

SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

Design of Short-term Solutions for Municipal SWM

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The Case of Al-Ekaider Landfill

- It is the second largest landfill in Jordan; established in 1983.
- It covers 90 hectares and serves more than 70 towns and villages (serving about 1 M for about 30 years).
- In addition to MSW, it also received industrial wastewater. MSW is landfilled while the wastewater is discharged into earthen ponds at the landfill site to be subjected to evaporation

Neither landfill cells nor wastewater ponds were lined. There were no leachate and/or gas collection systems.

Waste disposal was done openly and then spread while compaction was not applied properly due to mechanical failures and the lack of spare parts

Issues at Al-Ekaider prior to Interventions

	JSC Responsible	Identified Problems
Al Ekaider Dumpsite	Irbid JSC	<ul style="list-style-type: none">• Shortage in infrastructure (poor fencing, service roads)• Shortage in services (electricity network, generator, water tank)• Shortage in equipment• Little capacity to maintain/repair machinery and equipment• No standardization of machinery and equipment• Lack of trained personnel• Lack of planning• Difficult to locate and acquire landfill site in order to expand• Dumping of irregular hazardous waste• Internal fires causing harmful air emissions• Non-engineered dumping

The Emergency at Ekaider – An Environmental ‘Hotspot’

VIDEO 5 minutes

- SW intake increased from 900 tons/day (2010) to 1300 ton/day (2015)
- The dramatic increase in SW production stressed the limited airspace and operational capacity of the landfill which led to the site’s designation as an environmental “hotspot” in Jordan
- The MSW disposal practices were non-compliant with environmental best practices: no kind of technical features including bottom lining protection or leachate collection systems in addition to ineffective compaction and soil cover
- Deteriorated MSW collection systems with damaged equipment and vehicles, total absence of any MSW recycling and inappropriate and dangerous waste disposal activities in the existing landfill site of Al Ekaider.

UNDP Project: Construction of Emergency Sanitary Landfill Cell

Objectives:

Provide support to the Joint Services Council in Irbid to improve SWM at Al Ekaider dumpsite while offering durable solutions for improvement of social service delivery to affected populations.

Ensure that the assistance provided complements government and development efforts.

Construct a modern, technically engineered sanitary landfill cell in the free remaining airspace at the current landfill area to provide short-term operational capacity of 2 years of waste disposal//50,000m².

Provision of specialized machineries and bulldozers, necessary for implementing international standards and practices of MSW sanitary waste disposal.

Incorporating RMSWMP Standards

The proposed measures ensured the following:

- (1) Closure /rehabilitation of existing dumpsite and wastewater treatment ponds;
- (2) Construction of a sanitary landfill cells and airspace optimization;
- (3) Establishment of a landfill gas management and utilization system at the site;
- (4) Construction of complementary MSW treatment facilities, possibly in pilot scale and feasible, at the site (segregation, MRF, etc...).

Landfill Information

- **Local population :**

1,530,000

- **Refugees served :**

312,600

Based on EIA data

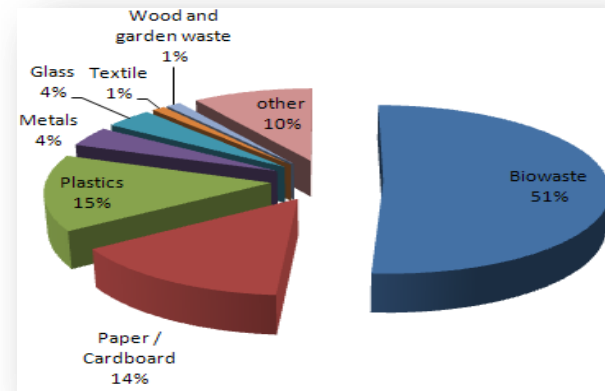
- **Waste generated:**

0.91 kg/cap/d (2014)

1.1 kg/cap/d (2025)

- **Waste to be disposed:**

725 – 1.900 tn/d according the scenario
implemented



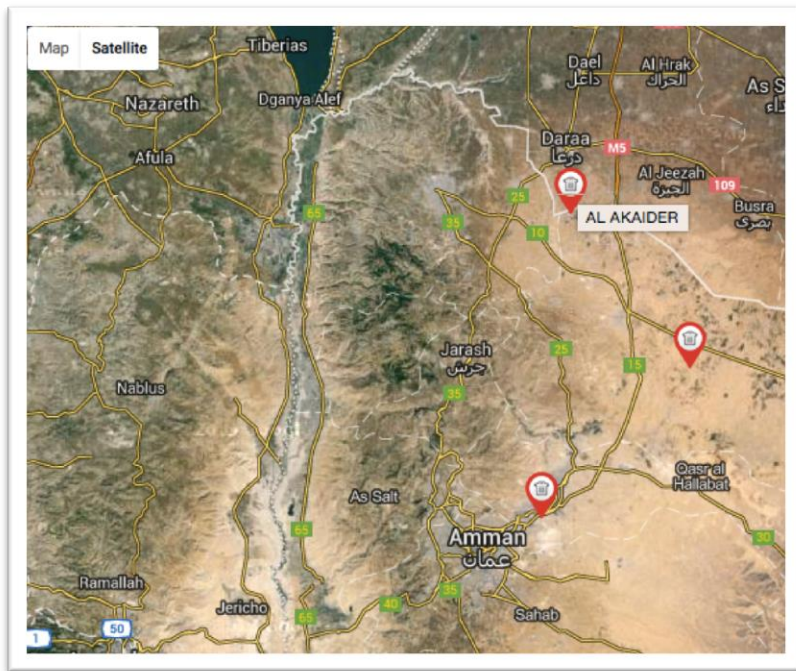
Based on weighbridge data

- **Waste disposed:**

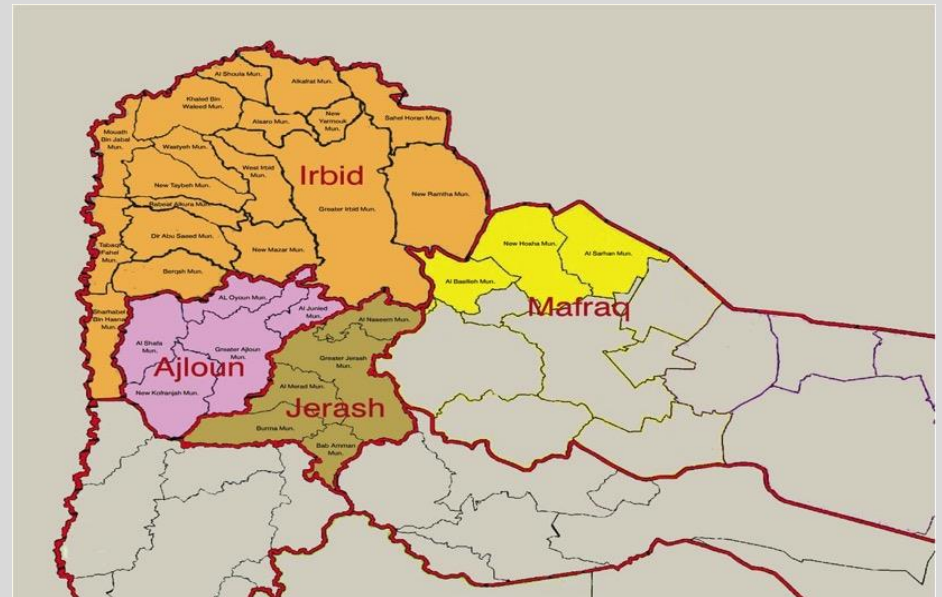
1,060 tn/d (2016) – 1830 tn/day

(Jun-Sep 2017)

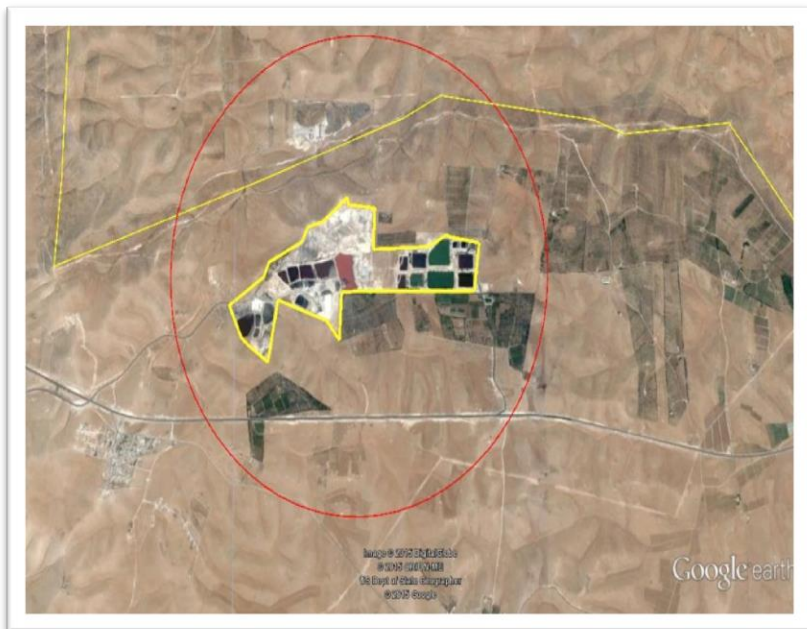
Al-Ekaider Site and Service Area



- Irbid Governorate (18 Municipalities)
- Ajloun Governorate (5 Municipalities)
- Jerash Governorate (5 Municipalities)
- Mafraq Governorate (3 Municipalities)



Al-Ekaider Site



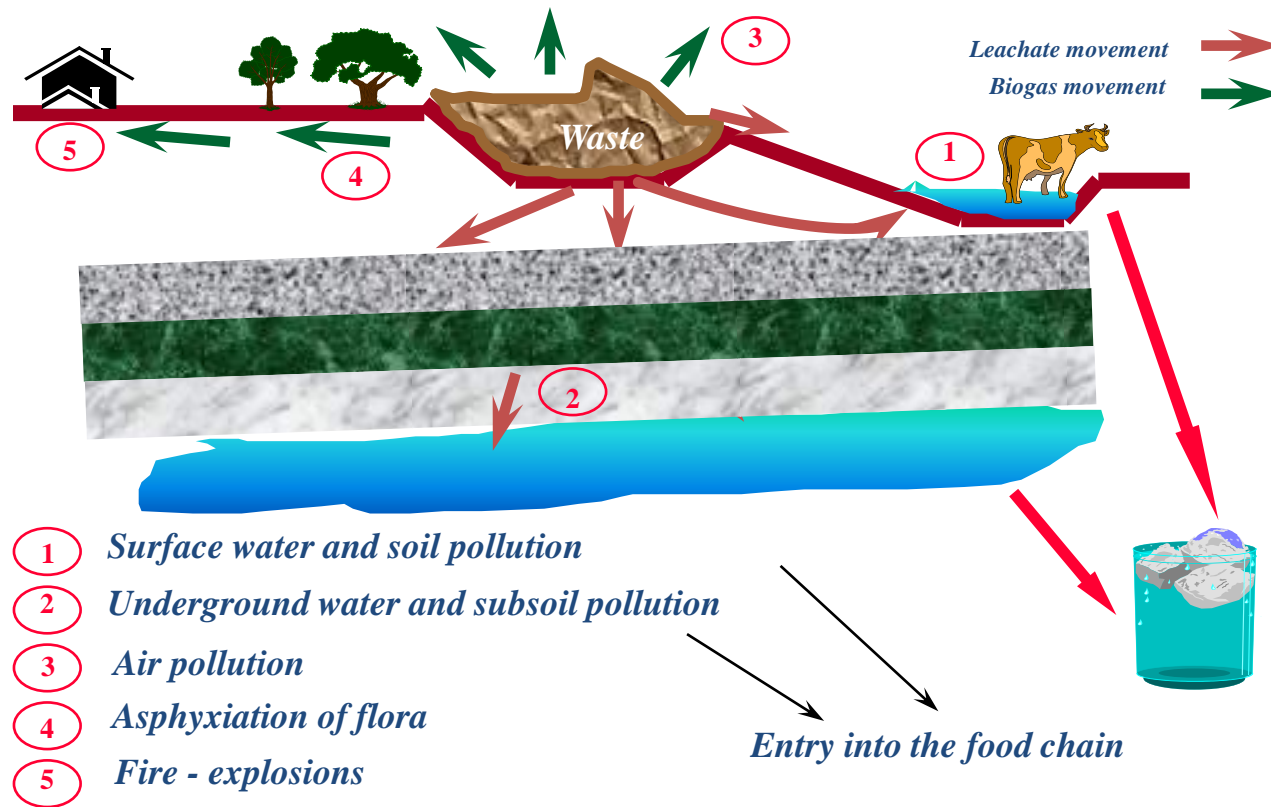
Al-Ekaider Site: Waste Disposal Gaps and Impacts

No lining system	→	No protection of soil and groundwater
No leachate collection system	→	Leachate dispersion in the environment
No biogas collection system	→	Methane dispersion in the atmosphere
No environmental monitoring system	→	Unknown environmental impacts
Low waste compaction	→	Loss of capacity and unstable landfill volume
Low soil coverage	→	Litter and waste dispersion; high leachate production; smells, H&S issues in personnel
Deficient waste entrance control	→	Possible disposal of hazardous waste

Al-Ekaider Site: Sanitary Landfill Definition

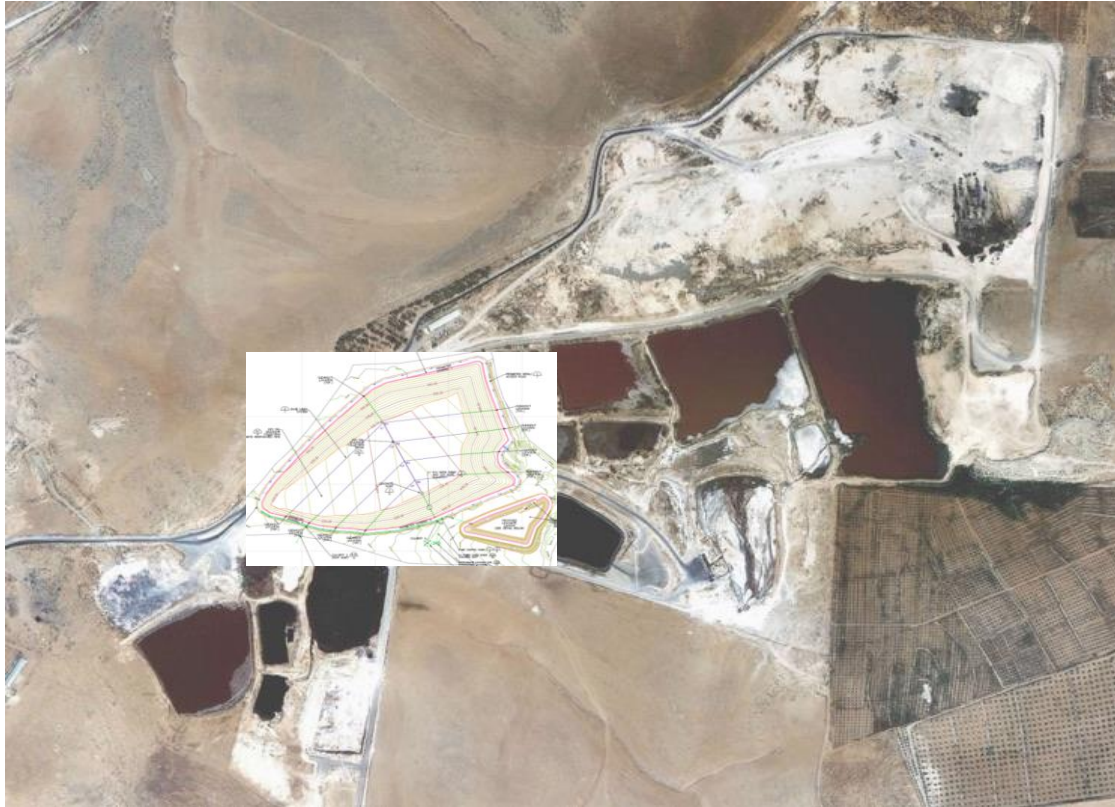
Sanitary Landfill is a system of combined barriers that blocks the dispersion of pollutants from waste disposal (leachate, biogas, litters, odors, etc.)

Al-Ekaider Site: Sanitary Landfill

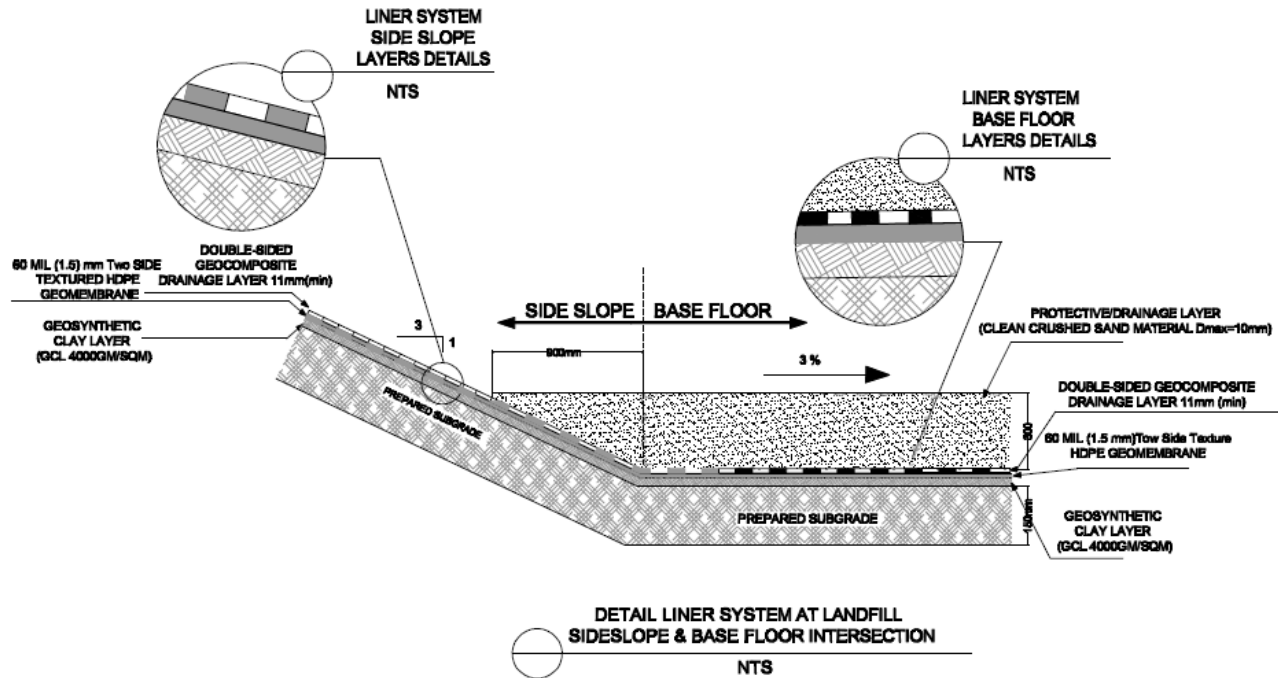


Al-Ekaider Site: Conceptual Design

Conceptual Design



Al-Ekaider Site: Lining System

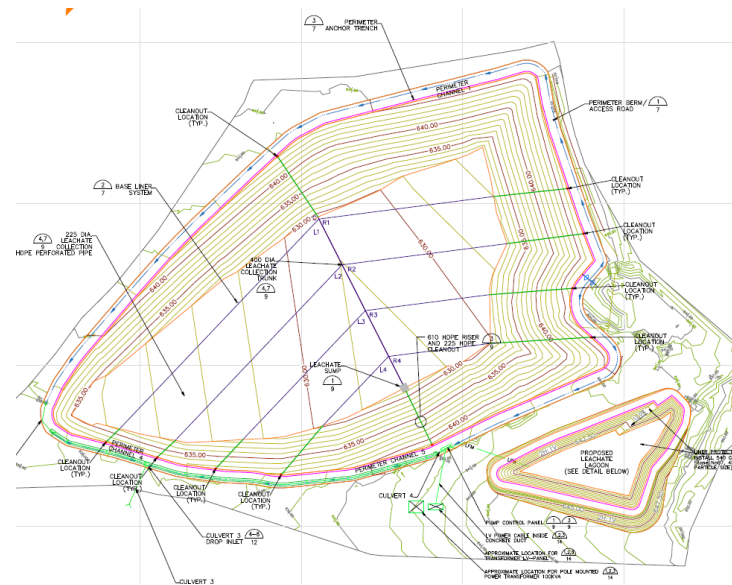


Al-Ekaider Site: Lining System



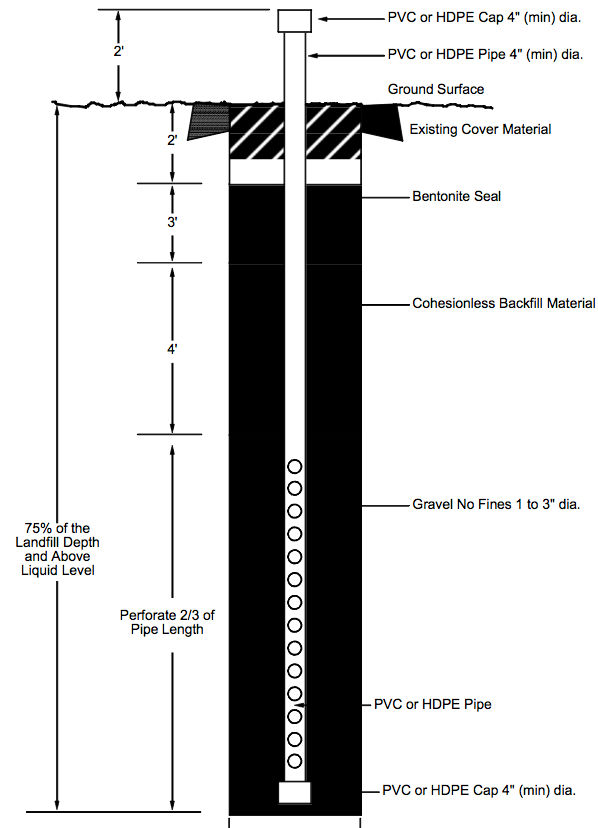
Al-Ekaider Site: Leachate Collection & Managment

- Landfill slopes' formulation - leachate collection in the one (deepest) point
- Piping network for leachate collection and transfer
- Pumping system for transferring the leachate to the lagoon



Al-Ekaider Site: Biogas Collection System

- Biogas collection through wells that will be constructed at the end of landfill's lifetime
- The wells will be connected to biogas burning installation (flare) or biogas utilization for energy production
- Landfill's lining system ensures that produced biogas will not move through the soil
- Operational practices ensure proper biogas production



Al-Ekaider Site: Biogas Collection System

- Leachate Monitoring System
- Groundwater Monitoring System
- Surface Water Monitoring
- Biogas Monitoring System
- Settlements Monitoring System
- Monitoring of weather conditions-Recording of data
- Volume and composition of incoming waste and soil material
- Noise Monitoring
- Odour and dust monitoring

Al-Ekaider Site: Landfill Operation

Landfill is:

- very similar to a construction site (as it is continuously developed) but with more dangerous and polluted “materials”
- subject to daily changes due to biodegradation procedures taking place for a long time (even for decades) and pollutants production

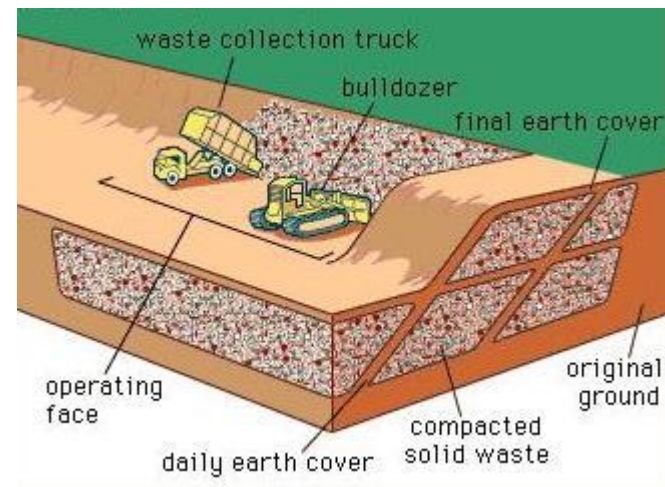
Landfill must be operated very carefully and very well organized under a certain plan ensuring that:

- Waste will be properly compacted
- Waste will be covered every day by soil
- Labour and guests' Health and Safety
- Pollutants production (leachate, biogas, litters etc) is controlled, properly managed and monitored
- Risk management plan in place

Al-Ekaider Site: Waste Disposal

Daily cell: is the basic unit of the landfill

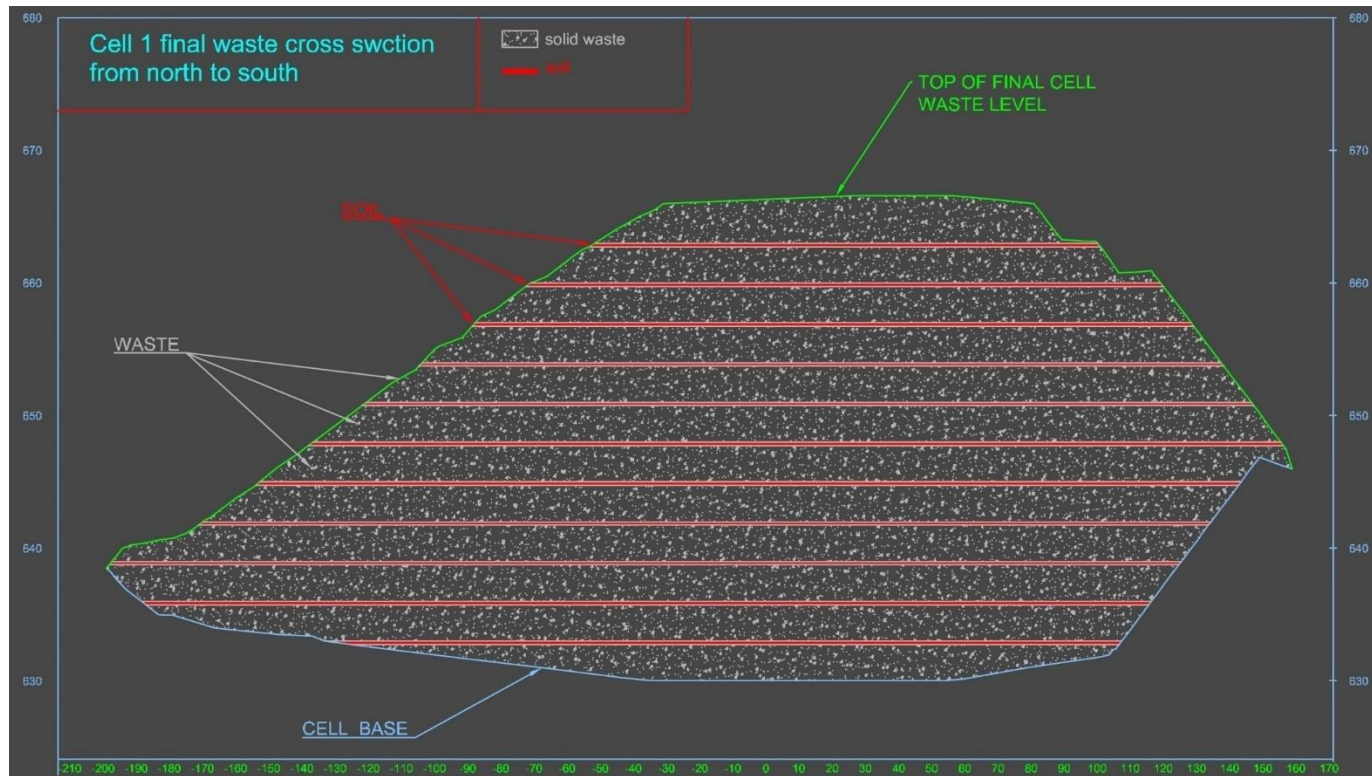
- It contains waste disposed in 1 day
- Waste must be very well compacted
- It must be covered by soil (daily cover) at the end of the day



Design Features: Landfill Final Layout

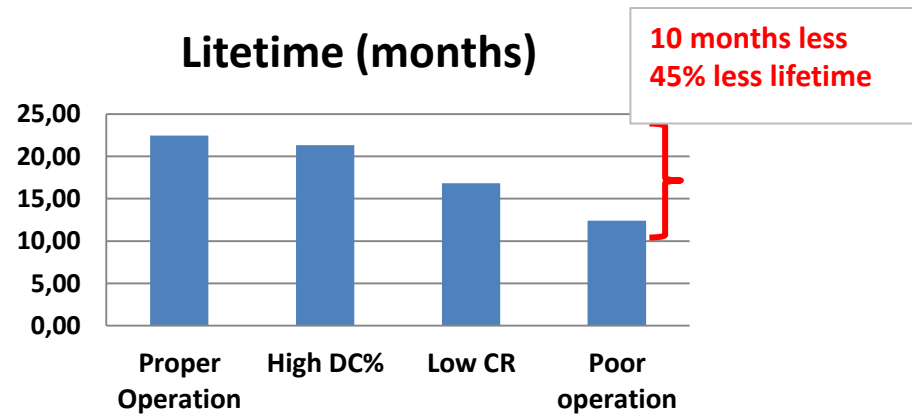


Al-Ekaider Site: Cross Section Final Layout



Al-Ekaidar Site: Lifetime Calculation

- Total landfill capacity: 1,080,000 m³
- Compaction rate: 0.8 tn/m³
- Daily cover % (v/v): 15%
- Lifetime (1100 tns/day): 1.87 years (22.45 months)



Al-Ekaidar Site: Environmental Benefits in Brief

100% leachate management

70-80% gas collection

Possible energy utilization

Odor control

Improved working conditions

Risk management

**Important
improvement,
but only the 1st
step...**

Composting Units: Objectives

- Reuse/recycling of organic waste
- Production of high-quality manure-based compost fertilizers of marketing value
- Reduction of the negative impact of untreated fresh manures on the public health and the environment
- Application of organic manure-based fertilizer in the agriculture sector will increase plant growth and protection from deterioration of the surface and ground water resources AND decrease demand of chemical fertilizers and soil degradation and erosion

Composting Units: Strategies

- Innovative and engineering-based technology (e.g. sustainable farm scale windrow composting)
- Proper design capacity building
- Introduction of modern technical knowledge and training for all relevant stakeholders and partners; including technical staff, local farmers and even students
- Step-by-step introduction of recycling/separation at source practices within the public SWM system; engage local citizens in management of their SWM system

Composting Units: Strategies

- Market analysis and revenue management for final products
- Launch of relevant public awareness campaigns and educational programs
 - proper conduction will greatly contribute in achieving the project's sustainability and multiplication effects



Composting Units: Stakeholders

Stakeholders include:

- Governmental institutions (MoMA, MoENV, etc.)
- CBOs, NGOs
- Farmers
- Households
- Manure generators
- Staff

Composting Units: Technologies and Mechanisms



Mechanical turning of windrows

Sorting stations:

Adopt manual waste separation and sorting mechanisms (non-automatic processing lines)

Enable local citizens to be engaged in the waste sorting process, facilitating labor incentive programs and ensure income generation potentials and livelihood opportunities

Composting Units: Technologies and Mechanisms

Aerobic windrow composting:

- Natural biological process that involves aerobic decomposition of organic matter
- Arrangement of manure mixtures in long, narrow piles that are periodically turned to maintain aerobic conditions
- Periodical addition of water to allow composting process
- Release of (necessary) heat, various gases and water vapor
- Reduction of volume and mass
- Production of denser and stabilize compost products
- Lower amounts of emitted GHGs to the atmosphere



Windrows being turned during processing