WASP Review Part 4: The failure of Operator Self-Monitoring of sewage treatment

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Windrush Against Sewage Pollution (WASP)

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CONTENTS

Appendices

Disclaimer

The analysis in this report is based on data provided by water companies, either directly in response to requests under Environmental Information Regulation legislation or indirectly via online government archives of data the companies have themselves submitted to the Environment Agency. The individual records of treated sewage testing in DEFRA's archive are not explicitly linked to the water company operating the sewage treatment works under scrutiny. The connection has been made through other data sources such as the annual Bioresources Market Information available on Ofwat's website.

Some of the data provided by the water companies, notably Yorkshire Water and Welsh Water was of very poor quality, so much so that some annual data series could not be analysed. Therefore, WASP's analysis may not be uniformly reliable across the six water companies who have co-operated.

WASP has made every effort to ensure accuracy but cannot guarantee the validity of third-party data.

Acknowledgement

While this report has benefited from discussion with WASP colleagues Eileen Boothroyd, Vaughan Lewis, Victoria Marsh, Ash Smith, Geoff Tombs and Soraya Wooller, the author accepts full responsibility for errors of analysis.

Background

WASP (Windrush Against Sewage Pollution) has previously shown that water companies have discharged untreated sewage more frequently than regulators were aware[1], often in breach of permit conditions and hence illegally[2,3]. WASP has also revealed that the untreated sewage spill data reported annually to the Environment Agency (EA) by water companies is often incorrect or unreliable[4].

WASP has recently turned its attention to statutory Operator Self-Monitoring (OSM) which obliges water companies to undertake their own monitoring of the quality of sewage treatment and report results to the EA[5]. Given concerns about discharges of untreated sewage via storm overflows, questions need to be asked about the regulation of treated sewage that is routinely discharged into watercourses continuously every day:

Q1 Has the water industry reported fully and accurately on sewage treatment as OSM requires?
Q2 Has the EA been regulating OSM as expected by the Department for Food, Rural Affairs and Agriculture (DEFRA)?
Q3 Has the financial regulator, Ofwat, diligently validated the EA's oversight of OSM?
Q4 Have customer charges for sewage treatment reflected accurate evaluation of water company performance in the annual price negotiations between Ofwat and individual water companies?
Q5 Do the current investigations of the EA, Ofwat and DEFRA by the Office for Environmental Protection (OEP) include OSM and the quality of sewage treatment?

Executive summary

Since its inception in 2009/2010, Operator Self-Monitoring (OSM) has required water companies to undertake statutory "spot" sampling and testing of treated sewage at their sewage works, typically 12 or 24 times a year, as part of the regulatory process. OSM test data submitted to the EA by water companies for sewage works in England, and some in Wales, are available online at DEFRA's data hub.

The EA's guidance is to constrain sampling to 9am to 3pm with 10% outside that range. WASP's analysis of OSM data has revealed that every water company has restricted its statutory monitoring of treated sewage to a narrow 8 hour window, almost exclusively between 7am and 3 pm, on the days selected for sample collection. Hence, the treatment of more than half of all sewage, that generated before 7 am and after 3pm, has avoided OSM quality monitoring for over 13 years.

With only 10% of OSM sampling outside normal hours, the EA has little knowledge of the quality of treated sewage outside the testing window. Water companies, however, are better informed, as most have installed devices that provide online monitoring of treated sewage 24/7, every 15 minutes or even more frequently. But such monitoring is non-statutory, so is not universally deployed. Moreover, none of the data gathered using it needs to be reported to the EA.

WASP submitted a request to each water company for this non-statutory monitoring data under Environmental Information Regulation (EIR) legislation. Severn Trent Water, South-West Water and United Utilities refused the request and withheld data; Northumbrian Water said it had no such

[1] Detection of untreated sewage discharges to watercourses using machine learning P Hammond et al NPJ Clean Water 4 (1), 1-10, 2021
[2] WASP REVIEW OF UNPERMITTED SPILLS FROM SEWAGE TREATMENT WORKS – Part 1 Thames Water
[3] WASP_REVIEW_OF_UNPERMITTED_SPILLS_FROM_SEWAGE_TREATMENT_WORKS – Part 2
[4] WASP REVIEW OF UNPERMITTED SPILLS FROM SEWAGE TREATMENT WORKS – Part 3 EDM SUBMISSIONS
[5] The report does not address monitoring related to Urban Waste Water Treatment Regulations 1994.

data. Non-statutory monitoring data for more than 1,500 annual data series were provided by the remaining 6 water companies but only for one parameter (the concentration of Ammoniacal Nitrogen - referred to hereafter as ammonia level) and for a limited time period (typically 2020 and 2021).

These detailed monitoring data, not normally open to scrutiny, show that statutory OSM testing gives an erroneous view of compliance with standards for ammonia levels as set by the Environment Agency's permits to discharge treated sewage to watercourses. Indeed, the more detailed non-statutory monitoring data suggest that many breaches of permitted levels may have occurred and have not been reported to the EA for over a decade.

These findings contradict the following responses by Sir James Bevan, Environment Agency CEO, on February 1st 2023 in a public session of the House of Commons Environmental Audit Committee[6]:

> *I like operator self-monitoring…we have some quite sophisticated ways to check that data.*
>
> *If you look at the sites that we regulate and ask how many of those are abiding by our regulations, the answer is almost all of them. It is something in the high 90% of the sites that we regulate that are abiding by the terms of their permit.* Sir James Bevan, CEO of the Environment Agency, 01/02/23[5]

If the analysis reported here is confirmed, the annual rates of compliance for some water companies are significantly worse than is suggested by the OSM data that they report to the EA. The overall rate of compliance with treated sewage standards is one of six metrics in the EA's annual Environmental Performance Assessment (EPA) of each water company. In turn, the EPA is a key contributor to Ofwat's financial regulation of the water industry and influences negotiation of customer charges.

The statutory online monitoring could inform the timing of statutory OSM "spot" sampling. Water companies could then choose to test treated sewage at times when they know compliance with EA standards is more likely. In this way, water companies could unduly influence their performance rating with a knock-on effect on the negotiation of customer service charges.

WASP would like answers to the following questions to:

The CEO of each water company

Does your implementation of statutory OSM monitoring accurately reflect the quality of treated sewage discharged continuously from your STWs to rivers and coastal waters?

Sir James Bevan, CEO of the Environment Agency:

1. Has the Environment Agency been aware or concerned that for over 13 years Operator Self-Monitoring has not provided an accurate picture of the quality of treated sewage discharges?
2. What are these "*sophisticated ways to check that data*" to which Sir James Bevan refers?

David Black, CEO of Ofwat:

1. Has Ofwat carried out due diligence on the depth and quality of compliance checking of sewage treatment standards by the Environment Agency?
2. What will Ofwat do if it is confirmed that its financial oversight of the water industry has been based on incomplete and incorrect compliance data provided by water companies?

[6] https://committees.parliament.uk/oralevidence/12619/pdf/

Therese Coffey, Secretary of State, Department for Environment, Food and Rural Affairs:

1 Does DEFRA accept that the findings in this report show that both environmental and financial regulation of the water industry could be based on erroneous data and therefore have failed?

2 Will DEFRA replace Operator Self-Monitoring by an independent scheme with appropriate funding and technical support? In 2021, Environment Minister Rebecca Pow said OSM would end[7].

Dame Glenys Stacey, Chair of the Office for Environmental Protection (OEP)

Will the OEP accept this report as evidence in its current investigations of the EA, Ofwat and DEFRA?

John Edwards, Information Commissioner at the Information Commisioner's Office (ICO)

Will the ICO continue to allow Severn Trent Water, South West Water and United Utilities to withhold data and suppress public scrutiny while other water companies comply with EIR legislation?

Findings Summary

1. Every year, the water industry submits to the EA test results for 150,000 or so statutory OSM spot samples of treated sewage that is routinely and continuously discharged from sewage treatment works into inland becks, brooks, streams, rivers and coastal waters.

2. Suspended Solids (SS), Biological Oxygen Demand (BOD) and Ammoniacal Nitrogen (AmmN) are the most frequently monitored parameters, accounting for over 100,000 OSM test results annually.

3. Every water company limits its statutory OSM "spot" sampling so that overall 97.7% take place within an 8 hour window between 7am and 3 pm. Therefore, over half of all treated sewage, the volume discharged each day before 7am and after 3 pm (**Fig**. 1a), has avoided statutory OSM monitoring of key quality parameters for 13 years.

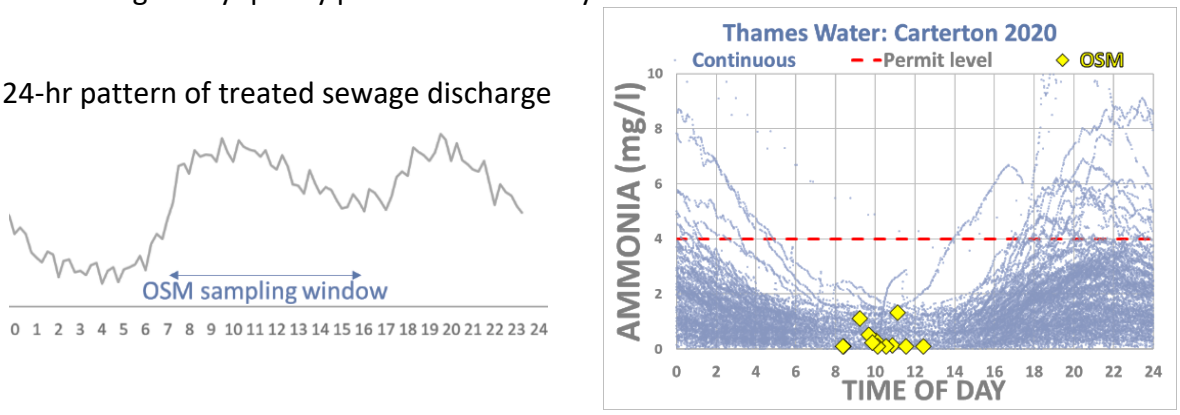


Figure 1: **a)** 24-hr pattern of treated sewage discharge; **b)** example of multiple potential breaches of a 95% permit limit for ammonia revealed by continuous monitoring whereas all 12 OSM samples are compliant.

4. Six water companies, in response to EIR requests, agreed to provide non-statutory continuous monitoring data but only if limited to a single parameter (ammoniacal nitrogen or ammonia level) and for a limited time period (mostly 200-2021; Wessex Water and Southern Water included data from as far back as 2012). Data was provided for 531 STWs across 6 water companies.

[7] https://www.endsreport.com/article/1734868/interview-rebecca-pow-great-british-sewage-scandal

5. For these 6 co-operating water companies, the non-statutory monitoring data suggest that ammonia levels in treated sewage often breach permit limits when statutory OSM data suggests compliance (**Fig** 1b).

6. Inspection of 1,040 non-statutory yearly data series identified 155, from 105 sewage works, that appear to be non-compliant when statutory OSM "spot" data suggest they are compliant (Table 1). Many of the annual data series provided were of such poor quality they were not analysable.

7. Annual compliances rates for these 6 companies, if the analysis is confirmed, are much reduced with a knock-on effect on the EA/Ofwat's evaluation of the performance of water companies (Table 2).

Table 1 Potential breaches of ammonia level in treated sewage identified by online monitoring

	Total	Anglian	Southern	Thames	Wales	Wessex	Yorkshire
non-compliant STWs	105	4	34	19	7	28	13
non-compliant yearly series	155	7	38	27	8	61	14
yearly series inspected	1,040	9	111	236	135	354	195
yearly series provided	1,569	9	406	236	135	588	195

Table 2 Comparison of annual % compliance for statutory OSM and non-statutory online monitoring data

	Anglian		Southern		Thames		Wales		Wessex		Yorkshire	
	stat OSM	non-stat	stat OSM	non-stat	stat OSM	non-stat	stat OSM	non-stat	stat OSM	non-stat	stat OSM	non-stat
2022	*NA*		*NA*	*NA*	*NA*	*NA*	*NA*		*NA*	98.0	*NA*	*NA*
2021	98.2	*ID*	97.9	*NA*	99.0	< 96.4	98.3	*ID*	100	< 96.2	99.0	< 97.1
2020	99.3	*ID*	97.1	< 91.2	99.7	< 96.4	99.7	*ID*	99.1	< 94.2	99.0	< 98.4
2019									98.5	< 97.2		
2018									100	98.0		
2017									99.0	< 97.7		

ID=insufficient data *NA* = not available or not yet analysed

Compliance rate shading as used in EA Environment Performance Assessment: >= 99% <99% and >= 98% < 98%

8. Reductions in performance ratings could have a serious effect on negotiations between water companies and Ofwat with potential for influencing customer charges or customer rebate.

Detailed Results

Water companies are obliged under the Environmental Permitting (England & Wales) Regulations 2016 to monitor discharges of treated sewage, also termed final effluent, from sewage treatment works. Since 2009/2010, the Operator Self-Monitoring (OSM) scheme has allowed water companies to choose the time and day to collect treated effluent samples subject to EA guidance. The normal sampling frequency is either 12 or 24 samples per year, scheduled before the start of the sampling year. For each permitted discharge activity, spot samples have to be collected at regular and random intervals i.e. at approximately equal intervals during the year and from different days of the week and at different times with 10% collected outside normal hours of 9 am to 3 pm. The EA requires STW operating staff to be unaware of schedules by company colleagues who collect the OSM samples.

Typically, a single sample is used to test multiple parameters. Some parameters may require monitoring at specific sewage outlets and occasionally it may not be possible to undertake a

scheduled OSM sample for technical reasons or due to flooding. After samples are tested at qualified laboratories, results are reported to regulatory bodies and made available at DEFRA's data archive[8].

Usually, two levels of quality standard for treated sewage are in operation at each sewage treatment works. An upper tier level, if breached just once, means immediate non-compliance. A lower level (sometimes referred to as 95% confidence) can be breached a fixed number of times before non-compliance (e.g. twice in a 12 consecutive monthly test series). More details are on the EA website.

1 Over 50% of treated sewage has not undergone statutory OSM quality monitoring for 13 years

Typically, in dry weather, the rate at which sewage arrives at a treatment works follows a regular diurnal pattern with one peak around breakfast time and another covering evening meal/bedtime (**Fig**. 1). Between 7 am and 3 pm, the proportion of the daily volume of treated sewage discharged from a sewage works is approximately 40%-45%. For the remainder of a day, i.e., midnight to 7 am and 3 pm to midnight, about 55%-60% of treated sewage (by volume) is discharged. There are, of course, weather, regional and seasonal variations.

Figure 2 shows the frequency of the time of day when tens of thousands of OSM statutory "spot" test samples were collected in 2022 to monitor levels of ammoniacal nitrogen (AmmN), biological oxygen demand (BOD) and suspended solids (SuspSolids) by all water and sewerage companies (WaSCs). Note that the period 7am to 3 pm covers almost all sampling activity.

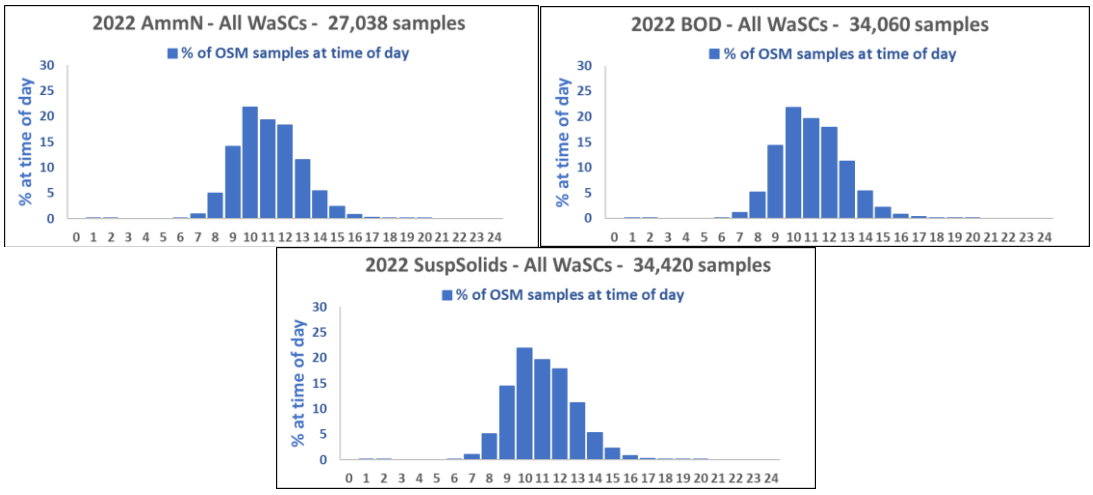


Figure 2: frequency of OSM spot sample times in 2022 by all WaSCs for ammonia, BOD and suspended solids

This limited monitoring of ammonia levels has been the case every year since OSM was introduced in 2009/2010 (**Fig**. 4 and Appendix 4). Given that multiple parameters are typically tested in each sample, this is almost certainly to be true for BOD, suspended solids and other quality parameters.

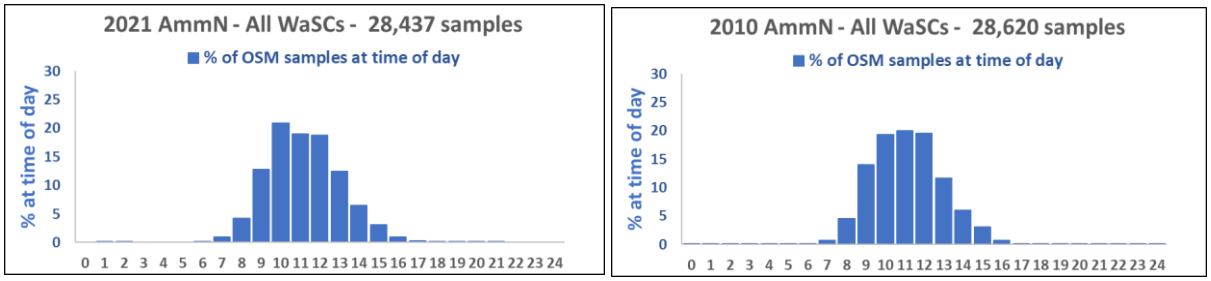


Figure 4: OSM spot sampling times in 2021 and 2010 for ammonia for all WaSCs

[8] https://environment.data.gov.uk/water-quality/view/landing

2 Water companies do not appear to sample treated sewage randomly as required by OSM

There is significant variation in the distribution of AmmN sampling times across the water industry. For example, in 2022, Anglian Water (SvT) had a wider, relatively "normal" looking spread of sampling times (**Fig**. 5). Thames Water had possibly the most skewed sampling times with heavy loading before 11 am. United Utilities' sampling scheme is narrow and both Northumbrian and Yorkshire Water appear to have instituted a scheme that is both narrow and skewed.

The EA requirements for OSM sampling (**Appendix** 1) and the detection of non-compliance with permit standards makes assumptions about randomness when allowing specific numbers of failures across a series of samples. For example, up to 2 of a series of 12 consecutive samples would be allowed to exceed the (lower) 95% compliance limit without a sewage works being designated as non-compliant. For United Utilities, Yorkshire Water, Thames Water and Northumbrian Water, such an assumption about randomness may not be possible. WASP decided to avoid technical squabbles about statistical properties of sampling regimes and instead has required 3 or more breaches of the lower tier (95% confidence) permit limit in an annual data series of 12 samples before designating an STW as potentially non-compliant.

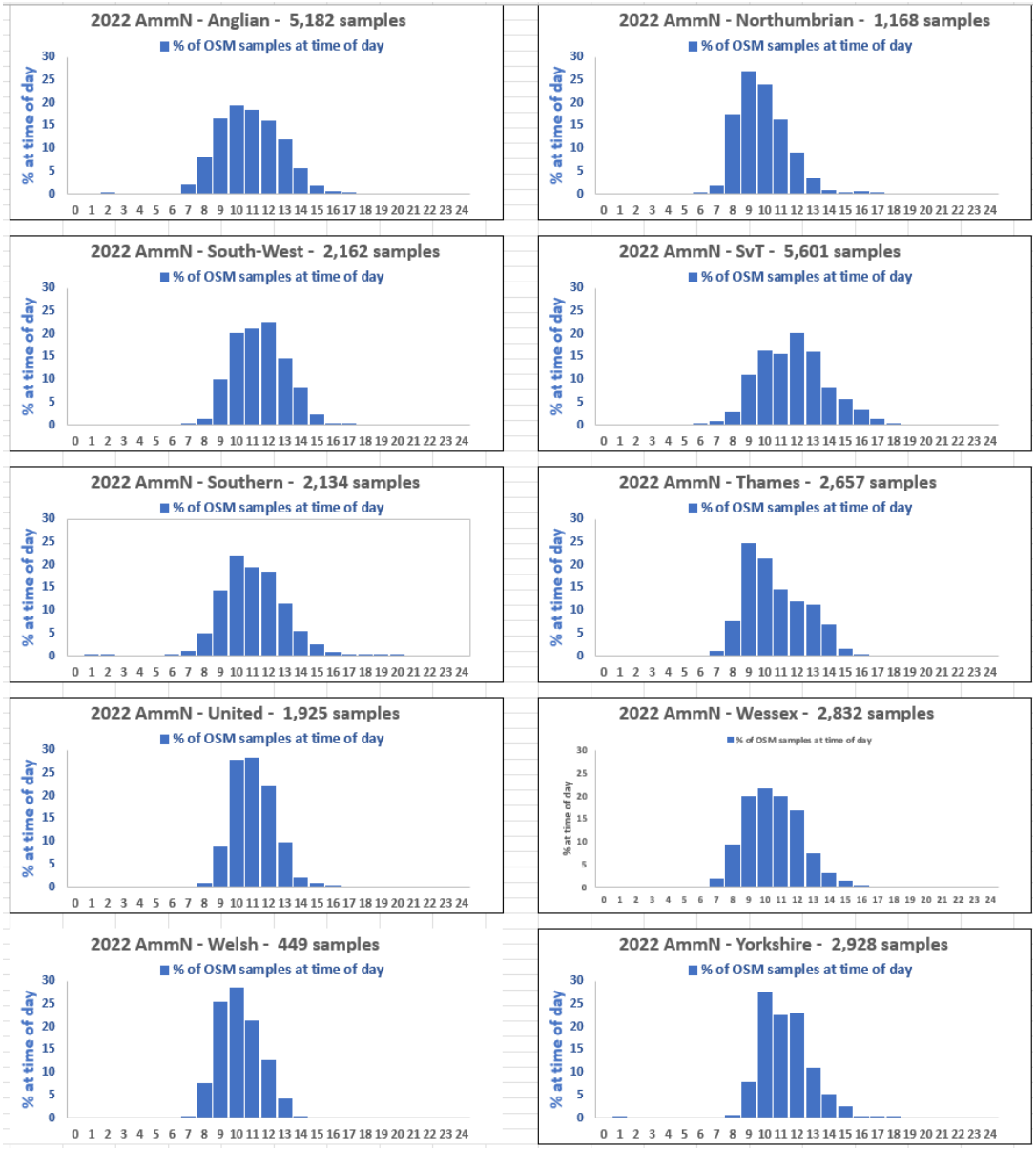


Figure 5: OSM spot sampling times in 2022 for ammonia across the water industry
(N.B only a small number of Welsh Water STWs are included on the DEFRA data archive)

Another important issue to consider is if non-statutory detailed monitoring has informed water companies when the statutory OSM sampling is less likely to fail compliance and hence has unduly influenced the precise time of the day when OSM samples have been undertaken. There are stark examples of extremely biased sampling times in annual OSM sampling series (for example, Anglian Water's Badwell Ash STW which is illustrated later in **Fig**. 15).

3 Comparison of statutory OSM "spot"sample and non-statutory online monitoring data

A: Wessex Water

Wessex Water's 2018 business plan[9] includes an appendix with a detailed discussion of the performance of many of its STWs. For Radstock STW, which serves a population of about 25,000, concern was expressed about an increasing trend in ammonia levels in its treated sewage over a 5-year period 2012-2017 (**Fig**. 6). The 95% confidence permit level for AmmN at Radstock STW is currently 6 mg/l and is due to be 4 mg/l in 2025.

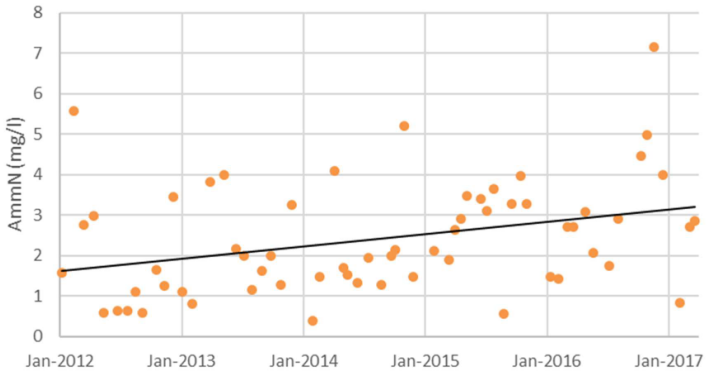


Figure 6: increasing trend in ammonia levels in treated sewage at Wessex Water's Radstock STW
(data source: Wessex Water's 2018 Business plan)

Wessex Water also showed non-statutory 15-min interval monitoring data from Radstock STW during one week in 2017 (**Fig**. 7) commenting that their *"on-line AnnN monitor at the STW has shown that at certain times of the day (afternoon) the final effluent reaches or breaches the permit level"*.

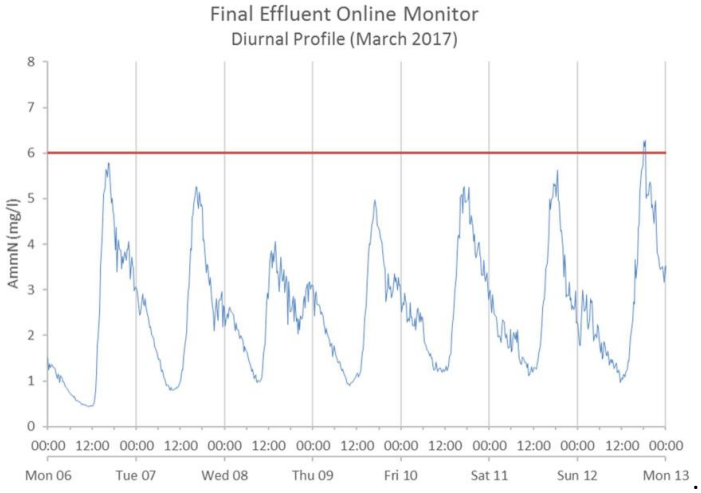


Figure 7: online AmmN monitor showing near and actual breaches of permit level at Radstock STW
(data source: Wessex Water's 2018 Business plan)

[9] www.wessexwater.co.uk//media/files/wessexwater/corporate/strategy-and-reports/business-plan/0806a--claim-wsx02--sewage-treatment-works-capacity-programme.pdf

What Wessex Water did not mention was that there were many breaches of the permitted ammonia level (6 mg/l) at Radstock STW in 2017 according to their online monitoring data which subsequently Wessex Water also provided to WASP in response to an EIR request (**Fig**. 8).

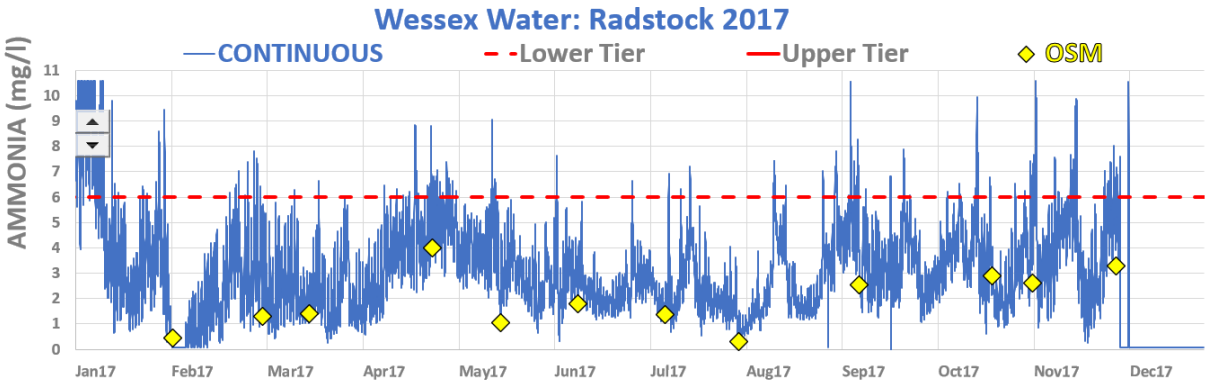
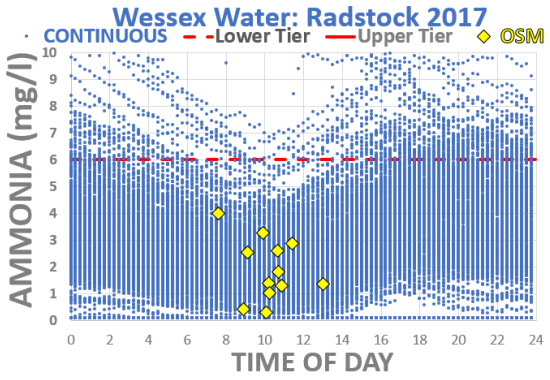


Figure 8: online "continuous" 15-min interval monitoring of AmmN at Radstock STW in 2017
(data source: Wessex Water in response to an EIR request from WASP)

Clearly, the times when Wessex Water undertook OSM spot sampling (yellow diamonds) coincidentally avoided periods when the online monitor suggested non-compliance (blue curve above dotted red line representing the lower 95% confidence permit level). This is demonstrated more precisely by **Fig**. 9a which shows the value and time of day for both non-statutory online "continuous" monitoring (blues potted curves) and statutory OSM spot sampling (yellow diamonds). Clearly, at Radstock STW, OSM sampling was restricted to 7 am to 1 pm. In addition, **Figs** 9b-d show 3 specific days in 2017 when OSM spot sample results complied with the permit level but online AmmN level was non-compliant at least once outside the 7am-1pm time range on the same day.



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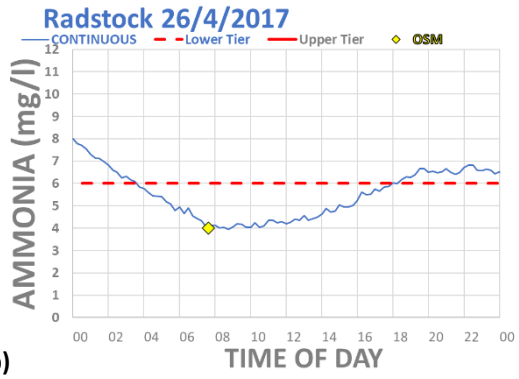

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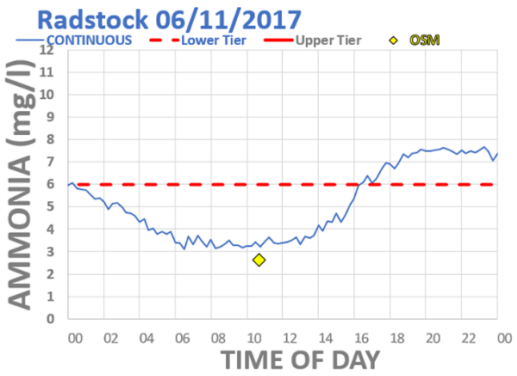

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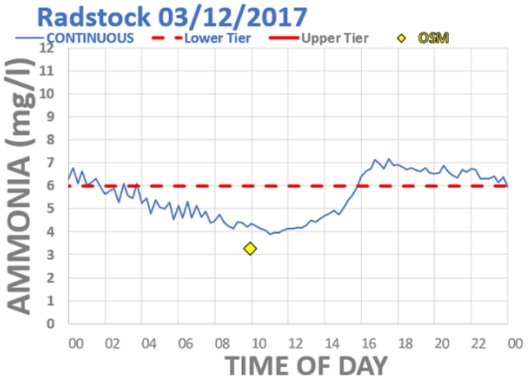


9d)

Figure 9: AmmN levels at Radstock STW in 2017
a) time of OSM sampling and online ammonia level;
b) to d) days when the AmmN 95% permit level was breached when the OSM sample suggested compliance

These data suggest, therefore, that the OSM spot sampling times at Radstock STW in 2017 avoided periods when AmmN breaches were more likely. So, as far as OSM monitoring is concerned, Radstock STW was compliant for AmmN in 2017. However, the online AmmN continuous monitoring appears to detect at least 3 breaches (Fig. 8b-d) which would have meant that Radstock STW was non-compliant in 2017 for treated sewage quality.

In the same 2018 business plan, Wessex Water cited Bath (Saltford) as another STW with breaches of permitted levels of ammonia in treated sewage. Figure 10 shows OSM sample results for AmmN for Bath (Saltford) STW that are compliant and 3 specific occasions when online non-statutory AmmN monitored levels breach the 95% permit. Thus, Bath (Saltford) was also non-compliant in 2017.

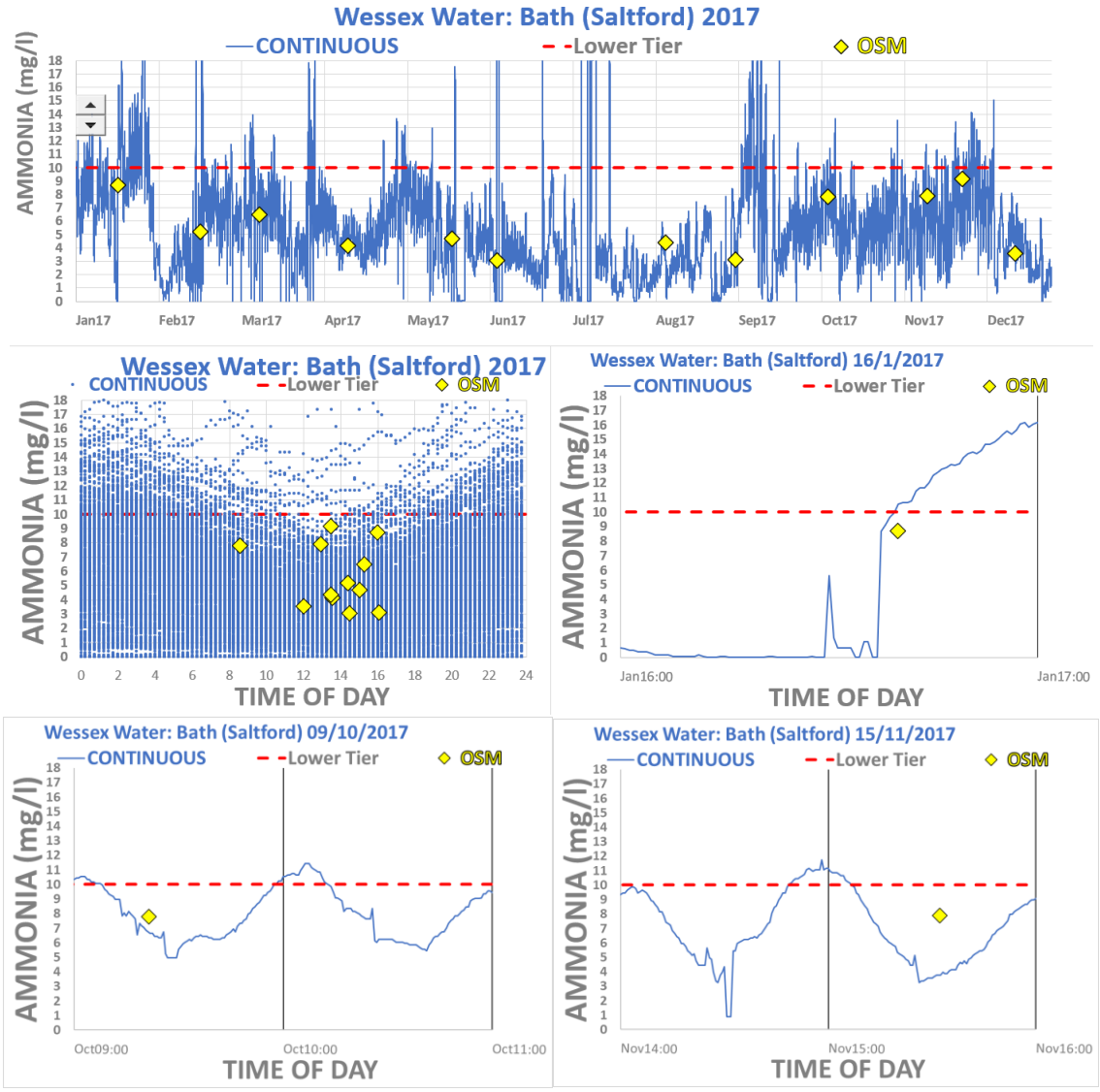


Figure 10: AmmN levels at Radstock STW in 2017 showing OSM sampling and online monitoring:
(charts above suggest compliance using OSM results but non-compliance using online monitoring)

Altogether, there are six such annual data series for 2017 where Wessex Water's OSM sampling suggests compliance (see Appendix 9). In contrast, continuous online monitoring identifies more than 3 breaches of the 95% confidence level which suggests non-compliance at each of the six STWs involved. An implication of multiple STW non-compliance in the same year is a reduction in the overall % compliance rate for the operating water company. For example, if the six examples referred to above were to be accepted as evidence of non-compliance, the overall compliance rate

for 2017 for Wessex Water would have been at most 97.7% rather than 99%[10], the latter being published by the EA in its annual environmental assessment of Wessex Water's performance[11]. Such a reduced annual % compliance would have forced Ofwat to reduce the star rating of Wessex Water for 2017 with a possible knock-on effect on discussions of customer charges.

A more recent example of possible non-compliance of an STW operated by Wessex Water is Amesbury STW, another embattled STW featured in the 2018 Business Plan (**Fig**. 11).

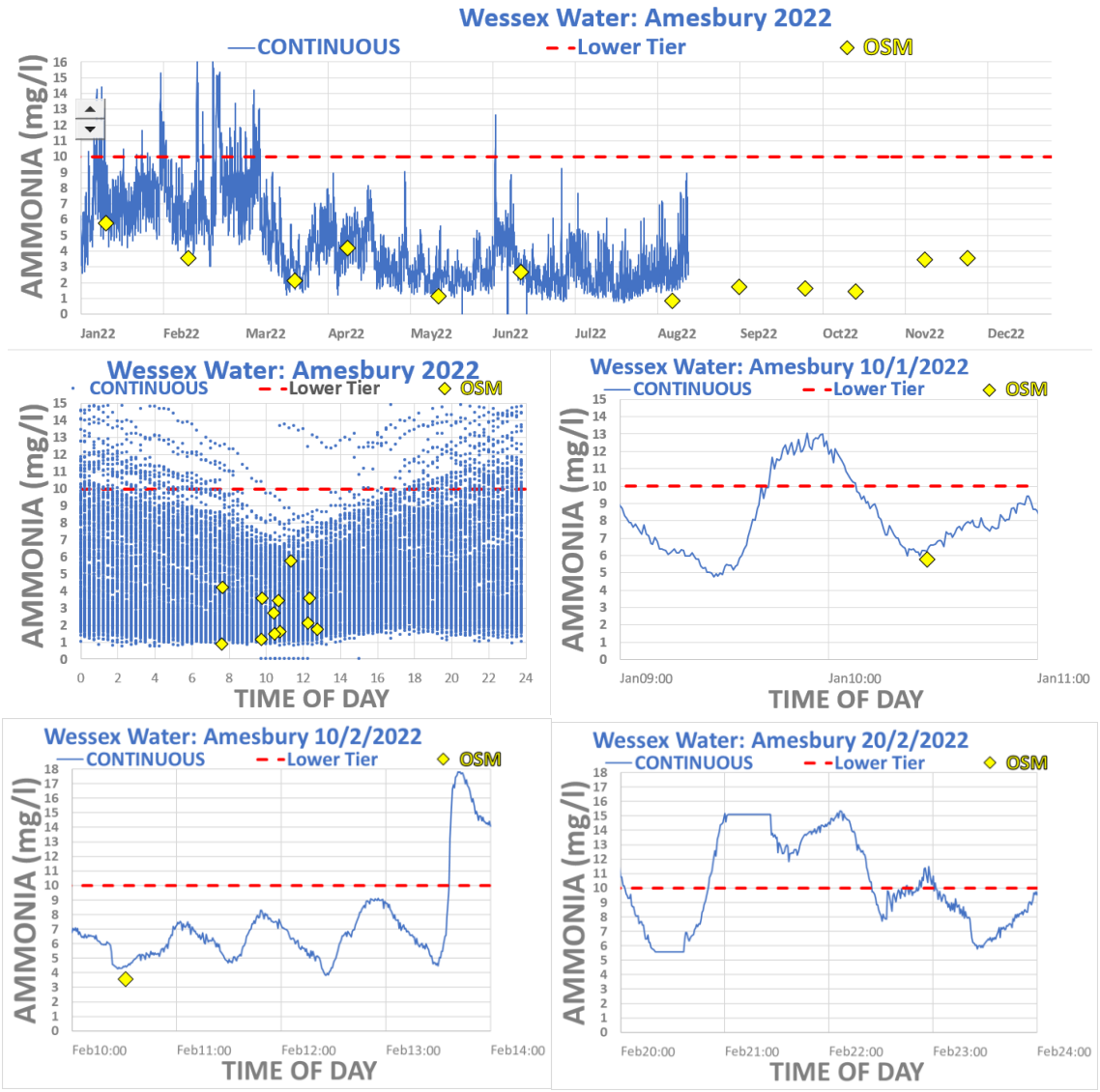


Figure 11: AmmN levels at Amesbury STW in 2022 showing OSM sampling and online monitoring:
(Wessex Water data suggesting compliance using OSM results but non-compliance using online monitoring)

WASP has identified many other annual time series where Wessex Water's OSM data suggest compliance for AmmN levels in treated sewage whereas Wessex Water's own online monitoring data suggest non-compliance. More detailed analysis of these cases is provided in Appendix 9. For convenience, Table 2 above summarises implications for the EA's annual assessment of compliance rates for Wessex Water between 2017 and 2021. Similar analysis for earlier years has yet to be undertaken.

[10] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/724028/Summary_graphic_water_company_performance_report_2017.pdf

[11] https://www.ofwat.gov.uk/wp-content/uploads/2017/12/WatCoPerfEPAmethodology_v3-Nov-2017-Final.pdf

Table 3 below is a summary of annual compliance for Wessex Water between 2017 and 2022 as computed from statutory OSM data and continuous detailed monitoring data.

Table 3 Annual compliance for statutory OSM spot sampling vs non-statutory continuous monitoring

Wessex Water	2017		2018		2019		2020		2021		2022	
	OSM	non-stat	OSM	non-stat	OSM	non-stat	OSM	non-stat	OSM	non-stat	OSM	non-stat
STW - failed	2	6	0	6	4	8	1	18	0	12		11
STW - sites	292	292	291	291	299	299	299	299	297	297		297
WTW - failed	1	1	0	0	1	1	2	2	0	0		0
WTW - sites	14	14	13	13	26	26	26	26	18	18		18
compliance	99.0%	97.7%	100.0%	98.0%	98.5%	97.2%	99.1%	93.8%	100.0%	96.2%		96.5%

B: Thames Water

Thames Water employs non-statutory continuous monitoring devices to capture ammonia levels in treated sewage at at least 113 sewage works. **Fig**. 12 below shows a few examples, from 2020 and 2021, where non-statutory monitoring suggest permit breaches for ammonia outside the limited OSM window. Appendix 7 gives a more detailed account of all 27 annual data series where continuous online monitoring data suggests non-compliance for ammonia levels in treated sewage.

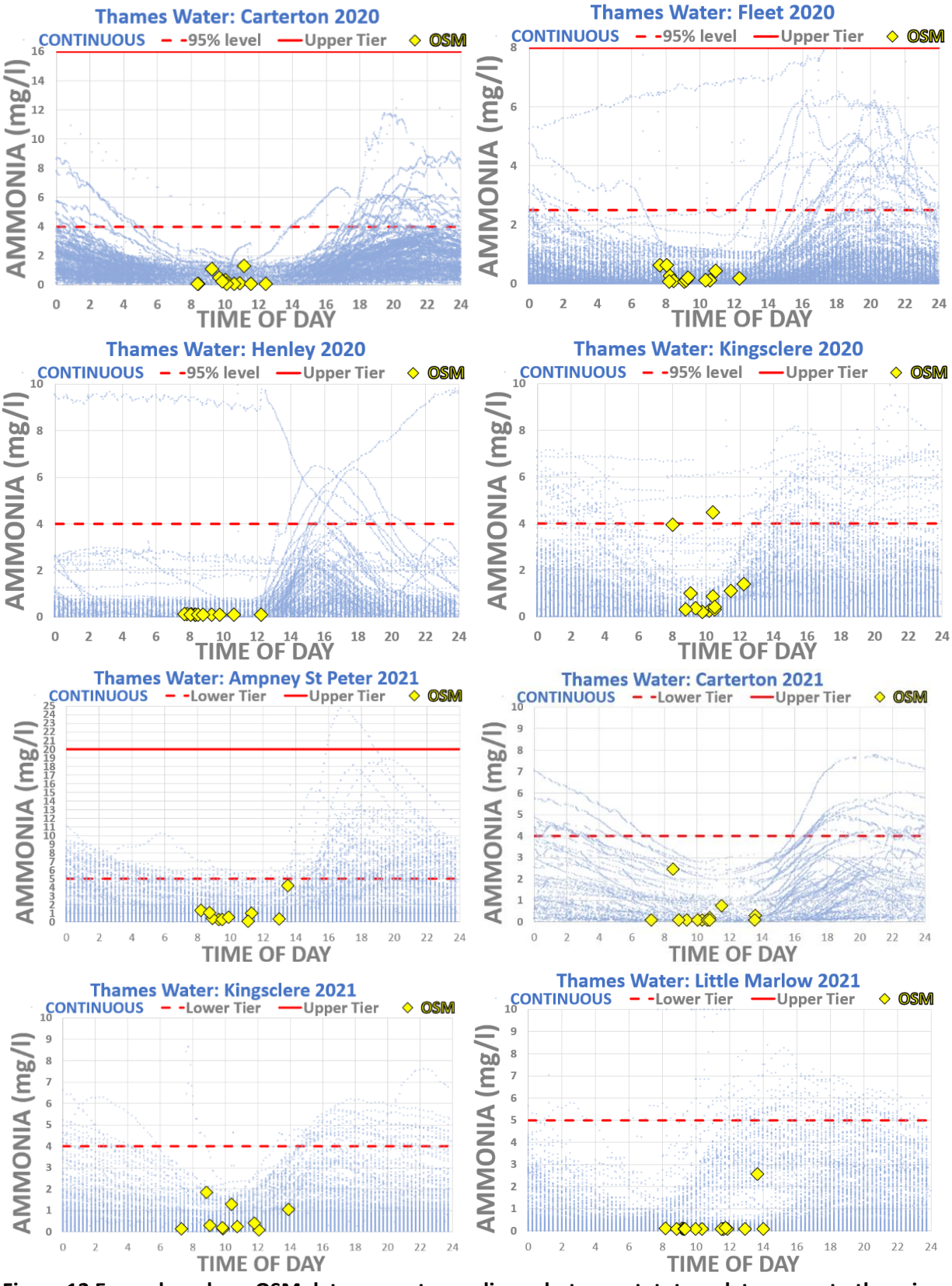


Figure 12 Examples where OSM data suggest compliance but non-statutory data suggest otherwise.

C: Southern Water

Southern Water has non-statutory online monitoring of treated sewage at more than 200 STWs and, for some, for as many as 10 years. Southern Water provided the associated data in 4 extremely large files that required significant reorganisation before annual data series were in a format convenient to be investigated in the simple spreadsheet charts presented in this report. Figure 13 shows a small sample of 37 annual data series described in more detail in Appendix 6 where continuous online monitoring data suggests non-compliance for ammonia levels in treated sewage.

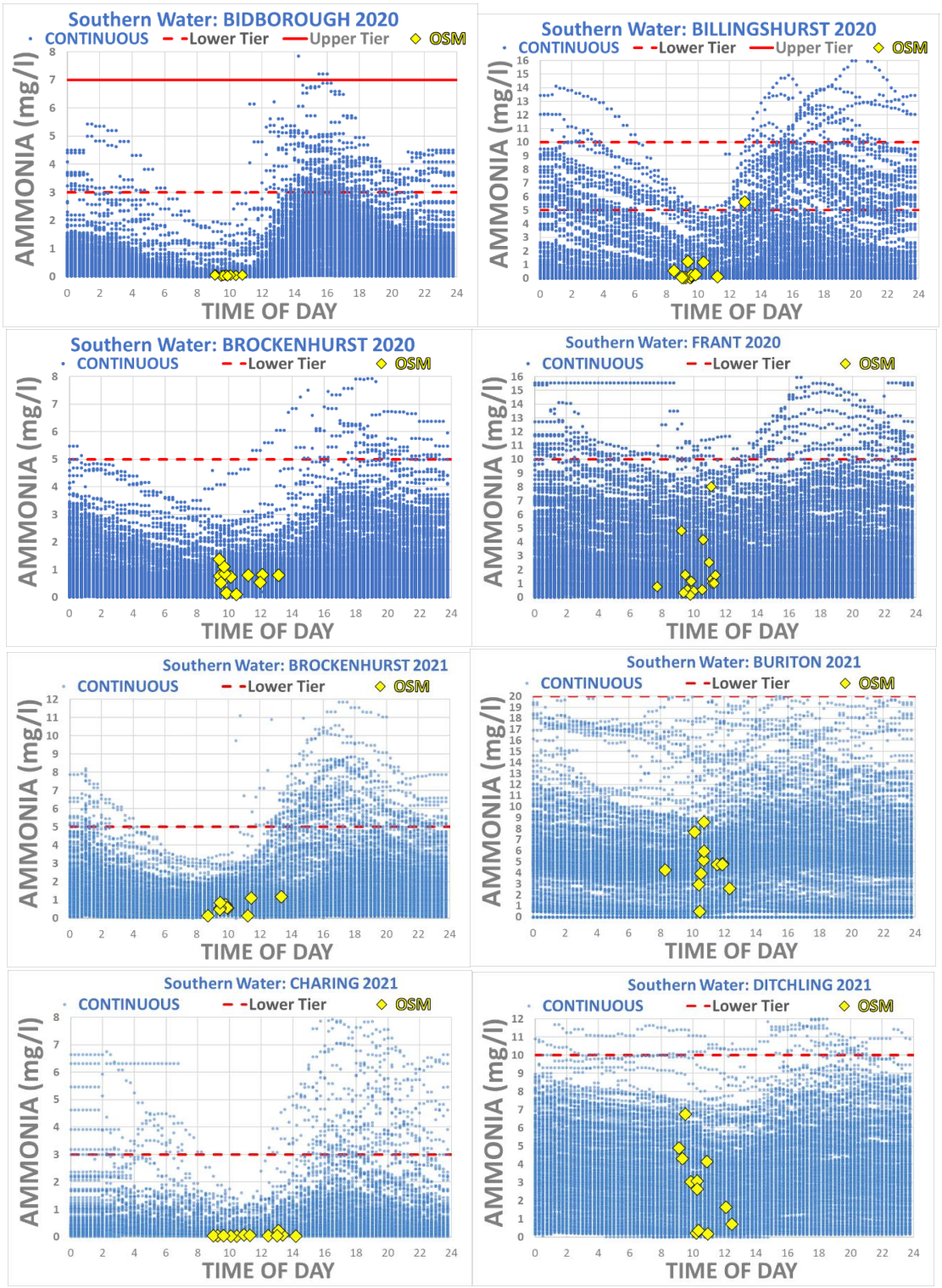


Figure 13 Examples of Southern Water STWs where OSM "spot" samples for ammonia appear to be compliant but continuous measurement suggests otherwise.

D: Yorkshire Water

Yorkshire Water has continuous online monitoring of treated sewage at more than 94 STWs. Unfortunately, the quality of the online monitoring data provided was extremely poor with, for example, 80% of the annual data series for 2020 deemed to be unreliable and so not analysable. Yorkshire Water clearly do not maintain the treated effluent monitoring equipment to the standard of other water companies. By way of illustration, Figure 14 includes 8 of the 14 potentially non-compliant data series for 2020 and 202 which are covered in more detail in Appendix 8.

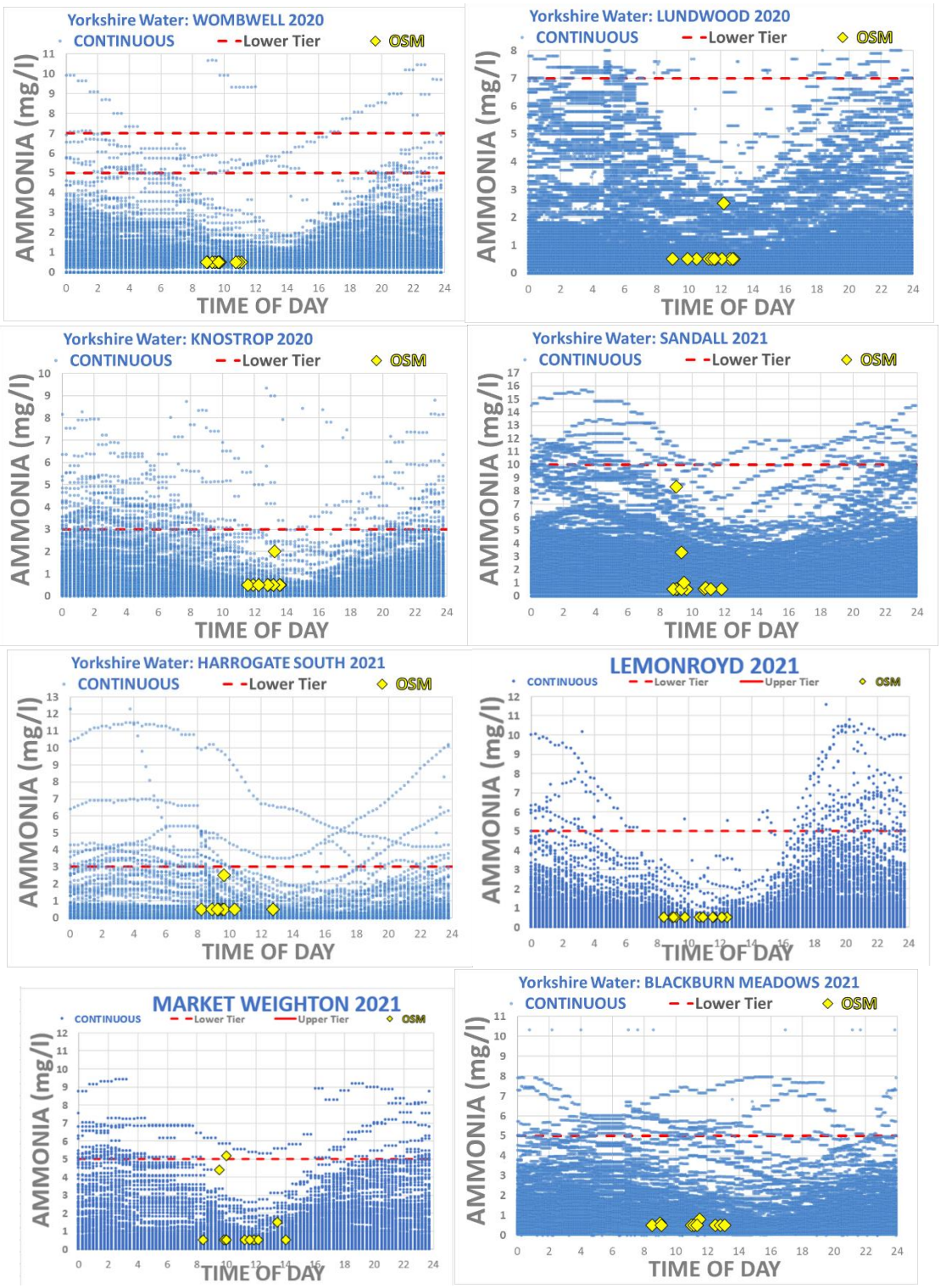


Figure 14 Examples of Yorkshire Water STWs where OSM "spot" samples for ammonia appear to be compliant but continuous measurement suggests otherwise.

E: Anglian Water

Anglian Water provided non-statutory online monitoring data of treated sewage for just 5 STWS. Seven examples are shown in **Figure** 15 below. In Appendix 5, a more detailed account is given of the 7 potentially non-compliant annual data series.

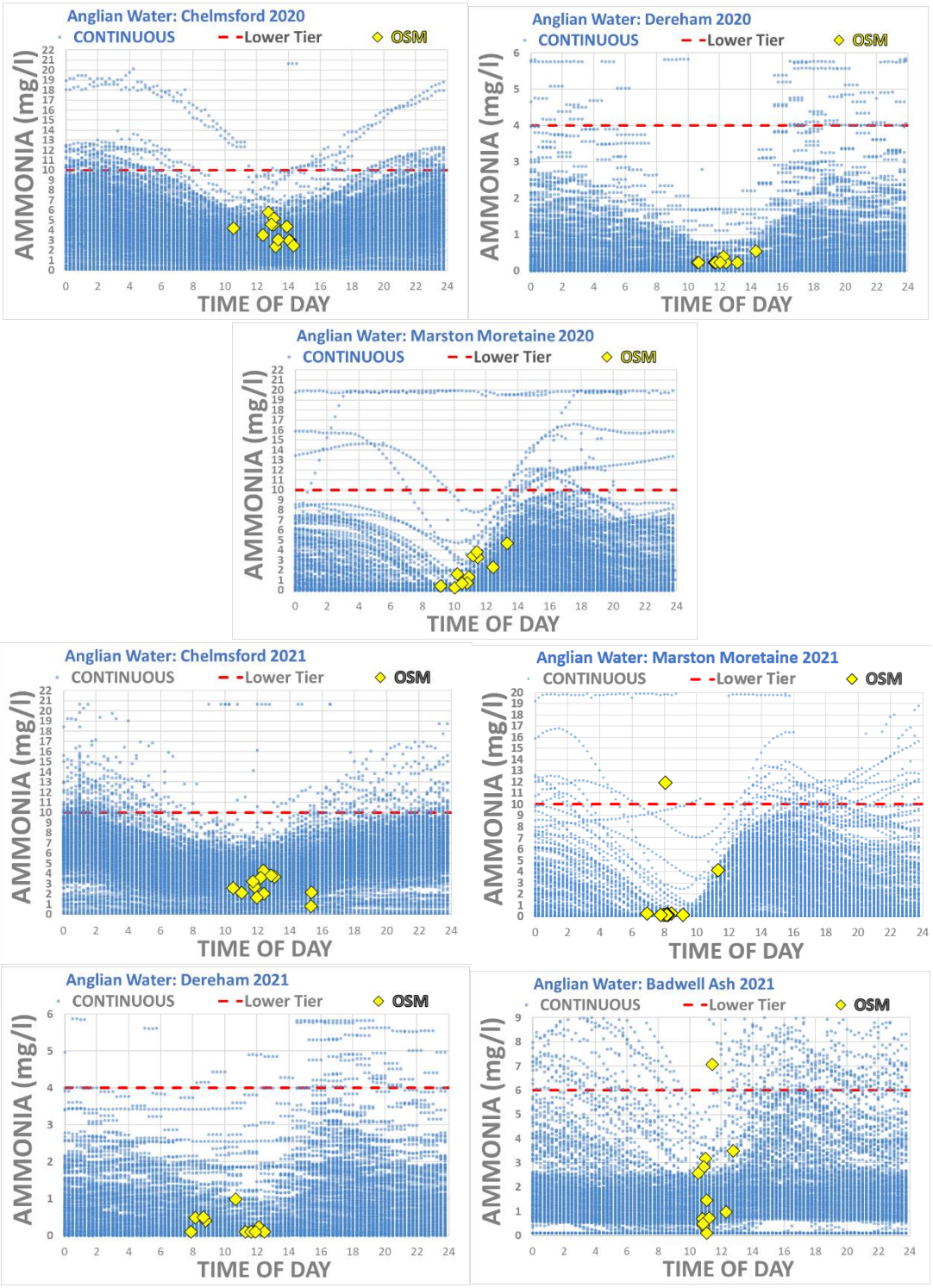


Figure 15 Examples of Anglian Water STWs where OSM "spot" samples for ammonia appear to be compliant but continuous measurement suggests otherwise.

F: Welsh Water

Welsh Water provided non-statutory, online monitoring data for 48 STWs. The quality of the data provided was the second worst of all 10 water companies, with Yorkshire Water being the worst. Less than a third of the annual online monitoring data series were analysable. Welsh Water do not appear to maintain the treated effluent monitoring equipment to the standard of other water companies. More detail is provided in Appendix 10.

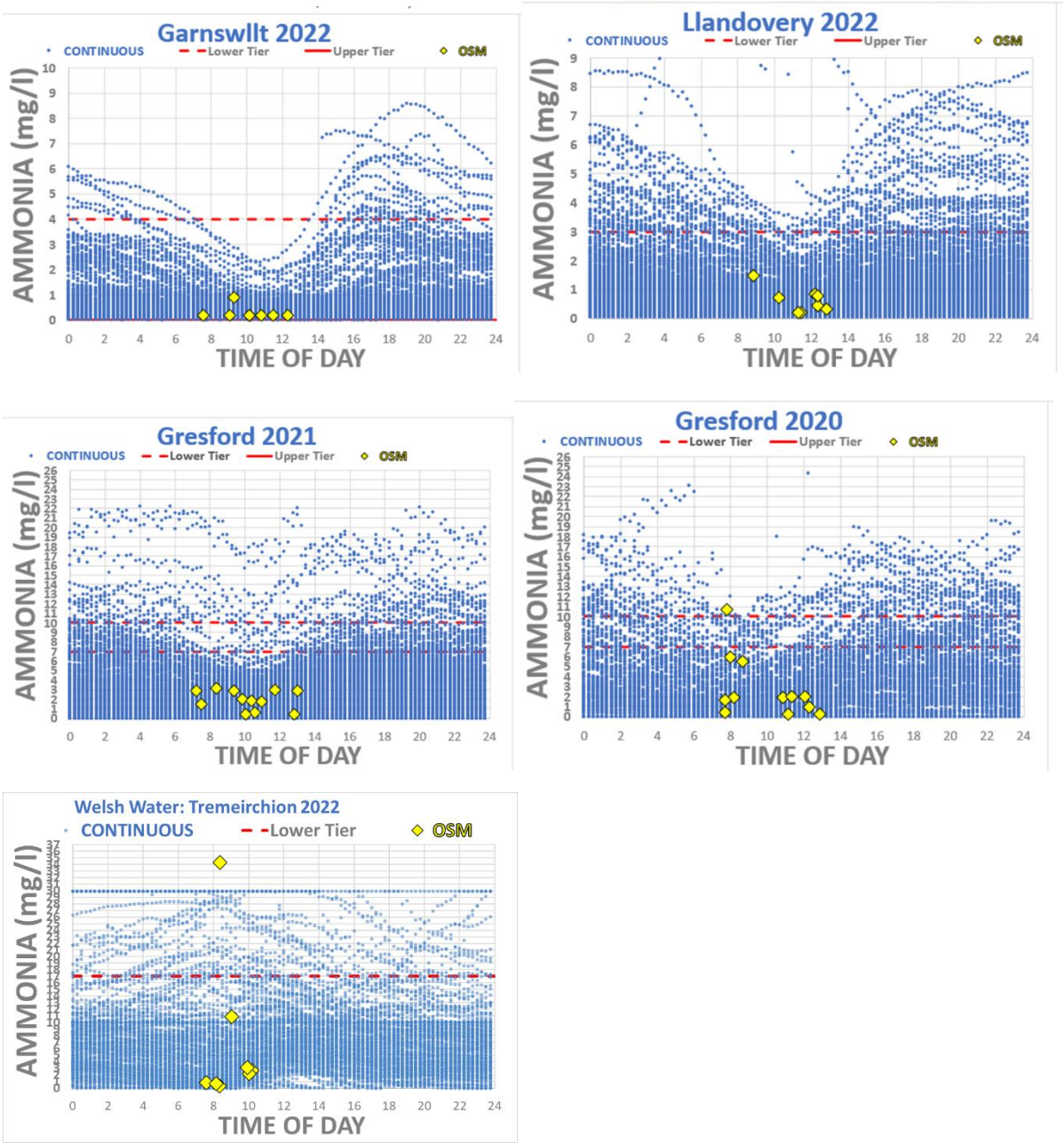


Figure 16 Examples of Welsh Water STWs where OSM "spot" samples for ammonia appear to be compliant but continuous measurement suggests otherwise.

Appendix 1 Data Sources

WASP downloaded the results of statutory OSM "spot" tests of treated sewage (final effluent) for 2010-2022 from the DEFRA data archive[12]. This included location, date and time of sampling and results of tests for specific parameters at approved laboratories. Biological Oxygen Demand, Suspended Solids and Ammoniacal Nitrogen, the most common parameters monitored, are considered in this report. Statutory monitoring standards for treated sewage quality at each sewage treatment works are set out in an individual EA permits to discharge to water[13] and in a comprehensive list on the *.gov.uk* website[14]. Some useful up-to-date permit level data is published in annual water company data such as that from Yorkshire Water at https://www.yorkshirewater.com/about-us/reports/ .

Analysis of statutory OSM data is the basis for WASP's claim that more than half of treated sewage is never subject to monitoring for quality.

In addition, each of the 10 major water companies was asked, under Environmental Information Regulation (EIR) legislation, to provide all data recorded by non-statutory, i.e., voluntary, online continuous monitoring of treated sewage.

United Utilities and Severn Trent Water refused to provide any continuous monitoring data whatsoever because disclosure might prejudice ongoing investigations of their performance by the EA and Ofwat. South-West Water provided a list of its STWs with continuous monitoring of treated sewage but refused to provide any recorded data on similar grounds. Northumbrian Water said it did not undertake continuous monitoring of AmmN in effluent discharges and so had no such data.

After negotiation, 6 water companies offered limited provision for a single parameter and time range. Data was provided for the following numbers of sewage works, time series and date range:

Company	# STWs	Provided time series	date range	Non-compliant STWs	Non-compliant series
Anglian	5	9	2020-2021	4	7
Northumbrian	0	0	-	-	-
Severn Trent	0	0	-	-	-
Southern	205	406	2020-2021	34	38
South-West	0	0	-	-	-
Thames	113	236	2020-2021	19	27
United Utilities	0	0	-	-	-
Welsh[15]	48	135	2020-2022	7	8
Wessex	66	588	2012-2022	28	61
Yorkshire	94	195	2020-2021	13	14
TOTAL	531	1,569		105	155

WASP selected Ammoniacal Nitrogen as the single parameter because it is potentially harmful to aquatic life if its concentration reaches high enough levels. For convenience, "ammonia" or "AmmN" are often used in the report instead of Ammoniacal Nitrogen.

[12] https://environment.data.gov.uk/water-quality/view/landing

[13] https://www.gov.uk/government/publications/waste-water-treatment-works-treatment-monitoring-and-compliance-limits/waste-water-treatment-works-treatment-monitoring-and-compliance-limits

[14] https://environment.data.gov.uk/portalstg/home/item.html?id=5e618f2b5c7f47cca44eb468aa2e43f0

[15] Limited to STWs operated by Welsh Water but reporting to the Environment Agency. Natural Resources Wales do not appear to publish monitoring data for treated sewage.

Appendix 2 Environment Agency requirements for sample reporting

Sampling programme annual submission format

Use a spreadsheet format with these column headers:

- WWTW name
- unique reference number (URN) – Environment Agency or operator
- population equivalent (method confirmed)
- sample frequency
- parameters (BOD, COD, N, P)
- % reduction and concentration or concentration only
- UWWTR monitoring threshold crossed since last submission (up or down, PE or monitoring under sensitive areas designation taking effect)
- number of samples Monday
- number of samples Tuesday
- number of samples Wednesday
- number of samples Thursday
- number of samples Friday
- number of samples weekend
- dates in January
- dates in February
- dates in March
- dates in April
- dates in May
- dates in June
- dates in July
- dates in August
- dates in September
- dates in October
- dates in November
- dates in December

Use a separate line for each WWTW.

Include the PE for all WWTW.

Clearly show any changes that affect the UWWTR monitoring of a WWTW compared to the previous year's monitoring.

https://www.gov.uk/government/publications/waste-water-treatment-works-treatment-monitoring-and-compliance-limits/waste-water-treatment-works-treatment-monitoring-and-compliance-limits#Population-equivalent-thresholds-for-analytical-parameters

Appendix 3 Compliance of discharges of treated sewage

Annual compliance is one of the six metrics in the EA's annual Environmental Performance Assessment (EPA) and is described on the Ofwat website as follows

2.3 Discharge permit compliance (numeric)
Permitted wastewater discharges from waste water treatment works and water treatment works are assessed for compliance with numeric limits in permits. The discharges and sites that are included in the assessment are agreed with water companies each autumn and the process of assessment and reporting is set out clearly in an EA Operational Instruction and supporting documents. This metric has been adopted as a common performance commitment by Ofwat for 2020 to 2025.

3. Discharge permit compliance (numeric)

Definition of measure
The performance of wastewater treatment works (to treat and dispose of sewage) and water treatment works (for the water supply service) in line with their numeric discharge permit conditions. The discharge permit compliance metric is reported as the number of failing sites and not the number of failing discharges. The calculation of the metric is set out below.

Obligation
Compliance with the requirements of permits issued for water discharge activities and groundwater activities under the Environmental Permitting Regulations (2016). The 2016 Regulations apply to any compliance breach from 1 Jan 2017 onwards.

OFFICIAL
Water & sewerage company Environmental Performance Assessment (EPA) methodology (version 9). May 2021. Environment Agency.

Calculation
(B-A)/B * 100 where: A is No. of sites where one or more discharges confirmed failing in calendar year; and
B is No. of discharges on EA / NRW register during calendar year (in force).

Failure to comply
A discharge can be confirmed as failing for the following breaches of a numeric permit at wastewater treatment works and water treatment works:

- **sanitary parameters numeric limits**
- **sanitary parameters Look Up Table (LUT) numeric limits (rolling 12 months but only counting exceedances that have occurred in the calendar year)**
- **sanitary parameters Upper Tier (UT) numeric limits**
- nutrient parameters numeric limits (annual mean limits only using samples collected in the calendar year)
- non sanitary parameters numeric limits (annual mean limits only using samples collected in the calendar year)
- non sanitary parameters Look Up Table (LUT) numeric limits (rolling 12 months but only counting exceedances that have occurred in the calendar year)
- non sanitary parameters Upper Tier (UT) numeric limits
- Urban Waste Water Treatment Directive (UWWTD) numeric parameters compliance

- UWWTD failure to collect or analyse required number of samples and/or parameters
- UWWTD LUT parameters numeric limits
- UWWTD UT parameters numeric limits
- UWWTD Nutrients parameters numeric limits
- Ultraviolet (UV) Disinfection Dose (failure to meet the permitted rolling annual or daily dose requirements)
- Water Treatment Works (WTW) compliance with numeric parameter limits

Notes:

a) 'sanitary parameters' mean Biochemical Oxygen Demand (BOD), Ammonia and Suspended Solids

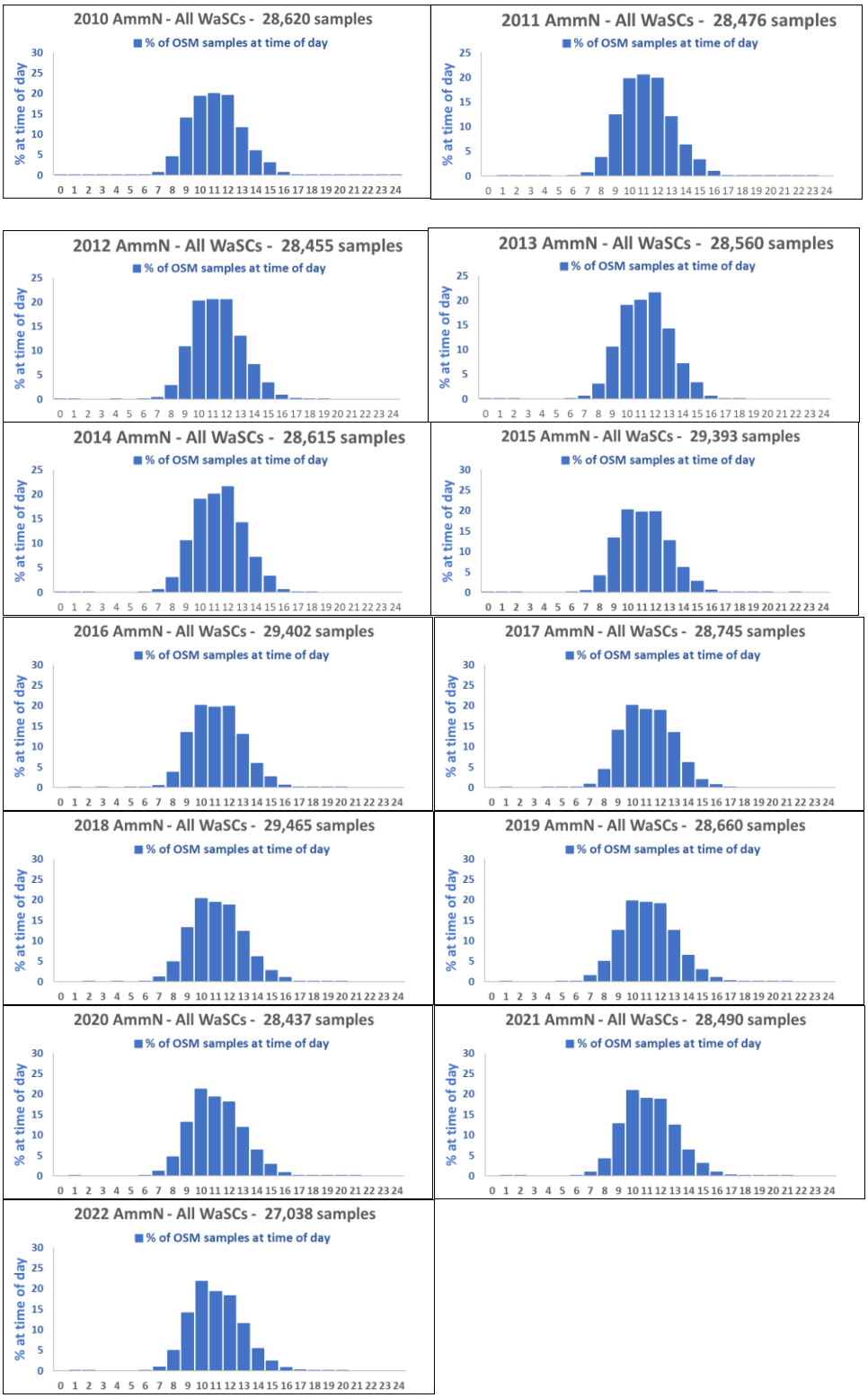
b) the calculation result is rounded to 1 decimal place for assessment against the thresholds below and for reporting

Target

100% discharge permit compliance. The thresholds set are based on our Water Industry Strategic Environmental Requirements (WISER) expectations. The trigger limits are based on statistical analysis of the data set and our expectations of the sector. In 2017 we set out our performance expectations for 2020 to 2025 in the WISER. Relevant extracts from WISER are reproduced in Appendix 3.

Frequency Annually based on a calendar year.

Appendix 4 Water company sampling times for OSM monitoring of AmmN 2010-22



Data source: DEFRA data archive