Clear Water Storages:
Critical Learnings in the Application of Protective Coatings

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Abstract

North East Water recently undertook a capital improvement project to repair a clear water storage basin, using a potable water-approved polyurea product to enhance its longevity. Following minor concrete repairs, the product was applied per manufacturer guidelines, and after rigorous disinfection and water quality testing, the basin was put back into service. However, customer complaints regarding a chemical taste and odour in the water prompted the immediate removal of the basin from service and reinstatement of a bypass used for the duration of the works. Despite the increased risks to supply during a hot, dry summer, the bypass was required for an extensive period while root-cause analysis and rectification planning was undertaken.

Subsequent investigations revealed unexpected compounds in the cured coating, which, although within safe drinking water aesthetic thresholds, were detectable through taste and did rise after prolonged water contact. Despite rigorous investigation and testing, the presence of these compounds, their pathway into the cured product, and their correlation with the taste and odour being experienced is still unclear. After extensive monitoring and collaboration with various stakeholders, including manufacturers and coating specialists, it was decided to remove the polyurea coating, a non-standard practice requiring careful trials to minimise damage to the concrete.

Following the removal, significant concrete repairs were necessary, and recoating was deemed unwise to prevent recontamination. The basin is now in a period of curing which will be followed by an extensive return-to-service plan that will include sanitisation, water quality testing, and taste and odour panels. This project yielded critical insights for North East Water and the broader industry regarding the application of coatings in clear water storages and will shape future practices.

Introduction

The Mount Beauty #1 Clear Water Storage Basin is a 900kl rectangular concrete tank housed within a steel shed structure and supplies drinking water to the local Mount Beauty community. In 2024, NEW installed a bypass pipeline and removed the basin from service to undertake remedial works on both the steel structure and the concrete basin.

This report summarises how these works led to a taste and odour event, the extensive effort required to identify and address the issue, and the key learnings to help avoid similar issues in future water storage refurbishment projects.

Figure 1. External shed structure

Figure 2. Interior basin view

Background

A March 2024 structural inspection undertaken by a Structural and Durability Consulting Engineer identified corroded steel components, soft-water attack on concrete surfaces, and deteriorated expansion joint materials. The engineer recommended steel preparation and recoating, concrete repairs, and application of a 3 mm polyurea protective coating.

A construct-only tender was issued using the comprehensive repair strategy provided by the engineer, and a reputable contractor was engaged. Works proceeded on time and on budget. After sanitisation and commissioning water quality tests, the basin was returned to service in late November 2024.

Soon after reinstatement, NEW received customer complaints regarding chemical taste and odour in the water. The basin was immediately removed from service, the bypass reinstated, and the network flushed. A Section 22 notification was issued to the Department of Health for widespread public complaint, and an internal investigation was launched.

The Investigation

Operators inspecting the basin detected a strong chemical odour and heavy condensation inside the shed. Water was dripping from newly coated steel beams into the basin. An odour had not been detected upon completion of the works; however, water had remained in the basin for several days for water tightness and quality testing, prior to being delivered to town. No other significant observations were made, and there was no clear evidence indicating the cause of the taste and odour issue.

Additional water samples were collected, and photographs taken. NEW contacted the contractor, product manufacturers, the engineering consultant, and various industry specialists. Support and information varied, and no immediate cause was identified. Industry experts suggested potential causes including polyurea overspray, uncured product, environmental conditions, or material interactions.

Several months were spent gathering information, consulting specialists, and knowledge sharing across the sector. NEW were able to engage with authorities who had experienced their own challenges with coating systems, though none mirrored our own situation. Significant water quality testing was conducted during this period, with varied results.

Rectification Attempts

On advice, NEW undertook two intensive chlorine washdowns with significantly higher concentrations than those used in the original return-to-service plan. There were suggestions that higher concentrations of chlorine and a longer contact time might neutralise the liner. Following the first washdown, an internal taste and odour panel continued to detect taste and odour issues.

The second washdown also included a mechanical brush to scrub the surface and remove any overspray. Overspray leaves fine particles of product on the surface that may not have mixed or cured properly and can cause taste and odour issues. This method also proved unsuccessful as the taint remained.

In parallel, works to improve ventilation and reduce condensation at the basin were complete. NEW remained in contact with the Department of Health and continued water testing to understand both the root case and the longer-term impact of the contamination.

Water Sampling Results

Over several months, NEW conducted extensive sampling and analysis, including VOCs, SVOCs, MAHs, PAHs, BTEXN, halophenols, THMs, HAAs, and sensory testing. Low-level detections of ethylbenzene and xylene were recorded in some samples. These compounds are not part of the polyurea formulation but were present in products used to recoat the beams, indicating an external or unrelated source. Although the concentrations were within ranges sometimes observed in drinking water, both compounds are undesirable and can be detected by human taste and odour at very low levels.

Ethyl citrate and dodecamethylcyclohexasiloxane (D6) were also detected. Both are odourless, are not assigned guideline values under the Australian Drinking Water Guidelines and are not associated with any materials used during refurbishment. Their origin therefore remains uncertain.

Table 1: Notable Detections by sample

	Nov 2024			Dec 2024					Jan 2025				Feb 2025	
Chemical	18	20	29	2	9	16	23	30	6	14	20	28	10	17
Ethyl Benzene	-	-	-	-	-	-	-	-	-	-	+	+	+	+
Xylene	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Ethyl Citrate	-	-	-	-	-	-	-	-	-	-	-	-	-	+
D6	+	-	-	-	-	-	-	-	-	+	+	-	-	-

Table 2: Detection Summary

Chemical	Reporting Level mg/l	Detection Levels mg/l	Taste & Odour threshold mg/l
Ethyl Benzene	0.3	0.003 – 0.004	0.003
Xylene	0.6	0.002	0.02
Ethyl Citrate	NA	0.006	NA
D6	NA	0.002 – 0.007	NA

The variability and generally low concentrations of these compounds made it difficult to predict how levels might change over time. Given the uncertainty, NEW engaged a specialist consultant to conduct targeted analysis of the polyurea coating.

Polyurea Coating Analysis

In February 2025, five liner samples were taken from different areas of the basin and sent to an independent laboratory for differential scanning calorimetry (DSC) analysis. Water quality results were provided alongside the samples to help identify any correlations between the DSC findings and the compounds detected in the water.

Fig. 3: A liner sample removed for testing.

The DSC analysis confirmed that the coating was fully cured but contained volatile organic compounds (VOCs) consistent with some of those found in the water. Chloroform, ethylbenzene, and xylene were present in the polyurea as absorbed compounds, though none had reacted chemically with the liner.

It remained unclear whether ethylbenzene and xylene would eventually desorb back into the water or persist within the coating. The analysis could not pinpoint how these compounds entered the liner, concluding only that they were likely either introduced during application or formed through secondary reactions soon after application.

Ethyl citrate and D6 were not detected in the liner and are not typically used in epoxy or polyurea systems, indicating they likely came from an external source unrelated to the refurbishment. Chloroform in water samples ranged from 0.007 to 0.012 mg/L—well below the Australian Drinking Water Guideline reporting value (1 mg/L) and below taste and odour thresholds (0.25 mg/L). It was therefore ruled out as a contributor to the taste and odour issue.

Remediation

Although the concentrations detected in laboratory-analysed samples were low, it is likely that concentrations across the basin varied and would remain perceptible to customers for some time. The specialist consultant proposed several mitigation options, including activated carbon filtration and installing PVC, geomembrane, or alternative polyurea liners to act as a barrier between the contaminated liner. These were assessed as high-risk due to uncertainty about the contamination source and the potential for re absorption into the new materials.

NEW determined the only effective option was to remove the polyurea coating entirely, despite risks to the underlying concrete. Removal of a newly applied coating is not common and posed

risk of damage to the older concrete structure. Trials were conducted with support of the original contractor, and high-pressure water was selected as the most appropriate method.

Removal took two weeks and caused variable concrete loss ranging from minor surface abrasion to loss of up to 10 cm in some areas. Extensive concrete and joint repairs were required. Following repairs, the basin was left uncoated to avoid future contamination risk. A full site clean-up was completed to remove loose polyurea debris and a thorough return-to-service plan is now in progress. This plan includes sanitisation, enhanced water quality testing, and formal taste and odour panels.

Fig. 4-6: Removal of polyurea coating from basin

Critical Learnings

The Mount Beaty Clear Water Storage incident has yielded several key learnings for NEW that can be applied to the wider industry:

1. **Mix of Potable and Non-Potable Materials**: Although the materials specified for the concrete basin were AS4020-approved, some products used on the steel structure prior to polyurea application were not. It is unclear whether off-gassing in the humid environment contributed to contamination. Future specifications will more carefully consider interactions between mixed material systems and the potential for cross-contamination.
2. **Lack of Taste and Odour Acceptance Criteria**: While the contract detailed application and QA requirements for the polyurea system, it did not require the basin to pass a taste and odour panel before final acceptance. This left NEW responsible for the investigation and remediation. Taste and odour panelling will be mandated in future contracts of this nature.
3. **Contractor Performance & Third-Party QA**: The contractor is highly regarded and experienced with polyurea applications. They worked closely with NEW throughout the investigation and rectification attempts. There is no evidence of contractor negligence or poor workmanship. In future, NEW will include third party QA in similar projects for more robust management.
4. **High Surface-Area-to-Volume Ratio**: Although the basin was within the ratios specified by the manufacturer, the influence of a high surface-area-to-water ratio on taste and odour

cannot be ruled out. NEW will reconsider the suitability of polyurea for similar future applications.

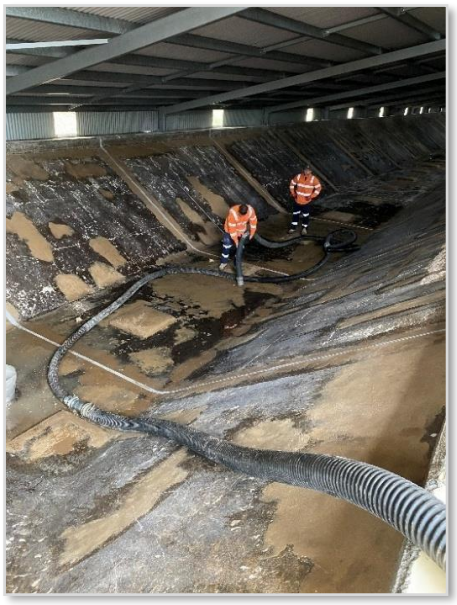
5. **Limitations of AS4020 Certification**: AS4020 certification applies only at the time of product testing, and there is no ongoing requirement for batch-to-batch verification. It is therefore not possible to confirm that the batches used in this project were free from contamination. NEW may consider independent batch testing in future.
6. **Reliance on Bypass Capacity**: Mount Beauty was fortunate to have a bypass capable of supplying potable water through two consecutive hot summers. Many sites do not have this capability, and similar incidents could significantly affect water supply. Future storage upgrades will require more robust contingency planning.
7. **Coating Not Critical for Service Delivery**: While the basin required some repairs, applying a polyurea coating was not essential for service delivery or water quality. It was intended to extend asset life. NEW will review its process for determining when protective coatings are necessary for similar assets.

Conclusion

Despite extensive investigation, the exact source of contamination causing the taste and odour incident at Mount Beauty Basin #1 could not be conclusively identified. Multiple remediation attempts were ineffective, and laboratory analysis confirmed that certain VOCs had been absorbed into the polyurea.

Given the uncertainty surrounding the contamination mechanism, the inability to rule out continued leaching, and the risks associated with alternative mitigation options, NEW made the decision to remove the coating entirely.

Figure 6: Post coating removal and repair



Although this process caused concrete damage requiring repair and incurred further costs, it eliminated the risk of further contamination and enabled the basin to progress toward safe reinstatement.

The incident has highlighted several important lessons relating to material selection, contract specifications, sensory acceptance criteria, contingency planning, and the limitations of industry certification standards. These learnings will be incorporated into future projects to strengthen NEW's management of coating systems and potable water assets, reducing the likelihood of similar incidents occurring elsewhere in the network.