**Contributions to food intake from PFAS in the diet**

Introduction

In this chapter the likely baseline intake of PFAS from food is estimated. There are no data collected for total dietary intake in Jersey, so data collected in the UK and other European countries are used. The usual method for estimating total dietary intake, involves both measuring PFAS in representative samples of food items and collecting data from dietary surveys of data on food sales to estimate the intake from average diets, along with upper and lower estimates. The contributions from each food group (e.g. the average weight of eggs or fish that is eaten, along with the measured concentrations in these foods) can be assessed and the daily or weekly intake for each PFAS can be calculated.

Collecting detailed measurements from thousands of food sample is expensive and ias only done intermittently, the last survey for PFAS across UK foods being in 2012 (Fernandes A, 2012). Unfortunately, there are no more recent data for the UK on total dietary PFAS intake so we have had to make estimates from European averages, these relatively old UK data and trends observed in other countries. The estimates are therefore necessarily uncertain but we believe of the right order of magnitude. Three further sources of uncertainty are 1) variability: the wide variability in both peoples dietary choices and the concentrations measured in different food samples, so we have to rely on averages; 2) time trends: much of the data is rather out of date and only a few countries regularly repeat these surveys to reveal changes over time; and 3) limits of detection: each laboratory has a minimum concentration which can be detected and whether the values below the limit of detection are assumed to be zero or close to the limit has an effect on the summed or averaged PFAS concentration estimates.

EFSA estimates of average dietary intake from food

We start with the European average measurements of PFAS in food assembled by EFSA, then compare with more recent measurements. EFSA summarised data from many European analyses of food samples and based their assessment on samples collected between 2007 and 2016 (EFSA et al., 2020). After some quality control there were 69433 analytical results with most provided by Germany, France and the UK. Many results were below the limit of detection (LOD) or limit of quantification (LOQ) for specific PFAS and they explain different ways of dealing with these low values. All laboratories have an LOD (and it varies between lab results) and the results are expressed as lower bound (LB) assuming all the values below LOD are zero and upper bound (UB) assuming all the below LOD values are at the LOD. The true result will lie somewhere in between the sometimes large range of values between LB and UB. So for example for PFOS in milk the LB is 0.001 ng/g and the UB is 0.14 ng/, and for herrings the LB and UB were 0.32 and 0.62 ng/g respectively.

The EFSA report summarises in detail the range and average levels of various PFAS in multiple foodstuffs. The daily intake were estimated by applying those concentrations to the average amounts of each food consumed, collected in dietary surveys (for the UK the national diet surveys of 2008-2011). It is expressed as ng of PFAS per day per kilogram of body weight. Applying these approaches they estimated average intake for adults of the 4 PFAS, and the European averages for adults were in the range 0.92 (LB) to 15.9 (UB) ng/kg/day. For the UK the equivalent two figures were 0.62 (LB) and 13.8 (UB) ng/kg/day.

Table 1

Estimate Lower Bound intakes for main food groups in EFSA report applied to UK adults

| Food group | PFHxS ng/kg/day | PFNA ng/kg/day | PFOA ng/kg/day | PFOS ng/kg/day | sum4 ng/kg/day | % |
|---|---|---|---|---|---|---|
| Alcoholic beverages | 0.020 | 0.000 | 0.036 | 0.000 | 0.056 | 9.1 |
| Drinking water | 0.017 | 0.001 | 0.013 | 0.006 | 0.037 | 5.9 |
| Eggs and egg products | 0.000 | 0.000 | 0.011 | 0.027 | 0.037 | 6.0 |
| Fish and other seafood | 0.001 | 0.006 | 0.039 | 0.260 | 0.306 | 49.5 |
| Fruit and fruit products | 0.028 | 0.014 | 0.011 | 0.033 | 0.085 | 13.8 |
| Meat and meat products | 0.000 | 0.001 | 0.016 | 0.044 | 0.061 | 9.9 |
| Milk and dairy products | 0.000 | 0.000 | 0.002 | 0.002 | 0.004 | 0.6 |
| Other foods | 0.000 | 0.000 | 0.003 | 0.001 | 0.004 | 0.7 |
| Starchy roots and tubers | 0.000 | 0.000 | 0.005 | 0.004 | 0.010 | 1.6 |
| Vegetables and vegetable products | 0.000 | 0.001 | 0.011 | 0.005 | 0.017 | 2.8 |
| Total | 0.067 | 0.023 | 0.145 | 0.382 | 0.617 | 100 |

Estimates of intake mainly used the LB results and for the LB estimates contributions were presented by food group with 49% from fish and seafood, 13% from fruit and fruit products, 10% from meat and 6% from drinking water.

PFAS concentrations in measured in foods contributing to dietary intake

The concentrations in foods that they use to make these estimates can be to an extent compared to the measurements made in the UK dietary contaminant survey of 2012. Categories do not easily correspond, and the dates of sampling do not exactly match (2012 in UK, 2007 to 2020 in EFSA with 40% of samples between 2016 and 2020). Furthermore the LB EFSA estimate is pulled down by a large number of below LOD estimates in the European dataset. Table 2 summarises the Upper and Lower bound average European contaminant level for the sum of 4 PFAS, and Table 3 the TDS results for the UK in 2012 (EFSA et al., 2020; Fernandes A, 2012).

Table 2

Average European PFAS contaminant concentration by food group, Upper and Lower Bound average from EFSA for the sum of 4 PFAS,

| EFSA data<br>Food group | Sum 4 LB<br>µg/kg | Sum 4 UB<br>µg/kg |
|---|---|---|
| Alcoholic beverages | 0.016 | 0.028 |
| Drinking water | 0.004 | 0.012 |
| Eggs and egg products | 0.374 | 0.712 |
| Fish and other seafood | 1.799 | 3.785 |
| Fruit and fruit products | 0.069 | 0.842 |
| Meat and meat products | 0.068 | 0.545 |
| Milk and dairy products | 0.001 | 0.437 |
| Starchy roots and tubers | 0.008 | 2.507 |
| Vegetables and vegetable products | 0.010 | 0.520 |

Table 3

Average UK PFAS contaminant concentration by food group 2012,for individual and sum of 4 PFAS

| UK TDS<br>Food group | **PFOA**<br>µg/kg | **PFNA**<br>µg/kg | **PFHxSH**<br>µg/kg | **PFOS**<br>µg/kg | **Sum4**<br>µg/kg |
|---|---|---|---|---|---|
| Bread | 0.54 | 0.73 | 0.07 | 0.10 | 1.44 |
| Cereals | 0.37 | 0.37 | 0.12 | 0.09 | 0.95 |
| Carcass Meat | 0.17 | 0.18 | 0.13 | 0.22 | 0.70 |
| Offal | 0.62 | 0.44 | 1.30 | 2.66 | 5.02 |
| Meat products | 0.20 | 0.22 | 0.23 | 0.17 | 0.82 |
| Poultry | 0.21 | 0.23 | 0.25 | 0.16 | 0.85 |
| Fish | 1.51 | 0.60 | 2.41 | 0.96 | 5.48 |
| Fats and Oils | <0.05 | 0.42 | 0.22 | 0.15 | 0.79 |
| Eggs | 0.11 | 0.21 | 0.10 | 0.31 | 0.73 |
| Sugars and Preserves | 0.48 | 1.21 | 0.16 | 0.08 | 1.93 |
| Green Vegetables | 0.22 | 0.25 | 0.17 | 0.10 | 0.74 |
| Potatoes | 0.12 | 0.12 | 0.07 | 0.05 | 0.36 |
| Other Vegetables | 0.18 | 0.17 | 0.10 | 0.04 | 0.49 |
| Canned Vegetables | 0.20 | 0.15 | 0.03 | 0.03 | 0.41 |
| Fresh Fruit | 0.20 | 1.10 | 0.18 | 0.07 | 1.55 |
| Fruit products | 0.17 | 0.17 | 0.08 | 0.02 | 0.44 |
| Milk | 0.03 | 0.01 | 0.02 | 0.05 | 0.11 |
| Milk and Dairy | 0.08 | 0.08 | 0.06 | 0.06 | 0.28 |
| Nuts | 0.54 | 0.72 | 0.09 | 0.10 | 1.45 |

For those categories where comparisons can be made, the UK measurements are higher in most cases than LB averages which are used to estimate the likely intake by EFSA. The largest contribution was estimated to come from fish intake, and the concentration for UK was 3 times the LB average for Europe, for eggs it was twice as high and for fruit products it was 6 fold higher. So to estimate likely intake around 2012, we can take the EFSA LB estimate multiply by 2 and 6 to provide a range of plausible intake estimates. This instead of 0.62 ng/kg/day, the estimated intake around 2012 in the UK would have been 1.2 to 3.6 ng/kg/day.

By way of comparison this was clearly over the recent EFSA intake guideline of 4.4 ng/kg/week.

<u>Food intake compared to water intake</u>

The average drinking water concentrations used to make these estimates were low, with LB values of PFHxS 1.8, PFOA 1.3, PFOS 0.6 and PFNA 0.08 ng/L. These values are much lower than expected in the UK. In the UK COT commentary on the EFSA document they cite estimates provided by the DWI (UKCOT, 2022) suggesting typical average levels of PFAS in groundwater derived drinking water could be 5 ng/L and surface water derived drinking water could be 10 ng/L.

If the water concentration of 5 ng/L is taken as the typical average water then the intake (assuming 1.5L and 75kg) would be 0.1 ng/kg/day, as both 5 and 10 were presented as tyrpical levels we can estimate the average water intake as between 0.1 and 0.2 ng/kg/day. If the food intake was 1.2 to 3.6 ng/kg/day, then water amounted to between about 3 and 15% of the water + food intake.

<u>Trends over time</u>

There have been significant declines in measured levels in food samples. In the UK 2012 TDS study it is noted that compared to the earlier Total Diet Study with samples collected in 2004, the range of concentrations of observed in the potato group in 0.03 - 0.85 μg/kg in 2012 compared to 1-10 μg/kg in 2004 (Fernandes A, 2012).

.

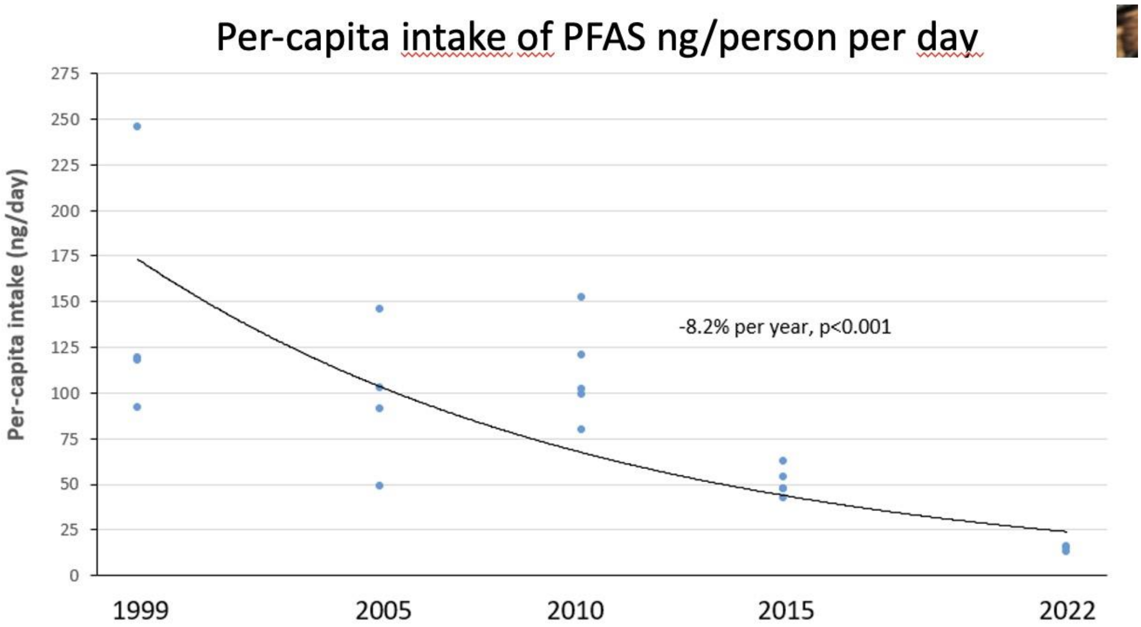
Within the UK a clue to trends can be seen in the fish data as a recent report has detailed measurements in a wide range of fish species (FERA, 2025). There is no aggregate estimate for fish overall but taking some of the results for species with the most measurements and then taking the average level of PFAS, we find the following: for the sum of 4 PFAS average concentrations were 0.46 μg/kg for Sardines, 0.65 for Crab and 0.0.63 for Cod. These compare to the overall fish average in 2012 of 5.48 μg/kg suggesting a 10 fold reduction.

Another specific fish category of interest is lobster with four results averaging 0.75 μg/kg. There are no values for oyster but a recent paper assessing PFAS marine contamination near

Portsmouth including analyses of 3 oyster samples (Ford & Ginley, 2024). All values were below the limit of detection (0.1 for most PFAS) except for one PFOA result of 0.19 µg/kg.

German data on eggs allow a comparison from 2018-22 to 2024 during which average PFAS levels fell from 0.29 to 0.06 µg/kg, a 5 fold reduction (BFR, 2025).

Swedish data on time trends over a 20 year period show declines, and comparing the difference between 2010 and 2022, the sum of PFAS fell from about 110 to 15 ng/person/day a 7 to 8 fold reduction, illustrated in the following figure (Livsmedelsverket, 2024). 15 ng/day would be about 0.2 ng/kg/day.




More dramatically the range of food categories that contributed to this decline has dramatically shifted. In the 2015 survey PFAS was measured in a wide range of food categories: Meat, Eggs, Cereals, Pastries, Sweets, Milk and Dairy Products, Fats, Oils. The repeat survey of 2022 only found PFOA, PFOS, PFHxS or PFNA in Lean and Fatty Fish, and Eggs, with all other food categories below detection limits.

A recent report on the intake of PFAS in the Netherlands, compared the intake in the most recent assessment based on food samples analysed in 2022 with an earlier assessment based on samples collected in 2009. They report that the total intake from food in 2022 for the sum of 16 PFAS was 40% lower than the sum of 4 PFAS in the earlier assessment so not simply comparable. The EFSA 4 accounted for about a 1/3 of the total intake from 16 PFAS so an approximate estimate for the reduction between the two surveys would be a 5-fold drop

Relative importance of diet

For as typical average drinking water concentration of 5 ng/L then the intake (assuming 1.5L and 75kg) would be 0.1 ng/kg/day, and double that if one takes 10 ng/L as typical.

From the results summarised and discussed above, the intake per day (LB) from EFSA for the UK was 0.62 ng/kg/day base on the older measurements used in the EFSA assessment from food, from which we can estimate the intake from UK food around 2012 as 1.2 to 3.6 ng/kg/day.

The expectation is that the intake would have fallen by 5 to 10 fold which would estimate the food intake now in the range 0.1 to 0.7 ng/kg/day from food and 0.1 to 0.2 ng/kg/day from water.

The average intake for the sum of 4 PFAS in the last survey in Sweden estimated average intakes of 0.1 ng/kg/day for food and the same amount from water, similar contributions. For food only fish and eggs contributed in Sweden.

These estimates are uncertain but suggest that, although only a small percentage from water compared to food intake would be expected based on food contamination some 10-15 years ago, they might be more similar now. This is of course assuming the trends observed in other contexts applied to our populations.

References

BFR. (2025). *Weniger PFAS in Hühnereiern aus Boden- und Freilandhaltung – Eier und Eiprodukte tragen aber weiterhin zur Gesamtexposition bei. (Lower levels of PFAS in barn and free-range eggs – however, eggs and egg products still contribute to overall exposure.) Statement No. 043/2025. Federal Institute for Risk Assessment.* . https://www.bfr.bund.de/stellungnahme/weniger-pfas-in-huehnereiern-aus-boden-und-freilandhaltung-eier-und-eiprodukte-tragen-aber-weiterhin-zur-gesamtexposition-bei/

EFSA, Schrenk, D., Bignami, M., Bodin, L., Chipman, J. K., Del Mazo, J., Grasl-Kraupp, B., Hogstrand, C., Hoogenboom, L. R., Leblanc, J. C., Nebbia, C. S., Nielsen, E., Ntzani, E., Petersen, A., Sand, S., Vleminckx, C., Wallace, H., Barregard, L., Ceccatelli, S.,...Schwerdtle, T. (2020). Risk to human health related to the presence of perfluoroalkyl substances in food. *EFSA J*, *18*(9), e06223. https://doi.org/10.2903/j.efsa.2020.6223

FERA. (2025). *Contaminants monitoring programme for wild caught fish, crustaceans and cephalopods*. (FSA Research and Evidence, Issue. https://doi.org/10.46756/001c.127617

Fernandes A, R. M., Smith F and Holland M (2012). *Organic Environmental Contaminants in the 2012 Total Diet Study Samples Report to the Food Standards Agency Fera Report FD 12/04*. https://www.food.gov.uk/sites/default/files/media/document/research-report-total-diet-study.pdf

Ford, A. T., & Ginley, F. (2024). Insights into PFAS contaminants before and after sewage discharges into a marine protected harbour. *Chemosphere*, *366*, 143526. https://doi.org/10.1016/j.chemosphere.2024.143526

Livsmedelsverket. (2024). *The Swedish Market Basket Study 2022. Per capita-based analyses of nutrients and toxic compounds in market baskets and assessment of benefit or risk*. https://www.livsmedelsverket.se/globalassets/publikationsdatabas/rapporter/2024/l-2024-nr-08-swedish-market-basket-study-2022.pdf

UKCOT. (2022). *Statement on the EFSA Opinion on the risks to human health related to the presence of perfluoroalkyl substances in food. Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment*. https://cot.food.gov.uk/sites/default/files/2022-11/COT%20PFAS%20%20Statement%20on%20EFSA%20Opinion_2022_04.22%20Acc%20V_0.pdf

## PFAS Soil Guidelines and Biosolid Management Options

### Soil guidelines

PFAS soil screening levels vary not only by jurisdiction but also by treatment goal, whether the aim is to protect human health through direct contact, prevent leaching to groundwater, guide land use decisions, or trigger site remediation. These thresholds are shaped by different exposure assumptions, regulatory philosophies, and technical constraints, resulting in wide variation across and within countries.

International soil guidelines for PFAS vary widely, with only a handful of countries publishing formal threshold values. The most comprehensive global overview is provided by the Interstate Technology and Regulatory Council (ITRC) (https://pfas-1.itrcweb.org/fact-sheets/), which compiles screening levels from the United States, Canada, Australia, and selected European countries. In the U.S., the Environmental Protection Agency (EPA) has published soil screening levels for direct contact exposure, including 0.019 µg/kg for PFOS and 6.3 µg/kg for PFOA, based on ingestion, dermal contact, and dust inhalation under residential exposure scenarios. The EPA has also derived soil-to-groundwater migration values, such as 0.030 µg/kg and 0.061 µg/kg for PFOS and PFOA, respectively to protect drinking water sources from leaching. However, their practical enforceability should be questioned as many of these values fall below typical background soil concentrations of <1 µg/kg (Washington, Rankin et al. 2019, Brusseau, Anderson et al. 2020, Sörengård, Kikuchi et al. 2022) and analytical detection limits. At the state level, guidance varies significantly. Washington State has adopted one of the most stringent residential soil screening levels for PFOS at 0.046 µg/kg, and an even lower saturated zone soil-to-groundwater protection value of 0.003 µg/kg, reflecting a highly precautionary approach to groundwater protection. Again, the enforceability of such low guidelines is highly questionable. Other states vary widely depending on the PFAS and the protection goal.

Canada and Australia have proposed national guidelines, with PFOS thresholds as low as 9 µg/kg in Australia for residential land use and 10 µg/kg in Canada for protection of leaching to groundwater. In Europe, only four countries, Belgium, Denmark, the Netherlands, and Norway, currently have formal soil values for PFAS, highlighting a significant regulatory gap across the EU. Denmark and the Netherlands provide screening levels used in site assessments and permitting, with the Netherlands setting relatively high thresholds of 1100 µg/kg for PFOA and 110 µg/kg for PFOS. Norway, by contrast, has adopted more precautionary values, with residential screening levels of 13 µg/kg for PFOA and 2.3 µg/kg for PFOS, as reported in the ITRC table.

In Europe, Belgium, particularly the Flemish Region under OVAM (Openbare Vlaamse Afvalstoffenmaatschappij, or Public Waste Agency of Flanders), stands out with the most detailed and operational framework.(OVAM 2025) It sets remediation values for PFOS and PFOA as low as 3.8 and 2.5 µg/kg dry weight, respectively, for nature land use. Belgium's approach has evolved in response to high-profile contamination cases, notably the Oosterweel project. The soil remediation values for PFOS and PFOA, with specific thresholds for natural land use are outlined in Table 1. These values are primarily based on human health risk and derived from the EFSA tolerable weekly intake (TWI) published in 2020. As we have used the EFSA guidelines as the basis for our recommendations for drinking water guidelines on Jersey, the Flemish soil guidelines seem particularly relevant. These thresholds sit only slightly above typical background levels: for PFOS, the Flemish background value is 1.5 µg/kg dw, and for PFOA, 1.0 µg/kg dw (OVAM 2025), which is consistent with the literature. (Washington, Rankin et al. 2019, Brusseau, Anderson et al. 2020, Sörengård, Kikuchi et al. 2022) All soils contain PFAS due to ambient atmospheric deposition.(Johansson, Shi et al. 2018)

**Table 1. The relevant soil threshold values for PFAS in Flanders, Belgium.**

| Threshold | Remediation value for nature land use (µg/kg dry weight) | Target value (µg/kg dry weight) | Background value (µg/kg dry weight) |
|---|---|---|---|
| PFOS (total) | 3.8 | 3 | 1.5 |
| PFOA (total) | 2.5 | 2 | 1 |
| Sum measured PFAS* | - | 8 | - |

*"Sum measured PFAS" refers to the total concentration of individually quantified PFAS compounds included in the Flemish analytical protocol, typically measured using targeted LC-MS/MS methods. This sum includes substances such as PFOS, PFOA, PFBS, PFHxS, and other regulated PFAS listed in OVAM guidance.

In addition to human health-based criteria, ecotoxicological thresholds have been developed. The lowest values were derived for nature and agricultural land uses. For PFOS and PFOA, the soil remediation values are 3 and 7 µg/kg dw, respectively. These Flemish thresholds are informed by earlier work from the National Institute for Public Health and the Environment in the Netherlands (RIVM),(RIVM 2017, RIVM 2020) which emphasized that the values are based on indirect ecological effects, particularly secondary poisoning.

For direct ecotoxicity, RIVM proposed higher thresholds: 16 µg/kg dw for PFOS and 500 µg/kg dw for PFOA. Using the Assessment Factor (AF)-approach tailored to the Blokkersdijk site, alternative direct ecotoxicity thresholds were calculated; 10 µg/kg dw for PFOS and 46 µg/kg dw for PFOA (see Table 2). The calculated values serve as a useful first-tier screening tool for risk assessment. In the context of environmental risk assessment, especially for PFAS-contaminated soil, Tier 1 risk assessment refers to the initial, conservative screening phase used to determine whether a site may pose a potential risk to human health or the environment. It is the first step in a tiered or phased approach to risk assessment and decision-making.

**Table 2. Overview of the AF-based PNEC values derived for direct toxicity in PFAS contaminated soil.**

| Threshold (µg/kg dw) | AF-based $PNEC_{soil}$ * |
|---|---|
| PFBS | 1000 |
| PFHxS | 10 |
| PFHpS | No data |
| PFOS | 10 |
| PFBA | No data |
| PFHxA | >20 |
| PFHpA | 10 |
| PFOA | 46 |
| PFNA | 10 |
| PFBSA | No data |
| MePFBSA | No data |
| EtPFOSAA | No data |
| 6:2 FTS | No data |

*Based solely on soil ecotoxicology data.

Although PFAS soil thresholds have been established in a few European countries, applying them in practice remains challenging. Belgium's framework is the most operational, with clear values and integration into permitting and remediation workflows. In contrast, Denmark's site-specific approach and Norway's background-based trigger require expert judgment and local adaptation.

Across all cases, effective implementation depends on reliable analytical methods, clear land use definitions, and the ability of regulatory authorities to interpret data and enforce decisions. Therefore, these thresholds are useful as first-tier screening tools but not sufficient on their own for comprehensive risk management. Also, it is important to establish the background soil levels on Jersey to determine the feasibility of introducing stringent soil guidelines.

Soil threshold values can be affected ongoing inputs from secondary sources such as sewage sludge (or biosolids). Biosolids applied to agricultural land can introduce PFAS at levels of concern, potentially elevating soil concentrations over time and undermining the effectiveness of existing thresholds. The following section explores how biosolids can contribute to PFAS accumulation in soil, with implications for crop uptake, groundwater contamination, and long-term regulatory control.

**Biosolids management options**

Sewage sludge or biosolids are a waste product from municipal wastewater treatment plants (WWTPs) and are known to be contaminated with PFAS.(Lenka, Kah et al. 2021) WWTPs are not primary sources of PFAS, but instead receive PFAS from diverse domestic, commercial, and industrial sources. PFAS enter WWTPs via influent wastewater and during treatment are redistributed across multiple environmental media; including treated effluent, air emissions, the untreated sewage sludge, and the biosolids. The composition and concentration of PFAS in these outputs reflect influent characteristics, treatment processes, and the presence of precursors that may transform during treatment.(Lenka, Kah et al. 2021)

PFAS in the WWTP influent originate from both point and diffuse sources. While industrial discharges historically dominated PFAS loading, recent studies suggest that domestic sources now contribute substantially, often primarily, to PFAS concentrations in municipal systems(Thompson, Mortazavian et al. 2022). These domestic sources include; laundry effluent from treated textiles, food packaging waste, personal care products and household cleaners, human excretion of PFAS and drinking water contaminated with PFAS.

WWTPs also receive PFAS via landfill leachate, industrial pretreatment discharges, and stormwater inflows. The influent PFAS profile includes both terminal perfluoroalkyl acids (PFAAs) and a wide range of precursors such as fluorotelomer sulfonates, polyfluoroalkyl phosphate esters (PAPs and diPAPs), and sulfonamides. Precursors may be more prevalent than the perfluoroalkyl acids in contemporary wastewater.(Thompson, Robey et al. 2023) These precursors can undergo biotic and abiotic transformation during treatment, contributing to the formation of persistent PFAAs in effluent and biosolids.(Lenka, Kah et al. 2021)

Conventional WWTP processes, including primary sedimentation, activated sludge, and secondary clarification, are not designed to remove PFAS. PFAAs such as PFOA, PFOS, and PFBS are frequently detected in treated effluent, often at concentrations ranging from tens to hundreds of ng/L.(Lenka, Kah et al. 2021) Treatment may increase PFAA concentrations via precursor oxidation.(Mlüler, Kindness et al. 2023) Advanced technologies such as granular activated carbon (GAC), reverse osmosis (RO), and ion exchange resins show promise but are costly, energy-intensive, and variably effective, particularly for short-chain PFAS.(Alsadik, Akintunde et al. 2025)

Partitioning behaviour during treatment results in significant PFAS accumulation in solids. Sludge, scum, and septage contain elevated concentrations of both PFAAs and precursors. These solids are typically stabilized through anaerobic digestion, then dewatered to produce sewage sludge (biosolids), which are managed via land application, landfilling, or thermal treatment (e.g., waste-to-energy plants, cement kilns, or pyrolysis). Anaerobic digestion does not effectively degrade PFAS;

instead, it may concentrate PFAS in solids and facilitate precursor transformation.(Lakshminarasimman, Gewurtz et al. 2021) Each management option presents potential for PFAS release. Land application can result in PFAS leaching to groundwater, runoff to surface water, and uptake by plants and soil organisms. Landfilling and compositing may lead to PFAS release via leachate, which is often treated at WWTPs, creating a feedback loop. Thermal treatments are being studied due to concerns about incomplete combustion and byproduct formation.

PFAS in biosolids include both terminal perfluoroalkyl acids (e.g., PFOS, PFOA) and precursors such as diPAPs, fluorotelomer sulfonates, and sulfonamides.(Zhou, Li et al. 2024) These compounds originate from domestic and industrial sources and can persist through treatment. Studies have reported PFOS concentrations in biosolids ranging from 0.02–601 µg/kg and PFOA from <0.01–2440 µg/kg.(Zhou, Li et al. 2024) Transformation of precursors to PFAAs has been observed in land-applied biosolids,(Washington, Yoo et al. 2010) although some precursors remain in soils for decades.(Washington, Rankin et al. 2019)

Given the persistence of PFAS in biosolids and their potential for environmental release, the method of sludge management plays a critical role in determining exposure pathways and long-term risks. The following sections examine key disposal and treatment options, beginning with land application.

**Land Application of biosolids**

Land application of biosolids is, potentially a major PFAS release pathway, particularly industrially-derived biosolids. PFAS can leach to groundwater or run off to surface water, with fate influenced by soil properties, infiltration rates, climate, and application practices. Elevated PFAS concentrations have been observed in water bodies near fields receiving biosolids from industrially impacted WWTPs.(Washington, Yoo et al. 2010) Municipal biosolids may pose lower relative risks, but still contribute to environmental loading.(Gottschall, Topp et al. 2017) PFAS mobility is enhanced in areas with high infiltration or shallow groundwater, and short-chain PFAS are particularly mobile in soils and groundwater.

PFAS in biosolids-amended soils can be taken up by plants and soil organisms, potentially entering the food chain. Uptake is compound- and crop-specific, with short-chain PFAS exhibiting higher bioaccumulation factors (BAFs) than long-chain analogues. Blaine et al.(Blaine, Rich et al. 2013, Blaine, Rich et al. 2014, Blaine, Rich et al. 2014) reported BAFs ranging from 0.1 to 10 in edible crops. Livestock fed silage from biosolids-treated fields have shown elevated tissue PFAS levels.(Lindstrom, Strynar et al. 2011) However, some studies found no detectable PFAS in grain grown on biosolids-treated plots.(Gottschall, Topp et al. 2017) Importantly, the PFAS concentration in the biosolids is a key factor in controlling the potential for contamination of groundwater and the agricultural food chain.

Applying biosolids to agricultural soil can increase PFOS concentrations above natural background levels and, over time, may challenge existing soil thresholds. To estimate this effect, consider a typical land application rate of 5 metric tons of biosolids per hectare. If the biosolids contain 25% solids (a common value for dewatered sludge) and PFOS at 50 µg/kg dry weight, this equates to 1,250 kg of dry matter and a total PFOS input of 0.0625 grams. Assuming uniform mixing into the top 15 cm of soil with a bulk density of 1.4 $g/cm^3$ (yielding approximately 2.1 million kg of soil per hectare), the resulting increase in soil PFOS concentration would be around 0.03 µg/kg dry weight. While this is well below the Flemish background value for PFOS (1.5 µg/kg dw), repeated applications or higher PFOS concentrations in biosolids could lead to cumulative buildup, potentially exceeding screening thresholds over time.

**Landfilling of biosolids**

Landfilling of biosolids can contribute to PFAS release via leachate, which is often routed to wastewater treatment plants (WWTPs) or discharged to surface water. PFAS concentrations in landfill leachate typically range from nanograms to hundreds of micrograms per litre,(Sabba, Kassar et al. 2025) and conventional leachate treatment is largely ineffective at removing these compounds. Liner failures or aging infrastructure can further exacerbate environmental releases. Landfilling of biosolids is not considered a viable option on Jersey given the shortage of landfills on the island.

**Thermal treatment of biosolids**

Incineration is currently used for a minority of biosolids, primarily in urban areas with limited land application capacity. While it offers benefits such as volume reduction, pathogen destruction, and energy recovery, its role in PFAS management is under increasing scrutiny. PFAS compounds are thermally stable and require high temperatures, typically above 850°C,(Weitz, Kantner et al. 2024) for complete destruction. In practice, incineration may not fully mineralize all PFAS, especially some small gaseous PFAS. Incomplete combustion can result in the formation of transformation products, including volatile fluorinated compounds and hydrogen fluoride (HF), which pose additional environmental and health risks. Stack emissions, fly ash, and bottom ash may retain residual PFAS, complicating disposal and air quality management.

Research is ongoing to evaluate the efficacy of incineration and to characterize PFAS emissions profiles under various operating conditions. A 2023 study by Björklund et al.(Björklund, Weidemann et al. 2023) investigated PFAS emissions during incineration of municipal solid waste (MSW) amended with 5–8 wt % biosolids in a Swedish waste-to-energy plant. PFAS were detected in all examined residues, with short-chain PFCAs (C4–C7) being most abundant. Total extractable PFAS levels were higher in biosolid-amended MSW than in standard MSWI, with estimated annual releases of 47 g and 13 g, respectively. Notably, PFAS were detected in flue gas for the first time (4.0–5.6 ng/m$^3$), underscoring that high-temperature incineration does not guarantee complete PFAS degradation. In 2024, Björklund et al. (Björklund, Carlund et al. 2024) extended this work by investigating PFAS fate in the in-house process-water treatment (PWT) system of the same waste to energy plant. Sampling across five locations over five days revealed that nine of eleven target PFAS were consistently present, with concentrations varying due to waste fuel composition. PFAS levels were highest in foam (130 times that of treated water) though the mass flow was lower. The condensate scrubber was identified as a key transfer step, increasing PFAS mass flow in the PWT sixfold after condensate addition. The study concluded that the existing PWT configuration was not effective at removing PFAS, despite potential for targeted improvements. Most recently, Johansson et al. (Johansson, Bolinius et al. 2024) investigated PFAS emissions from bottom ash at Swedish municipal solid waste incineration (MSWI) sites. Sampling ash from facilities representing 70% of Sweden's incineration capacity, the researchers found that PFAS concentrations were low, typically in the nanogram-per-gram (µg/kg) range, with PFBA, PFBS, and PFHxA most frequently detected. However, measurements of extractable organofluorine (EOF) revealed that unidentified fluorinated compounds were present at higher levels than the sum of known PFAS, suggesting that conventional targeted analysis may underestimate total PFAS-like content. Leaching tests showed limited PFAS mobility from bottom ash under standard conditions, indicating a low risk to groundwater when ash is properly managed. Collectively, these studies suggest that while bottom ash may pose limited risk under controlled conditions, flue gas, process water, and residues from sludge-enhanced incineration represent more significant emission pathways. The presence of unidentified EOF across waste streams highlights the need for broader monitoring and precautionary management, especially when residues are reused or landfilled without containment. There is a waste to energy management plant on Jersey, and if biosolids are incinerated there, monitoring of the waste streams for PFAS is recommended.

To address the limitations of conventional incineration and to provide alternative management options, several emerging thermal and chemical technologies are being explored. Cement kilns, for example, operate at temperatures up to 1,450°C and offer long residence times, making them promising for PFAS destruction. They are widely used in Switzerland for the treatment of biosolids. Co-processing biosolids in kilns may achieve near-complete fluorine mineralization, but concerns remain about volatilization, emissions control, and regulatory oversight. There are no cement kilns on Jersey so this is not a viable management option.

Pyrolysis, which involves heating biosolids in the absence of oxygen (typically 400–900 °C), produces three main products: a solid product called biochar, a py-liquid that consists of aqueous phase and non-aqueous phase liquid, and py-gas. The biochar serves as a carbon-sequestering soil amendment, while py-gas can be used for on-site energy recovery. The py-liquid is a potentially hazardous complex mixture. Although pyrolysis can reduce PFAS in solids, it does not fully destroy them; instead, PFAS may partition into the py-liquid, which requires further treatment, e.g. by catalysis or thermal oxidation, to mitigate environmental risks. The fate of PFAS in py-gas remains poorly understood, representing a key knowledge gap. Moisture content in biosolids significantly affects the energy balance of pyrolysis, making the process more viable for utilities that already produce dried biosolids. Gasification, operating at even higher temperatures (800-1200°C) than pyrolysis with controlled oxygen or steam, shows potential for PFAS breakdown given the higher operating temperatures, though it remains technically complex and capital-intensive.(Winchell, Ross et al. 2022) Neither pyrolysis nor gasification facilities are currently available on Jersey. While technically feasible, installation at the wastewater treatment plant would require substantial capital investment and careful consideration of operational needs, regulatory requirements, and long-term cost-effectiveness.(Winchell, Ross et al. 2022)

In summary, while incineration and emerging thermal technologies offer potential pathways for PFAS destruction in biosolids, none are yet universally accepted or proven for PFAS. Continued research, technology refinement, and regulatory alignment are essential to ensure safe, effective, and scalable solutions. The choice of treatment method must consider PFAS speciation, operational feasibility, environmental trade-offs, and long-term liability.

## References

Alsadik, A., O. O. Akintunde, H. R. Habibi and G. Achari (2025). "PFAS in water environments: recent progress and challenges in monitoring, toxicity, treatment technologies, and post-treatment toxicity." ENVIRONMENTAL SYSTEMS RESEARCH **14**(1).

Björklund, S., A. Carlund, E. Weidemann and S. Jansson (2024). "Occurrence and mass flow rate of PFAS in a Waste-to-Energy water treatment process." Waste Management **190**: 169–173.

Björklund, S., E. Weidemann and S. Jansson (2023). "Emission of Per- and Polyfluoroalkyl Substances from a Waste-to-Energy Plant–Occurrence in Ashes, Treated Process Water, and First Observation in Flue Gas." Environmental Science & Technology **57**(27): 10089–10095.

Blaine, A. C., C. D. Rich, L. S. Hundal, C. Lau, M. A. Mills, K. M. Harris and C. P. Higgins (2013). "Uptake of Perfluoroalkyl Acids into Edible Crops via Land Applied Biosolids: Field and Greenhouse Studies." Environmental Science & Technology **47**(24): 14062–14069.

Blaine, A. C., C. D. Rich, E. M. Sedlacko, L. S. Hundal, K. Kumar, C. Lau, M. A. Mills, K. M. Harris and C. P. Higgins (2014). "Perfluoroalkyl Acid Distribution in Various Plant Compartments of Edible Crops Grown in Biosolids-Amended soils." Environmental Science & Technology **48**(14): 7858–7865.
Blaine, A. C., C. D. Rich, E. M. Sedlacko, K. C. Hyland, C. Stushnoff, E. R. V. Dickenson and C. P. Higgins (2014). "Perfluoroalkyl Acid Uptake in Lettuce (Lactuca sativa) and Strawberry (Fragaria ananassa) Irrigated with Reclaimed Water." Environmental Science & Technology **48**(24): 14361–14368.
Brusseau, M. L., R. H. Anderson and B. Guo (2020). "PFAS concentrations in soils: Background levels versus contaminated sites." Science of The Total Environment **740**: 140017.
Gottschall, N., E. Topp, M. Edwards, M. Payne, S. Kleywegt and D. R. Lapen (2017). "Brominated flame retardants and perfluoroalkyl acids in groundwater, tile drainage, soil, and crop grain following a high application of municipal biosolids to a field." Science of The Total Environment **574**: 1345–1359.
Johansson, J. H., D. Bolinius, J. Strandberg, J.-J. Yang, J. P. Benskin and R. Awad (2024). "Emission of Perfluoroalkyl Acids and Unidentified Organofluorine from Swedish Municipal Waste Incineration Plants." Environmental Science & Technology Letters **11**(12): 1377–1383.
Johansson, J. H., Y. Shi, M. Salter and I. T. Cousins (2018). "Spatial variation in the atmospheric deposition of perfluoroalkyl acids: source elucidation through analysis of isomer patterns." Environmental Science: Processes & Impacts **20**(7): 997–1006.
Lakshminarasimman, N., S. B. Gewurtz, W. J. Parker and S. A. Smyth (2021). "Removal and formation of perfluoroalkyl substances in Canadian sludge treatment systems - A mass balance approach." SCIENCE OF THE TOTAL ENVIRONMENT **754**.
Lenka, S. P., M. Kah and L. P. Padhye (2021). "A review of the occurrence, transformation, and removal of poly- and perfluoroalkyl substances (PFAS) in wastewater treatment plants." WATER RESEARCH **199**.
Lindstrom, A. B., M. J. Strynar, A. D. Delinsky, S. F. Nakayama, L. McMillan, E. L. Libelo, M. Neill and L. Thomas (2011). "Application of WWTP Biosolids and Resulting Perfluorinated Compound Contamination of Surface and Well Water in Decatur, Alabama, USA." ENVIRONMENTAL SCIENCE & TECHNOLOGY **45**(19): 8015–8021.
Mlüler, V., A. Kindness and J. Feldmann (2023). "Fluorine mass balance analysis of PFAS in communal waters at a wastewater plant from Austria." WATER RESEARCH **244**.
OVAM (2025). Informatie over richtinggevende toetsingswaarden voor bodemonderzoek en sanering voor PFAS: Aanvulling bij Basisinformatie voor risico-evaluaties. Publicatiedatum: 1 juli 2025. Openbare Vlaamse Afvalstoffenmaatschappij (OVAM), Mechelen, België. https://ovam.vlaanderen.be.
RIVM (2017). RIVM (Rijksinstituut voor Volksgezondheid en Milieu). (2017) Report. Risicogrenzen PFOA voor grond en grondwater. https://rivm.openrepository.com/bitstream/handle/10029/622062/2018-0060.pdf?sequence=1&isAllowed=y.
RIVM (2020). RIVM (Rijksinstituut voor Volksgezondheid en Milieu) Report. Ecotoxicologische risicogrenzen voor PFOS in bodem en grondwater. www.rivm.nl/bibliotheek/rapporten/2020-0085.pdf.
Sabba, F., C. Kassar, T. Zeng, S. P. Mallick, L. Downing and P. McNamara (2025). "PFAS in landfill leachate: Practical considerations for treatment and characterization." JOURNAL OF HAZARDOUS MATERIALS **481**.
Sörengård, M., J. Kikuchi, K. Wiberg and L. Ahrens (2022). "Spatial distribution and load of per- and polyfluoroalkyl substances (PFAS) in background soils in Sweden." Chemosphere **295**: 133944.
Thompson, J. T., N. M. Robey, T. M. Tolaymat, J. A. Bowden, H. M. Solo-Gabriele and T. G. Townsend (2023). "Underestimation of Per- and Polyfluoroalkyl Substances in Biosolids: Precursor Transformation During Conventional Treatment." ENVIRONMENTAL SCIENCE & TECHNOLOGY.
Thompson, K. A., S. Mortazavian, D. J. Gonzalez, C. Bott, J. Hooper, C. E. Schaefer and E. R. V. Dickenson (2022). Poly- and Perfluoroalkyl Substances in Municipal Wastewater Treatment Plants in

the United States: Seasonal Patterns and Meta-Analysis of Long-Term Trends and Average Concentrations, Figshare.
Washington, J. W., K. Rankin, E. L. Libelo, D. G. Lynch and M. Cyterski (2019). "Determining global background soil PFAS loads and the fluorotelomer-based polymer degradation rates that can account for these loads." Science of The Total Environment **651**: 2444–2449.
Washington, J. W., H. Yoo, J. J. Ellington, T. M. Jenkins and E. L. Libelo (2010). "Concentrations, Distribution, and Persistence of Perfluoroalkylates in Sludge-Applied Soils near Decatur, Alabama, USA." ENVIRONMENTAL SCIENCE & TECHNOLOGY **44**(22): 8390–8396.
Weitz, K., D. Kantner, A. Kessler, H. Key, J. Larson, W. Bodnar, S. Parvathikar, L. Davis, N. Robey, P. Taylor, F. De la Cruz, T. Tolaymat, N. Weber, W. Linak, J. Krug and L. Phelps (2024). "Review of per- and poly-fluoroalkyl treatment in combustion-based thermal waste systems in the United States." Science of The Total Environment **932**: 172658.
Winchell, L. J., J. J. Ross, D. A. Brose, T. B. Pluth, X. Fonoll, J. W. Norton and K. Y. Bell (2022). "Pyrolysis and gasification at water resource recovery facilities: Status of the industry." WATER ENVIRONMENT RESEARCH **94**(3).
Zhou, T., X. Li, H. Liu, S. M. Dong, Z. H. Zhang, Z. Y. Wang, J. B. Li, L. D. Nghiem, S. J. Khan and Q. L. Wang (2024). "Occurrence, fate, and remediation for per-and polyfluoroalkyl substances (PFAS) in sewage sludge: A comprehensive review." JOURNAL OF HAZARDOUS MATERIALS **466**.

Infrastructure and Environment

# Private Water Supplies in Jersey

OCTOBER 2025

Government of Jersey

## Contents

## Introduction

This paper, prepared by the Pollution Control team, with input from the other relevant teams in Environment and Consumer Protection, provides an oversight on private water supplies in Jersey, focusing on the regulations governing them and highlighting similarities and differences in legislation, oversight and practical implementation in Jersey and the UK/England. It also provides data on the number and usage of private water supplies in Jersey.

## What is a Private Water Supply?

Private water supplies are when water is drawn from a source that is not a mains water supply so can include sources such as boreholes, wells, springs, streams and other abstraction points. It can be used for domestic (house) uses or other uses such as garden watering / swimming pools.

## Regulations

### Jersey

**Water Resources (Jersey) Law 2007** – this requires all private water supplies (using up to 15m$^3$ of water a day) to be registered (there is currently no cost for this), and anyone using abstraction over 15m$^3$ of water a day from any type of private water supply, must be licensed. Licenced abstractions fall into 3 fee bands:

- Less than 100 cubic metres (about 22,000 gallons) in any 24 hour period
- Between 100 to 250 cubic metres (about 55,000 gallons) in any 24 hour period
- Over 250 cubic metres (about 55,000 gallons) in any 24 hour period

A significant number of licences are held by farmers for crop irrigation over a growing period (typically 4 months).

There is no fee for registration, the fees for abstraction licences are detailed below.

**Housing legislation for rented properties** – Private water supplies serving rented dwellings fall within the scope of residential rented-dwelling legislation. Under the Residential Dwelling Licence scheme, the associated Code of Practice—based on the UK's Housing Health and Safety Rating System (HHSRS)—requires landlords to ensure that the water supply provided to tenants is safe for drinking. While the Code does not prescribe specific water-quality parameters, it refers to the standards used for private water supplies in England. Where a rented property fails to meet these requirements under the Public Health and Safety (Rented Dwellings) (Jersey) Law 2018 and its associated Regulations, enforcement action may be taken under the relevant housing legislation.

**Statutory Nuisances (Jersey) Law 1999** – covers wells, tanks, cisterns for domestic water supply if contamination poses a health risk. In most cases, an occupant must demonstrate that another resident's actions are adversely affecting their property, such as compromising their water supply.

**Loi sur la Sante Publique 1934 (Public Health Law)** – authorities are granted powers to prevent and combat anything detrimental to public health, including ensuring access to safe water supplies and proper drainage. However, this legislation is dated: its provisions are broad and intrusive, reflecting historical approaches to public health, and it lacks many procedural safeguards that are standard in modern public health statutes.

### England

Private Water Supplies (England) Regulations 2016 (as amended) – the main legislation covering private water supplies in England and is similar to legislation in other UK jurisdictions. Private water supplies are categorised by type (large/commercial, standard and single supplies) and depending on the category, depends on the sampling/monitoring required and the risk assessment requirement. The supplies are defined under the legislation as:

- Regulation 8 supplies under these regulations are those where a water supply is provided by a water company but it is then further distributed by a person other than a water company.
- Regulation 9 supplies are commercial or public use supplies, including those supplies where the daily average volume of water consumed for domestic purposes if 10m3 or more per day of water or where the water is used as part of a commercial or public activity (irrespective of the volume they consume).
- Regulation 10 supplies are small shared supplies (more than one property using the supply) where there are no commercial activities using the water (therefore no tenanted properties) and the water consumed for those domestic purposes is less than 10m3 a day).

More information can be found at: [Types of private supplies (England) - Drinking Water Inspectorate]

The responsibility of the private water supply lies with the 'relevant person' and there is a significant involvement of the local authority, who undertake the risk assessments and testing. There are enforcement actions available under these regulations for supplies that fail to meet the standards set out in these regulations.

## Parameters

### Jersey

There are currently no parameters set out in any legislation regarding the quality of private water supplies.  Generally, the English legislative requirements are used as guidance.

### England

Depending on the type and volume of water supply, along with the type of premises using the water (as described above), depends on what parameters are tested for as a requirement, plus any extra parameters due to local knowledge or complaints received. Schedule 1 sets out the parameters for the following substances:

Microbiological Parameters - *E. coli, Enterococci, Pseudomonas aeruginosa (in bottled water only), Colony count at 22 °C (for bottled water only)*

Chemical Parameters - Directive Requirements (Part I) – *Acrylamide, Antimony, Arsenic, Benzene, Benzo(a)pyrene, Boron, Bromate, Cadmium, Chromium, Copper, Cyanide, 1,2-dichloroethane, Epichlorohydrin, Fluoride, Lead, Mercury, Nickel, Nitrate, Nitrite, Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide, Other pesticides, Sum of pesticides, Polycyclic aromatic hydrocarbons, Selenium, Tetrachloroethene and Trichloroethene, Trihalomethanes (total), Vinyl chloride*

Chemical Parameters - National Requirements (Part II) – *Aluminium, Colour, Iron, Manganese, Odour, Sodium, Taste, Tetrachloromethane, Turbidity, Indicator Parameters (Excluding Radioactive Substances), Ammonium, Chloride, Clostridium perfringens (including spores), Coliform bacteria, Colony counts at 22 °C (non-bottled water), Conductivity, pH (hydrogen ion), Sulphate, Total organic carbon (TOC), Turbidity*

Indicator Parameters (Radioactive Substances) - *Indicative dose, Gross alpha, Gross beta, Radon, Tritium*

## Testing options

### Jersey

The States Analyst and Jersey Water are the only laboratories who can test water samples on island and they can also only test for certain common parameters. Samples are collected by regulators if there is a suspected pollution incident or similar, or are delivered by the occupant of the property to the States Analyst or are taken at the property by Jersey Water, dependant on the circumstances. Some less common parameters require samples to be sent off island, usually organised by Jersey Water.

### England

Samples are usually collected from Local Authorities (or other regulators) by UKAS accredited laboratories and results sent back within 2 weeks.

## Statistics

### Jersey

Jersey Water have advised that approx. 6693 people in Jersey are on private water supplies for drinking water.

Land and Resource Management and Pollution control hold data on private water supplies in Jersey. Current data indicates that 1759 properties consume water from a borehole while 485 consume water from a well, the numbers are those estimated to be consuming water (e.g. drinking water) from their private water supply. A breakdown of how private water supplies are used in Jersey can be seen below:

| Type | Boreholes | Wells |
|---|---|---|
| Agriculture | 18 | 3 |
| Amenity | 15 | 4 |
| Business | 122 | 9 |
| Garden and pool | 107 | 21 |
| Garden watering | 508 | 223 |
| Garden, business | 5 | 2 |
| House and Business | 52 | 12 |
| House and garden | 815 | 178 |
| House and pool | 30 | 2 |
| House supply | 630 | 258 |
| House, Garden, Business | 21 | 3 |
| House, Garden, Other | 12 | 7 |
| House, garden, pool | 199 | 25 |
| | | |
| Licensed | 117 | 3 |
| | | |
| **Total** | **2651** | **750** |
| | | |
| Drinking water | 1759 | 485 |
| | | |

Private water supplies registered for house use, presumed consumption of the water from the kitchen (or other) tap. This includes properties listed as using their water supply for just the house supply, or house supply plus other uses (such as gardening, pool supply etc).

51 properties which have a UPRN that supplies more than 1 property. However, as there are no legislative requirements in Jersey based on how many properties a supply feeds and the types of these properties, data is not held on the number of properties supplied by each private water source so this figure is likely to be severely inaccurate.

There are also properties that are not registered or licenced for a private water supply and also did not have a public water supply. These properties are not known unless identified during the course of other investigations.

### England

A 2020 Drinking Water Inspectorate report reported approximately 36,913 private water supplies in use in England. This includes single-household supplies through to large domestic supplies supplying a number of properties and large commercial supplies (such as hotels).

## Costs

### Jersey

Under Jersey legislation, the only charges associated with regulations and private water supplies are the charges imposed by the Water Resources (Jersey) Law 2007 for abstractions.

Licenced quantity in any 24 hour period.

| **Annual fee** | **2025** |
|---|---|
| Less than 100 cubic metres (about 22,000 gallons) | £51.40 |
| Between 100 to 250 cubic metres (about 55,000 gallons) | £103.90 |
| Over 250 cubic metres (about 55,000 gallons) | £156 |
| Jersey Water (single charge) | £129,948.50 |

### England

In England there are a number of charges imposed by the Private Water Supply Regulations, as set out below:

- Risk assessments – these are carried out initially on all new declared supplies (apart from those serving one single domestic dwelling). Risk assessments are then updated on all those supplies at least once every five years, or on request.
- Water sampling and analysis – these are carried out at least every 6 months, yearly, or 5 yearly (depending on the size and use of the supply), or on request.
- Investigations – these will be carried out when there are failures of water samples meeting the statutory requirements.

In the 2016 Regulations there were maximum costs set that could be imposed by regulators to recover costs for the risk assessments, sampling and other activities set out in the Regulations. The 2018 amendment to these Regulations removed this maximum cost but the provisions for what can be charged for remain the same. Depending on the type of supply, depends what can be tested for, as set out in the law. For example, this means that any PFAS testing cannot be charged back to the 'relevant person' responsible for the private water supply.

More information can be found at: Information note on Regulation 21 - Drinking Water Inspectorate

## Overview

| Aspect | Jersey | England |
|---|---|---|
| **Legislation** | No specific PWS legislation, relies on other legislation to cover some circumstances. | Dedicated PWS Regulations. |
| **Supply registration** | Mandatory registration of any PWS. | No requirement for 'registration'. |
| **Risk assessment information** | No legal requirement. | Mandatory requirement, depending on supply size. |
| **Testing frequency** | No legal requirement. Encourage sampling annually. | Mandatory requirement, frequency dependant on supply use/size. |
| **Enforcement authorities** | Regulation Directorate, Government of Jersey. | Local Authorities and the Drinking Water Inspectorate. Enforcement actions available. |
| **Standards and outcomes** | No legal requirements. Guidance aligned to UK and EU limits. | Specific standards in PWS Regulations (aligned with rest of UK/EU). |

## Conclusion

The regulatory approaches to private water supplies in Jersey and England reflect differing legislative frameworks and historical contexts. The UK operates under a dedicated and structured set of Private Water Supply Regulations, which provide a clear, risk-based approach to monitoring, enforcement, and public health protection. In contrast, Jersey currently regulates private water supplies through a combination of existing legislation, including the Housing Health and Safety Rating System (HHSRS), the Statutory Nuisances (Jersey) Law 1999, and the *Loi sur la Santé Publique* (1934). However, it is key to remember that the majority of private water supplies are not covered by any legislation in Jersey and therefore there is a lack of monitoring.

While Jersey does not have a standalone private water supply law, its existing frameworks offer mechanisms to address water quality concerns, particularly in rented properties and in response to public health risks. However, the reliance on older legislation and complaint-driven enforcement may present challenges in ensuring consistent oversight and proactive risk management.

Infrastructure
and Environment

# La Collette Energy Recovery Facility

## Overview

Infrastructure & Environment operates the Energy Recovery Facility (ERF) at La Collette to incinerate Jersey's municipal and commercial waste. Typically, 70,000 tonnes of waste is received and processed every year. The process also normally generates around 7.5MW of electricity some of which is transmitted directly onto the Jersey electrical grid network. The ERF is regulated under Waste Management (Jersey) Law and holds licence WML019 which describes the types of waste that can be accepted and defines limits on emissions to land, sea and air.

## Plant and Operational Description

The ERF receives commercial and municipal waste from the Jersey Parishes and Jersey's commercial companies. The waste is mixed in the bunker by two grab cranes and fed to two identical boilers where it is burnt as it travels down the boiler grates. The internal combustion temperature is maintained above the minimum requirement of 850ºC. There is around three hours retention time for waste to travel across the grates before dropping into the ash extraction system. The ash is exported to the UK where it is processed in a facility that removes any metal for recycling and prepares the ash to be used as aggregate, for example in road foundations etc.

The hot gasses from the combustion process flow through the boilers turning water into superheated steam with conditions of up to 43 Bara and 397ºC. This steam is then expanded through a steam turbine before being condensed back to water in the condensers and pumped back around the system and reused.

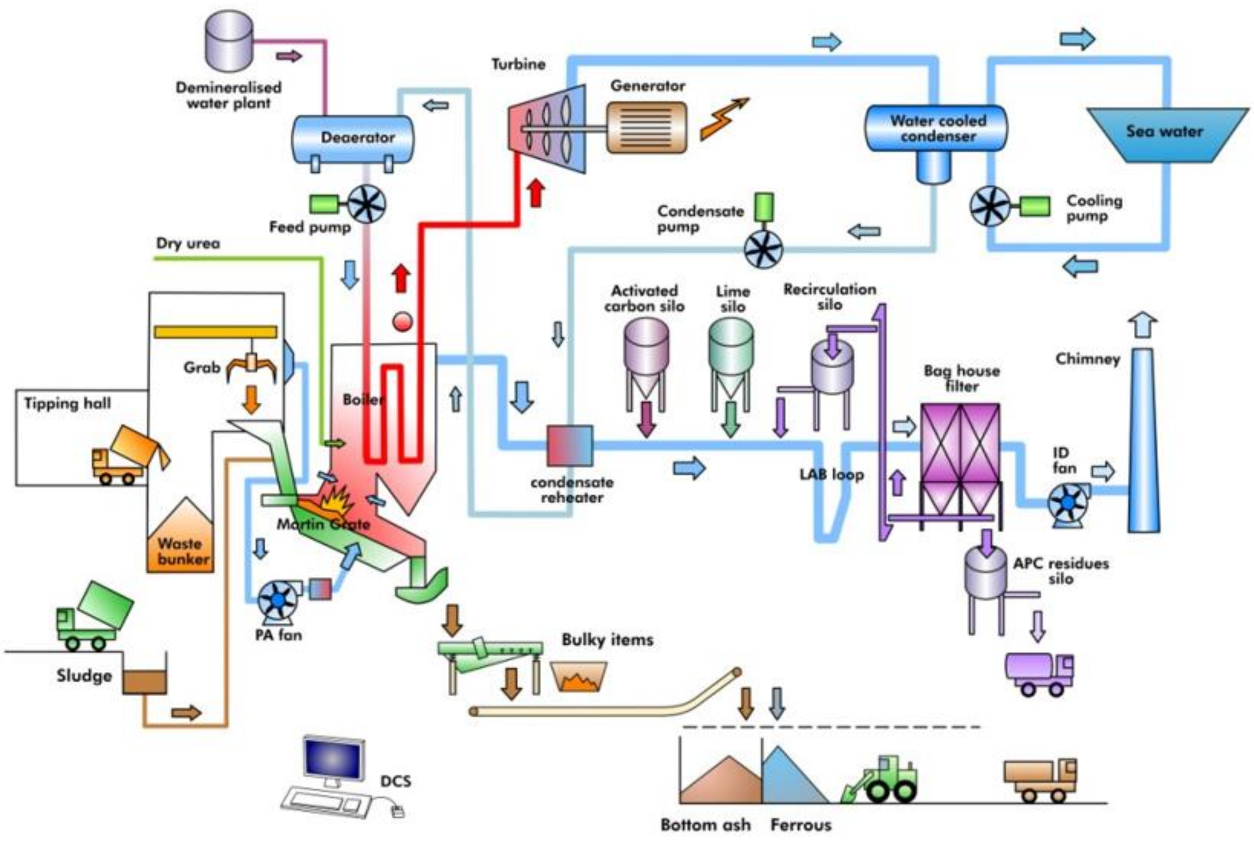
The superheated expanding steam from the boilers spins the single steam turbine shaft that is mechanically coupled to a 4-pole generator. The generator spins at 1500rpm to produce up to 10.24MW of electrical power for distribution to the La Collette Peninsula and the Jersey electricity grid.

The condensers are cooled by seawater passing through titanium tubes. The differential between inlet and outlet temperature is limited to 8°C so there is negligible impact on sea life.

The hot combustion gasses are cleaned and conditioned by the flue gas treatment system so that they can be released into the atmosphere via the chimney within licence limits without causing pollution. Urea is added to remove nitrogen oxides (NOx), lime is added to correct the pH and activated carbon is added to remove any dioxins & furans, trace amounts of any heavy metals and volatile organic compounds (VOCs). Bag filters then filter the gasses to prevent small particles being discharged. The small particle residue or air pollution control residue (APCR) is bagged and exported to the UK to be used in concrete production etc following stringent testing.

The diagram below shows the process for the ERF as per the above description.

**PROCESS OVERVIEW - DIAGRAM**



## Waste Inputs

Municipal and commercial rubbish that has not been separated for recycling is accepted at the ERF. In 2023 a waste composition analysis was carried out which shows the unseparated waste is made up of:

| Categories | Average |
|---|---|
| 1. Paper and Card | 24.5% |
| 2. Plastic Film | 7.8% |
| 3. Dense Plastic | 9.7% |
| 4. Textiles | 3.4% |
| 5. Other Combustible | 22.2% |
| 6. Other Non-Combustible | 1.3% |
| 7. Glass | 2.4% |
| 8. Putrescibles | 21.4% |
| 9. Metal | 3.4% |
| 10. Waste Electrical and Electronic Equipment | 0.7% |
| 11. Potentially Hazardous Waste Items | 0.6% |
| 12. Fine Material | 2.6% |

## Operational Parameters

Although the ERF typically receives 70,000 tonnes of waste per annum the design can handle more than this.  The ERF design parameters are shown below:

| Parameter | Design Quantity |
|---|---|
| Waste | 16.1 t/h @ CV between 7.5 and 8.5 MJ/kg |
| Steam production | 47.1 t/h at 43 bara and 397°C (8,000 hours) |
| Gross electrical output | 10.24 MWe |
| Hydrated lime consumption | 185 kg/h (with recirc.) |
| Activated carbon consumption | 10.7 kg/h |
| Urea consumption | 35 kg/h |
| Process water consumption | 4.5 m3/h |
| APCR production | 550 kg/h |

## Monitoring, Testing and Reporting

All monitoring, testing and reporting requirements are set out in the Waste Management Licence WML019 sections 4 & 5 and the tables in Schedules 4 & 5. All reports are sent to the Regulator as required under the licence.

Infrastructure and Environment

# La Collette Clinical Waste Incinerator

## Overview

Infrastructure & Environment operates the Clinical Waste Incinerator at La Collette to dispose of wastes generated by healthcare industries. Such wastes require incineration at higher temperatures than the Energy Recovery Facility runs at. Typically, 150 tonnes of waste is received every year; the maximum It could process in a year is 230 tonnes. The incinerator is regulated under Waste Management (Jersey) Law and holds license WML038 which describes the types of waste that can be accepted and defines limits on airborne emissions.

## Plant Description

The Clinical Waste Incinerator is an auto-load, stepped hearth plant with two-staged pyrolytic gasification and combustion. The maximum throughput is 200 kg per hour, and the internal combustion temperature is maintained at above 1,100°C.

## Waste Inputs

Only clinical wastes are accepted for disposal. Clinical wastes include infectious wastes, needles and other sharps, and some types of medicines. These wastes may come from the General Hospital, private medical practices, pharmacies, dentists, tattoo and piercing studios, or nursing homes.

## Operational Throughput

The plant typically receives 150 tonnes of healthcare waste per annum. Although the maximum design throughput is 200 kg per hour, the plant is run at 180 kg per hour as higher throughputs can cause exceedances of the emissions limits.

Due to the large amount of metal and glass within the waste, the plant can run for up to three consecutive days before it needs to be shut down to manually clear large solid parts of bottom ash. It takes four days for the plant to cool and one day to clean the primary chamber, so the plant runs on an eight-day cycle. This reduces the possible annual throughput through the plant and means that the maximum volume of waste the plant could burn is 230 tonnes per year.

## Operational Process

Clinical Waste is delivered to the facility in lockable wheeled bins. The bins are weighed before they are stored in refrigerated cold rooms until incineration. When the incinerator is online, bins are placed into an elevator which empties the contents into the ram loader. A series of hydraulic functions delivers the waste into the incinerator's primary combustion chamber through the charge door.

The primary combustion chamber incorporates a stepped hearth which cascades the waste down a series of steps to the conditioning vestibule where combustion is completed and the solids are rendered to ash. Dehydration and ignition of the waste is provided by a diesel-fired ignition burner. Bottom ash is discharged into a water bath with a conveyor which deposits the ash into an external skip.

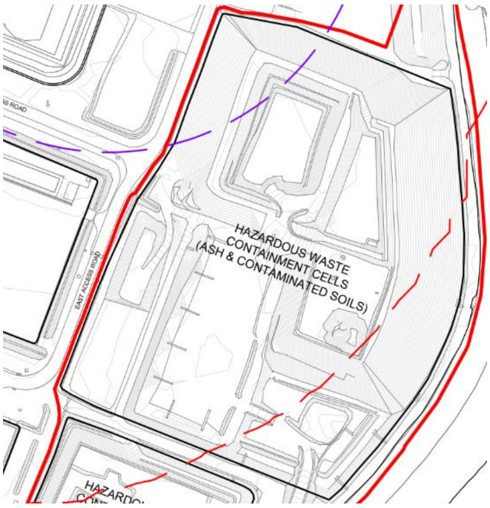
Gaseous products of combustion flow into the floor-mounted secondary combustion chamber where they are further heated, oxidised, and subjected to turbulence to ensure complete destruction of the combustion emissions. The temperature within the secondary chamber is maintained in excess of 1,100$^{o}$C.

The gases exit the secondary chamber along a refractory lined hot gas ductwork. Gas within the transfer duct is treated with a urea solution to reduce the levels of nitrogen oxide and nitrogen dioxide. The duct incorporates a dilution fan to ensure the optimum reaction temperature.

Treated gases then pass into the heat exchanger which is a low-pressure boiler containing water and glycol. The resulting exchange of energy cools the gases to approximately 180°C. Gases exiting the boiler are injected with sodium bicarbonate and activated carbon to neutralise the acid content and to capture vapour phase heavy metals before entering the abatement plant.

The abatement plant consists of a filter house which captures both the combustion particulates and the chemicals injected to control the acid gases and heavy metals. The resulting gases are continuously monitored by an emission monitoring system to ensure they are clean before being finally released to atmosphere. The particulate air pollution control residues are disposed off-island as solid waste.

Infrastructure
and Environment



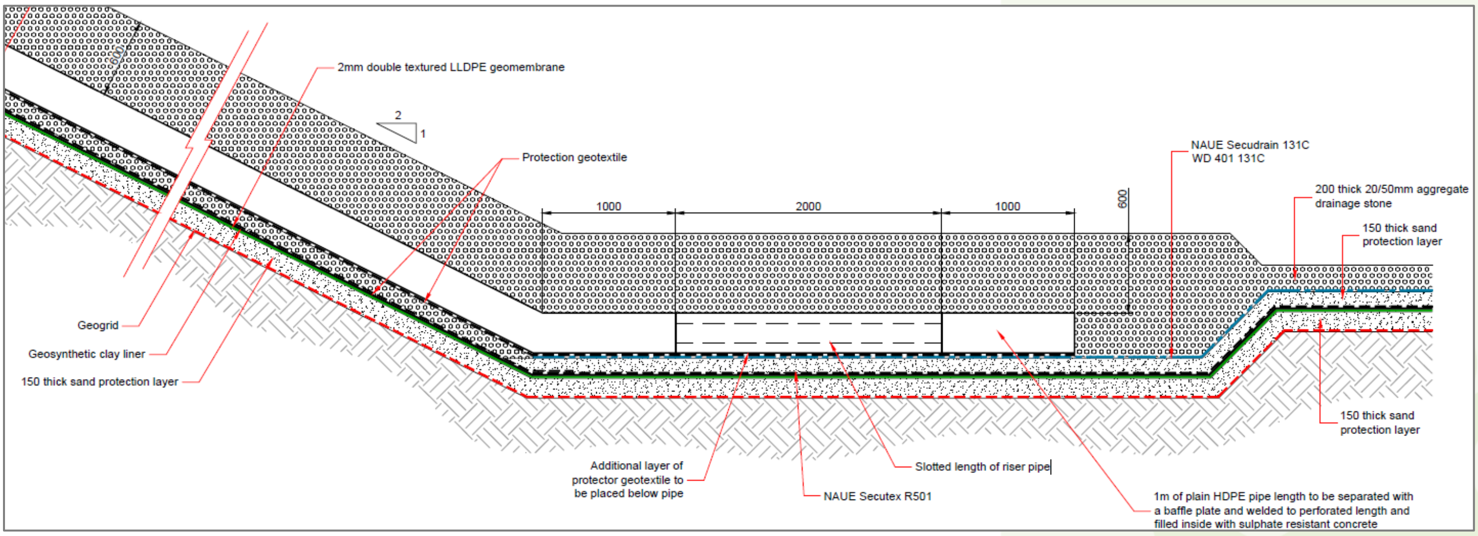

# Waste Disposal Cells at La Collette Reclamation Site

## Overview

The engineered containment cells at La Collette are operated by the Infrastructure & Environment Department. They are used to dispose of wastes produced by Jersey's industries that cannot be locally recycled, recovered or used for land reclamation. Typically, 17,000 $m^3$ of waste is received into the cells every year.

## Cell Engineering

The construction of cells meets the requirements for the landfill of non-hazardous waste as set out in Annex I of the EU Landfill Directive (1999/31/EC). The absence of clay in Jersey means that a geotechnical membrane is used with impermeable liners to meet the attenuation requirements.



## Waste Inputs

The types of waste that are accepted for disposal are: contaminated soils from property development, ash and residues from the clinical waste and animal carcass incinerators, gas scrubbers from the sewage treatment works and spent sandblasting material. Asbestos wastes are deposited into a separate cell which does not receive any other type of waste. Annual input volumes are:

| ERF Ash | ACI Ash | CWI Ash | Soils | Asbestos | Other | **Total** |
|---|---|---|---|---|---|---|
| 0 $m^3$ | 250 $m^3$ | 50 $m^3$ | 16,000 $m^3$ | 1,000 $m^3$ | 10 $m^3$ | **17,310 $m^3$** |

All waste accepted into the cells is classified by the waste producer following WM3 Guidance and checked against the site's waste acceptance criteria prior to disposal. The department insists on waste treatment prior to disposal where this is feasible to remove or reduce the hazard or to reduce the volume of material for disposal.

## Waste Acceptance Criteria

The acceptance criteria for landfilling of waste are published on www.gov.je to allow waste producers to easily reference them and plan treatments or disposal. The criteria have been designed to ensure the liners are protected from chemical or physical damage. No waste will be accepted if it does not meet all the criteria.

## Leachate Monitoring & Management

Leachate is the liquid that forms when rainwater filters through waste. As it passes through, it can pick up the chemicals in the waste stored in the cells and become contaminated. This liquid is carefully managed to protect the sea and the environment. Leachate is collected and pumped into the sewage treatment system so it can be safely processed. This prevents it from leaking into the sea or surrounding land. Once a disposal cell is full, it is sealed with a permanent cap which stops rainwater from getting and forming more leachate.

A water quality monitoring regime that tests for heavy metals, nitrates and organic compounds in the leachate, groundwater and seawater has been in place since 2011.

## Exporting Waste

Jersey is a member of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The convention requires that adequate disposal facilities are made available, and the export of waste is reduced to the minimum amount possible.

It is estimated that the cells will be operational for another 8 to 10 years at the current rate of disposal. When filled, there will be no more space to dispose of contaminated or hazardous wastes unless an alternative solution can be found.

Infrastructure and Environment

# Bellozanne Valley Wastewater Treatment Plant Summary

## Overview

The works is a conventional activated sludge facility utilising biological processes to break down waste to ensure a compliant final effluent. It incorporates a complete sludge treatment line utilising pasteurisation and anaerobic digestion to produce biogas for energy recovery, as well as dewatering to allow for biosolids utilisation.

## Inlet

All flow that enters the plant, regardless of whether it enters the main plant or is sent to the storm tanks, goes through a set of metal mesh screens to remove large solids and rags from the flow. The screened flow then enters a vortex grit chamber, which removes grit, sand, and any other heavy solids that typically have no calorific value.

From this point, the flow enters the primary settlement tanks. This is where the plant separates between the liquid and solids portion of the sewage. Heavy organic particles sink to the bottom of the tank and are pumped out from the bottom – this solid matter is known as sludge. Any fats, oils, and grease (FOG) floating on the surface are removed by a rotating bridge, which scrapes the FOG into a hopper and sends it along with the sludge to the digester site.

The plant from this point onward is split into two processes: one for processing the remaining liquid waste and the other for processing sludge at the digester site.

## Liquid Processing

The liquid portion that weirs over the weir wall from the primary settlement tank then enters the activated sludge process, which comprises firstly an anoxic zone. Due to its very nature of being devoid of oxygen, the purpose of the anoxic zone is to break down nitrates and nitrites into nitrogen gas via denitrification. The anoxic zone is a plug flow configuration.
This is then fed into the aeration zone, whereby air is blown into the tanks to provide oxygen for the biological organisms known as “bugs” to break down any carbonaceous matter. The input of air also causes nitrification, whereby ammonia is turned into nitrates and nitrites. The retention time for these tanks is approximately an hour depending on the rate of flow to the works.

At the outfall of this tank, a portion of the outfall is returned via the mixed liquor return pumps to the start of the anoxic zone to break down the nitrates and nitrites produced in the anoxic zone. The remaining outfall is distributed between six final settlement tanks (FSTs).
Once again, any remaining sludge that settles to the bottom is pumped out. The sludge in the final settlement tank is known as activated sludge due to the presence of bugs.

To keep a healthy culture alive in the activated sludge tank, this sludge is pumped back to the start of the anoxic zone so that bugs are retained in the system (known as return activated sludge (RAS)). To ensure the bugs don’t grow too large and die off from over competition, a portion of the activated sludge is diverted and sent to the digester site for solids processing (known as surplus activated sludge (SAS)). The SAS can also be co-settled with raw sludge in the primary settlement tanks.

The water that weirs over the FST weir wall is then sent through one final screen (known as the “leaf screen”) to remove any remaining large objects. It is then passed through a series of UV banks to kill off any bacteria and bugs still present in the final effluent. This is then sent through the culvert to the outfall at sea at First Tower.

The final effluent is tested two to three times a week to understand the composition of the raw sewage, settled sewage, and final effluent.

## Digester Plant

The SAS from the activated sludge process is put into the un-thickened sludge tank, whereby a drum thickener is used to thicken the sludge to around 5–6% dry solids.

This thickened SAS is then sent along with the raw sludge and FOGs to the thickened sludge tank. The sludge then proceeds through one final screen to remove any remaining rags or solids before entering the heat exchanger. It is heated up to 55°C and sent to the pasteurisation tanks, where it remains at 55°C for four hours. This kills off any diseases and harmful pathogens in the sludge. It also helps break down the sludge in preparation for digestion.

The sludge is then fed through another heat exchanger to cool the sludge down to 35°C. This is then sent to the anaerobic digesters, which have a retention time of approximately 12 days to ensure the sludge is broken down. This is achieved by microbes in the tanks, which generate biogas. This biogas is then cleaned and utilised by the combined heat and power unit (CHP) to provide electricity for the plant, as well as heating for the heat exchanger used in the pasteurisation process. A supplementary boiler is also present on site to provide heating for the pasteurisation process should the CHP undergo servicing or maintenance.

The digested sludge is then sent to the digested sludge tank, where it is dewatered into biocake via the use of centrifuges, which dry the cake to approximately 25% dry solids.
The sludge composition is tested daily during the working week. Pathogens in the biocake are tested quarterly.

## Biosolid Disposal

The solid material resulting from the wastewater treatment plant is known as “enhanced treated biosolids.” The annual production of biosolids is approximately 6,800 m³. The biosolids are routinely sampled and analysed for pH, bacteria, nutrient values, and potentially toxic elements as a suite of heavy metals.

The application of biosolids to agricultural land has a fertilising effect due to the concentration of nitrogen, phosphorus, and potassium. These values are used to calculate the maximum beneficial application of the biosolids within the specifications of the Water Pollution (Code of Good Agricultural Practice) (Jersey) Order 2009, Code of Practice for Agricultural Use of Sewage Sludge (Defra, 1996), and other guidance notes. The typical rate of application is 2.3 m³ per vergée for arable land and 3.4 m³ per vergée for grass (NOTE: 1 Jersey vergée = 1,798.6 m²). Farmers or land managers are consulted prior to application to ensure that

allowances for soil pH, crop-available nitrogen, and loadings of phosphate, potash, and magnesium are made and the spread rate is adjusted accordingly.
Biosolids are collected from the STW production site and delivered to the field in an agricultural spreader. Grass applications are distributed to the surface only. Arable applications are ploughed into a depth of 30 cm. Watercourses and boreholes are avoided. The receiving land is recorded and will only have biosolids applied once in any rolling 12-month period.

Intensive farming practices in Jersey mean that there is not enough landbank to handle all of the biosolids produced. Currently, around 50% of the production is used in this way. The remainder is delivered to the Energy Recovery Facility at La Collette. Biosolids are approximately 70% water, so incineration is currently seen as a last resort.

# PFAS Testing Protocol – Informing Report Four by the Independent PFAS Scientific Panel

## 1. Rationale for Testing

The rationale for PFAS testing in Jersey is grounded in the need to protect public health and the environment, supporting Jersey to understand the levels of PFAS on the broader environment and food chain. The Water Quality and Safety (WQS) Programme is a comprehensive initiative that addresses public concerns about PFAS contamination in the environment and its impact on water quality.

The programme will review and monitor PFAS in the broader environment and food, ensuring that actions are grounded in research and backed by scientific evidence.

The Independent Scientific Advisory Panel, commissioned by the Government, is undertaking Report 4 - PFAS in the Environment in 2025. This report will review global water standards to recommend a regulatory standard for Jersey. The Minister for the Environment plans to introduce this standard within the current government term, with a phased implementation period.

The European Food Safety Authority (EFSA) has established a Tolerable Weekly Intake (TWI) of 4.4 nanograms per kilogram of body weight per week for the sum of four PFAS compounds: PFOS, PFOA, PFNA, and PFHxS.

The PFAS testing programme in Jersey is designed to support the Independent Scientific Advisory Panel in understanding the average PFAS exposure of residents through food, water, and environmental sources

This data will be critical in determining whether current PFAS levels in drinking water are compatible with maintaining exposure below the EFSA TWI threshold. If food contributes significantly to the total PFAS intake, the regulatory standard for PFAS in water may need to be adjusted downward to ensure that total exposure remains within safe limits.

This approach mirrors international best practices, such as those used in Denmark, where water quality standards were derived by working backwards from the TWI, factoring in dietary intake and vulnerable population groups like children.

The WQS Programme will also focus on understanding PFAS in food, water, the marine environment, and waste, to gain a better understanding of PFAS levels and their impacts on public health and the environment.

The panel will ensure comparison with international data to understand how PFAS levels in Jersey compare generally. The testing information will also help to shape Jersey PFAS remediation strategy relating to the historic hotspot contamination at Jersey Airport.

## 2. Scope of Testing

### 2.1. Selection of Vegetables for PFAS Testing

Given the known behaviour of long-chain PFAS compounds, such as PFOS and PFOA, which tend to bind strongly to soil and accumulate in the roots and lower parts of plants, the vegetable testing strategy recommended by the panel will prioritise crops that are either root vegetables or grow close to the ground.

Vegetables and fruit grown as crops in Jersey will be tested to ascertain the level of PFAS compound contamination. Additionally, where possible, produce grown in areas of proven increased exposure will be compared to produce grown outside of these areas to determine the effect of the contaminated area on fruit and vegetables grown for consumption.

A range of fresh produce grown as commercial crops will be sampled for PFAS testing. These will include root vegetables such as potatoes and carrots and low growing vegetables such as cauliflower and courgettes. These are more likely to absorb PFAS from contaminated soil or irrigation water due to their proximity to the ground and the nature of their edible parts. A range of commercially grown fruit will also be tested, such as grapes and strawberries.

This targeted approach ensures that testing focuses on the most likely exposure pathways for consumers, supporting accurate dietary exposure assessments.

### 2.1. Selection of Meat Products for PFAS Testing

Although the production of beef, pork, and offal in Jersey is limited and most meat products are imported, it remains important to test locally produced meat to assess potential PFAS exposure from the environment.

The following meat products are recommended for PFAS testing as the main meat products produced and sold in Jersey.

- **Beef**
- **Pork**
- **Offal** (e.g. liver, kidney)

These products are prioritised because PFAS compounds, especially long-chain variants, are known to bioaccumulate in animal tissues, particularly in liver and kidneys, which are key organs for PFAS retention. Testing offal provides a sensitive indicator of environmental exposure in livestock.

While Jersey's domestic meat production is small, testing local samples will provide reassurance to consumers and help validate whether international data on PFAS levels in meat products applies to Jersey's context. The Independent Scientific Advisory Panel can also draw on comparative data from global studies to contextualise findings.

## 2.1. Selection of Dairy and Egg Products for PFAS Testing

Milk and eggs are important components of the local diet and can serve as indicators of PFAS transfer through the food chain, particularly where livestock are exposed to contaminated water, feed, or pasture.  Jersey Milk is the only milk available in Jersey and is therefore of particular importance.

The following products are recommended for PFAS testing:

- **Milk**
- **Jersey Eggs**

Milk is a key focus because PFAS compounds can be excreted through lactation, and levels in milk may reflect environmental exposure from soil, water, and feed. Testing milk from farms with differing land management practices, particularly those that have or have not applied sewage or water treatment sludge, will help assess the influence of biosolids on PFAS uptake.

Eggs are also relevant, as PFAS can accumulate in poultry exposed through feed or water, and eggs provide a concentrated biological sample for detecting contamination.

Although Jersey's production of these items is relatively small, testing local samples will provide reassurance to consumers and help determine support the Independent Scientific Advisory Panel in building a comprehensive exposure profile for the Island.

## 2.1. Selection of Marine Environment and Seafood for PFAS Testing

The marine environment is a critical component of Jersey's ecosystem and food chain. PFAS contamination in coastal waters can affect both marine biota and seafood consumed by the public, particularly in areas near known discharge points such as St Ouen's Bay and St Aubin's Bay. Where historic/third party local data is available this will be used in conjunction with any new sampling undertaken by government officers.

The following marine elements are recommended for PFAS testing:

- **Marine**:
    - Sea lettuce and seaweed which may be applied to land
    - Sea foam

- **Seafood**:
    - Crustaceans (e.g. crabs, lobsters)
    - Bivalve molluscs (e.g. oysters, mussels)
    - Fish (including freshwater and low-water)
- **Seawater**:
    - Seawater sampling, with a focus in St Ouen and St Aubin's Bay. Control sites in the North and East of the Island

Marine matter, such as seaweed and sea lettuce, is stationary and absorbent, making them useful indicators of PFAS presence in the marine environment. These samples will help assess ecological exposure.

Seafood testing will prioritise species that are locally harvested, especially those likely to be caught or gathered by amateur fishers. This includes low-water fish and shellfish, which may be consumed. Crustaceans and molluscs are particularly important due to their sediment-dwelling and filter-feeding behaviours, which increase their risk of PFAS accumulation.

Seawater samples will be collected from across the Island, with targeted sampling to support both environmental and food safety assessments.

This integrated approach ensures that marine testing is ecologically representative, dietarily relevant, and aligned with international best practice. It also supports public reassurance and provides essential data for the Independent Scientific Advisory Panel to assess total exposure and inform regulatory decisions.

### 2.1. Selection of Water Sources for PFAS Testing

**Water is a primary exposure pathway for PFAS, and understanding its contribution to overall intake is essential for public health protection and regulatory planning. Jersey's approach to water testing will combine existing data with targeted sampling to build a comprehensive picture of PFAS presence across the Island.**

The following water sources testing for PFAS will be undertaken:

- **Drinking Water**:
    - Post-treatment water supplies (existing data)
- **Surface and Rainwater**:
    - Streams entering reservoirs
    - Raw water pre-treatment at treatment plants

    - Rainwater (existing data)

- **Groundwater**:

    - Island-wide boreholes (a representative number of boreholes in each of the Island's water catchment areas)

Jersey Water already publishes extensive annual testing data for the public water supply, including PFAS results. This data will be used by the Independent Scientific Advisory Panel to assess compliance with international standards and to understand the contribution of mains water to overall PFAS exposure.

In addition, private borehole testing, particularly in areas affected by the plume, will be used to assess localised exposure risks. Where data gaps exist, new borehole samples will be collected to ensure island-wide coverage and to establish background PFAS levels in groundwater.

Surface water testing will focus on streams feeding reservoirs and raw water entering treatment plants, helping to identify upstream sources of contamination. Seawater sampling in known discharge areas will support the marine and seafood testing programme.

This integrated approach ensures that water testing is scientifically robust, geographically representative, and aligned to protect public health and inform future regulatory standards for drinking water.

### 2.1. Selection of Waste Processes and Soil for PFAS Testing

Waste and soil are key environmental reservoirs for PFAS, particularly where biosolids from water and sewage treatment processes have been applied to land. Testing in these areas is essential to understand the potential for PFAS to enter the food chain and water courses and to assess the long-term environmental impact.

The following waste and soil sources will be tested for PFAS:

- **Sewage Sludge**:

    - From sewage treatment works

    - Effluent discharge from sewage works

- **Water Treatment Process**

    - Sludge from water treatment process

    - Effluent from the water treatment process

- **Soil**:

    - Before and after biosolid application to assess PFAS uptake and persistence

    - On control fields with no history of biosolid use, to establish background levels
    - At inert waste sites, to monitor for any leaching or contamination from stored materials
    - From the fields where potato samples have been taken
    - Environmental background soil sample from wild/unfarmed or developed land.
- **Leachate and Surface Water**:
    - Landfill leachate
    - Surface water near landfill sites

## 3. Methodology

### 3.1 Analytical Methods

- **PFAS Suite**: Where possible full panel of UK Drinking Water Inspectorate 48 PFAS compounds will be tested for.
- Please note for food sampling it may only be possible to test for the 4 EFSA TWI compounds.
- **Testing Requirements**:
    - Individual PFAS compound concentrations
    - Sum of PFAS compounds
    - Specific quantification of the 4 EFSA TWI compounds
    - Use of existing Jersey Water data, where available
    - New borehole sampling to fill data gaps and establish background levels

### 3.2 Laboratory and Quality Assurance

- **Accreditation**: Where possible, new testing must be conducted by ISO/IEC 17025-accredited laboratories with demonstrated PFAS testing capability relevant to the sample being taken.
- **Detection Limits**: Laboratories must achieve ultra-trace detection limits:
    - Water: Low ng/L (parts per trillion)

    - Solids/Food: Low ng/kg
    - Lowest detection rate achievable

- **Chain of Custody for New Samples**:
    - Use of PFAS-free sampling equipment (e.g. HDPE or polypropylene containers)
    - Avoidance of fluoropolymer materials (e.g. PTFE, Gore-Tex)
    - Use of appropriate methods and procedures to minimise the possibility of cross-contamination.
    - Use of field and procedural blanks
    - Full documentation of sample handling, transport, receipt and through to results.

- **Cost and Capability Review**:
    - Evaluation of lab turnaround times, capacity, and cost-effectiveness

# 4 Data Management and Reporting

## 4.1 Data Aggregation

- Test results will be interpreted alongside existing international studies to provide context and comparability.
- Where appropriate, data from other jurisdictions will be used to benchmark Jersey's results and support evidence-based conclusions.

## 4.2 Exposure Assessment

- A comprehensive exposure model will be developed by combining PFAS concentrations from:
    - Food (local and imported)
    - Drinking water and private supplies
    - Environmental sources (soil, sludge, marine and freshwater)
- This model will estimate total PFAS intake for Jersey residents and help assess compliance with the European Tolerable Weekly Intake (TWI).

## 4.3 Interpretation and Reporting

- All test results will be reviewed and interpreted by the Independent PFAS Scientific Advisory Panel as part of Report Four.
- The Government of Jersey (GOJ) will not release individual test results separately.
- Instead, all findings will be published collectively within Report Four to ensure:
    - Scientific interpretation is provided
    - Results are placed in appropriate context
    - Public understanding is supported by expert commentary
    - Public consultation will take place on Report Four late in 2025

**Transparency and Scientific Integrity**

- This approach ensures that data is not misinterpreted or taken out of context.
- It also aligns with the Government's commitment to evidence-led policy, public transparency, and international best practice in environmental health reporting.

Infrastructure
and Environment

# Food and Soil

# Testing Methodology

## Water Quality and Safety Programme

Government of Jersey

# 1. Introduction

The PFAS testing programme in Jersey is designed to support the Independent Scientific Advisory Panel in understanding the average PFAS exposure through food, water, and environmental sources.

This data will be critical in determining whether current PFAS levels in drinking water are compatible with maintaining exposure below the EFSA TWI threshold. If food contributes significantly to the total PFAS intake, the regulatory standard for PFAS in water may need to be adjusted downward to ensure that total exposure remains within safe limits.

This approach mirrors international best practices, such as those used in Denmark, where water quality standards were derived by working backwards from the TWI, factoring in dietary intake and vulnerable population groups.

The WQS Programme will also focus on understanding PFAS in food, water, the marine environment, and waste, to gain a better understanding of PFAS levels and their impacts on public health and the environment.

# 2. Methodology

## 2.1 Sampling

In order to minimise the risk that the samples of food and soil were not contaminated during collection a number of precautions were taken. These included the use of:

- **Powder-free nitrile gloves** (no PTFE/fluoropolymer coatings)
- **Nitrile shoe covers**
- **Stainless steel or HDPE tools** (e.g., trowels, spatulas, scissors)
- **Polypropylene (PP) or high-density polyethylene (HDPE) containers** (no Teflon® or PTFE linings) (as recommended by the accredited laboratories used to test the samples)
- **Aluminium foil** (PFAS-free) for wrapping samples when needed
- **Cool boxes with PFAS-free ice packs**
- **PFAS-free water** for cleaning tools between samples if needed

## 2.2 Sample Collection Procedures

### General Precautions

- Avoid clothing or PPE treated with water-repellent coatings (may contain PFAS) and use natural fibres where possible. Ensure this is not washed with fabric softener.
- Do not apply sunscreen, insect repellent, or cosmetics prior to sampling.

- Clean sampling tools with blue paper towel and rinse with PFAS-free water before and between sample points if required.

## 2.3 Soil Sampling

### Procedure:

1. Identify and mark the sampling location using the 'PFOS Sampling Points' form on Survey123 app. This will record the field number and location of your points giving a 5m radius within which to take the sample.
2. Clear the surface of organic debris without disturbing the soil.
4. Use a **stainless-steel auger** to collect cores of soil.
5. Place soil in **PFAS-free polypropylene sample pots** (lab supplied).
6. For composite samples, mix soil in a stainless-steel bowl before subsampling.
7. Label and seal container; record date/time, depth, and sample ID.
8. Repeat for 4 more points in a w-shaped path across the field.

### Storage:

- Freeze samples at -20°C as soon as possible or store at 4°C for short-term holding (<48 h).

## 2.4 Plant Material Sampling

### Procedure:

1. Identify and mark the sampling location using the 'PFOS Sampling Points' form on Survey123 app. This will record the field number and location of your points giving a 5m radius within which to take the sample.
2. Use **clean stainless-steel scissors or shears** if needed.
3. Wear fresh nitrile gloves, changing them between samples.
4. Collect aboveground tissue (e.g., leaves, stems) or root material depending on study aim using gloved hands.
5. Place samples in **aluminium foil (PFAS-free)** or polypropylene containers.
6. Record species, part collected, location, and sampling time.
7. Use different gloves and tools between sampling points or decontaminate thoroughly.

### Storage:

- Store in fridge and place filled sample pots in cool box containing PFAS-free ice packs and a data logger

## 2.5 Potato sampling

### Procedure:

1. Identify and mark the sampling location using the 'PFOS Sampling Points' form on Survey123 app. This will record the field number and location of your points giving a 5m radius within which to take the sample.
2. Clear the surface of organic debris without disturbing the soil.
3. Put on fresh nitrile gloves. Using nitrile-gloved hands, pull up potato plant and grub up and select 2-3 potatoes from 5m radius of recorded survey point.
4. Rub off as much soil as possible if its relatively dry. If soil adheres to the potato, scrub it off with blue paper towel and gloved hands (we did this later at the lab, collecting potatoes in PFAS-free sandwich bags and wrapping filled bags in PFAS-free aluminium foil until preparing the samples at the lab).
5. Repeat for 4 more points in a w-shaped path across the field.
6. Place potatoes in **PFAS-free polypropylene sample pot** labelled with sample number in ballpoint pen.
7. Add all potatoes from field to the same pot, using a second one if required.
8. Place filled sample pot in cool box with PFAS-free ice packs and a data logger.

## 2.6 Product of animal origin sampling

1. Select the Jesey produce from the fishmonger or shellfish supplier. The UK produce was purchased from Jersey supermarkets that stock UK products.
2. Place samples in aluminium foil (PFAS-free) or polypropylene containers when purchased if not packaged, otherwise keep sample in original packaging.
3. Samples kept chilled with the use of PFAS-free frozen gel packs and aluminium foil (PFAS-free) lined insulted cool box.
4. Samples taken directly to central facility, wrapped in aluminium foil (PFAS-free) where necessary and placed into designated freezer.
5. Frozen samples then wrapped in aluminium foil (PFAS-free) where necessary for transport

## 2.7 Labelling and Documentation

- Each sample must be labelled with the below information. This can be written on the evidence bag with sample sealed in it.
- Sample ID (generated by Bigbit before sampling)
- Matrix type (soil or plant)
- Date and time
- Collector initials
- Complete a **chain-of-custody form** for each sample batch.
- Log all actions in the field notebook/ on mobile phone, taking photos where possible.

## 2.8. Transport and Storage

- Use **coolers with non-fluorinated ice packs** for transport.

- Prevent samples from warming above 4°C.
- Send chilled samples with a datalogger so maintenance of cold chain can be demonstrated.
- In the lab, store at -20°C or colder until analysis.

## 2.9. Quality Assurance and Control

- Ensure equipment and methodology is consistent across the sampling team.
- Include **equipment blanks** and **trip blanks** where appropriate.
- Use UK origin **control samples** for reproducibility checks and comparisons.

# 3.0 Locations

Fresh produce sampled was selected based on area where it was grown, and to include most of the crops grown on a commercial scale by local producers for human consumption.

Soil areas were selected to cover the following criteria:

- Fields where potatoes and other vegetables are grown.
- Fields where bio-solids from sewerage works have been spread.
- Fields where water filter cake from water treatment works has been spread
- 'Wild' areas for baseline comparison.
- Creepy Valley area.
- Re-sampling fields previously analysed for PFAS contamination.
- Fields within the known plume area.

Consideration was also given to distributing areas sampled across the Island where possible and appropriate.

# 4.0 Laboratories used

**Fera Science Ltd (FERA)** is a UK-based scientific organization specialising in agri-food research, environmental safety, and diagnostics. They are assessed externally by both the United Kingdom Accreditation Service (UKAS) and the Good Laboratory Practice (GLP) Monitoring Authority.

**Eurofins Scientific** is a global leader in laboratory testing services across food, environment, pharmaceuticals, cosmetics, and clinical diagnostics. Eurofins hold a wide range of internationally recognized accreditations, including ISO/IEC 17025 and UKAS, depending on the country and specific lab.

**Veritas Laboratory Services Ltd** is a leading analytical laboratory in the UK, based in Southampton, Hampshire. Established in 2022, we are a family-owned and independent laboratory specialising in the testing of Persistent Organic Pollutants (POPs). Veritas Laboratory Services Ltd achieved UKAS accreditation to ISO/IEC 17025:2017.