



المعمل المتقدم للتحاليل الكيميائية

Environmental implications of Tajoura RO desalination plant

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Background

- Despite the fact that Libya has the largest coast on the Southern Mediterranean Sea (1950 km), desalination technology is not being widely used in Libya as a main source of providing clean water. The previous government adopted Man-Made River project (MMRP) to be an alternative for groundwater shortage in the Northern side of the country.
- The vision of this project was to bring water from huge aquifers in the South to coastal cities and desert towns via very long pipelines. Since the MMRP has some difficulties to reach many districts and towns in the North such as Tajoura, the MMRP did not achieve its full target.

- Due to the current situation of MMRP, water shortage is still a continuing problem in most of the Libyan land. National committee has recommended that environmental friendly desalination technology should be taken seriously into account to be the main option for solving the water shortage crisis in Libya. For that reason the author intends in this paper to highlight the environmental implications of an old local operating desalination plant

Aims

- The main aim of the work was to gain information that can be useful and helpful for constructing a new and bigger desalination plant nearby the old plant. In order to achieve this aim the following tasks had to be done:
- Regular visits to the Tajoura RO desalination plant
- Talk and discussion with the operators and manger; and
- Monitoring and observation

Tajoura RO desalination plant

➤ Plant description

Tajoura reverse osmosis desalination plant is one of the main plants in Libya. The plant is located at the coast of the Mediterranean sea. The plant produces 10,000 m³/day of clean water which makes it the largest production of desalinated water in Libya using reverse osmosis membranes (RO technology). In spite of the plant has been running for almost 30 years, there have not been any investigation of any kind to examine or evaluate its negative impacts on the environment. In this study we will review some environmental aspects of Tajoura desalination plant. The study will attempt to highlight some major environmental concerns include issues related to location, chemical hazards, noise and concentrate disposal of Tajoura desalination plant.

➤ Environmental aspects of Tajoura desalination plant

The following sections identify potential Environmental aspects of Tajoura desalination plant:

○ Land usage by the desalination plant of Tajoura

Tajoura RO desalination plant is located 10 km from the town center. This location was at the time a good choice for construction the plant for some reasons;

- It is next to the sea, this advantage keeps the quality of the raw water is safeguarded. The proximity of seawater, and brine transfer reduced the risk of land pollution.
- It is next to the Nuclear research center in which can be provided with water.
- The raw water seems to be of good quality since the intake is located away from any ports or points of discharge of water of questionable quality.
- Long way from the main residential areas. Recently some changes were created nearby the area, small village of (200) people is built in the neighborhood (~ 1000 m from the plant).

- Visual impacts of the plant

The infrastructure design of Tajoura desalination plant at a lower bench level which is environmentally convenient as does not cause any visual impact across the coastal plain. The plant is also surrounded by landscape planting from three directions: South, East, and West. This makes the plant has low visibility on the surrounding area.

- Pipeline system

The route of the pipeline to transfer raw water from the sea to the desalination plant and discharging the concentrated brine from the plant back to the sea is installed underground without any visibility. Thus prevents any visual impacts but could cause impacts on the aquifer if there are some leakages.

○ Noise and vibration emissions

- ✓ Noise is generally defined as unwanted or undesirable sound. Sound (noise) levels are usually measured in decibels (dB). Decibel levels range from zero to 140.
- ✓ Excessive noise cannot only be undesirable but may also cause physical and/or psychological damage.
- ✓ As any other industrial plant; Tajoura reverse osmosis desalination plant could be a source of noise. The noise generated in a reverse osmosis desalination plant is mainly produced by the high-pressure pumps, and the turbines used for energy recovery.
- ✓ Noise level was measured at different sites inside the main building of the plant. Measuring sites included the high pressure pumps chamber, the main hall, the laboratory, injection room, workshop, bed room, kitchen and some other sites as shown on Figure 1.

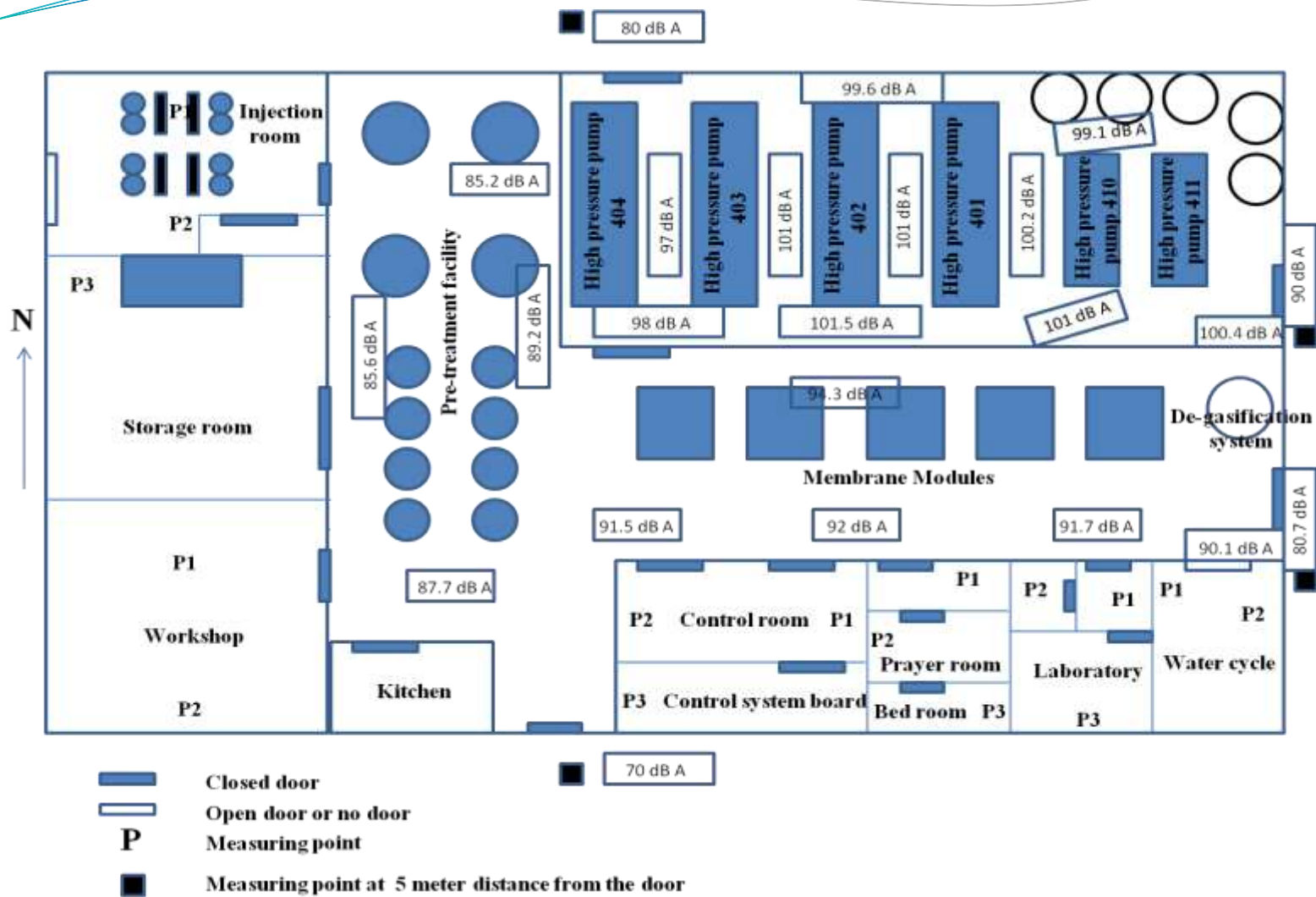


Figure 1. Noise measurements at different sites at Tajoura plant

✓ Table1: Summary of noise levels at different sites in Tajoura RO plant

Position	International standard	Noise level dBA					
		Measuring site					
		P1		P2		P3	
		Door					
		Open	Closed	Open	Closed	Open	Closed
Control room	60	80.6	70.3	82.6	70	67.5	66.5
Laboratory	-	85	73.2	78.5	68.5	75.3	62
Injection room	-	73	71.3	74.5	70.1	70.8	69.5
Bed room	55	81	68	71	57.4	68	55.5
Workshop	70	75.6	70.3	74	69.8		
Kitchen	60	82	79.8				
Water cycle	60	82					

- Brine disposal point

Brine disposal is a liquid waste from a desalination plant, which contains a high content of salts and dissolved minerals as well as remaining chemicals used for pre-treatment and post-treatment stages. It returns back to the sea and spreads according to different aspects. The pretreatment chemical agents are important to consider because they remain in the concentrate before disposal. Tajoura RO desalination plant discharges brine directly to the sea. The disposal point as can be seen in Figure 2, is placed exactly on the beach [coastline].



Figure 2. Brine disposal point at Tajoura plant



- ✓ According to Brika et al, 2015, the major concern of brine discharged from Tajoura plant is represented by its high salinity Table 2 summarize the brine composition as obtained from a previous work done on Tajoura RO desalination plant.

Table 2. Chemical composition of seawater and brine reject from Tajoura desalination plant

Element	Concentration in Seawater (mg/l)	Concentration in Brine (mg/l)
TDS	37,050	49,335
Salinity	37,900	52,600
Sodium	13,230	17,788
Calcium	420	1,160
Potassium	452	608
Chloride	22,500	30,841
Sulphate	2,800	4,333
Nitrate	0.53	1.07
Silicon	0.25	0.7
Copper	0.30	0.45
Chromium	0.11	0.21
Manganese	0.20	0.45

Environmentally, the site of the brine disposal point is not considered to be the right place for discharging large amount of high concentrated seawater. It would have been desirable to place the point of brine disposal far away from the beach and from rocky areas which are rich in organisms, as well as far away from areas where are certain activities take place in special occasions such as summer resorts.



Figure 3 . Swimming in front of the brine discharge point at Tajoura coast



Conclusions

The desalination technology has never been one of the main sources for portable water in Libya; therefore, there has never been so much discussion on its environmental impacts. The following points can be extracted from this study;

- ✓ High-pressure pumps and energy recovery system, such as turbines in Tajoura desalination plant produce significant level of noise and are not provided with equipment to reduced noise level. Therefore, these machines should be equipped with appropriate technological means for reducing the noise level. Furthermore, a serious action should be taken soon and health care and acoustic devices should be provided to all of those who are affected by this contamination.
- ✓ Depending on the current conditions of the surroundings, the location of the brine discharge point is not appropriate because of the interference of the mixing zone with recreation on the beach. Therefore, serious action should be taken regarding re-locating the brine disposal point, or making it inaccessible to public.

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Thank you for your attention

