disposal/recycle to approved locations
- Waste generation Site location
- Type, classification and category of waste.
- Quantification – Weight in MT (for solids) and volume m^3 (for liquids/slurry/ sludge's) before and after processing.
- Disposal location/recycle companies.
- Transporter details
- Handling/treatment methodology

Continual inspection / auditing of waste management activities is carried out through HSE Site Inspection, Site Verification Visits (CAE SVV, NCAE SVV) and HSE Leadership Visits.

During such visits, waste management aspects / systems / arrangements are reviewed by KOC Team personnel and reports submitted for corrective measures.

5. Acknowledgments

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