International Journal of Innovative Research in Engineering and Management (IJIREM)
ISSN (Online): 2350-0557, Volume-11, Issue-3, June 2024
https://doi.org/10.55524/ijirem.2024.11.3.4
Article ID IJIRD-1330, Pages 19-24
www.ijirem.org

Wastewater issue in IDPs Camps Northwest Syria

Dr. Ayşe Yeter Günal[1], and Khalil Al Taha[2]

[1] Assistant Professor, Department of Civil Engineering, Gaziantep University, Gaziantep, Türkiye
[2] Student, Department of Civil Engineering, Gaziantep University, Gaziantep, Türkiye

Correspondence should be addressed to Dr. Ayşe Yeter Günal; agunal@gantep.edu.tr

Received: 3 May 2024 Revised: 17 May 2024 Accepted: 29 May 2024

ABSTRACT- The study sheds light on the reality of sanitation in informal displacement camps in northwest Syria near the Turkish border. It addresses the methods adopted by the displaced people in collecting, transporting, and disposing of wastewater. It also discusses the challenges facing both the displaced individuals, local authorities and humanitarian organizations working in these camps to implement safe and effective sanitation systems. Additionally, it examines some of the solutions implemented by various organizations and evaluates their efficiency from technical, operational, and economic perspectives.

The study concludes the necessity of concerted efforts to implement effective sanitation systems for the safe and efficient collection and transport of wastewater, away from the areas where displaced people gather. Furthermore, it emphasizes the need to mitigate pollutants as much as possible by adopting some of the mentioned methods, or others before final disposal. Moreover, if these wastewater treatments are intended for agricultural irrigation, adherence to relevant Syrian standard specifications for the use of treated water in crop irrigation is essential.

KEYWORDS- Sanitation, Informal Displacement Camps, Northwest Syria, Displaced People, Humanitarian Organizations, Wastewater Treatments

I. INTRODUCTION

After more than 13 years of conflict, Syria is today home to the world's second-largest number of internally displaced people (IDPs). In the north-west alone, 1.98 million people live in over 1,527 camps or self-settled sites as shown in figure 1 who are living with limited predictable access to clean water, sanitation, or other necessities. According to the Camp Coordination and Camp Management (CCCM) Cluster 79 per cent live in sites with a critical level of overcrowding that puts their health at risk. 80 per cent of residents in IDP sites are women and children [1].

Figure 2 shows the biggest crowded camp has been established at the Turkish border, Syria side, where more than 139,000 individuals live in this camp [2].

With the onset of the Syrian conflict, many areas in Syria witnessed successive waves of internal displacement in search of a safer living environment, as many displaced people gathered in northwestern Syria, near the Syrian-Turkish border. These displaced people were randomly distributed among camps, either self-built or established by local and international organizations working in northwestern Syria.

However, and due to insufficient infrastructure within these camps, displaced residents relied on water tankers to meet their daily water needs. This dependence has escalated since the beginning of the conflict, rising from 15 liters per person per day to the current 35 liters due to several crises that have swept the region, such as the Covid-19 pandemic and the spread of cholera in northwestern Syria.

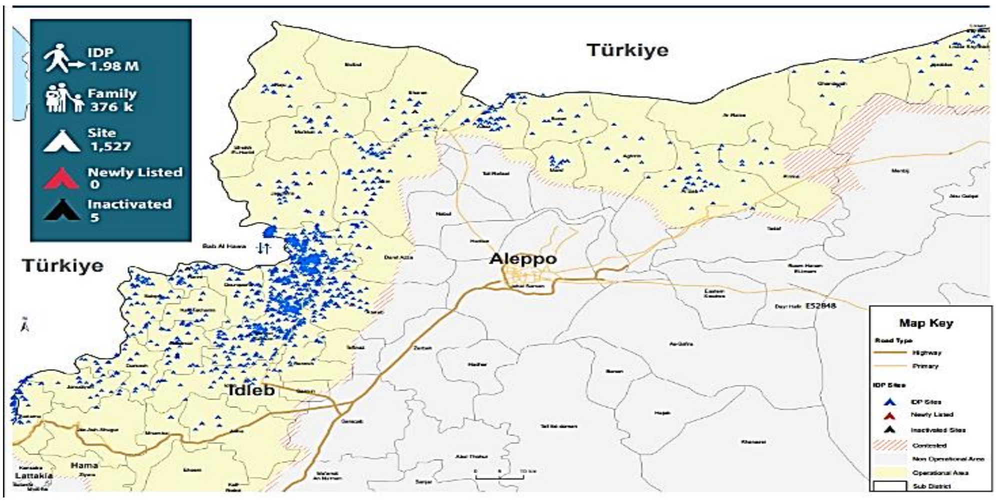

Figure 1: A Map Showing the Distribution of Camps in Northwestern Syria

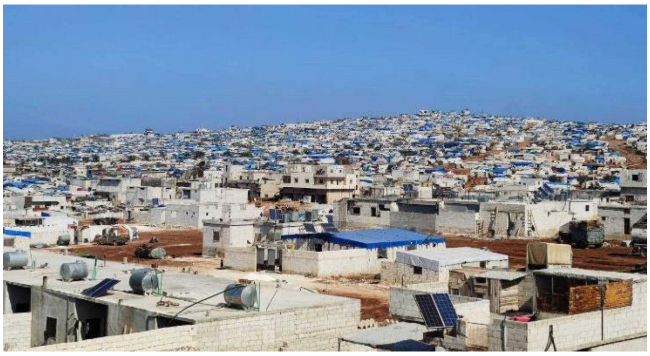

Figure 2: Largest Camp in Northwest Syria Atma Camp Close to the Turkish Border at Idleb Governorate

According to the Humanitarian Overview Needs assessment, HNO, for the year of 2024, there is 13.56 million people need water, sanitation assistance, of whom 51 per cent are women and girls, 44 per cent are children and 17 per cent have a disability. Despite overall 90 per cent of Syrians having access to improved sanitation, 29 per cent still face challenges in accessing functional toilets or with wastewater disposal (39 per cent of households in northern Syria). In northern Syria, around 9 per cent of the households reported sharing toilets with individuals outside their households, 3 times more in IDPs sites, while almost half of those toilets are not segregated by gender, especially in camps. [3]

II. TYPES OF WASTEWATER COLLECTION

Inadequate sewerage networks and inadequate wastewater disposal facilities are prevalent problems within IDP camps in northwest Syria, however, compared to the situation at the beginning of the Syrian crisis, significant progress has been observed in sanitation infrastructure within these camps, along with ways to get rid of them. Initially, IDPs faced the problem of open defecation due to the lack of latrines during the beginning of the crisis, and moved to using individual latrines, both self-built latrines and collective latrines set up by organizations working in northwest Syria.

To gain further understanding of the current situation, a random sample was collected from two different governorates, Aleppo and Idlib, in three regions as shown in figure 3 at the sub-district level, where the chart shows the number of camps and the total number of displaced people living in these camps in each of the three sites.

The number of sites in this sample is 37, with a total population of 26,068. The sample shows different means used to collect wastewater, where the majority of these means are cesspits, 651 cesspits in total as shown in figure 4, all of which lack proper and safe construction standards, as their depth does not exceed 1 m3. The pit was covered with either a metal sheet whose thickness does not exceed 0.5 mm, or a plastic sheet surrounded by several stones to fix it, as shown in figure 8.

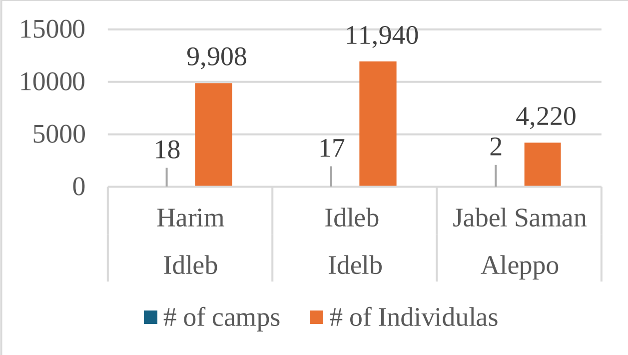

Figure 3: Number of Individuals in the Surveyed

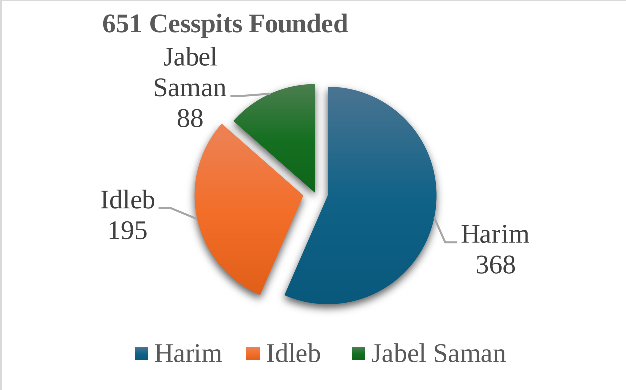

Figure 4: Number of Cesspits in Each Location

Several septic tanks were also observed, and in some cases the wastewater directly discharged into the surrounding environment. The principle of each method is explained below with some illustrative pictures.

A. Open Discharge

Which means the direct release of wastewater into the surrounding environment without utilizing any systems or structures to transport it away from the source or to provide any form of containment or covering as shown in figure 5 where its shows how a Syrian Child walks in a stream of open sewage in one of the IDP camps in Northwest Syria. Also, at figure 6 which shows gray water resulting from household uses, such as bathing and cleaning dishes, which is drained directly behind the tent in which the displaced people live, which poses a danger to their children falling into it, and it also constitutes a source of pollution of the surrounding environment as well.

Figure 5: A Syrian Child Walks in a Stream of Open Sewage in the Idp Camps in Northwest Syria

Figure 6: Open Discharge behind the IDP Tents

B. Cesspit

Which is a hole buried underground that has no outlet and only a single utility hole cover for access by desludging service suppliers in case it's needed for discharging. Where most of these cesspits are 1 m3 in size, covered by metal and plastic sheet cover as shown in figure 7 which explain the design of this kind of pits and figure 8 shows real cesspit constructed by IDPs themselves.

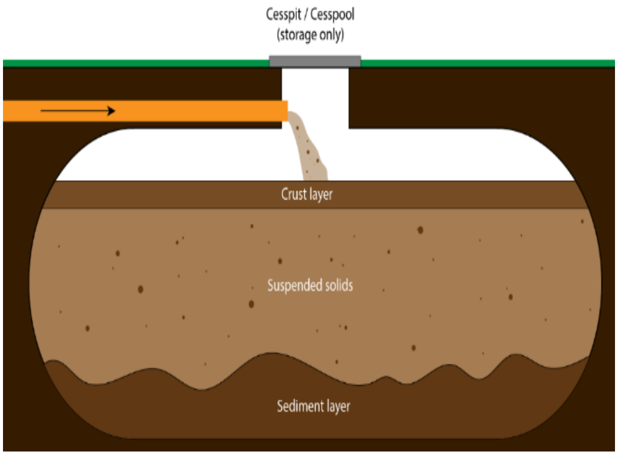

Figure 7: Cesspits Design

Figure 8: Cesspits installed by the IDPs

C. A Septic Tank

Septic tank is a watertight chamber made of concrete, fiberglass, PVC or plastic, through which blackwater and greywater flows for primary treatment. Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate [4]. As the design showed in figure 9 and the real septic tank constructed in one of the IDPs sites in northwest Syria in Figure 10. The septic here its play a role to some extent in the biological treatment process and reduces the concentration of organic pollutants to between 30 and 35% of Biological Oxygen demands, BOD5, based on the study issued by the United Nations International Organization for Migration of a sample of these technologies used in some sites in displaced persons sites in Northwest Syria [5].

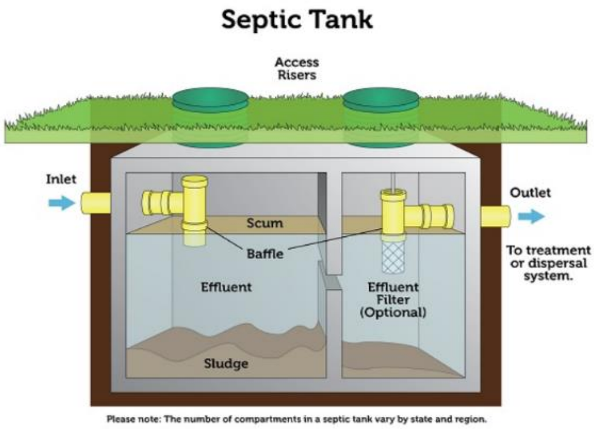

Figure 9: Septic Tank Design

Figure 10: Constructed Septic Tank

However, the risk of contamination of surface water or shallow wells is high, as high levels of ammonia have been observed in drinking water sources near these communities. Pollution of several surface wells has been recorded in some camps in the Azaz and Jarabulus regions on the Syrian-Turkish border, at 500 meters between the nearest drainage hole and a water source.

The study examines the various methods used by local authorities or NGOs to transport wastewater from IDP sites to its destination, which can be categorized as follows:

- Utilization of sewage networks, where available, which may be connected to either septic tanks or closed networks serving surrounding communities.
- Desludging the tanks through service providers contracted to remove wastewater from IDP sites. Which is somehow costly about 1.25-1.5 $ per m3.

Regardless of the method used to transport wastewater, there is environmental Impact, where improper disposal of wastewater can have negative environmental consequences, including pollution of soil and water sources, which can further exacerbate health problems and impact agricultural productivity. The destination of this waste is either disposed of in open areas such as valleys as shown in **Figure 11**, or selling the wastewater to farmers to irrigate their crops, or throwing it directly into bodies of water, which also threatens aquatic life.

Figure 11: Desludging Tanker Discharging the Wastewater to the Valley

Despite that, NGOs and IDPs in northwest Syria camps are facing several challenges related to wastewater discharge and the implementation of effective sewage networks:

- ***Infrastructure Damage***: Ongoing conflict and displacement often lead to damage or destruction of existing sewage infrastructure, making it difficult to establish or maintain effective sewage networks. **[9]**
- ***Limited Resources:*** IDP camps are facing a lack of the financial resources and technical expertise needed to develop and maintain adequate sewage systems. This results in makeshift solutions that are not sustainable in the long term.
- ***Access Constraints***: Limited access to sanitation facilities and clean water exacerbates the challenges faced by IDPs in managing wastewater. This lack of access can be due to physical barriers, such as checkpoints or damaged infrastructure, as well as economic constraints.
- ***Security Concerns***: Ongoing conflict and instability in the region can pose security risks to those involved in implementing sewage networks and wastewater management systems. This can hinder efforts to address sanitation needs effectively.
- ***Housing, Landing***, and Property issue, HLP: Many camps are situated on private or rented lands, where the owners may not permit the installation of sewage networks due to various reasons. This poses a serious obstacle to implementing effective wastewater disposal systems [10].

Addressing these challenges requires a comprehensive approach that involves collaboration between local authorities, humanitarian organizations, and the affected communities to develop sustainable solutions for wastewater management in IDP camps.

III. COMMON PRACTICES

As for the final disposal sites for wastewater, which need to be treated to mitigate the environmental and health impact, some local and international organizations have adopted some techniques:

A. Multi-Chamber Communal Septic Tanks

Offer good containment and both primary and secondary wastewater treatment in IDPs and or refugee camps. However, the availability of land space and vacuum trucks or pumps are critical for effective operation and maintenance of the communal septic tanks. Septic tanks achieve high solids removal 70-90%, 50-80% Chemical Oxygen Demands, COD and BOD of about 30-50%. However, effluent from septic tank requires further treatment since it partially removes BOD load and does not kill pathogens or remove nutrients [5].
In cases where septic tanks are solely used as treatments units, a holding tank or equalization tank is recommended to allow regulation of flow and achieving optimum hydraulic retention time of about 1 day. In addition, in semi-arid and arid areas or other areas with deep groundwater tables, connection of septic tanks to soak away or infiltration might further improve treatment. Other ways to optimize performance include adopting an up-flow septic tank design, longer first chamber and addition of outlet filter inside the septic tank [5].

B. Sequencing Batch Reactor SBR

The sequencing batch reactor is a specific fill-and-draw version of the activated-sludge process. In contrast to the continuous-flow alternative, metabolic reactions and solid-liquid separation are carried out in one tank and in a well-defined and continuously repeated time sequence. **[6]**
It’s also called the single tank technology, where only one unit was installed in Azaz area in Aleppo Governorate, to serve Sijo camp, close to Turkish border as shown in figure 12, two sample of wastewater before the SBR and after. Which produces approximately 260 m3 of wastewater per day, with a concentration of 450 millimeters per liter of organic pollutants.12 The efficiency of the station reaches 95% and the effluents somehow considered safe. To irrigate vegetables and crops according to the Syrian standard filters for treated water intended for use in irrigation.
This method requires continuous operating expenses and periodic maintenance work, and the resulting sludge at the bottom of the tank is invested as organic fertilizer, which farmers in the region are keen to invest in after drying it in drying ponds.

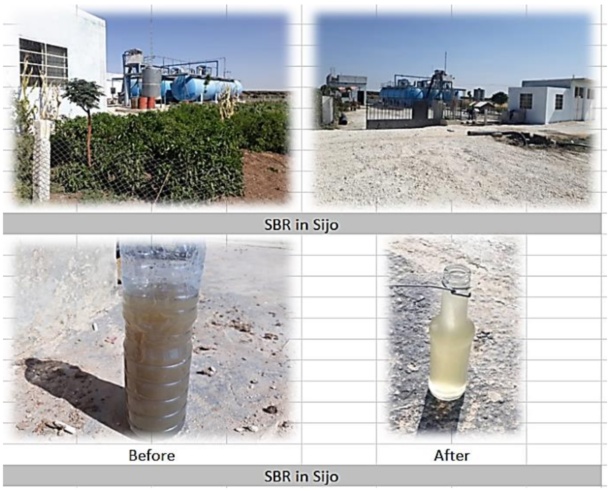

Figure 12: SBR Sijo camp Syria Aleppo Turkish border

C. Anaerobic Baffle Reactor (ABR)

The anaerobic baffled reactor (ABR) is a reactor design which uses a series of baffles to force wastewater containing organic pollutants to flow under and over (or through) the baffles as it passes from the inlet to the outlet [8].

Bacteria within the reactor gently rise and settle due to flow characteristics and gas production but move down the reactor at a slow rate. The original design is shown in figure 13.

This method relay on the principle of aerobic treatment, which has recently begun to spread in northwestern Syria as one of the methods used in treating wastewater with low operating costs. Figure 14 shows one of the concrete ABR installed in northwest Syria.

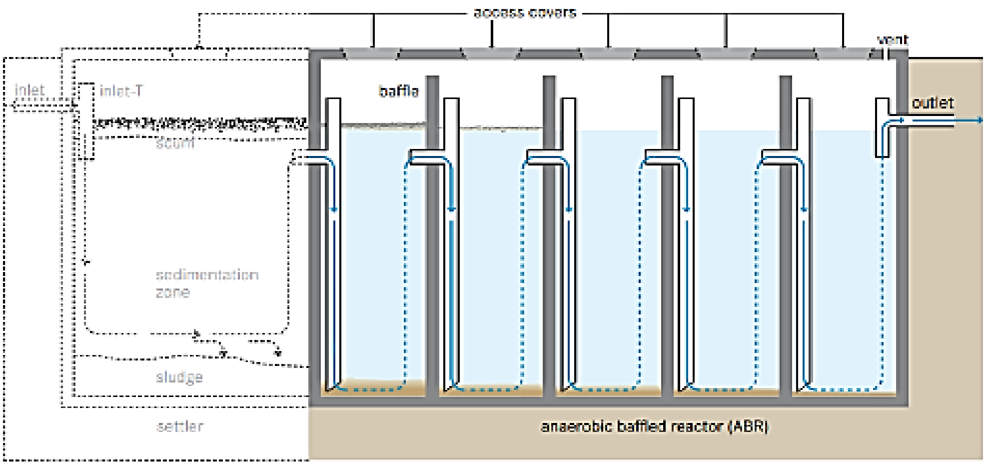

Figure 13: ABR Design

Figure 14: Anaerobic Baffle Reactor in Zoghara Camp Jarablus Aleppo Turkish Border

However, despite claims by some influential authorities regarding their high efficiency, the effectiveness of these units remains uncertain, particularly in terms of reducing pollutant concentrations. The method involves collecting wastewater into multiple chambers, with the initial chamber facilitating the sedimentation process. Subsequent chambers are equipped with pipes to compel wastewater from the primary filtration to traverse settled sludge at the chamber bottom, fostering biological interaction between aerobic bacteria and pollutants, provided an appropriate medium with specific temperatures and nutrient percentages such as phosphorus, nitrogen, and organic load is present. One drawback of this method is its time-consuming nature, potentially taking up to three months for the biological reactor to function effectively, so active bacteria may be added.

D. Up flow Anaerobic Sludge Blanket (UASB0

The up flow anaerobic sludge blanket reactor (UASB) is a single tank process. Wastewater enters the reactor from the bottom and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it [4] (shown in figure 15).

Th UASB technology has been installed in Idleb governorate by NGOs. The unit is now providing 1000 m3/day of water for irrigation to benefit 100 farmers with 655 donums of land. Where wetland have been constructed as well.

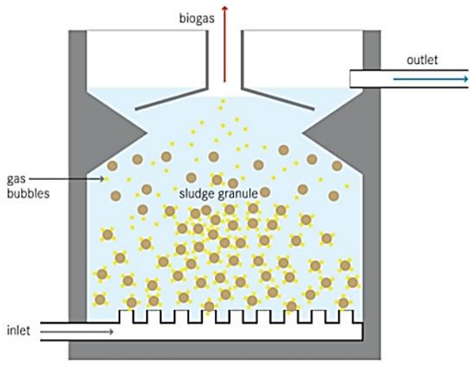

Figure 15: UASB Design

IV. CONCLUSIONS AND RECOMMENDATIONS

To mitigate the environmental and health impacts resulting from the lack of safe disposal and drainage systems for wastewater in the camps of northern Syria. Some local authorities and organizations operating in northwestern Syria have taken some measures that can be summarized as follows:

- Transferring the displaced people who were settled in random camps to organized camps that were established and equipped with good infrastructure for the safe disposal of sewage.
- Implementing sewage networks within informal settlements if there is no problem that prevents or hinders the implementation of this solution (objection from the landowner, difficult geographical nature, random spread of shelter units, lack of final drainage points nearby, and other obstacles)
- Continue to discharge the cesspits and the septic tanks at the level of the house, or collective houses shared one septic tank, if the land allows this and there is access to desludging tankers. cars. And carry out the necessary maintenance for pits or the septic tanks in terms of isolating them and covering them well and safely.
- In case any treatment methods will be applied for crop irrigation. the treated water needs to match the Syria standards for reused water for irrigation purposes [7].

These solutions are considered topical solutions that address the problem of widespread swamps and cesspits that may contaminate nearby drinking water sources, or even affect the environment living conditions.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1) CCCM Cluster Syria, "IDP Sites in NW of Syria," August 2023.
2) CCCM Cluster Syria, "IDP Sites Integrated Monitoring Matrix (ISIMM)," April 2024.
3) Syrian Arab Republic, "2024 Humanitarian Needs Overview," February 2024.
4) Tilley, L. Ulrich, C. Lüthi, P. Reymond, R. Schertenleib, and C. Zurbrügg, "Compendium of Sanitation Technologies in Emergencies," 2nd ed., Swiss Federal Institute of Aquatic Science and Technology – Eawag, 2018.
5) International Organization for Migration, "Septic Tank Pilot Factsheet," April 2021.
6) P. A. Wilderer, R. L. Irvine, and M. C. Goronsky, "Sequencing Batch Reactor Technology, Scientific and Technical Report No. 10," IWA Publishing, London, 2001.
7) Syrian Standard, "Standards and Specifications for Treated Sanitation Water for Agricultural Use, No. 2752," 2008.
8) P. L. McCarty and A. Bachmann, 1992.
9) The World Bank Group, "The Economic and Social Consequences of the Conflict in Syria," 2017.
10) North-West Syria Response: Housing, Land and Property Technical Working Group, "Due Diligence Guideline," Nov. 2,2020.