IMAGE: MSF

Safe Water Optimization Tool

SWOT CASE STUDY: LAS ANOD GENERAL HOSPITAL

Testing the Safe Water Optimization Tool to manage water quality in a health facility in Somaliland

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DAHDALEH INSTITUTE FOR GLOBAL HEALTH RESEARCH

MEDECINS SANS FRONTIERES DOCTORS WITHOUT BORDERS

Tufts UNIVERSITY | School of Engineering

HIF Humanitarian innovation fund | elrha

Location:	Las Anod General Hospital, Sool, Somaliland
Type of water system:	Institutional water supply system in a medical facility with RO-treated groundwater supplied by a private vendor
Data collection:	September – December 2022
Partner organisation(s):	MSF, Tufts University
Funding:	Humanitarian Innovation Fund/ELRHA

BACKGROUND

In 2022, the situation in Sool, Somaliland was marked by territorial disputes, political tensions, and humanitarian crises. The region has been a subject of on-going disputes between political and tribal factions. Conflict, coupled with severe drought and disease outbreaks, have led to a deteriorated humanitarian situation in the region.

Las Anod General Hospital, located in the capital city of the Sool region, is a Level 5 hospital with a 73-bed capacity. Médecins Sans Frontières (MSF) began its operations at the Las Anod GH in May 2019, providing technical and financial assistance for the hospital's emergency room, operating theatre, and sexual and reproductive healthcare services, among other kinds of support. MSF's work at Las Anod is run through a partnership with the Ministry of Health Development (MoHD) Somaliland. Due to the security constraints, international staff are only able to visit intermittently for short periods.

SITE INFORMATION

Securing a safe and reliable water supply for the hospital has been a persistent challenge. The hospital has its own borehole, which was constructed in 2019, as well as a reverse osmosis (RO) treatment system. However, the RO system stopped functioning in 2020 due to lack of maintenance and spare parts. Since then, MSF has been supporting the hospital to purchase RO-treated groundwater from a local supplier for drinking, medical, and infection prevention and control (IPC) purposes.

The estimated potable water demand of the hospital is around 26 m3 per month. Water deliveries are made every few days. Water is delivered via truck by the private supplier, who is required to chlorinate water before delivery to the hospital's underground tank. On arrival, the water is tested for FRC, pH, and turbidity by the MSF team, and additional HTH chlorine is added when the FRC is below 0.2 mg/L. MSF has also instituted regular water quality monitoring at various points in the water supply chain at the hospital. Chlorinated water is then pumped into an elevated tank connected to a piped distribution system serving six potable water tapstands located in the staff and patient areas (a separate piped network provides non-potable water for other domestic purposes).

The SWOT was deployed at the Las Anod General Hospital as part of normal WASH operations and used routine water quality monitoring data (some modifications were made to the monitoring program to generate data amenable for SWOT analysis). Data collection was handled by the MSF Water and Sanitation (WatSan) Technician using KoBoToolbox with a SWOT survey template.

Using the SWOT in a hospital setting required making some adaptations to the tool, as it has previously been used in refugee and IDP camp settings. Specifically, water deliveries are made every few days to the hospital, so chlorinated water must be stored after chlorination in the overhead tank for much longer than it would typically be stored in a camp setting. The SWOT was therefore modified to allow for much longer durations of protection than would normally be the case in a camp setting (up to multiple days).

At the same time, the distance from the water tanks to the taps was much shorter at the hospital compared to the considerable distances that people sometimes have to transport water in the camp setting. While in a camp people would typically collect water in large containers for the whole family to use over the course of a day, in the hospital people usually filled small personal water bottles which they would drink from over a short period (typically 1 to 3 hours at most). For this reason, we considered the drinking water taps in the hospital wards to be the point-of-consumption, and this was where we wanted to ensure water safety. This contrasts with a camp setting where we consider the point-of-consumption to be in the household several hours later.

We Adapted the water sampling protocol to match the hospital use case and provided training to the MSF WatSan team on the sampling procedure and use of the water quality testing and data collection equipment.

DATA COLLECTION

Data collection happened in two rounds (baseline and endline) between 11 September and 29 December 2022. Regrettably, the security situation around Las Anod deteriorated dramatically in December 2022 and we had to curtail the second round of monitoring (MSF was forced to suspend its operations at Las Anod Hospital in July 2023 due to repeated attacks affecting the facility and staff).

Water quality measurements including free residual chlorine (FRC), turbidity, pH, water temperature, and electrical conductivity were collected from trucks as they delivered water to the hospital (point-of-delivery), at the hospital's elevated storage tank (point-of-distribution), and at six taps (points-of-consumption) around the hospital grounds where staff and visitors filled their water bottles.

Every morning, the MSF WatSan Technician tested the water at the elevated tank, and then throughout the day sampled each of the six taps. Each tap was sampled two or three times per day at around 9am, 12pm, and 4pm. Every three to four days when water was delivered to the hospital, water testing was conducted from the water truck. Water testing was carried out using a digital chlorometer and turbimeter, and a pH/EC/temperature multi-meter. Data was uploaded to the KoboToolbox platform by the MSF team and reviewed regularly to ensure data consistency. Datapoints were dropped if the FRC or the sampling time was inconsistent between the initial and follow-up visits indicating errors in data collection (i.e., if FRC increased, or if time went backwards).

SWOT RECOMMENDATION & IMPLEMENTATION RESULTS

The first round of data collection was conducted between 11 September and 2 November 2022. During this period 11 samples were collected at delivery, 27 at the water tank, and 508 from taps. After reviewing the data, 42 datapoints were removed because of inconsistencies. The remaining data was uploaded to the SWOT to produce a site-specific FRC target. The second round of data collection was carried out between 26 November and 29 December 2022. During this period, the MSF team collected 5 samples at delivery, 10 at the water tank, and 94 from taps. All datapoints from the second round met the quality criteria for the SWOT and were retained. A total of 560 valid paired samples were built by linking tap samples with the relevant tank sample. This was the first time we piloted a method to pair samples after data collection was complete; this significantly reduced the time required to manually collect paired samples.

Before the SWOT recommendation was provided, the baseline data showed that the median FRC at the tank was 0.40 mg/L, and 64% of tap samples had an FRC meeting the water safety threshold of at least 0.2 mg/L.

The baseline data was uploaded to the SWOT, which generated a site-specific FRC target recommendation of 0.8 mg/L FRC to be maintained at the elevated tank to ensure sufficient FRC at taps for up to 24 hours.

The FRC target, however, was soon decreased to 0.6 mg/L FRC in response to taste and odour complaints received from water-users in the days following the initial change. This modified target was seen to better balance the competing concerns of having sufficient FRC to ensure water safety and not so much as to drive taste and odour driven rejection of treated water.

After the SWOT FRC target recommendation was issued to the MSF team, they were able to increase the FRC at the tank up to a median of 0.49 mg/L, however only two of the ten water tank samples showed the SWOT target of 0.6 mg/L had been reached. Despite this, water safety at the taps increased, all samples taken within 24 hours of chlorination had an FRC of at least 0.2 mg/L. This reduced slightly to 93% for samples taken over 24 hours from chlorination (up to 150 hours) (Figure 1).

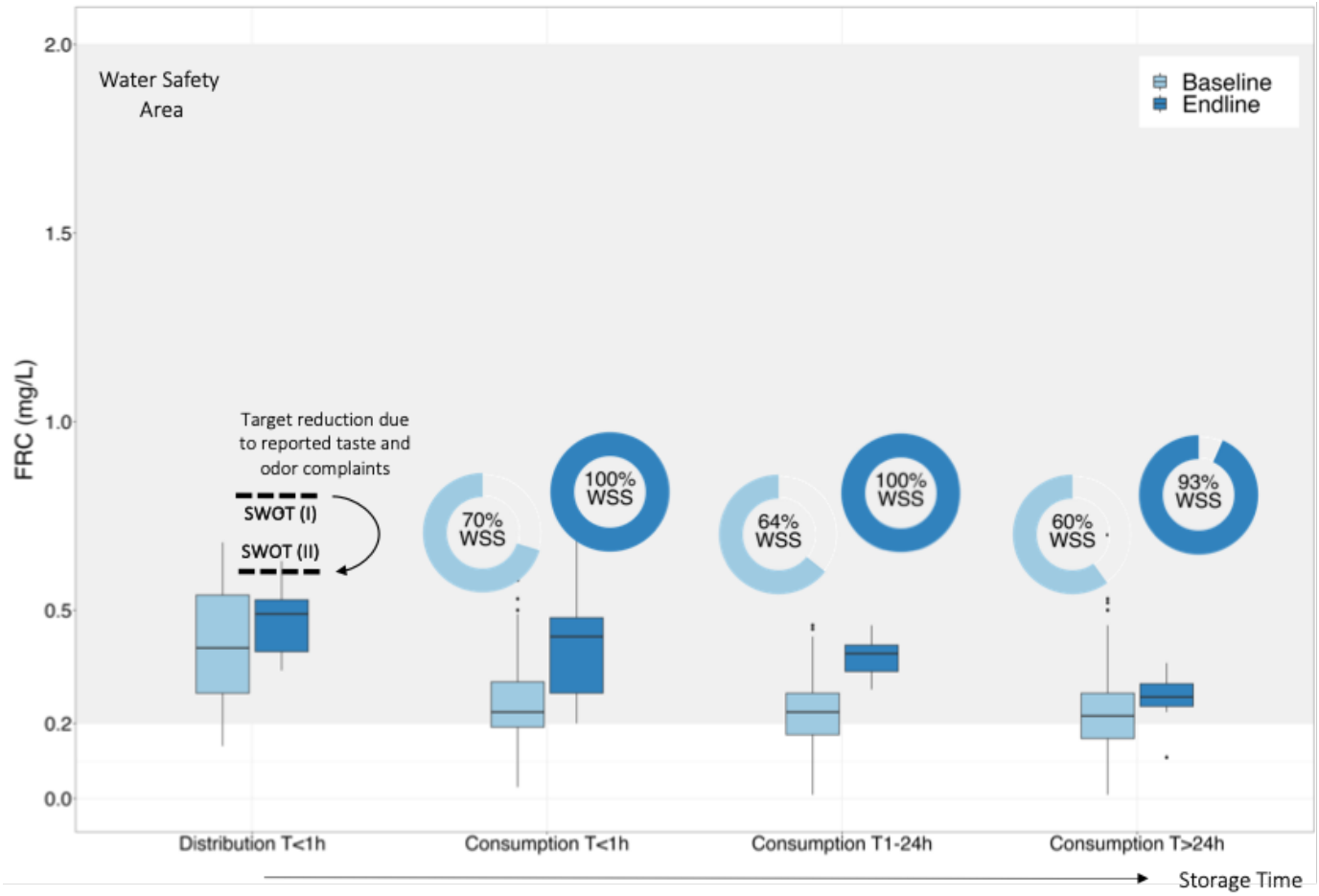

Figure 1: Key water safety results showing the evolution of the FRC and associated water safety score (WSS) for the baseline (light blue) and the endline (dark blue) by storage duration (less than 1 hour, between 1 and 24 hours, and more than 24 hours). The grey-shaded area represents international recommendations for FRC at the point-of-distribution indicating safe water (0.2-2 mg/L). The first target (SWOT target I) was set initially at 0.8 mg/L but was reduced to 0.6 mg/L (SWOT target II) because of water users' complaints.

KEY TAKEAWAYS

In this medical facility water system application, water was delivered on average every 5 days, highlighting the need to ensure sufficient residual in the elevated tank to protect the water over an extended period. By comparison, the SWOT is usually applied to water systems where the maximum storage duration is 24 hours. This challenged us to develop new methods for data collection and analysis. Working within the bounds of a specific institution, however, made this process easier to pilot. Compared to working in a larger site, like a refugee camp, we were able to rely on a single person for data collection, who was able to sample the same taps repeatedly over the course of a single day. Combined with the daily water tank samples, this allowed us to investigate the differences in chlorine decay characteristics both in the tank and in the piped water network.

This case study offered valuable insights on how the SWOT can help improve water safety in institutional water systems, including medical facilities such as the Las Anod General Hospital. With water quality monitoring data from tanks and taps at the hospital, the SWOT was able to generate a site-specific and evidence-based water chlorination target that could optimize water safety at taps around the hospital for extended durations (up to 5 days of storage). After the partial implementation of the SWOT's FRC target recommendation in the hospital's water system by the MSF WatSan Team, there was a considerable improvement in the proportion of hospital taps with sufficient FRC to protect water against pathogenic recontamination (i.e., 0.2 mg/L) after one or more days of stroage—going from 60% at baseline to 93% at endline following SWOT implementation.

The study also, once again, highlighted the importance of taste and odour as a critical factor to balance when setting a water chlorination target, as adjustments were made to the FRC target recommendation in response to water-user preferences. Acceptance of chlorine taste and odour in drinking water is highly personal and can vary greatly across populations. We recommend understanding local chlorine taste and odour acceptability thresholds as part of a chlorination programme, and always providing channels for water users to feedback their concerns. We are developing tools to help water system operators rapidly determine population-specific chlorine taste and odour acceptability thresholds to be part of the SWOT toolkit.

Overall, this case study in Somaliland demonstrated the effectiveness of the SWOT as a tool for enhancing water safety in healthcare settings in resource-constrained and crisis-affected settings.

NEXT STEPS

For our next steps, we will apply lessons learned from the Las Anod Hospital to similar environments and continue to refine and enhance the SWOT for the medical facility water system and other humanitarian water supply use cases. We also hope to expand the use of the SWOT beyond humanitarian response settings to be used by local health authorities in healthcare facilities in non-emergency settings.

Unfortunately, the conflict affecting the Sool region of Somaliland has escalated rapidly, to such a point that MSF had to withdraw from the Las Anod Hospital in July 2023. We hope that the situation improves, and the MSF team can return to provide medical care to patients in need at Las Anod and in the surrounding regions. The SWOT team is ready to support MSF and any medical humanitarian actors with deploying the SWOT to ensure water safety for patients, caregivers, and staff in medical facilities.