

## SHORT PAPER

# Derogation from drinking water quality standards in Italy according to the European Directive 98/83/EC and the Legislative Decree 31/2001 - a look at the recent past

A. Azara<sup>1</sup>, P. Castiglia<sup>1</sup>, A. Piana<sup>1</sup>, M.D. Masia<sup>1</sup>, A. Palmieri<sup>1</sup>, B. Arru<sup>1</sup>, G. Maida<sup>1</sup>, M. Dettori<sup>1</sup>

*Key words: Derogation, Drinking water, Water quality*

*Parole chiave: Deroghe, Acqua potabile, Qualità dell'acqua*

### Abstract

**Background.** Until 2012, the European Directive 98/83/EC and the Italian Legislative Decree 31/2001 allowed derogation from the drinking water quality standards in Italy with a number of requests higher than any other European country.

The present work aims to assess the extent of the derogation granted in Italy, in particular by noting those issued from 2001 to 2012, in order to obtain a retrospective quality indicator, useful for evaluating the risk arising from population exposure.

**Methods.** The most significant factors leading to derogation were analyzed. We first carried out an in-depth analysis of the European, national and regional legislation and subsequently distributed the obtained data according to: parameters regarding derogation; length of the derogation; area involved; and maximum parameter value granted by the derogation acts.

**Results.** We found approximately 100 derogation acts, granted in 14 Regions and concerning 19, mostly chemical, parameters. The most frequently granted derogation, in 12 Regions, was due to the presence of arsenic. Furthermore, given its 10-year presence in Campania and Lazio, fluoride was the most widespread parameter in the Italian territory. The year 2006 had the largest number of derogations issued with 22 acts found: this decreased to one during the third three-year derogation granted in 2012.

**Conclusions.** Data collected showed how often Italy applied for drinking water quality derogation in recent years, going so far as to request a third three-year derogation. While this phenomenon has highlighted a practice largely ignored by the public, derogation acts have often involved the same parameters, underlining how difficult it can be to comply with the standards in a timely manner.

---

<sup>1</sup> Department of Clinical and Experimental Medicine, University of Sassari, Sassari, Italy

## Introduction

Water is an essential resource for the life and development of the entire planet. As such, it must be considered an asset to protect and guarantee, and not only to exploit. Thus, on the one hand, we must take action to avoid a long-term deterioration of the resource; on the other, we must optimize its quantitative aspects and improve its quality, in order to ensure a fair and sustainable worldwide water management (1).

In 1998, European Member Countries adopted the Directive 98/83/EC (2), which introduced some substantial innovations in protecting human health from water contamination. In particular, the main elements of this regulatory framework focused on: i) adopting a risk prevention system based on standardized procedures; ii) executing analytical controls also at user taps; iii) allowing derogation from water quality standards due to chemical parameters; iv) informing consumers in a timely manner about water quality with appropriate communication strategies.

Moreover, Section 11 of the Directive states that the European Commission (EC) should review the standard values set out in the Annexes, in line with scientific and technical progress and at least every five years, proposing changes within the same Directive.

The European Directive established limit values for several parameters according to the World Health Organization (WHO) guidelines. In particular, WHO Drinking Water Quality Guidelines clarified which values did not necessarily represent a health risk for consumers (3, 4). Therefore, we know that the effects on health caused by values exceeding standards depends on a number of variables, such as the substance characteristics, the margin of safety of the parameter values and the specific exposition contexts, taking into account any vulnerable population groups.

In Italy, Legislative Decrees 31/2001 (5) and 27/2002 (6) implemented the European Directive 98/83/EC and at present represent the reference laws for drinking water.

The above-mentioned Decrees established that the presence of substances, which could make drinking water unfit, must prompt Regional Health Trusts to identify and propose interventions to protect public health. However, both Europe (Section 9 of Directive 98/83/EC) and Italy (Section 13 of the Legislative Decree 31/2001) have instituted the possibility to request derogation, allowing for the safe management of a systematic exceeding of parameter values, mostly related to geological elements found in water. Indeed, the granting of derogation depended on the execution of structural works with great economic commitment, necessary to restore water quality in adequate implementation times.

Furthermore, the European Directive 98/83/EC established (Section 9, subsection 1 and 2) that all the Member States may grant at most two derogations; each one must comply with conditions proposed by the EC and be as short as possible, but in any case no longer than three years.

In exceptional cases, Member States could ask for a third derogation. Were it to be issued, the request would have to be carefully evaluated and the derogation could be refused or granted within three months and for three years at most. The Directive did not provide for more than three derogations.

In Italy, a Decree by the Ministry of Health and the Ministry of the Environment and Protection of Land and Sea granted the derogation requests. However, this act has always referred to the Maximum Permissible Value (MPV), established for each specific parameter, following a rigorous assessment carried out by the National Health Council and the National Institute of Health, based on the latest risk knowledge regarding human water consumption. Finally, Regional

Authorities must entrust the national act transposition and define the derogation implementation regulations.

Generally, subsequent three-year derogations (2003-2006, 2007-2009) were useful to restore the parameter values compliant with the Directive in Europe. Despite this, on the one hand, since 2010 the EC has issued a third derogation in France, Germany, the Czech Republic, Hungary and Italy (7), mainly related to nitrate, nitrite, chlorite, fluoride, boron, arsenic and nickel; on the other, the EC has rejected the request advanced by Estonia.

In particular, values of arsenic and chlorite were often not compliant with the MPV standards, because of the continued updating of the European Directive with significantly more restrictive parameter values, based on new scientific risk evidence and the consequent adoption of a precautionary approach. As a result, the “derogation arrangement” has been largely used in Italy, with a number of requests higher than any other European Country. There could be many reasons for this phenomenon: i) the more restrictive parameter values; ii) the geological contaminants found in many aquifers; iii) the fragmentation of the aqueduct systems; iv) the absence of alternative water supplies.

All of these reasons led to a peculiar event, occurring at the end of 2009. In that year the second three-year derogation granted to Italy expired. Despite this, there was a systemic non-compliance relating to some chemical parameters determined by geological origin. For this reason Italy requested a further three-year derogation (2010-2012) from the EC, applying what is provided for by the Legislative Decree 31/2001 (Section 13, Subsection 6). The derogation requests concerned three parameters (arsenic, fluoride and boron) in five Regions (Lombardy, Tuscany, Lazio, Campania and Umbria); and two parameters (arsenic and fluoride) in Trentino Alto Adige (8).

This further derogation request was granted by the EC, firstly, because of the exceptional conditions encountered in the affected territories and secondly, following a risk assessment evaluation performed by the European Scientific Committee on Health and Environmental Risks. In particular, this assessment took into consideration sensitive population groups (9).

The situation described has affected more than one million consumers, highlighting the need to consolidate the quality of the information provided to the public (10, 11). Indeed, in July 2014 the EC sent a formal note regarding an infringement procedure against Italy, for failing to ensure compliance of its drinking water with European standards (in particular for arsenic and fluoride, especially in Lazio) (12).

Therefore, based on these premises, and in particular:

- the real, current difficulty of having a national drinking water quality database;
- the public's low (or even absent) perception of the derogation granted;
- the potential health risks caused by some parameters derogated, especially in relation to the derogation length and the number of inhabitants affected;
- the ongoing difficulties in solving the above-mentioned problems;

the present work aims to assess the extent of the derogation granted in Italy, in particular by noting those issued from 2001 to 2012 (1), in order to obtain a retrospective quality indicator, useful for evaluating the risk arising from population exposure.

## Methods

Firstly, we carried out an in-depth analysis of the European, national and regional reference legislation (2, 5, 6, 19, 22, 24). In particular, in order to pursue our aims and obtain reliable data, we exclusively examined official sources. Thus, we carried

out an extensive and punctual bibliographic research by consulting national (Ministry of Health) decrees issued, published in *Gazzetta Ufficiale*, which concerned the derogations granted between 2001 and 2012. Secondly, we distributed data obtained, according to: parameters which lead to a derogation request; length of the derogation; area concerned; maximum value granted, related to the Parameter Value (PV) defined by law. Finally, data obtained was added to a database and elaborated.

## Results

Between the years 2001 and 2012, we found 99 derogation acts, involving 14 Italian Regions (Campania, Emilia Romagna, Lazio, Lombardy, Marche, Piedmont, Bolzano, Trento, Apulia, Sardinia, Sicily, Tuscany, Umbria and Veneto) (Table 1).

In particular, we noticed that only Emilia Romagna, Bolzano and Umbria did not indicate a specific spatial location and the derogation referred to an entirely

Table 1 - Region, derogation acts and parameters in the years 2001-2012

Region	Derogation Acts (N.)	Parameters in derogation	
		N.	Parameter
Piedmont	8	4	Arsenic, Manganese, Nickel, Sulphate
Valle d' Aosta	0	0	-
Lombardy	9	13	Ammonia, Arsenic, Boron, Chlorite, Iron, Fluoride, Magnesium, Manganese, Nickel, Selenium, Sulphate, Trihalometanes, Vanadium
Bolzano	5	8	Arsenic, Boron, Chlorite, Fluoride, Nickel, Selenium, Trihalometanes, Vanadium
Trento	7	8	Arsenic, Boron, Chlorite, Fluoride, Nickel, Selenium, Trihalometanes, Vanadium
Veneto	3	7	Ammonia, Arsenic, Iron, Manganese, Sulphate, Tetrachloroethylene, Trichloroethylene
Friuli Venezia Giulia	0	0	-
Liguria		0	-
Emilia Romagna	3	8	Arsenic, Boron, Chlorite, Fluoride, Nickel, Selenium, Trihalometanes, Vanadium
Tuscany	11	10	Arsenic, Boron, Chlorite, Fluoride, Magnesium, Nickel, Selenium, Solphate, Trihalometanes, Vanadium
Umbria	2	1	Arsenic
Marche	3	1	Chlorite
Lazio	16	7	Arsenic, Fluoride, Manganese, pH, Selenium, Trihalometanes, Vanadium
Abruzzo		0	-
Molise		0	-
Campania	10	7	Arsenic, Boron, Chlorite, Fluoride, Nickel, Selenium, Vanadium
Apulia	8	9	Arsenic, Boron, Chlorite, Fluoride, Nickel, Selenium, Bromodichloromethane, Trihalometanes, Vanadium
Basilicata	0	0	-
Calabria	0	0	-
Sicily	9	11	Arsenic, Boron, Chlorite, Chloride, Fluoride, Magnesium, Nickel, Selenium, Sodium, Trihalometanes, Vanadium
Sardinia	5	3	Chlorite, Trihalometanes, Vanadium
Italy	99	-	-

regional context. However, specific local requirements have often been indicated, even on a municipal scale, due to particular geological environmental conditions. This phenomenon arose, for example, regarding fluoride in various municipalities in the “Vesuvius area” and in Rome District. Moreover, arsenic frequently appeared in many municipalities of Lazio, Lombardy, Tuscany and Trento.

The parameters involved in derogation requests totalled 19 (Table 1), mainly chemical (included in *Annex I*, Part B of Legislative Decree 31/2001: arsenic, boron, chlorite, fluoride, magnesium, nickel, selenium, bromodichloromethane, tetrachloroethylene, trichloroethylene, trihalomethanes, vanadium) and, to a lesser extent, “indicators” (*Annex I*, Part C: ammonia, chloride, pH, iron, manganese, sulphate, sodium).

In order to assess the length of derogation granted and to highlight more easily how widespread this phenomenon sometimes was, we counted the years during which the above-mentioned parameters derogated in the Italian Regions. Thus, we found that fluoride was in derogation for over 10 years in Campania and Lazio, even exceeding deadlines foreseen by the law. On the contrary, arsenic was within the legislative time limits with 9 years of derogation in Tuscany; 8 years in Lombardy and Trento; 7 years in Lazio and 6 years in Bolzano. Vanadium also derogated for a long time: 8 years in Sicily and 6 years in Lazio. Finally, it the length of derogation for halogenated compounds (trihalomethanes) was significant: 7 years in Apulia and Tuscany, 4 years in Lazio. There were also numerous parameter exemptions for shorter periods.

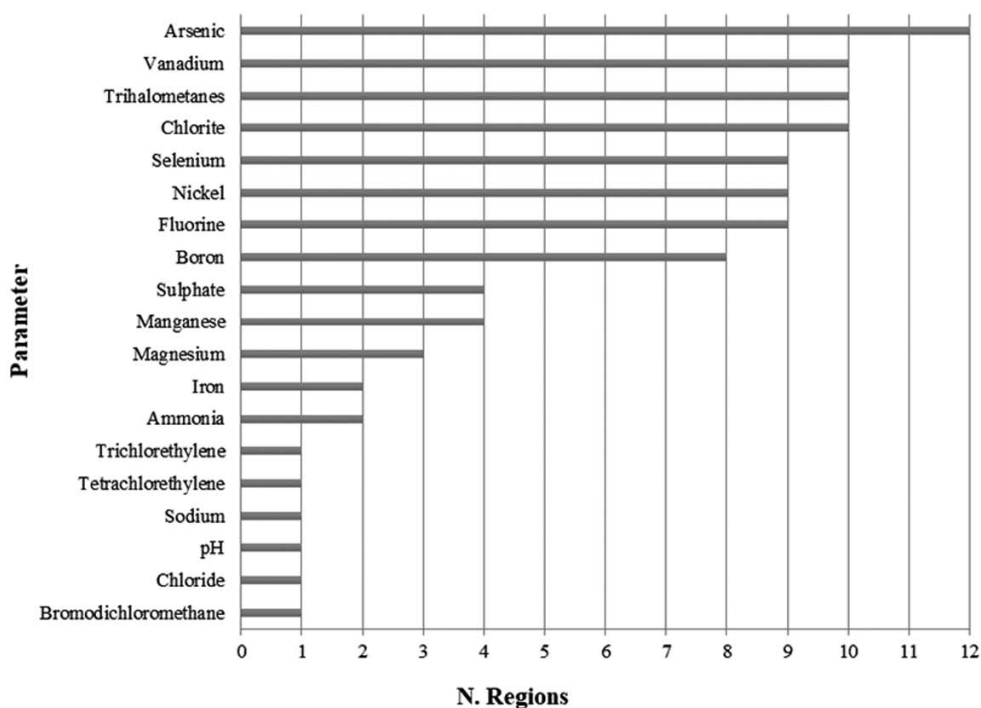


Figure 1 - Parameters in derogation and number of Italian Regions involved between 2001 and 2012

Table 2 - Parameter Value (VP) set by the main national and international regulations and Maximum Permissible Value (MPV) of the substances admitted in derogation

Parameter	VP <i>WHO</i> <i>Guidelines,</i> 2006	VP <i>WHO</i> <i>Guidelines,</i> 2011	VP European Directive 98/83	VP Legislative Decree 31/2001 and updates	MPV Derogation
pH	-	-	≥6.5 ≤9.5	≥6.5 ≤9.5	<b>5.8</b>
Ammonia (mg/l)	-	-	0.5	0.5	<b>10</b>
Arsenic (µg/l)	10	10	10	10	<b>50</b>
Boron (mg/l)	0.5	2.4	1	1	<b>3</b>
Iron (µg/l)	-	-	200	200	<b>1000</b>
Magnesium (mg/l)	-	-	-	50	<b>200</b>
Manganese (µg/l)	400	-	50	50	<b>1400</b>
Nickel (µg/l)	70	70	20	20	<b>50</b>
Selenium (µg/l)	10	40	10	10	<b>20</b>
Sodium (mg/l)	-	-	200	200	<b>324</b>
Vanadium (µg/l)	-	-	-	50	<b>160</b>
Chloride (mg/l)	-	-	250	250	<b>664</b>
Chlorite (µg/l)	700	700	-	700	<b>1300</b>
Fluoride (mg/l)	1.5	1.5	1.5	1.5	<b>3</b>
Sulphate (mg/l)	-	-	250	250	<b>600</b>
Trihalometanes (µg/l)	-	-	10	30	<b>80</b>
Trichloroethylene (µg/l) Te-	-	20	-	10	<b>20</b>
trachloroethylene (µg/l)	-	40	-	-	-

On the other hand, looking at a Regional context (Figure 1), we observed that the most frequently granted derogation was due to arsenic (in 12 Regions), followed by: chlorite, trihalometanes and vanadium in 10 Regions. Furthermore, we found derogations due to non-compliant values of: fluoride, selenium and nickel in 9 Regions; boron in 8 Regions; manganese and sulphate in 4 Regions; magnesium in 3 Regions; ammonia and iron in 2 Regions; a set of parameters, consisting of bromidic chloride, chloride, pH, sodium, tetrachloroethylene and trichloroethylene, in 1 Region.

Moreover, the aforementioned parameters had concentration values, which not only exceeded the European Directive standards (2), but also the most recent WHO guidelines (Table 2). In particular, chloride ranged from 250 to 664 mg/l, whereas: magnesium, from 50 to 200 mg/l; sodium, from 200 to of 324

mg/l; manganese, from 50 to 1400 µg/l; pH, from 6.5 to 5.8; selenium, from 10 to 20 µg/l; ammonia, from 0.50 to 10 mg/l; iron, from 200 to 1000 µg/l; nickel, from 20 to 50 µg/l; sulphate, from 250 to 600 mg/l; fluoride, mostly from 1.5 to 3 mg/l, although in Lazio (in the municipalities of Anguillara and Cerveteri) the MPV was 4 mg/l; boron, from 1 to 3 mg/l, reaching as high as 3.8 mg/l in Piombino (a municipality in Tuscany); vanadium, 50 to 160 µg/l; arsenic, 10 to 50 µg/l; trichloroethylene and tetrachloroethylene, from 10 to 20 µg/l.

We also noted that the disinfectant by-product values observed were, for trihalometanes, from 30 to 80 µg/l, whereas for chloride it ranged from 700 to 1300 µg/l, except for Apulia where it reached 1800 µg/l.

Lastly, we studied the trend of derogations issued during the years 2001 - 2012 (Figure

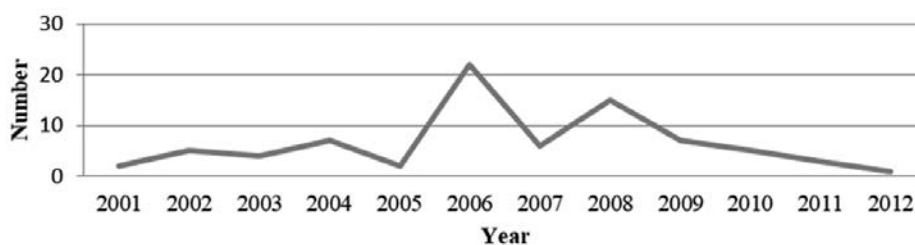


Figure 2 - Trend of the derogation acts issued between 2001 and 2012

2). As shown, the highest number of acts was in 2006 with 22 derogations granted. Subsequently, this decreased to 6 acts in 2007 and, gradually, to 3 in 2011. The lowest number of derogations granted was found in 2012 with only one act observed.

## Discussion and conclusions

Our study allowed us to indicate how often Italy applied for drinking water quality derogation in recent years, highlighting a practice usually ignored by the public (13, 14).

In particular, on the one hand, the data we collected are a significant indicator to describe the drinking water quality delivered in Italy from the early 2000s; on the other, they emphasize how many difficulties the Water Management Authorities have faced in making the supply of drinking water comply with the standards. Undoubtedly, the reasons behind this difficulty include, among others, natural peculiarities in the soils of water flow, as well as the excessive concentrations of secondary compounds (by-products) arising from treatment processes (14-17).

Furthermore, these (often-natural) factors have certainly influenced the difficulty faced by some Regions in solving qualitative problems within the derogation timeframe.

Additionally, the adoption of Legislative Decree 31/2001 (5) led to a larger number

of derogation requests, due to its more restrictive standards than the previous DPR 236/88 (i.e. arsenic, vanadium, boron, nickel) (18, 19).

Chlorite, instead, merits a separate discussion. Indeed, through a regulatory pressure implemented by adopting a precautionary principle, we wanted to limit these compounds, firstly by optimizing the use of chlorine dioxide, secondly by stimulating scientific and technological innovation (20, 21).

The removal of some natural chemicals from the water represents a real, unsolved problem, already documented in European Reports (2011-2013), which showed that in Italy the substance which mainly exceeded set limits was arsenic, with 7.38% in 2011 and 4.29% in 2013 (22).

In particular, arsenic was the most frequently derogated parameter during the observed timeframe, showing a large percentage variance between VP and MAV; moreover, both the duration of derogations and the high natural level in some regional soils (besides the complexity of removal methods), contributed to an increase in the risk perception of the population.

Moreover, if the limited validity of derogation were to cause no negative effects on consumers, at the same time, the situation may represent just the tip of the iceberg, concealing a much wider exceeding of the parameter values and, consequently, a potential risk to the public. Indeed, from

2010 to 2015, in Sardinia more than 700 municipal ordinances of drinking water supply limitation were reported, involving over 50% of the municipalities and about 80% of the island's population. Among the most frequent parameters of these ordinances, we observed trihalometanes and chlorite, which previously led to derogation. Therefore, this proves that granting a derogation was not always a solution to the problem (23).

Indeed, despite a great improvement in the purification treatment systems in recent years (transition from hypochlorite to chlorine dioxide; combined use of chlorine dioxide and chloramines) (20), the poor quality of the superficial waters represents the main reason for the presence of DBPs. Furthermore, chlorites and trihalomethanes are known to be produced by water disinfection and even if studied and understood, they have become endemic and difficult to eradicate from the Sardinian water supply network. Overall, chlorite and trihalomethanes, present in almost 25% of the warnings, represent together the main cause of limitation (23).

Despite this, if we analyse the trend of derogations granted, we can see that the situation has improved considerably. Most of the derogations were issued in the years between 2004 and 2008, a symptom of an objective difficulty in observing more restrictive standards defined by the "new" Legislative Decree (31/2001). On the contrary, the lowest number of derogations granted overlapped with its expiry period (2012).

Moreover, we wish to underline that in the same spatial area the MPVs decreased compared with the previous derogation (eg fluoride from 3 to 2.5 mg/l in Campania; trihalometanes from 80 to 60 µg/l in Lazio and 50 in Tuscany; arsenic from 50 to 20 µg/l in Lazio, Lombardy, Trento and Tuscany).

Therefore, if it is true that an abuse of derogation requests could have been likely to trigger carelessness regarding water quality, it is also true that applying for derogation

(especially in the absence of alternative supplies) has been an efficient strategy, which has represented the best compromise between health risks and benefits, rather than water supply interruption and/or limitation.

Thus, with the aim of providing consumers with the best quality drinking water, we need a pivotal commitment by:

- the Water Managing Authorities, who must implement the search for the most technologically advanced methods to provide a product with qualitative standards compliant with regulations;

- the Surveillance Authorities, who must check drinking water quality and estimate risks due to exposition to non-compliant values;

- public opinion, which must, firstly, contribute to the preservation of such an important resource and, secondly, accept without any alarm the health authorities' advice.

In conclusion, a new and far-reaching preventive approach, which prefers a proactive risk management (based on the WHO Water Safety Plans model), represents one of the main objectives of the recent European Directive 1787/2015, contributing to achieve the above-mentioned quality goals (24).

## Riassunto

*Utilizzo dell'istituto della deroga alla qualità dell'acqua potabile in Italia secondo la Direttiva Europea 98/83/CE e D.Lgs 31/2001. Uno sguardo al recente passato.*

**Premessa.** Le normative europea e italiana hanno previsto la possibilità di utilizzare lo strumento della deroga, ampiamente impiegato in Italia con un numero di richieste superiore ad ogni altro paese europeo.

**Obiettivi.** Al fine di utilizzarlo retrospettivamente quale indicatore di qualità, il presente lavoro si prefigge di valutare l'entità della concessione delle deroghe alle caratteristiche di qualità delle acque destinate al consumo umano emesse in Italia dal 2001 al 2012.



**Metodi.** Attraverso una puntuale raccolta ed analisi della normativa europea, nazionale e regionale sono stati analizzati i determinanti più significativi: parametro in deroga, durata temporale, ambito territoriale interessato, Valore Massimo Ammissibile concesso in relazione al Valore di Parametro.

**Risultati.** Sono stati rilevati circa 100 provvedimenti di deroga articolati in 14 regioni riguardanti 19 parametri, prevalentemente chimici rispetto a quelli "indicatori". Il parametro più frequentemente concesso in deroga (in 12 regioni) è l'Arsenico. Il Fluoro, per 10 anni in Campania e Lazio è il parametro e l'ambito territoriale maggiormente coinvolto. Il 2006, con ben 22 atti, è l'anno in cui sono stati emessi il maggior numero di decreti per poi calare progressivamente ad 1 nel 2012.

**Conclusioni.** I dati raccolti hanno permesso di mettere in luce quanto sovente l'istituto di deroga sia stato utilizzato negli scorsi anni in Italia, evidenziando, da un lato, una pratica generalmente ignorata dalla popolazione; dall'altro, le difficoltà nel conseguire gli obiettivi di ripristino della qualità in tempi congrui e secondo gli standard normativi.

## References

1. Azara A, Moscato U. Rapporto Osservasalute Ambiente 2008. Milano: Prex, 2009.
2. Direttiva 98/83/CE: concernente la qualità delle acque destinate al consumo umano. G.U.U.E n. L 239 del 5 dicembre 1999.
3. World Health Organization (WHO). Guidelines for drinking-water quality [electronic resource]: incorporating first addendum. Vol. 1, Recommendations. 3<sup>rd</sup> ed. Geneva: WHO, 2006.
4. World Health Organization (WHO). Guidelines for drinking-water quality. 4<sup>th</sup> ed. Geneva: WHO, 2011.
5. Decreto Legislativo 2 Febbraio 2001, n. 31. Attuazione della direttiva 98/83/CE relativa alla qualità delle acque destinate al consumo umano. G.U. n. 52 del 3 marzo 2001.
6. Decreto Legislativo 2 Febbraio 2002, n. 27 Modifiche e integrazioni al Decreto legislativo 2 febbraio 2001, recante attuazione della direttiva 98/83/CE relativa alla qualità delle acque destinate al consumo umano. G.U. n. 58 del 9 marzo 2002.
7. Commissione Europea, Decisione della Commissione C (2010) 7605, del 28.10.2010 sulla deroga richiesta dall'Italia ai sensi della direttiva 98/83/CE del Consiglio concernente la qualità delle acque destinate al consumo umano. Bruxelles, 28.10.2010.
8. Commissione Europea. Decisione sulla deroga richiesta dall'Italia ai sensi della direttiva 98/83/CE del Consiglio concernente la qualità delle acque destinate al consumo umano, Bruxelles 22.3.2011, C(2011) 2014.
9. Commissione Europea, Directorate-General for Health & Consumers. Scientific Committee on Health and Environmental Risks (SCHER). Derogation on the Drinking Water Directive 98/83/EC, 16 April 2010.
10. Ministero della Salute. Attività centrali di area previste nel programma CCM 2010 con particolare riguardo al monitoraggio deroghe acque potabili ed alla comunicazione, Allegato 1.
11. Istituto Superiore di Sanità (ISS). Nota informativa: Deroghe per l'Arsenico nelle acque destinate al consumo umano in Italia, 30 Novembre 2010.
12. Commissione Europea, Comunicato stampa IP/14/816. Bruxelles, 10 luglio 2014.
13. Messineo A, Curcio M, De Carolis A, Gallo L, Pastore L. Arsenico nelle acque potabili e provvedimenti emergenziali: un esempio di comunicazione del rischio da migliorare, Atti XII Conferenza Nazionale di Sanità Pubblica. Roma, 12-15 Ottobre 2011.
14. TAR Lazio. Sentenza n. 664/2012: Arsenico nell'acqua (risarcimento).
15. Azara A, Piana A, Ciappeddu PL, Posadino S, Muresu E, Maida A. Cloriti e clorati nelle acque potabili della Sardegna centro-settentrionale. Ital J Public Health 2003; 1(1). Atti VIII Conferenza Nazionale di Sanità pubblica. L'armonizzazione delle pratiche di sanità pubblica in Europa. Roma, 19-20 Novembre 2003.
16. Maida A, Azara A. Aspetti igienico-sanitari dei D.B.PS. (Disinfectant By-Products) nelle acque potabili della Sardegna centro-settentrionale. Atti 40° Congresso Nazionale S.It.I. Cernobbio (Como), 8-11 settembre 2002. Vol. I. Relazioni. Panorama della Sanità 2002; 31(Suppl): 168-73.
17. Romano G, Maida A, Mura I, Azara A. Il monitoraggio delle risorse idriche destinate al consumo umano. Esperienze nel Nord Sardegna. Ig Mod 1991; 95: 187-215.
18. Spagnesi M, Soma R. Il significato del controllo delle acque potabili per la tutela della salute. Atti 40° Congresso Nazionale S.It.I., Cernobbio (Como), 8-11 settembre 2002. Vol. I. Relazioni.

- Panorama della Sanità 2002; **31**(Suppl): 164-167.
19. Decreto del Presidente della Repubblica 24 maggio 1988, n. 236. Attuazione della direttiva CEE n. 80/778 concernente la qualità delle acque destinate al consumo umano, ai sensi dell'art. 15 della legge 16.04.1987, n. 183. G.U. n. 152 del 30 giugno 1988.
  20. Azara A, Muresu E, Dettori M, Ciappeddu PL, Deidda A, Maida A. Riduzione dei Disinfection By-Products (DBPS) nelle acque potabili. Primi risultati dell'impiego della Clorammina. *Ig Sanita Pubbl* 2010; **66**: 583-600.
  21. Azara A, Piana A, Mura I, et al. Riduzione dei by-products nelle acque potabili. Supplemento al n. 39/2006 di Panorama della Sanità. *Atti 42° Congresso Nazionale S.It.I.* 27-30 ottobre 2006: 420.
  22. UE - European Topic Center. Overview of the drinking water quality in Italy. Results of the reporting 2011 - 2013 under the Drinking Water Directive 98/83/EC.
  23. Dettori M, Piana A, Castiglia P, Loria E, Azara A. Qualitative and quantitative aspects of drinking water supply in Sardinia, Italy. A descriptive analysis of the ordinances and public notices issued during the years 2010-2015. *Ann Ig* 2016; **28**: 296-303.
  24. Direttiva UE 2015/1787 della Commissione del 6 ottobre 2015 recante modifica degli allegati II e III della direttiva 98/83/CE del Consiglio concernente la qualità delle acque destinate al consumo umano.

Corresponding author: Prof. Antonio Azara, Department of Clinical and Experimental Medicine, University of Sassari, Via P. Manzella 4, 07100 Sassari, Italy  
e-mail: azara@uniss.it