

**International Legal Requirements and Solutions for
Countering the Adverse Environmental Impacts of the
Construction and Operation of Desalination Plants in
the Persian Gulf and the Sea of Oman
(Original Research)**

Mahnaz Rashidi *

Rana Madadi**

Mehdi Piri ***

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Extended Abstract

The current needs of the international community require States to employ new technologies. Among these technologies, seawater desalination facilities are used to address the water shortage crisis faced by the arid States bordering the Persian Gulf and the Sea of Oman.

The aridity of the coastal areas of the Persian Gulf and easy access to seawater has led to the establishment of about 45% of the world's desalination plants in the Persian Gulf. Given that the number and capacity of desalination plants on the coasts of the Persian Gulf and the Sea of Oman are expected to increase, and on the other hand, noting the possible negative impacts of desalination plants built in the coastal states of the Persian Gulf and the Sea of Oman on the environment, the present study seeks to assess the international environmental legal requirements incumbent upon the States that establish and operate such facilities which are necessary to comply with.

Scientific predictions indicate that by 2030, the water resources of the coastal states of the Persian Gulf and the Sea of Oman will be reduced to more than half of their current capacity, and the region will experience water stress. Therefore, states in this area have established desalination plants to

* Corresponding Author, Assistant Professor, Law Department, Faculty of Humanity Sciences, Shahed University, Tehran, Iran; ma.rashidi@shahed.ac.ir.

** Ph.D. Student in International Law, Faculty of Law, Shahid Beheshti University, Tehran, Iran, r.madadi@ut.ac.ir

*** Assistant Professor, Department of Public Law, Faculty of Law and Political Science, University of Tehran, Tehran, Iran; Mehdi.piri@ut.ac.ir



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cope with water shortage and meet the increasing water demand. While it is expected that the provision of fresh water through desalination of water from the Persian Gulf and the Sea of Oman will reduce the likelihood of problems arising from water stress, concerns have been raised regarding the increased levels of environmental pollution resulting from the discharge of brine from the desalination process into marine areas, which may cause tension between states in the region in the future. Therefore, addressing the issue is vital.

The article's research method is descriptive-analytical, using library resources and analysis of existing legal documents. In order to achieve the research goal, this study is structured in three main sections. The first section discusses the history of seawater desalination projects in the Persian Gulf and the Sea of Oman and their impacts on the marine environment. The second section elaborates on the international legal obligations of coastal states in the Persian Gulf and the Sea of Oman in constructing and operating desalination facilities, and the final section examines and puts forward strategies for the sustainable operation of seawater desalination projects in the Persian Gulf and the Sea of Oman.

There are no specific provisions in public international law to prohibit, control, or reduce the discharge of brine resulting from the desalination process into the sea and to protect the marine environment against such facilities. However, given the definitions of the terms “pollution” and “land-based sources” provided in relevant general and regional treaties — including the United Nations Convention on the Law of the Sea (1982), the Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution (1978), and its related protocol, the Protocol for the Protection of the Marine Environment against Pollution from Land-based Sources (1990) — and considering that seawater desalination facilities, including those in the Persian Gulf and the Sea of Oman, are located on the coast and that the brine resulting from their activities is often discharged into the sea, the host and operator States of such facilities are required to take all necessary measures to ensure their sustainable operation in compliance with relevant international obligations, including protecting the marine environment, preventing pollution from these facilities from entering marine areas, and conserving marine biodiversity.

Given that the identified obligations are a type of obligation of conduct, the identification of the type and examples of measures necessary to fulfill them should be carried out by coastal States, taking into account the standard of care. Among the most important of these measures are the adoption of technical methods such as brine dilution, wastewater discharge in safe areas, desalination of groundwater as an environmentally friendly alternative, and the adoption of methods to reduce energy consumption and manage carbon emissions from these facilities.

furthermore, adopting a number of legal provisions by delving into the content and using the capacity of the Kuwait Regional Convention of 1978 and the Regional Organization for the Protection of the Marine Environment (RAPME), such as approving technical and quality standards for the use of desalination facilities, approving a new protocol under the Kuwait Convention governing the use of desalination plants, establishing a Compliance and Implementation Committee to monitor the level of compliance of coastal States with their obligation to protect the marine environment and, if necessary, providing them with technical and financial assistance.

Finally, implementing the Kuwait Convention's dispute resolution mechanism is one of the legal methods that can significantly reduce any environmental damages that could be caused by desalination plants on the coasts of the Persian Gulf and the Sea of Oman. Undoubtedly, the effectiveness of these methods will yield benefits when political, economic, and technical obstacles, such as political and developmental rivalries give way to international empathy and solidarity to preserve the region's environment as a valuable heritage for the present and future generations.

Keywords

Water Scarcity, Seawater Desalination, Persian Gulf, Sea of Oman, Kuwait Convention, Land-based Sources of Pollution, Marine Environment

Bibliography

- Books

1. Axworthy, Thomas S. and Bob Sandford. "The Global Water Crisis: Framing the Issue." In: *The Global Water Crisis: Addressing an Urgent Security Issue*. edited by Bigas, Harriet, 2-7. Canada: Paper for the InterAction Council, 2011-2012.
2. Hosseini Azad, Seyed Ali. *International Marine Environmental Law*. Tehran: Ganjedanesh, 1402. (in Persian)
3. Schäli, Judith. "Part 2 The Protection of the Marine Environment from Land-based Sources of Plastic Pollution in International Law." In: *The Mitigation of Marine Plastic Pollution in International Law*. 107-373. The Netherlands: Brill | Nijhoff, 2022.

- Articles

1. Al-Saidi, Mohammad et al. "Governing desalination, managing the brine: A review and systematization of regulatory and socio-technical issues." *Water Resources and Industry* 30, (2023). <https://doi.org/10.1016/j.wri.2023.100225>
2. Amini, Azam et al. "Procedural Principles Ruling the Utilization of Tigris-Euphrates River Basin." *Iranian Research letter of International Politics* 11, no. 2 (2023). (in Persian)

3. Boyle, Alan E. "Land-Based Sources of Marine Pollution: Current Legal Regime." *Marine Policy* 16, no. 1, (1992). [https://doi.org/10.1016/0308-597X\(92\)90052-Q](https://doi.org/10.1016/0308-597X(92)90052-Q)
4. Buzaina, Moossa et al. "Desalination in the GCC Countries- A Review." *Journal of Cleaner Production* 357 (2022). <https://doi.org/10.1016/j.jclepro.2022.131717>
5. Chang, Yen-Chiang. "Responsibility under international law to prevent marine pollution from radioactive waste." *Ocean and Coastal Management* 227 (2022). <https://doi.org/10.1016/j.ocecoaman.2022.106294>
6. Derakhshan alamdarloo, Pezhman et al. "Simulation of the Flow of Water in the Persian Gulf using the MIKE 3D Model." *Journal of Environmental Science Studies* 4, no. 4 (2019). (in Persian)
7. Ibrahim, Hamed D., and Elfatih A.B. Eltahir. "Impact of Brine Discharge from Seawater Desalination Plants on Persian/Arabian Gulf Salinity." *Journal of Environmental Engineering* 145, no. 12 (2019). [https://doi.org/10.1061/\(ASCE\)EE.1943-7870.0001604](https://doi.org/10.1061/(ASCE)EE.1943-7870.0001604)
8. Khalilabadi, Mohammad Reza. "3D modeling of Circulation in the Oman Sea Using the MITgcm Model." *Hydrophysics* 2, no. 1 (2016). (in Persian)
9. Larson, Rhett B. "Innovation and International Commons: The Case of Desalination under International Law." *Utah Law Review* 2, no. 6 (2012).
10. Lattemann, Sabine, and Thomas Hoepner. "Environmental Impact and Impact Assessment of Seawater Desalination." *Desalination* 220, 1-3 (2008). <https://doi.org/10.1016/j.desal.2007.03.009>
11. Le Quesne, William. J.F. et al. "Is the Development of Desalination Compatible with Sustainable Development of the Arabian Gulf?" *Marine Pollution Bulletin* 173, Part A (2021). <https://doi.org/10.1016/j.marpolbul.2021.112940>
12. Mirfakhraei, Seyed Hasan, and Zeynab Priabbasi. "International Maritime Organization (IMO) and Environmental Issues (Caused by Human Activity) in Persian Gulf." *Political Quarterly* 50, no. 1 (2020). (in Persian). [10.22059/jpq.2020.238953.1007110](https://doi.org/10.22059/jpq.2020.238953.1007110)
13. Ngoc Nguyen, Lan. "Jurisdiction and Applicable Law in the Settlement of Marine Environmental Disputes under UNCLOS." *Korean Journal of International and Comparative Law* 9, no. 2 (2021). <https://doi.org/10.1163/22134484-12340161>
14. Omerspahic Mustafa, et. al, "Characteristics of Desalination Brine and Its Impacts on Marine Chemistry and Health, With Emphasis on the Persian/Arabian Gulf: A Review", *Frontiers in Marine Science* 9 (2022). [doi:10.3389/fmars.2022.845113](https://doi.org/10.3389/fmars.2022.845113)
15. Paleologos, Evan. K. et al. "Risks and threats of desalination in the Arabian Gulf," *The 4th International Conference on Water Resource and Environment (WRE)* 191 (2018). [doi:10.1088/1755-1315/191/1/012008](https://doi.org/10.1088/1755-1315/191/1/012008)
16. Paparella, Francesco et al. "Long-term, Basin-scale Salinity Impacts

from Desalination in the Arabian/Persian Gulf.” *Scientific Reports* 12, 20549 (2022). <https://doi.org/10.1038/s41598-022-25167-5>

17. Shahmirzadi M. A., and S. Hosseini. "Environmental Aspects of Brine Management in Seawater Desalination." *Iran-Water Resources Research* 10, no. 3 (2014). (in Persian)
18. Sharifinia, Moslem. "Prevention is better than cure: Persian Gulf biodiversity vulnerability to the impacts of desalination plants," *Global Change Biology* 25, no. 12 (2019). doi: 10.1111/gcb.14808
19. Tanaka, Yoshifumi. "Regulation of Land-Based Marine Pollution in International Law: A Comparative Analysis between Global and Regional Legal Frameworks." *Zeitschrift für Ausländisches Öffentliches Recht und Völkerrecht* 66, (2006).
20. Ziaee, Seyed Yaser, and Mahnaz Rashidi. "The Nature and Content of the Obligation to Environmental Impact Assessment in the Light of the ICJ Case Law." *Journal of Legal Studies* 13, no. 3 (2021). (in Persian)

- Thesis

1. Mohammadi, Aghil, "Non-Compliance Procedure in International Treaties of Environmental, Human Rights and Disarmament Law" Ph.D. Dissertation, University of Tehran Faculty of Law and Political Science, 2018. (in Persian).

- Documents

1. 2003 Guidelines for the Environmental Sound Management of Seawater Desalination Plants in the Mediterranean, as amended in 2019. <https://www.unep.org/resources/report/sea-water-desalination-mediterranean-assessment-and-guidelines>
2. Kuwait Action Plan & Legal Documents, Ropme. Available at: https://ropme.org/?page_id=290. Accessed: March 6, 2025.
3. Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution, 1978. <https://www.ecolex.org/details/kuwait-regional-convention-for-co-operation-on-the-protection-of-the-marine-environment-from-pollution-tre-000537/participants/>. Accessed: March 6, 2025
4. Protocol for the Protection of the Marine Environment against Pollution from Land-Based Sources, 1990. https://ropme.org/wp-content/uploads/2019/12/Land_Based_Protocol.pdf
5. Ropme Policy Brief: Ropme Sea Area Climate Change Risk Assessment, 2022. <https://ropme.org/wp-content/uploads/2022/07/Risk-Assessment-Policy-Brief-English.pdf>
6. United Nations Convention on the Law of the Sea (UNCLOS), 1982. <https://treaties.un.org/pages/showdetails.aspx?objid=0800000280043ad5>

- Cases

1. ICJ, *Alleged Violations of Sovereign Rights and Maritime Spaces in the Caribbean Sea (Nicaragua v. Colombia)*, Judgement, ICJ Reports 2022.
2. ITLOS, *Southern Bluefin Tuna (New Zealand v. Japan; Australia v. Japan)*, Provisional Measures, Order of 27 August 1999, ITLOS Reports 1999.
3. PCA. *Arbitration regarding the Chagos Marine Protected Area between Mauritius and the United Kingdom of Great Britain and Northern Ireland*. Award of 18 March 2015. RIAA. Vol. XXXI.
4. PCA. *The South China Sea Arbitration between the Republic of the Philippines and the People's Republic of China*. Award of 12 July 2016. RIAA. Vol. XXXIII.
5. *Request for Advisory Opinion Submitted by the Commission of Small Island States on Climate Change and International Law*, Advisory Opinion, Case no. 31, 21 May 2024, ITLOS Reports 2024.

- Websites

1. About ROPME, Ropme, https://ropme.org/?page_id=15. Accessed: March 6, 2025.
2. United Nations Treaty Collection, "Convention on Biological Diversity." Available at: <https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY>
3. United Nations Treaty Collection, "Convention on Biological Diversity." Available at: https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-8&chapter=27. Accessed: 3 March, 2025.
4. <https://www.irna.ir/news/84793611>, accessed: May, 14, 2025.
5. <http://www.persiangulfstudies.com/fa/pages/166>, accessed: May, 14, 2025.