Thames Water Utilities Limited

Audit Report

Water Industry National Environment Programme Assurance	Version: 3	
Areas of the WINEP Process assured: • Data audit via sample of WINEP schemes **Relevant regulatory guidance and documentation:** • WINEP Methodology, published by the Environment Agency, available here. • WINEP Options Development Guidance (version 3, July 2022), published by the Environment Agency. • WINEP Options Assessment Guidance (version FINAL, March 2022), published by the Environment Agency. • WINEP Wider Environmental Outcomes Metrics (version 2.1, 07.04.2022), published by the Environment Agency. **Approach** 1. Data Audit, Step 1: Desk based review of Cypermethrin ODR (PR24 WINEP Options Development Report Cypermethrin.pptx) 2. Data Audit, Step 2: Interviews with staff to address any queries raised through Step 1 and to conduct data spot checks	Originator:	Ed. Ruswa
	Report completion date:	15/3/2023
	Reviewer:	S M Weatherup
	Review date:	16/03/2023

Key to RAG assessments	No issues identified (low risk that process is not compliant with guidance)	Non-material issues identified (low to medium risk that process is not compliant with guidance)	Material issues identified (medium to high risk that process is not compliant with guidance)	Significant material issues identified (high risk that process is not compliant with guidance)	Assurance activity not complete / to be completed
	A	B	C	D	N/A or TBC

Version details for document(s) reviewed (include links / screenshots as appropriate)	PR24 WINEP Options Development Report Cypermethrin.pptx and the following embedded documents • Generic WINEP Approach • WINEP Customer, Communities and Stakeholder Engagement • Method Statement: Chemicals • CIP Treatment Assessments for Cypermethrin and Nonylphenol for PR24 • Options Screening Workbook for Thames Water PR24 WINEP Options Development • Assumptions

Summary Scoring		Explanation
Summary RAG Score	B	The combination of a review of Trader Permits + ASPs + Multimedia Filters + GAC is a comparatively robust solution however the application of GAC may require further work to ascertain breakthrough bed volumes and whether pre-treatment is necessary. As some of the cypermethrin permits are more stringent than the 0.08ng/l Environmental Quality Standard for Cypermethrin, this presents a risk of whether compliance can be reliably achieved in the long term.

Data Audit

Action ID		Various
Primary Driver (WINEP Driver Code)		WFD_IMP_CHEM, WFD_NDLS_CHEM1
Preferred Option		Trader Investigations & Multimedia Filters
Step 1: has the documented process been followed?		
Component of Optioneering	**Has the documented process been followed? (Y/N/Unclear)**	**Comments** ***To complete this section of the proforma, check that the Options Development Report (ODR) includes all of the requirements outlined in the ODR template. Identify any missing requirements / discrepancies.*** ***Also check that the Options Assessment Report (OAR) includes all of the requirements outlined in the ODR template. Identify any missing requirements / discrepancies.*** ***Also check that requirements of relevant method statements here have been addressed in the ODR and OAR reports.***
Confirming environmental risks and issues	Y	Environmental issues and risks are clearly documented and referenced to WINEP driver codes.
Developing constrained options list	Y	New cypermethrin limits were imposed on 43 Thames Water sites by the EA and Thames water recognised sites with an immediate chemical challenge (ODR p. 37). The ODR lists six options that were assessed through coarse screening (ODR p. 27). The coarse screening available within the ODR (p. 26-28) and embedded technical note provide information of option progression/rejection. Coarse Screening Outcome and Constrained Options List is clearly presented (ODR p. 31).
Developing feasible options list	Y	The fine screening table is presented and summarised evidence for progression is noted (ODR p. 34). The preferred options are noted on depending on the existing secondary treatment process ASP or Trickling Filters (p. 42).
Assessing wider environmental outcomes	Y	Wider environmental outcomes assessment files for the feasible options are embedded within the ODR.
Identifying the preferred option	Y	Preferred options are identified within the ODR (p. 35). The risks, opportunities, synergies and assumptions are considered in the preferred option selection (ODR p. 40)

Test	**Question**	
Suitability	Does the optioneering provide a transparent record of decisions made and evidence used? Is it clear what evidence is driving the decision to propose the option(s)?	Cypermethrin removal is driven by 2 mechanisms, sorption to the organic matter and biological treatment, with sorption being the main removal driver. In effect, the combination of total suspended solids removal and biological treatment may likely give the best treatment outcomes. A more in-depth analysis of the CIP3 data could be added to the ODR to support this learning. This will help to bridge the gap between the treatment challenges and solution tabled (ASPs + Multimedia Filters + GAC).

	Has the constrained list and feasible list been develop fully i.e. all possible solutions being taken into account? Is this clear in the ODR?	A more in-depth assessment of CIP3 data may allow for the comparison of processes with a suspended solids element only against those with a dual function, suspended solids removal and biological treatment. An assessment of the assured Cypermethrin measurement techniques would have allowed for some of the future permits to be challenged as they may be close to the current limit of detection. There is a clear technical challenge in meeting some of the cypermethrin permits proposed, as such, the compliance risk may need to be highlighted further. Therefore, it is recommended, the CIP3 results are assessed in-depth and opportunities to challenge Cypermethrin permits below EQS levels are investigated.
	Is there evidence to indicate that the technology selected is appropriate?	ASPs + Powdered Activated Carbon (PAC) has been shown to meet the treatment requirement however the GAC adsorption capacity requires further investigation as long-term compliance may be challenging. The application of GAC treatment directly downstream of ASPs exposes the media to comparatively higher levels of Total Organic Carbon (TOC) relative to drinking water applications, which can rapidly saturate the media. Therefore, the long-term removal efficiency of cypermethrin likely requires further investigation. Therefore, the technology selected appears appropriate, however sustained performance requires further investigation due to the risk of the GAC media adsorption sites being rapidly saturated.
	Is the rejection of alternative options justified?	Yes, as most tertiary solids removal technologies alone, may prove unreliable in effecting sufficient treatment. This leaves a few alternatives which may be appropriate, as such, the selection of ASPs + Multimedia Filters + GAC is justified, however the pre-treatment ahead of GAC and the type of GAC media need further investigation.
	Are wider environmental outcomes assessed (for preferred and feasible options)?	Yes. The technology ranking methodology and course and fine screening exercises appear all encompassing with aspects such as Biodiversity, Air Quality, Amenity, Carbon among others being reviewed per technology option
	Are there any discrepancies or outstanding questions in the ODR that need to be addressed? Are these critical to the programme of the risk profile?	The biological treatment mechanism for cypermethrin may need further consideration. The CIP3 trial results have demonstrated generally greater removal may be achieved by technologies that remove both suspended solids and offer biological treatment. Therefore, it is recommended the performance of Nitrifying Sand Filters is reviewed.
	Are there any permits which are uncertain and could present a risk if changed?	N/A, this review is assessing the compliance risk of the permits put forward. Amendments to these permits have not been tabled
	Is there evidence that the preferred option provides best value? Is the comparison against other feasible options transparent?	Yes, “Best Value” versus “Least Cost” comparisons have been conducted. The application of GAC will likely require the selection of pre-treatment processes and bench testing to forecast breakthrough bed volumes. This will allow for regeneration costs to be more accurately estimated.
	Are whole life costs and benefits presented (for preferred and feasible options)?	Yes, whole life costs (WLC) and option benefits are summarised in the ODR. It may be necessary to present these costs, site-by-site instead of a combined figure for the whole programme.
	Are residual risks presented (for preferred and feasible options)?	Yes, risks are presented. As the compliance risks are elevated, it is recommended additional commentary is added against each risk.
Reliability	Is there evidence presented to indicate that the preferred option can deliver the required	ASPs + PAC has been shown to meet the treatment requirements however the GAC adsorption capacity requires further investigation as long-term compliance may be challenging. The application of GAC treatment downstream of ASPs exposes

	outcome/goal/outcome under a range of scenarios?	the media to comparatively higher levels of TOC relative to drinking water applications, which can rapidly saturate the media. The long-term removal efficacy of cypermethrin likely requires further investigation. Therefore it is recommended, in addition to the proposed pilot trials, initial bench testing to underpin process selection is performed.
	Are risks associated with delivery identified and mitigated? Are any residual risks identified and managed?	11 risks are identified however further commentary can help explain the likely impact if the risks are realised. Pilot trials on all the permitted sites are proposed. It may be preferable to run pathfinder trials on selected sites whose outcomes can be rolled out across the programme. The process risks associated with the application of GAC on wastewater final effluent may require greater emphasis as the frequency of regeneration is yet to be established. As Pilot trials are ahead of project completion, they may need to be carefully programmed to ensure there is sufficient time for the outcomes of the trials be applied to the final solutions. This may present a programming risk.
Additional sections to ensure all questions covered	Compliance with Asset Standards – do the proposed solutions comply with AS?	N/A as these are first time Cypermethrin permits.
	Are any trials proposed in the case that the technologies are not yet proven?	Yes, pilot trials have been costed. It may be advisable to add detail on how they are to be rolled out. The current proposal is for pilot trials to be carried out on every site with a cypermethrin permit, however it may be advisable to channel resources to more intensive pathfinder trials whose outcomes can be rolled out to the remaining sites. As stated above, the application of GAC may need to be prefaced by understanding the pre-treatment requirements. It is likely bench tests to narrow down the type of GAC and forecast breakthrough bed volumes may inform process selection before pilot tests commence.
	Will the solutions selected meet the target Cypermethrin permit or outcome	CIP3 trials demonstrate up to 98% removal can be achieved with ASPs + PAC however the following aspects may need to be investigated further • The adsorption capacity of the activated carbon media • The reliability of performance for sites with permits well below the 0.08ng/l EQS for Cypermethrin.
	What are the other technologies or solutions that could be used and have these been considered in the development of the constrained and feasible solutions list?	Veolia OPACARB is mentioned in the accompanying technical document; as this process can be combined with ozonation, this may represent a method to further reduce the TOC concentration and thus cypermethrin levels. In addition, the introduction of this pre-treatment step ahead of GAC adsorption may help preserve adsorption capacity for the target pollutant. As such, innovative technologies could have been included in the pilot trial scope. This may preclude the conversion of all trickling filter works to ASPs. The investigation of new treatment technologies may require greater emphasis as opposed to deferring to ASPs on all sites with cypermethrin permits
	Are there specific sites or solutions that present a risk to meeting compliance? Is this a risk to compliance or other risk(s)?	Sites with permits below the cypermethrin EQS are at an increased risk of non-compliance.
	Are there any sites or solutions that are too conservative in their approach? In what areas	The standard solution offered of ASPs + Multimedia Filters + GAC may be challenged by • Innovative solutions that combine ozonation and GAC treatment.

	and how can the solution be changed if more risk can be taken?	• The efficacy of existing technologies such as Nitrifying Sand Filters which may need further review as the results from the CIP3 trials appear promising. • As cypermethrin usage peaks during the autumn months, it may be advisable to engage with local farmers to assess whether they can use alternative chemicals or manage application rates. Ground control operatives on wastewater treatment works may also need to use alternative chemicals. Moreover, as cypermethrin is non-persistent and only lasts for a few days in aquatic environments, tackling diffuse pollution from farmers may allow for river needs to be met in a multi-faceted manner, possibly reducing the treatment requirements on site.
	Are there specific risks associated with meeting programme? What measures can be taken to mitigate this risk?	As Pilot trials are ahead of project completion, they may need to be carefully programmed to ensure there is sufficient time for the outcomes of the trials be applied to the final solutions. This may present a programming risk. Bench testing may be needed to quickly narrow down GAC options and more accurately forecast OPEX.
	Are there specific risks associated with cost? What measures can be taken to mitigate this risk?	The GAC breakthrough bed volumes may need to be estimated with greater accuracy in order to evaluate regeneration frequencies. Rapid Small Scale Column Tests (RSCCTs) may be conducted to quickly forecast the GAC adsorption capacity. These will also help advise where pre-treatment steps such as ozonation may be required.
	Are there specific risks associated with compliance? What measures can be taken to mitigate this risk?	Addressed in questions above
	Outstanding questions to be discussed before report completion	N/A as Thames have already provided clarifications to posed questions. These minor clarifications have not changed the outcome of this assessment