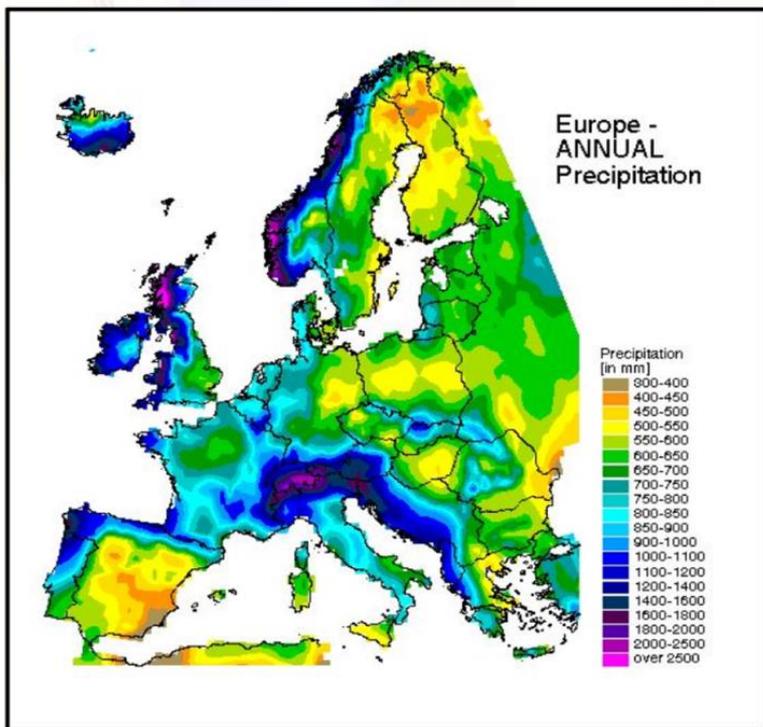




EL REGLAMENTO EUROPEO Y SU INCORPORACIÓN AL PLAN DE SANEAMIENTO DE LA REGIÓN DE MURCIA

Murcia, 16 de Septiembre de 2020

Pedro Simón Andreu
Director Técnico ESAMUR



Precipitación anual
media 350 mm

REGIÓN DE MURCIA



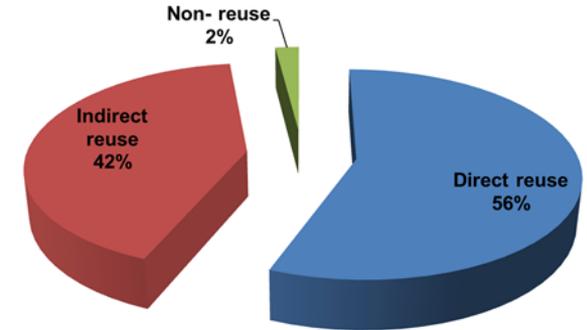
Se producen más de 2,5 millones de ton
de productos agrícolas cada año





- 1.500.000 habitantes
- 99,3 % población tiene servicio de depuración
- 98 % agua depurada se reutiliza
- Volumen medio agua tratada : 105 Hm³/año
- 98 depuradoras

¿ REUTILIZACIÓN ?



Alrededor del 15 % del total de las aguas usadas para riego en la Región de Murcia corresponden a aguas regeneradas.



Reglamento europeo de reutilización

L 177/32

EN

Official Journal of the European Union

5.6.2020

REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 25 May 2020
on minimum requirements for water reuse
(Text with EEA relevance)

Article 2

Scope

- 
1. This Regulation applies whenever treated urban waste water is reused, in accordance with Article 12(1) of Directive 91/271/EEC, for agricultural irrigation as specified in Section 1 of Annex 1 to this Regulation.
 2. A Member State may decide that it is not appropriate to reuse water for agricultural irrigation in one or more of its river basin districts or parts thereof, taking into account the following criteria:
 - (a) the geographic and climatic conditions of the district or parts thereof;
 - (b) the pressures on and the status of other water resources, including the quantitative status of groundwater bodies as referred to in Directive 2000/60/EC;
 - (c) the pressures on and the status of the surface water bodies in which treated urban waste water is discharged;
 - (d) the environmental and resource costs of reclaimed water and of other water resources.

Any decision taken pursuant to the first subparagraph shall be duly justified on the basis of the criteria referred to in that subparagraph and submitted to the Commission. It shall be reviewed as necessary, in particular taking into account climate change projections and national climate change adaptation strategies, and at least every six years taking into account river basin management plans established pursuant to Directive 2000/60/EC.

Entrará en vigor el 26 de Junio de 2023

Principales aspectos técnicos del nuevo Reglamento

- Requerimientos de cumplimiento habitual
 - Validación de los tratamientos
 - Plan de gestión de riesgos
 - Punto de cumplimiento
-

Table 1 Classes of reclaimed water quality and allowed agricultural use and irrigation method

Minimum reclaimed water quality class	Crop category*	Irrigation method
A	All food crops, including root crops, consumed raw and food crops where the edible part is in direct contact with reclaimed water	All irrigation methods
B	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops to feed milk- or meat-producing animals	All irrigation methods
C	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops to feed milk- or meat-producing animals	Drip irrigation** or other irrigation method that avoids direct contact with the edible part of the crop
D	Industrial, energy, and seeded crops	All irrigation methods***

Table 2 Reclaimed water quality requirements for agricultural irrigation

Reclaimed water quality class	Indicative technology target	Quality requirements				
		<i>E. coli</i> (number/100 ml)	BOD ₅ (mg/l)	TSS (mg/l/g/l)	Turbidity (NTU)U	Other
A	Secondary treatment, filtration, and disinfection	≤10	≤10	≤10	≤5	<i>Legionella</i> spp.: <1,000 cfu/l where there is risk of aerosolization Intestinal nematodes (helminth eggs): ≤1 egg/l for irrigation of pastures or forage
B	Secondary treatment, and disinfection	≤100	According to Council Directive 91/271/EEC ¹	According to Directive 91/271/EEC ((Annex I, Table 1))	-	
C	Secondary treatment, and disinfection	≤1,000	((Annex I, Table 1))		-	
D	Secondary treatment, and disinfection	≤10,000	¹ Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment (OJ L 135, 30.5.1991, p. 40).		-	

Table 4 Validation monitoring of reclaimed water for agricultural irrigation

Reclaimed water quality class	Indicator microorganisms (*)	Performance targets for the treatment chain (log ₁₀ reduction)
A	<i>E. coli</i>	≥ 5.0
	Total coliphages/ F-specific coliphages/somatic coliphages/coliphages(**)	≥ 6.0
	<i>Clostridium perfringens</i> spores/spore-forming sulfate-reducing bacteria(***)	≥ 4.0 (in case of <i>Clostridium perfringens</i> spores) ≥ 5.0 (in case of spore-forming sulfate-reducing bacteria)



(*) The reference pathogens *Campylobacter*, Rotavirus and *Cryptosporidium* can also be used for validation monitoring purposes instead of the proposed indicator microorganisms. The following log₁₀ reduction performance targets should then apply: *Campylobacter* (≥ 5.0), Rotavirus (≥ 6.0) and *Cryptosporidium* (≥ 5.0).

(**) Total coliphages is selected as the most appropriate viral indicator. However, if analysis of total coliphages is not feasible, at least one of them (F-specific or somatic coliphages) has to be analyzed.

(***) *Clostridium perfringens* spores is selected as the most appropriate protozoa indicator. However sporeforming sulfate-reducing bacteria is an alternative if the concentration of *Clostridium perfringens* spores does not allow to validate the requested log₁₀ removal.

Validación de tratamientos



Validation monitoring has to be performed before a new reclamation facility is put into operation.

Reclamation facilities that are already in operation and meeting the reclaimed water quality requirements set out in Annex I table 2 at the date of entry into force of this Regulation, shall be exempted from this validation monitoring obligation.



Validation monitoring has to be performed in all cases where equipment is upgraded, and when new equipment or processes are added.



Validation monitoring shall be performed for the most stringent reclaimed water quality class, Class A, to assess that the performance targets (\log_{10} reduction) are complied with. Validation monitoring entails the monitoring of the indicator microorganisms associated to each group of pathogens (bacteria, virus and protozoa). The indicator microorganisms selected are *E. coli* for pathogenic bacteria, F-specific coliphages, somatic coliphages or coliphages for pathogenic viruses, and *Clostridium perfringens* spores or spore-forming sulfate-reducing bacteria for protozoa. Performance targets (\log_{10} reduction) for the validation monitoring for the selected indicator microorganisms are set out in Table 4 and shall be met at the point of compliance, considering the concentrations of the raw waste water entering the urban waste water treatment plant. At least 90% of validation samples shall reach or exceed the performance targets.



If a biological indicator is not present in sufficient quantity in raw waste water to achieve the \log_{10} reduction, the absence of such biological indicator in reclaimed water shall mean that the validation requirements are complied with. The performance with the compliance target may be established by analytical control, by addition of the performance granted to individual treatment steps based on scientific evidence for standard well-established processes, such as published data of testing reports, case studies etc., or tested in laboratory under controlled conditions for innovative treatment.

Aspectos relativos al análisis de riesgos

- En la práctica, ¿ con qué grado de detalle se llevará a cabo el análisis de riesgos ?
- Aspectos que se deben contemplar según normativa :

The following requirements and obligations shall, as a minimum, be taken into account in the risk assessment:

- (e) the requirement to reduce and prevent water pollution from nitrates in accordance with Council Directive 91/676/EEC²;
 - (f) the obligation for drinking water protected areas to meet the requirements of Council Directive 98/83/EC³;
 - (g) the requirement to meet the environmental objectives set out in Directive 2000/60/EC of the European Parliament and of the Council⁴;
 - (h) the requirement to prevent groundwater pollution in accordance with Directive 2006/118/EC of the European Parliament and of the Council⁵;
 - (i) the requirement to meet the environmental quality standards for priority substances and certain other pollutants laid down in Directive 2008/105/EC of the European Parliament and of the Council⁶;
 - (j) the requirement to meet the environmental quality standards for pollutants of national concern (i.e. river basin specific pollutants) laid down in Directive 2000/60/EC;
 - (k) the requirement to meet the bathing water quality standards laid down in Directive 2006/7/EC of the European Parliament and of the Council⁷;
 - (l) the requirements concerning the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture under Council Directive 86/278/EEC⁸;
 - (m) the requirements regarding hygiene of foodstuffs as laid down in Regulation (EC) No 853/2004 of the European Parliament and of the Council⁹ and the guidance provided in the Commission Notice on guidance document on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene;
 - (n) the requirements for feed hygiene laid down in Regulation (EC) No 1831/2005 of the European Parliament and the Council¹⁰;
 - (o) the requirement to comply with the relevant microbiological criteria set out in Commission Regulation (EC) No 2073/2005¹¹;
 - (p) the requirements regarding maximum levels for certain contaminants in foodstuffs set out in Commission Regulation (EC) No 1881/2006¹²;
 - (q) the requirements regarding maximum residue levels of pesticides in or on food and feed set out in Regulation (EC) No 396/2005 of the European Parliament and of the Council¹³;
 - (r) the requirements regarding animal health in Regulation (EC) 1069/2009 of the European Parliament and of the Council¹⁴ and Commission Regulation (EC) 142/2011 of the European Parliament and of the Council¹⁵.
5. When necessary and appropriate to ensure sufficient protection of the environment and human health, **specify requirements for water quality and monitoring that are additional to and/or stricter than those specified in Annex I.**
- Depending on the outcome of the risk assessment referred to in point 4, such additional requirements may in particular concern:
- (a) heavy metals;
 - (b) pesticides;
 - (c) disinfection by-products;
 - (d) pharmaceuticals;
 - (e) other substances of emerging concern;
 - (f) anti-microbial resistance.

Valoración por parte de ESAMUR del nuevo Reglamento de reutilización

- Es bastante más exigente que nuestra normativa actual, pero va a aumentar significativamente la seguridad.
- Económicamente va a suponer un esfuerzo importante, pero es asumible
- Amplía el rango de patógenos a eliminar a virus y protozoos
- Reparte responsabilidades entre los distintos actores de la reutilización
- La tramitación de los permisos para reutilizar deja margen a los Estados miembros
- **La elaboración y el seguimiento de los obligatorios Planes de Gestión del Riesgo, aún no definidos por JRC podrían afectar a la viabilidad de los proyectos de reutilización**

Instalaciones de depuración en la Región de Murcia

I Plan Director de Saneamiento (2001-2010)

3.2. Clasificación de objetivos

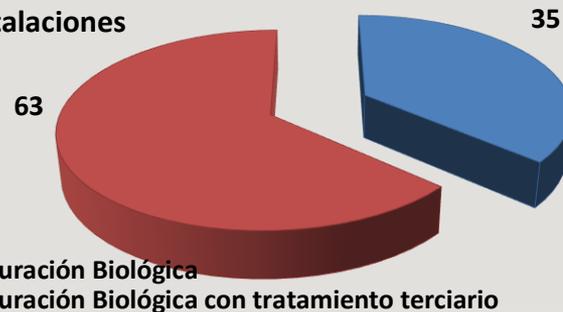
En resumen, los objetivos que se plantea el Plan General de Saneamiento pueden clasificarse como sigue:

1. Cumplimiento de los horizontes temporales y de los niveles de tratamiento de las aguas residuales urbanas exigidos en la Directiva 91/271/CEE.
2. Recuperación ambiental del río Segura
3. Recuperación del agua usada como recurso natural, restituyendo sus características iniciales que permitan la reutilización de las aguas depuradas.
4. Protección integral de Mar Menor, consiguiendo el objetivo de vertido cero de aguas residuales a las aguas de la laguna.
5. Protección de la calidad ecológica de las aguas de las cabeceras de los ríos y afluentes del Segura que nacen en el territorio de la Región.
6. Protección de las aguas del litoral mediterráneo de la Región de Murcia
7. Valorización agrícola y ambiental de los lodos de depuradoras

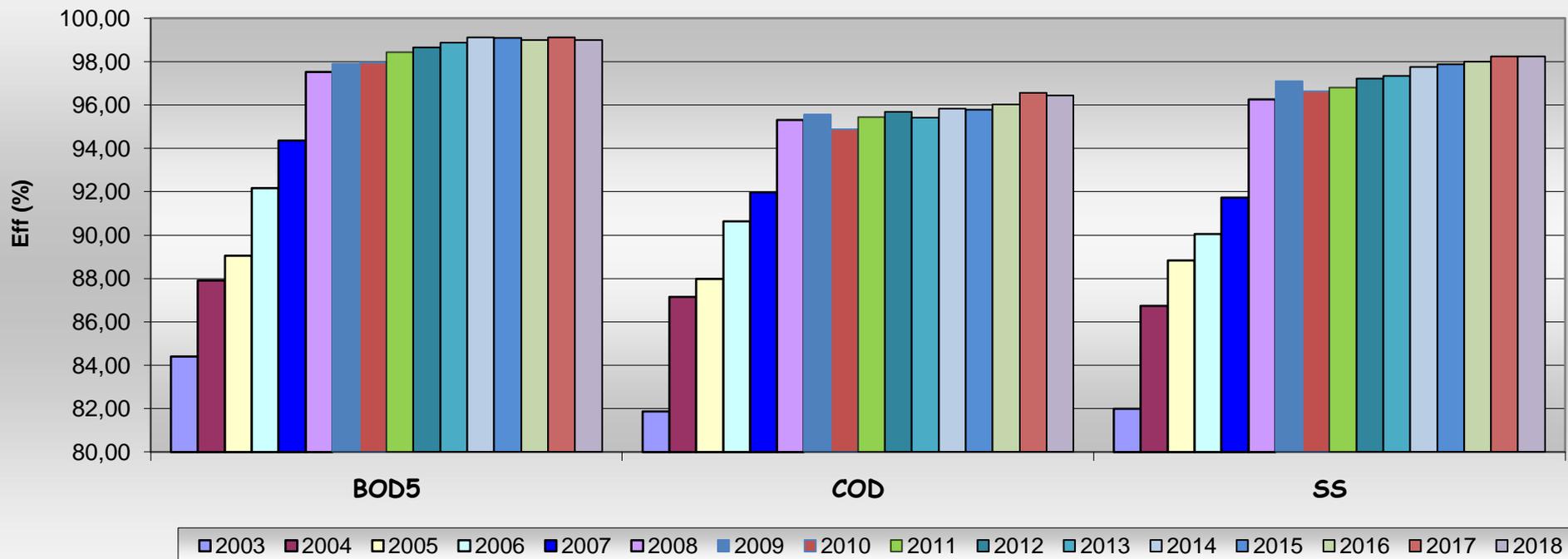
Tamaños de las EDAR de la Región de Murcia (2018)

Tamaño EDAR (habitantes equivalentes)	Nº EDAR	Caudal Tratado (m ³ /año)	%
> 100.000	4	55.472.340	50,75%
100.000 - 50.000	5	10.208.504	9,34%
50.000 - 10.000	26	38.845.654	35,54%
10.000 - 2.000	10	3.105.079	2,84%
≤ 2.000 h-e	53	1.675.626	1,53%
Total	98	109.307.203	100,0%

Nº de instalaciones



EDARs REGIÓN MURCIA EVOLUCIÓN DE RENDIMIENTOS



Tratamientos terciarios habituales



Resultados conseguidos con las instalaciones actuales

✓ Cumplimiento habitual de RD 1620/2007

¿ Y con los nuevos parámetros del Reglamento ?

Terciario convencional (F-Q + Filt + UV)

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)
Abanilla	01/11/2017	40.000	4
Abanilla	01/12/2017	460.000	80
Abanilla	01/01/2018	320.000	4
Abanilla	01/02/2018	310.000	4
Abanilla	01/03/2018	200.000	1
Abanilla	01/04/2018	110.000	160
Abanilla	01/05/2018	170.000	1

Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)	E. coli Inf. (ufc/100ml)	E. coli Efl. (ufc/100ml)
51.000	100	12.000.000	1
80.000	100	14.000.000	1
1.600.000	100	17.000.000	1
120.000	100	16.000.000	1
200.000	100	14.000.000	1
380.000	100	7.700.000	1
230.000	100	9.200.000	1

Terciario convencional

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)	Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)
Cieza	01/11/2017	320.000		230	270.000
Cieza	01/12/2017	310.000		1	170.000
Cieza	01/01/2018	600.000		45	460.000
Cieza	01/02/2018	330.000		4.200	220.000
Cieza	01/03/2018	270.000		1	230.000
Cieza	01/04/2018	60.000		310	2.700.000
Cieza	01/05/2018	440.000		1	250.000
Cieza	01/06/2018	330.000		30	980.000
Alcantarilla	01/11/2017	220.000		1.300	200.000
Alcantarilla	01/12/2017	210.000		1.800	300.000
Alcantarilla	01/01/2018	300.000		2.700	1.500.000
Alcantarilla	01/02/2018	210.000		3.600	2.700.000
Alcantarilla	01/03/2018	200.000		790	2.000.000
Alcantarilla	01/04/2018	220.000		3.200	1.300.000
Alcantarilla	01/05/2018	290.000		3.200	430.000
Alcantarilla	01/06/2018	140.000		2.000	
Alguazas	01/11/2017	620		1	3.900.000
Alguazas	01/12/2017	40.000		1	73.000
Alguazas	01/01/2018	300.000		1	2.300.000
Alguazas	01/02/2018	37.000		1	160.000
Alguazas	01/03/2018	50.000		1	2.200.000
Alguazas	01/04/2018	51.000		1	2.500.000
Alguazas	01/05/2018	49.000		1	2.000

Desinfección Hipoclorito

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)	Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)
Ceutí Nueva	01/11/2017	360	38	240.000	700
Ceutí Nueva	01/12/2017	390.000	1.700	3.300	8.800
Ceutí Nueva	01/01/2018	180.000	100	4.100.000	100
Ceutí Nueva	01/02/2018	210.000	4.900	72.000	4.300
Ceutí Nueva	01/03/2018	23.000	1.900	60.000	4.400
Ceutí Nueva	01/04/2018	130.000	3.200	600.000	9.000
Ceutí Nueva	01/05/2018	50.000	780	250.000	300

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)	Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)	E.
La Hoya	22/11/2017	410000	3000	450000	300	
La Hoya	19/12/2017	3000000	1400	330000	100	
La Hoya	10/01/2018	1200000	11000	240000	200	
La Hoya	20/03/2018	630000		670000		
La Hoya	25/04/2018	130000	540	140000	200	
La Hoya	29/05/2018	610000	82	430000	100	

MBR Ultrafiltración

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)	Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)
Calasparra	01/11/2017	800.000		1	150.000
Calasparra	01/12/2017	410.000		4	350.000
Calasparra	01/01/2018	380.000		1	330.000
Calasparra	01/02/2018	480.000		1	20.000
Calasparra	01/03/2018	200.000		1	780.000
Calasparra	01/04/2018	84.000		1	1.100.000
Calasparra	01/05/2018	320.000		1	960.000
Calasparra	01/06/2018	150.000		1	720.000

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)	Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)
San Pedro del Pinatar	06/11/2017	650000		120	3000
San Pedro del Pinatar	30/11/2017	150000		20	2300000
San Pedro del Pinatar	17/01/2018	230000		30	850000
San Pedro del Pinatar	14/02/2018	260000		110	2200000
San Pedro del Pinatar	15/03/2018	330000		46	440000
San Pedro del Pinatar	17/04/2018	270000		11	550000
San Pedro del Pinatar	08/05/2018	220000		1	2800000

MBR Microfiltración

EDAR	Fecha	Esp. Clostridium Inf. (ufc/100ml)	Esp. Clostridium Efl. (ufc/100ml)	Colifagos f Inf. (pfp/100 ml)	Colifagos f Efl. (pfp/100 ml)
Aledo	15/11/2017	400000		300	89000
Aledo	13/12/2017	1900000		40	360000
Aledo	17/01/2018	1100000		5000	480000
Aledo	14/02/2018	600000		40	63000
Aledo	15/03/2018	500000		8	240000
Aledo	25/04/2018	250000		69	140000
Aledo	29/05/2018	310000		4	100000

Conclusiones previas

- Cumplir verificación será factible pero exigente. Principal dificultad es cumplir la validación
- Membranas de ultrafiltración y UV parecen los mejores candidatos
- Hay que estudiar cada planta individualmente para que cumpla validación



Dosis validada por terceros.

	[UV dose mJ/cm ²]	1 log	2 log	3 log	4 log	5 log	6 log
E. Coli		5	10	20	25	30	40
Total Coliphages (MS2)		20	40	60	90	120	150
Clostridium perfringens spores		45	95	145	220	-	-
<u>Campylobacter</u>		2	4	6	8	10	20
<u>Rotavirus</u>		15	25		35		60
Cryptosporidium		2,5	5,8	12	22	45	85

 **xylem**
Let's Solve Water

References:

- W.A.M. Hijnen et al.; Inactivation credit of UV radiation for viruses, bacteria and protozoan (oo)cysts in water: A review; Water Research 40 (2006), p. 3 – 22.
- A. H. Malayeri et al.; Fluence (UV Dose) Required to Achieve Incremental Log Inactivation of Bacteria, Protozoa, Viruses and Algae; IUVA News Fall 2016.
- US EPA UVDGM validation report
- University of Bonn

Conocimiento de los tratamientos y combinaciones

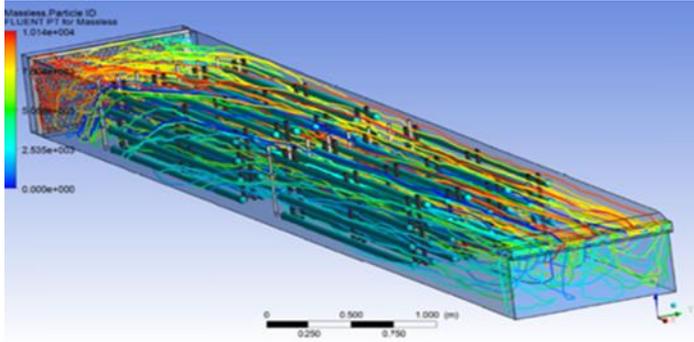
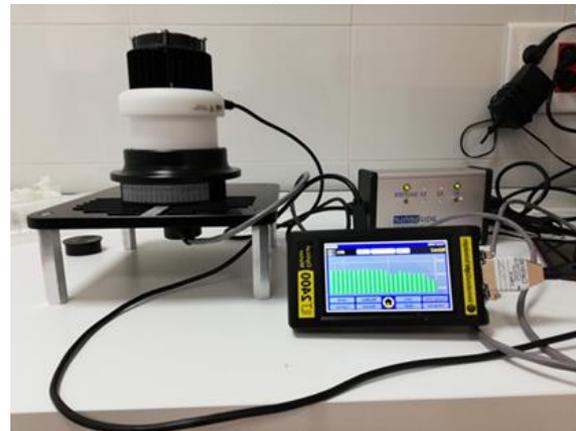
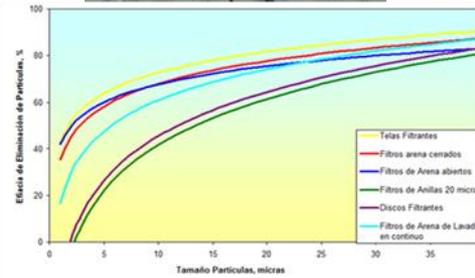


Figura 21. Trayectorias de 100 partículas sin masa liberadas en el reactor.



Implantación de posibles nuevos tratamientos



Aumento del control y de la fiabilidad



Muy estricto mantenimiento



Incremento sistemas control
(reactivos, transmitancia, etc...)



Sistemas medición en continuo



Seguimiento tamaño partículas

EN 15975-2 Security of drinking water supply - Guidelines for risk and crisis management - Part 2: Risk management

Reglamento exige una alta transparencia

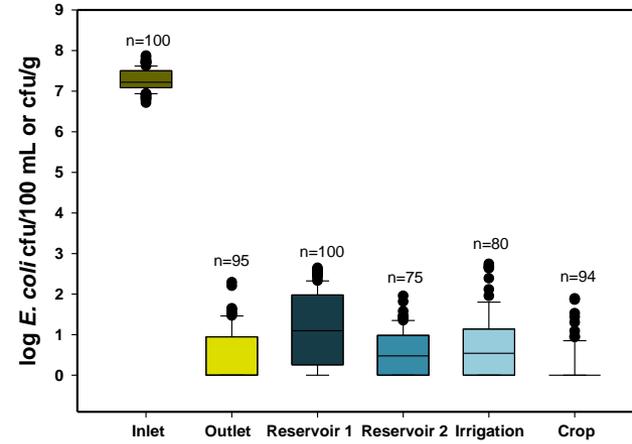
Estudios de riesgos

Dos estudios de riesgo a gran escala

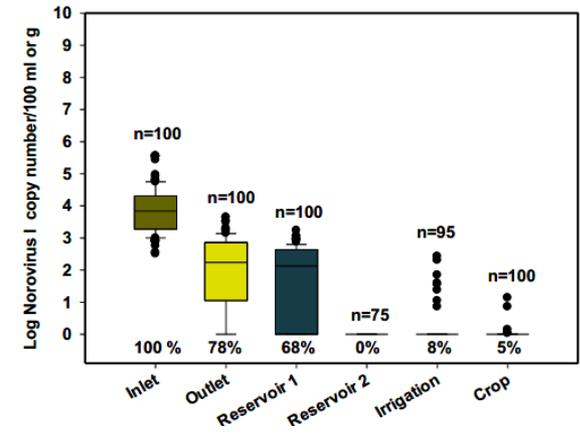
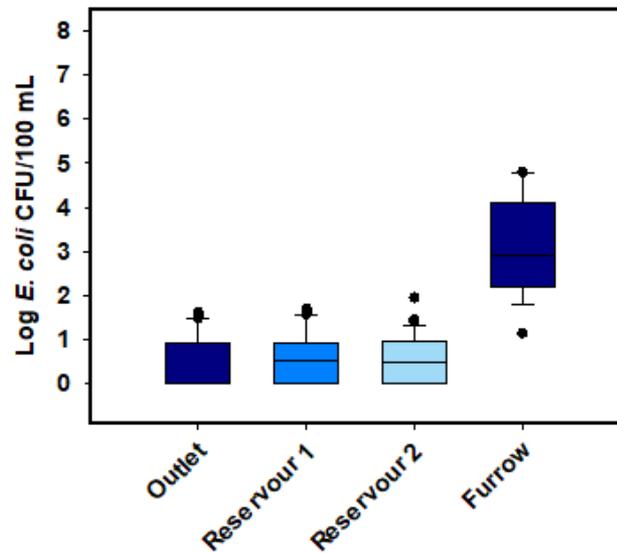
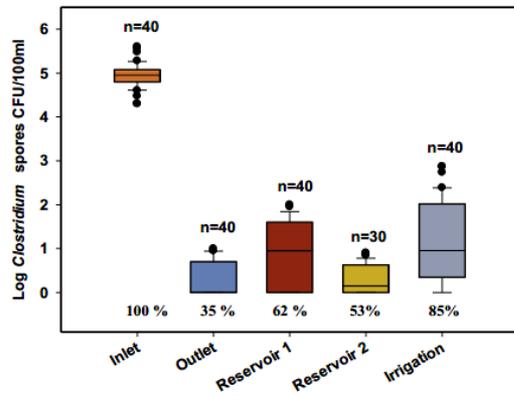


- Diferentes tratamientos (Cloro y UV)
- Diferentes situaciones de riego (con y sin almacenamiento)
- Diferentes sistemas de riego (Inundación, aspersión, goteo)
- Cosechas de lechuga y espinaca
- Midiendo indicadores and patógenos (Norovirus, Salmonella, Hepatitis,..) y subproductos de desinfección

Algunos resultados de interés



Balsas
almacenamiento



Aspectos relativos al análisis de riesgos

- En la práctica, ¿ con qué grado de detalle se llevará a cabo el análisis de riesgos ?
- Aspectos que se deben contemplar según normativa :

The following requirements and obligations shall, as a minimum, be taken into account in the risk assessment:

- (e) the requirement to reduce and prevent water pollution from nitrates in accordance with Council Directive 91/676/EEC²;
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 - (h) the requirement to prevent groundwater pollution in accordance with Directive 2006/118/EC of the European Parliament and of the Council⁵;
 - (i) the requirement to meet the environmental quality standards for priority substances and certain other pollutants laid down in Directive 2008/105/EC of the European Parliament and of the Council⁶;
 - (j) the requirement to meet the environmental quality standards for pollutants of national concern (i.e. river basin specific pollutants) laid down in Directive 2000/60/EC;
 - (k) the requirement to meet the bathing water quality standards laid down in Directive 2006/7/EC of the European Parliament and of the Council⁷;
 - (l) the requirements concerning the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture under Council Directive 86/278/EEC⁸;
 - (m) the requirements regarding hygiene of foodstuffs as laid down in Regulation (EC) No 853/2004 of the European Parliament and of the Council⁹ and the guidance provided in the Commission Notice on guidance document on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene;
 - (n) the requirements for feed hygiene laid down in Regulation (EC) No 1831/2005 of the European Parliament and of the Council¹⁰;
 - (o) the requirement to comply with the relevant microbiological criteria set out in Commission Regulation (EC) No 2073/2005¹¹;
 - (p) the requirements regarding maximum levels for certain contaminants in foodstuffs set out in Commission Regulation (EC) No 1881/2006¹²;
 - (q) the requirements regarding maximum residue levels of pesticides in or on food and feed set out in Regulation (EC) No 396/2005 of the European Parliament and of the Council¹³;
 - (r) the requirements regarding animal health in Regulation (EC) 1069/2009 of the European Parliament and of the Council¹⁴ and Commission Regulation (EC) 142/2011 of the European Parliament and of the Council¹⁵.
5. When necessary and appropriate to ensure sufficient protection of the environment and human health, **specify requirements for water quality and monitoring that are additional to and/or stricter than those specified in Annex I.**
- Depending on the outcome of the risk assessment referred to in point 4, such additional requirements may in particular concern:
- (a) heavy metals;
 - (b) pesticides;
 - (c) disinfection by-products;
 - (d) pharmaceuticals;
 - (e) other substances of emerging concern;
 - (f) anti-microbial resistance.

Costes

- Costes inversión (para cumplir clase A) : Entre 180 €/m³ / día y 400 €/ m³ / día según la tecnología empleada (membranas sería el sistema más caro)
- Costes explotación (clase A): Entre 7 c€/ m³ y 18 c€/ m³ según la tecnología empleada (el menor coste sería con membranas de ultrafiltración)

Observaciones

- Muchas tecnologías no van a ser útiles
 - El control deberá ser muy exhaustivo, y ello implicará un coste.
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Conclusiones

- La reutilización es una fuente de agua de la que no vamos a poder prescindir
- La nueva normativa europea es bastante exigente pero con esfuerzo se cumplirá. Y va a hacer la reutilización mucho más segura
- Aún hay que definir las exigencias del estudio de riesgos, que podrían llegar a comprometer la viabilidad de la reutilización
- Habrá que ser MUY RIGUROSO en el mantenimiento y la explotación de las instalaciones de regeneración
- El marco administrativo (permisos, control, etc) debería empezar a definirse por autoridades estatales cuanto antes
- Hay que ganar la batalla de la confianza de usuarios y consumidores
- **EL TIEMPO VUELA (26 de Junio de 2023)**



