

Brine discharges from desalination in Morocco: what two impact assessments show, and what the draft decree would measure

Nizar Younes Mqam

MARAMM, Moroccan Association of Reliability, Asset, Facility & Maintenance Management, Rabat, Morocco ·
ORCID 0009-0008-5549-7620 · n.mqam@maramm.org

Abstract. Morocco is rapidly developing seawater desalination. This production comes with brine discharges whose impact depends not only on their salinity, but also on their dilution and dispersion once they reach the sea. To see how these discharges are assessed, we examined the impact assessments published for the Jorf Lasfar and Safi plants, then compared their data with the Moroccan draft decree on coastal discharges. Our analysis covers only publicly available documents; it does not rely on any on-site measurement.

Both assessments describe the brine and its mixing with cooling water before discharge. However, the salinities stated for these mixtures cannot be recovered from the figures provided: the calculation gives 35.7 g/l instead of 35.4 at Jorf Lasfar, and 47.8 g/l instead of about 45 at Safi. Nor do the documents show how the saline plume disperses at sea, or what happens to the discharge if the cooling-water flow decreases.

The draft decree is a step forward, but its general limits appear ill-suited to effluents derived from seawater. Its conductivity threshold is close to that of natural seawater at 25 °C, while its limits for magnesium, calcium and sulfate are below the concentrations naturally present in the sea. The challenge is therefore to define specific rules that can be verified at each site: a salinity threshold in the receiving environment, a clearly located measurement point, reproducible mixing balances, and consideration of the dependence on cooling circuits. This finding prejudices neither the actual quality of the discharges nor any non-compliance.

Keywords: seawater desalination; reverse osmosis; brine discharge; environmental impact assessment; salinity; electrical conductivity; coastal discharge regulation; Morocco; asset dependency.

1. Introduction

A reverse osmosis desalination plant does not only make fresh water: it also produces a saline concentrate that has to be sent back somewhere. With a recovery rate of 40 to 45 %, each cubic metre of drinking water comes with 1.2 to 1.5 m³ of brine, whose salinity approaches twice that of the intake water. At Jorf Lasfar, the impact assessment reports about 70 g/l for seawater at 35 g/l [1]. Worldwide, this flow is estimated at 142 million m³ per day, nearly 50 % more than earlier assessments, and it comes from 15,906 plants delivering 95 million m³ of desalinated water per day, 48 % of it in the MENA region [2].

The ecological problem is well identified: denser than seawater, brine sinks, then spreads over the seabed as a hypersaline layer that affects benthic fauna and seagrass first [3, 4]. When authorities have decided to address this risk directly, they have done so through a criterion bearing on the environment that receives the discharge. The California Ocean Plan, for example, allows at most 2.0 ppt above natural salinity, as a daily maximum, measured no more than 100 m horizontally from each

discharge point [5]. At Carlsbad, the first large plant subject to this rule, a bottom plume was measured up to 2.7 units above ambient salinity (33.2) over about 600 m offshore, therefore beyond the limit, without any significant effect being detected on the benthic indicators monitored (macrofauna, BOPA index, survival and growth of brittle stars) [6]. The risk is therefore real, its effects depend on the site, and only a measurement at a defined point can settle the matter.

Morocco, for its part, is accelerating. Its desalination capacity reached about 420 million m³ per year in May 2026. The national water utility (ONEE) is targeting more than 1.3 billion m³ per year for drinking water, i.e. 63 % of needs, and the Greater Casablanca plant, planned for 300 million m³ per year, 200 of them in a first phase, was 81 % complete in August 2026 [7]. The legal framework exists on paper: Article 37 of Law 81-12 on the coastline (Dahir 1-15-87 of 16 July 2015) prohibits discharges that pollute the coastline, while allowing the administration to authorise liquid discharges that meet specific limit values. These values have never been enacted, which both impact assessments studied here explicitly acknowledge [1, 8]. Draft decree 2-25-860, put out for consultation on 11 November 2025, is meant to fill this gap [9]. The press presented it as finalised and sent to the Secretariat General of the Government in February 2026 [10], but we found no publication in the Official Bulletin as of 29 September 2026.

We therefore seek to answer two questions. First, what do the published impact assessments of Moroccan reverse osmosis plants actually say about brine discharge, and can a reader recover their conclusions from the figures they print? Second, how would the limits of the draft decree apply to an effluent made of seawater? We should also state what this article does not claim to do: no measurement was made, and nothing in it constitutes an allegation of non-compliance, since the decree is not in force and the assessments were written in the absence of a national criterion for discharges to sea.

2. Material and method

The analysis rests exclusively on public documents. The two impact assessments, published by the OCP Group, are final versions from June–July 2023: 272 pages for Jorf Lasfar [1], 331 for Safi [8]. At Jorf Lasfar, 42 million m³ per year are added to the 40 already in service, for a total of 82 million supplying the industrial complex, El Jadida and Azemmour ([1], p. 54). At Safi, two plants of 22 million (industrial use) and 30 million m³ per year (drinking water) are planned ([8], p. 52). We supplemented this corpus with the non-technical summary of Jorf Lasfar prepared for the EBRD in July 2024 (project 54662, 12.5 ha plot) [11]. The draft decree exists only in Arabic, as eight scanned pages published by the SGG on 11 November 2025 [9]. We read it by optical character recognition (Tesseract, Arabic, French and English models, 300 dpi) and re-read Annex 1, which contains the limits, directly on the image of page 6. We treated the table of responses to public comments (22 January 2026, seven pages) [12] in the same way: it contains no mention of conductivity or desalination, which we report as a limitation of the method.

To assess the documents, we built a grid of ten criteria, drawn from what a reader needs in order to judge an outfall: what is discharged, into what, how it is diluted, what reaches the environment and where, against which threshold, and what happens when operating conditions change. The criteria are the salinity of the brine, that of the ambient water, the dilution mechanism, the flows, the salinity of the mixture, the consistency between flows and mixture, plume modelling, the definition of a mixing zone and a compliance point, monitoring, and dependence on the cooling circuit. Each assess-

ment was searched in full text. Each criterion is coded “provided” when the document gives the value or the analysis, “partial” when it gives an element without allowing it to be verified or used, and “absent” when no occurrence was found, with the supporting page (Table 1).

To check the mixture salinities, we applied conservation of salt. When a document gives the salinity of the brine C_b , that of the dilution water C_s and the brine fraction f in the mixture, the discharged salinity equals $C_s + f \times (C_b - C_s)$, with $f = Q_b / (Q_b + Q_c)$, neglecting density differences of a few per cent. This is the formula printed in the Safi assessment ([8], p. 188), in the form $C3 = (C1V1 + C2V2) / V3$. We also used it to estimate how the Jorf Lasfar mixture responds when the cooling-water flow Q_c falls below its nominal value. The conductivities corresponding to a given practical salinity and temperature were computed with the TEOS-10 Gibbs SeaWater library (function C_from_SP atmospheric pressure) [13], treating the assessments' g/l as practical salinity, which introduces an error of a few per cent with no effect on the conclusions. For reference seawater, we took the composition of Millero et al. (2008) at $SP = 35$ [14], i.e. 1.28372 g/kg of magnesium, 0.41208 of calcium and 2.71235 of sulfate, converted to mg/l with the TEOS-10 density at 25 °C (1.0233 kg/l). The calculation script is provided as supplementary material.

3. What the two impact assessments show

#	Criterion	Jorf Lasfar [1]	Safi [8]
1	Brine salinity	Provided: about 70 g/l (p. 64)	Provided: 62.54 g/l (pp. 65, 188)
2	Ambient salinity	Provided: 35 g/l (p. 60)	Provided: 36–40 g/l, 38 used in the calculation (p. 188)
3	Dilution mechanism	Provided: cooling water of the complex, main canal with cascades (p. 60)	Provided: cooling water of unit MP2, existing MP2 outfall pipe (p. 65)
4	Flows	Provided: 318,200 m ³ /h cooling water, about 6,600 m ³ /h brine, 2 % (p. 60)	Partial: brine stated as 40 % of the mixture, no flows (p. 188)
5	Mixture salinity	Partial: “from 35 to 35.4 g/l”, calculation not shown (p. 60)	Provided: about 45 g/l, formula shown (p. 188)
6	Consistency of flows and mixture	Not consistent	Not consistent
7	Plume modelling	Absent (modelling mentioned for air emissions only, p. 215)	Absent
8	Mixing zone, compliance point, salinity criterion	Absent; no Moroccan criterion applies (p. 217)	Absent; same statement (p. 245)
9	Monitoring	Partial: canal conductivity, twice a month (p. 216)	Partial: conductivity and TDS at plant outlet, twice a month; final MP2 discharge twice a year (p. 243)
10	Dependence on the cooling circuit	Absent	Absent

Table 1. Ten-criterion grid applied to the two impact assessments, with page references.

The two assessments share a structure and a good part of their regulatory chapter, but they do not document the brine at the same level of proof. At Jorf Lasfar, the brine is given at about 70 g/l ([1], p. 64) and the ambient water at 35 g/l (p. 60). It is diluted in the cooling water of the complex and discharged through the main canal, with cascades (p. 60). The flows are given: 318,200 m³/h of cooling water for about 6,600 m³/h of brine, i.e. 2 % (p. 60). At Safi, the brine is at 62.54 g/l ([8], pp. 65 and 188), the ambient water ranges from 36 to 40 g/l and the value of 38 is used for the calculation (p. 188). Dilution is with the cooling water of unit MP2, through its existing outfall pipe (p. 65). Safi, however, gives no flow: the brine is simply presented as 40 % of the mixture. It is also Safi that offers the reader the most useful figure, the salinity of the mixture actually discharged, about 45 g/l, with the formula that leads to it (p. 188), and that describes the receiving environment: currents of 0.1 to 0.2 m/s offshore, 0.3 m/s near the coast, summer upwelling (p. 99). Jorf Lasfar merely states that the mixture goes “from 35 to 35.4 g/l”, without showing the calculation (p. 60), and refers to a “Complément 6: évaluation de l’impact des saumures sur le milieu marin” (p. 64) that we did not find in the published PDF. This assessment also applies the World Bank reference for temperature, with a difference limited to 3 °C, for lack of a Moroccan standard (p. 60).

On the last four criteria, the two documents converge, and this is the clearest finding of the grid. Neither models the plume: the only modelling mentioned at Jorf Lasfar concerns air emissions ([1], p. 215). Neither defines a mixing zone, a compliance point or a salinity criterion, and both note that no Moroccan criterion applies to direct discharges to sea ([1], p. 217; [8], p. 245). Monitoring is partial: at Jorf Lasfar, the conductivity of the canal is monitored twice a month ([1], p. 216); at Safi, conductivity and total dissolved solids are measured at the plant outlet twice a month, and the final MP2 discharge twice a year ([8], p. 243). Finally, neither assessment addresses the dependence of dilution on the cooling circuit.

The stated mixture salinities cannot be recovered from the figures printed alongside them (Table 2). At Jorf Lasfar, the flows on page 60 give a brine fraction of 6,600 / (6,600 + 318,200), i.e. 2.03 %. With brine at 70 g/l and seawater at 35 g/l, the mass balance leads to 35.7 g/l, whereas the document states 35.4. This last value corresponds to a fraction of 1.1 %, the bottom of the “1 to 2 %” range quoted in the same paragraph, and not to the flows that accompany it. The difference is small in absolute terms, but it bears on the only quantitative basis put forward to conclude that the cumulative impact is negligible ([1], p. 175). At Safi, the assessment states that brine represents 40 % of the mixture formed with the cooling water and the neutralised effluents, and that this mixture reaches about 45 g/l. With the values the document itself uses (brine at 62.54 g/l, dilution water at 38 g/l), a fraction of 40 % gives 47.8 g/l, and a result of 45 g/l implies a fraction of 28.5 %. Three explanations are possible: the fraction is misprinted, the result is misprinted, or the calculation rests on data that are not shown. We have no means of deciding, and we confine ourselves to noting that the reader cannot reproduce the result.

Site	Figures printed in the assessment	Stated mixture	Recomputed mixture	Fraction implied by the stated result
Jorf Lasfar	$C_b \approx 70$, $C_s = 35$; $Q_b \approx 6,600$ and $Q_c = 318,200$ m ³ /h	35.4 g/l	35.7 g/l ($f = 2.03$ %)	1.1 %
Safi	$C_b = 62.54$, $C_s = 38$; $f = 40$ %	≈ 45 g/l	47.8 g/l	28.5 %

Table 2. Stated and recomputed mixture salinities.

Two other points deserve attention. The first concerns the phrase “no direct discharge into the marine environment is planned”, which appears in both assessments ([1], p. 174; [8], p. 188) although the brine does reach the sea, through the cooling-water canal or outfall ([1], p. 175). There is no contradiction, since “direct” in these documents means a discharge without prior dilution, and at Jorf Lasfar the sentence on page 174 concerns neutralised liquid effluents. But the wording lends itself to misunderstanding, as a reader of the summary tables could understand that nothing reaches the sea. The second point is Table 36 of the Jorf Lasfar assessment ([1], pp. 174–175), on which the conclusion of negligible cumulative impact rests. It compares three years of data at the plant outlet and at the discharge point in the sea. At the outlet, the values vary as expected: dissolved solids from 35 to 70 depending on the stream, temperature from 15 to 25.5 °C, pH from 6.5 to 8.2. At the discharge point in the sea, however, minimum, mean and maximum are identical on every row: temperature “19–23”, pH 6.29, dissolved solids 0.19. A zero variance over three years has nothing of a plausible measurement series, and 0.19 corresponds to no seawater, whatever the usual unit. The table is probably incomplete or affected by a unit error. We put this as a question and not as an accusation, but it should be corrected or explained, since it underpins a conclusion.

There remains the dependence on another asset, which both assessments ignore. At both sites, the dilution that makes the discharge acceptable is provided by the cooling water of installations designed and operated for another purpose: the industrial complex at Jorf Lasfar, unit MP2 at Safi. No document considers what happens to the discharge if this flow changes, during a shutdown, a load reduction, a modernisation or a change in the energy mix. Yet the Jorf Lasfar mass balance shows the scale of what is at stake. At nominal flow, the mixture stays at 35.71 g/l, i.e. less than 0.7 g/l above the intake water. It rises to 35.94 g/l at 75 % of the flow, 36.39 at 50 %, 37.68 at 25 % and 41.01 at 10 %. The brine has not changed from one case to the next; it is the environmental conclusion that changes. In other words, the acceptability of the discharge does not depend on the desalination plant but on the availability of a circuit that is foreign to it, and no one has recorded it as a risk. Figure 1, which reproduces this balance, sets it against the salinities at which the conductivity threshold of the draft decree is reached at 25 °C and at 18.5 °C. On this point, both documents share the same gap: a sensitivity analysis is missing, which a few lines of calculation would suffice to produce, and which would show from what cooling flow the discharge ceases to be comparable to the intake water. The two assessments thus provide valuable material, but not the demonstration that their conclusions require.

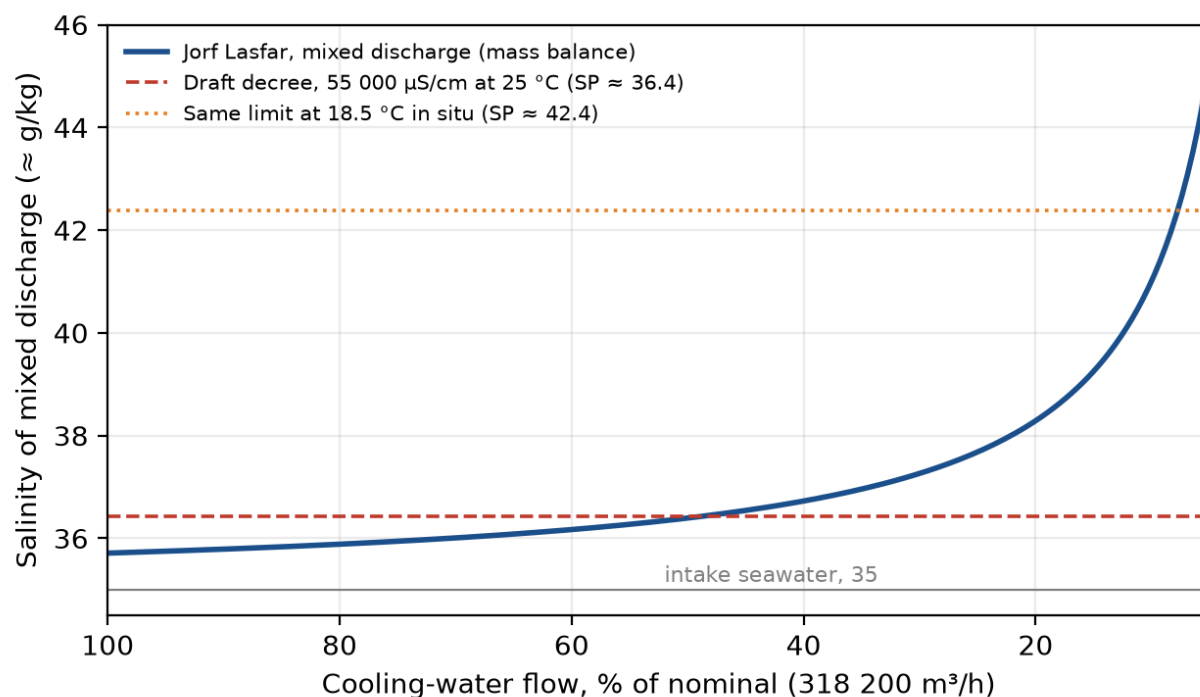


Figure 1. Salinity of the Jorf Lasfar mixed discharge as a function of cooling-water flow (mass balance on the values of [1], p. 60), compared with the practical salinity at which the draft decree's conductivity limit is reached at 25 °C and at 18.5 °C (TEOS-10).

4. What the draft decree would measure

The draft decree implements Articles 37, 39, 41, 43 and 56 of Law 81-12 [9]. Its Article 3 requires every liquid discharge to the coastline to meet the general limits of Annex 1, unless it falls under specific limits, set according to the state and sensitivity of the receiving environment after consultation of the competent research bodies. Article 4 allows Annex 1 to be amended by order. Compliance is assessed on at least four composite samples per year, taken at regular intervals at the same place (Art. 5): the discharge complies if three samples out of four meet the limits and if the fourth does not exceed them by more than 25 %, that is, stays below 125 % of the value (Art. 6). Operators keep a register, submit an annual report before the end of March and keep their data for five years (Arts. 28–29). Existing discharges have three years to come into compliance (Art. 30). Annex 1 contains 38 parameters. The press described them as 38 “pollutants” expressed in mg/l [15], but it also includes temperature, pH, turbidity and electrical conductivity. One notices a detail revealing hasty data entry: pH is shown with the unit “mg/l”.

The text is undeniably a step forward. It gives operational content to Article 37, with a compliance rule, a transition period and, among the parameters, conductivity, the only salinity indicator of the whole set. It is precisely this parameter that raises a problem. Annex 1 sets a general limit of 55,000 $\mu\text{S}/\text{cm}$, applicable to the effluent itself and not to the environment that receives it, without stating a reference temperature. Common practice in effluent analysis is to report conductivity at 25 °C. At that temperature, TEOS-10 places 55,000 $\mu\text{S}/\text{cm}$ at a practical salinity of 36.4, that is, that of ordinary Atlantic water. At the temperatures recorded in the assessments, the equivalent salinity is higher: 46.3 at 15 °C, 42.4 at 18.5 °C and 37.7 at 23.5 °C (Table 3).

Water	Salinity ($\approx$ SP)	at 15 °C	at 18.5 °C	at 23.5 °C	at 25 °C
Seawater, Jorf Lasfar intake	35	42,918	46,401	51,510	53,071
Seawater, Safi mean	38	46,184	49,925	55,411	57,087
Jorf Lasfar mixture, stated	35.4	43,356	46,873	52,033	53,610
Safi mixture, stated	45	53,647	57,972	64,315	66,252
Safi brine	62.54	71,452	77,159	85,527	88,083
Salinity at which 55,000 μ S/cm is reached		46.3	42.4	37.7	36.4

Table 3. Electrical conductivity (μ S/cm, TEOS-10, atmospheric pressure) of the waters described in the assessments, compared with the draft decree's general limit of 55,000 μ S/cm.

The calculation applied to the waters described by the two assessments illustrates the mismatch. At 25 °C, the seawater at the Jorf Lasfar intake (salinity 35) has a conductivity of 53,071 μ S/cm, and the mean seawater at Safi (salinity 38) 57,087 μ S/cm. The stated mixture at Jorf Lasfar (35.4) reaches 53,610 μ S/cm, that of Safi (45) 66,252 μ S/cm, and the Safi brine (62.54) 88,083 μ S/cm. Read at 25 °C, the limit would therefore be exceeded by the Safi mixture as stated, by about 20 %, and even by Safi seawater, while the Jorf Lasfar mixture would remain just below. At 15 °C, on the other hand, the same Safi seawater (46,184 μ S/cm) would fall below the threshold, which shows that the absence of a reference temperature is not a detail. In every case, the limit does not make it possible to distinguish a brine discharge from the water it comes from: it is set at the level of the sea. It is moreover defined at the outlet of the structure, with no mixing zone and no distance, whereas it is these two elements that give the Californian criterion, measured in the environment 100 m from the discharge, its full meaning [5].

The limits on major ions go further still. Annex 1 sets general maxima of 34.2 mg/l for magnesium, 38 mg/l for calcium and 250 mg/l for sulfate. Reference seawater, at salinity 35 and converted at 25 °C, contains about 1,314 mg/l of magnesium, 422 of calcium and 2,776 of sulfate [14]: it therefore exceeds these limits by factors of 38, 11 and 11 (Table 4). The reasoning holds for any seawater, including plain cooling water returned with no change other than its temperature. As the text stands, no seawater-based effluent, brine or not, can meet the general limits, whatever its treatment. The only route left open is that of Article 3, that is, specific limits set site by site, for which no criterion of determination is yet known.

Parameter	General limit, Annex 1 [9]	Reference seawater, SP = 35, mg/l at 25 °C [14]	Ratio
Magnesium	34.2 mg/l	1,314	38
Calcium	38 mg/l	422	11
Sulfate	250 mg/l	2,776	11
Electrical conductivity	55,000 μ S/cm	53,071 μ S/cm at 25 °C	$\approx$ 1

Table 4. Selected general limits of the draft decree compared with reference seawater.

The two impact assessments give a clue to the possible origin of such a mismatch. Both reproduce the same comparison table, entitled “general limit values for wastewater discharges to sea”, in which the most stringent conductivity is 2,700 μ S/cm ([1], pp. 212 and 217; [8], p. 245). Yet this value is the

one that Joint Order 2942-13 of 7 October 2013 set for discharges into surface and ground waters [16] ([8], pp. 24–25). Seawater exceeds it about twentyfold. A limit designed for a freshwater receiving environment, applied to a seawater effluent, is either inapplicable or impossible to meet. We do not claim that the ion limits of the draft decree have the same origin; we only note that, as printed, they refer the entire regulation of desalination and cooling discharges to the specific limits of Article 3.

This reading calls for methodological caution. The decree was read from a scanned Arabic text, and the values of Annex 1 were re-read on the image of the page, then checked twice. The table of responses to public comments, published by the SGG in January 2026 [12], contains no comment on conductivity or desalination according to the optical reading. A manual reading could nonetheless reveal points that character recognition missed. Finally, the text may change before its adoption: what we describe is a draft, not law in force, and that is precisely why these observations can still be of use. The fact remains that the gap between the stated intention and the current wording is measurable, and that it can be corrected without technical difficulty: a limit expressed as an excess over natural salinity, an explicit reference temperature and a measurement point would suffice to make the annex usable for seawater discharges. A text that de facto excludes every seawater discharge from its general limits, without saying so, exposes operators, who do not know under which rules they will be judged, as much as local residents, who do not know what will be checked and where.

5. Discussion

These results first call for a fundamental observation: the two impact assessments are more transparent than many others. They are public, detailed and quantified, and this is precisely what makes it possible to redo their calculations. They also show that the same operator, a month apart, described two neighbouring sites with different levels of proof: Safi gives the formula and the salinity of the mixture, Jorf Lasfar gives the flows but not the calculation. We do not see this as a fault of the operator. It is the sign that no common rule imposes a level of proof for brine discharges. The two mass-balance inconsistencies are modest in value, but they bear on the only figures meant to support the conclusion of a negligible impact. And in both cases the same piece is missing: a plume model that predicts the salinity excess at a defined distance from the discharge. Without it, one can neither judge the acceptability of the discharge, nor set a threshold that makes sense, nor know where to measure.

The draft decree, for its part, does not fill this gap. It is real progress, but for seawater effluents its general limits would not work as limits: the conductivity limit is at the level of the sea, the ion limits are below it. Everything will therefore be decided by the specific limits of Article 3, set site by site, without any criterion yet published to establish them. For a programme that will add several hundred million cubic metres of brine per year to the Moroccan coasts, this is where the decision that matters is taken.

Four measures follow from these findings, and none of them is costly. The first is a salinity criterion in the receiving environment, expressed as an excess over the natural level at a given distance from the outfall, on the Californian model but adapted to Atlantic and Mediterranean conditions, upwelling included. The value of this criterion can be debated; its absence cannot be defended for installations designed to operate for decades. The second is the publication, in each impact assessment,

of the complete mass balance of the discharge: brine and dilution flows, salinities, detailed calculation and resulting concentration at the outlet, so that any reader can reproduce it. Safi already does most of this. The third is a plume model accompanied by a monitoring point in the receiving environment, and not only at the plant outlet or in the canal. Both assessments monitor conductivity, which is the right instrument, but at the structure rather than at sea, and against no threshold. The fourth is to treat dilution by a third party's cooling circuit as a dependence between assets. When the acceptability of a discharge rests on the flow of another installation, this dependence must appear in the risk register of both assets, with failure scenarios and planned responses. This is common practice in asset management, where ISO 55001 requires the risks related to assets to be determined and addressed. It is currently absent from both documents, whereas the Jorf Lasfar balance shows that a drop in cooling flow to 25 % of its nominal value is enough to bring the mixture from 35.7 to 37.7 g/l, and to 41.0 g/l when it falls to 10 %.

6. Limitations

The limitations of this work must be stated clearly. It rests only on published documents and uses no measurement: it therefore cannot establish the actual salinity of either discharge, only the internal consistency of what the assessments state. Salinities expressed in g/l were treated as practical salinity, which introduces an error of a few per cent that does not change the conclusions. The draft decree was read from a scanned Arabic text; Annex 1 was re-read on the image of the page and its values checked twice, but the SGG's response table was read only by optical recognition. The text itself may still change before its adoption. Finally, the absence of a plume model in the assessments does not mean that such a model does not exist: the "Complément 6" cited at Jorf Lasfar was not found in the published version, and its content is unknown to us. None of this constitutes an accusation of non-compliance, since the assessments were written without a national criterion and the decree is not in force.

7. Conclusion

In conclusion, the two impact assessments published for neighbouring plants on the Moroccan coast state the salinity of the brine and of the ambient water, a dilution mechanism and a salinity of the discharged mixture. But neither mixture salinity can be recovered with the values printed next to it, neither assessment models the plume or specifies where compliance would be judged, and neither examines what becomes of the dilution if a third party's cooling circuit changes regime. The draft decree that would implement the coastline law measures salinity only at the outlet, at a level close to that of seawater, and it sets limits for magnesium, calcium and sulfate that seawater exceeds by an order of magnitude or more. In its current form, it therefore leaves the entire regulation of desalination discharges to specific limits yet to be defined. Setting them with a salinity criterion in the receiving environment, a measurement point and a distance would give the national desalination programme what it lacks today: a common and verifiable benchmark, identical for all plants.

Declarations

The data come from public documents cited with their pages, the calculation script is provided as supplementary material, and no funding or competing interest is to be declared for the analysis itself. The text is published under a CC BY

4.0 licence, AI having been used for the optical reading of the decree, the checking of references, the TEOS-10 calculations and the translation, under the author's responsibility.

References

1. OCP Group (2023). *Rapport d'étude d'impact sur l'environnement, projet de la station modulaire de dessalement des eaux de mer à Jorf Lasfar*, final version, July 2023, 272 pp.
2. Jones, E., Qadir, M., van Vliet, M. T. H., Smakhtin, V., Kang, S. (2019). The state of desalination and brine production: A global outlook. *Science of the Total Environment*, 657, 1343–1356. <https://doi.org/10.1016/j.scitotenv.2018.12.076>
3. Roberts, D. A., Johnston, E. L., Knott, N. A. (2010). Impacts of desalination plant discharges on the marine environment: A critical review of published studies. *Water Research*, 44(18), 5117–5128. <https://doi.org/10.1016/j.watres.2010.04.036>
4. Missimer, T. M., Maliva, R. G. (2018). Environmental issues in seawater reverse osmosis desalination: Intakes and outfalls. *Desalination*, 434, 198–215. <https://doi.org/10.1016/j.desal.2017.07.012>
5. State Water Resources Control Board (2019). *Water Quality Control Plan for Ocean Waters of California (California Ocean Plan)*, chapter III.M.3. Sacramento, CA.
6. Petersen, K. L., Heck, N., Reguero, B. G., Potts, D., Hovagimian, A., Paytan, A. (2019). Biological and physical effects of brine discharge from the Carlsbad desalination plant and implications for future desalination plant constructions. *Water*, 11(2), 208. <https://doi.org/10.3390/w11020208>
7. Maroc Diplomatie (5 May 2026). Dessalement : une capacité de production annuelle de 420 millions m³; La Vie Éco (28 July 2026). ONEE : plus de 248 MMDH d'investissements entre 2026 et 2030; LesEco.ma (3 August 2026). ONEE : un plan d'investissement de 248 MMDH pour les cinq prochaines années.
8. OCP Group (2023). *Rapport EIE du projet des stations de dessalement modulaires de Safi*, final version, July 2023, 331 pp.
9. Kingdom of Morocco, Ministry of Energy Transition and Sustainable Development (2025). Draft decree n° 2-25-860 (in Arabic), 11 November 2025, published for consultation by the Secretariat General of the Government. https://www.sgg.gov.ma/portals/0/AvantProjet/275/Avp_Art_%202.25.860_Ar.PDF
10. le360.ma (27 February 2026). Littoral : de nouveaux décrets musclent la stratégie nationale (press review from Al Akhbar).
11. European Bank for Reconstruction and Development (2024). Résumé non technique de l'EIES, projet de dessalement de Jorf Lasfar (project 54662), July 2024.
12. Secretariat General of the Government (2026). Response matrix to public comments on draft decree n° 2-25-860 (in Arabic), 22 January 2026. https://www.sgg.gov.ma/portals/0/AvantProjet/275/Matrice-reponse_225860.pdf
13. IOC, SCOR, IAPSO (2010). *The international thermodynamic equation of seawater – 2010: Calculation and use of thermodynamic properties*. Manuals and Guides No. 56, UNESCO; McDougall, T. J., Barker, P. M. (2011). *Getting started with TEOS-10 and the Gibbs Seawater (GSW) Oceanographic Toolbox*. SCOR/IAPSO WG127.
14. Millero, F. J., Feistel, R., Wright, D. G., McDougall, T. J. (2008). The composition of Standard Seawater and the definition of the Reference-Composition Salinity Scale. *Deep-Sea Research I*, 55(1), 50–72. <https://doi.org/10.1016/j.dsr.2007.10.001>
15. LesEco.ma (19 November 2025). Rejets côtiers : le projet de décret n° 2-25-860 active le principe du pollueur-payeur.
16. Kingdom of Morocco (2013). Joint Order n° 2942-13 of 7 October 2013 setting general limit values for discharges into surface or ground waters.