Reservoir water turnover

Question 1:

S. LaRoy: Could you please explain the mechanics of how the header internal pipe, with lower check valve system would work if the top of the stack is opened at the top, without a check valve? Experience tells me it would just suck air from the top when the call is to draw from the reservoir. The Tideflex mixing system, recommended by McElhanney, has orifice inlet nozzles that collapse when not under pressure, which seems would be needed to prevent sucking air from the reservoir when drawing the water down.

Answer:

Mechanics of the Header Internal Pipe are based on the simple principal of the water pressure. The check valve closes when the pump turns on, forcing water out of the top, and then when the pump stops, the external tank water pushes open the check valve. This is the same concept of the Tideflex mixing system. This is a good option, and just a little more expensive than a simple flap check valve, doing exactly the same. Remember that air ways much less than water so the route will be through the check valve.

Question 2:

How much will an extension of the interior fill pipe to the top of the tank assist in the mixing process?

Answer:

When water is pumped to the top of the tank, is spills over an splashes at the top of the standing water column, and then you pull water from the bottom of the water column. Some would call this plug flow. The current method does offer some mixing, but you are generally pulling in the water you just filled the reservoir so the upper portion can be stagnant and stratified.

Reservoir Condition and remediation/repair/disinfection

Question 3:

S. LaRoy: Which contractors would you recommend for the following remedial actions that you've recommended, with the assumption that all recommended contractors would employ confined space entry certified personnel to do the jobs:

Apply Epoxy coat?

Assess and examine the reservoir, from the inside, to give us an idea of the extent of internal cracking, if not the outfit chosen to apply an internal epoxy coat?

Spray clean the reservoir with contact chlorination?

Answer:

For this, I default to Herold Engineering as the concrete guys, and perhaps with more local contacts. None of what I have recommended varies much from their recommendations as we are generally on the same page, I just like to get to solutions. So a general concrete contractor whom you feel comfortable with, and having the proper safety gear will be best for you.

Question 4:

In the two-stage reservoir chlorination procedure, would filling the reservoir from 5% to overflow result in adequate mixing of the disinfectant? At the end of that procedure, is the chlorinated water drained/discarded? Or distributed to water users?

Answer:

Two-Stage chlorination procedure will be adequately mixed with an internal piping extension, or left as is in the current bottom inlet. The water can be distributed with notice of high chlorine levels, or left for a few days to be consumed. Alternatively, dump with sodium thiosulphate pucks for dichlorination.

Question 5:

Question from Craig Kerstens: In section 5.1 about disinfection of the reservoir it says use 27 litres of 5% (sodium hypochlorite) which is typical house bleach. This 27 litres (6 IG) was for the entire reservoir of 120,000 IG. Therefore 13.5 litres per cell. When I spoke to the water operator a month ago I asked when he does a cell dump, adds bleach and refills, how much he is adding. He uses 12% grade bleach and when I asked how many gallons of 12% does he add to one cell of 60,000 IG he said "about 2 cups". 2 cups is 1 pint which equals 1/4 gallon. From my operating an industrial cooling tower water system many years ago this seemed low. So if using 12% vs 5% bleach is the volume of bleach required 5/12 x 13.5 = 5.625 litres per cell? That converts to 10 cups of 12% bleach per cell. If an initial concentration of 50 ppm is desirable in 3000 IG, then only using 2 cups is achieving just 10 ppm. And once the cell is filled to overflow the concentration would drop to 0.5 ppm. Is my math correct in converting the different bleach strength used?

Answer:

Disinfection with 27 Litres of 5% solution. 5% solution is 50,000 mg/L of Chlorine (12% is 120,000 mg/L). One imperial cup is 284 mL, or 34,000 mg of Chlorine of 12% solution. When added to 60,000 ImpGal (272,700 L) you end up with 0.25 mg/L of disinfectant if 2 cups are added. For a 1 mg solution, I would be adding 2.27 Litres of 12% bleach.

Question 6:

The proposed daily manual disinfection procedure is noted to cost an estimated $150/day. Is that 365 days per year? Until when?

Answer:

Daily manual disinfection cost of $150/day is a standalone cost assuming nothing by your operator. As an item from the road to the site, I am looking at 1 hour additional work, and likely completed every other day until you have a dedicated mechanical solution in place.

Question 7:

Why is the section entitled “manual disinfection chlorine residual” listed under the 5.2 “external options”? Is that a procedure that is done to the interior contents of the reservoir?

Answer:

Manual disinfection is under external options as you are required to climb to the top hatch and add the chlorine manually.

Question 8:

The last sentence in the section 5.4 Disinfection options reads “delay the future potential”. Potential of what?

Answer:

Delaying the future potential means the desire by Island Health to have you pursue some method of secondary disinfection.

Question 9:

The last line in the chart in section 7 notes “chlorine disinfection at the wellhead” at a cost of $101,250 including engineering. Please provide further details. Would equipment be installed at each of the four wellheads? Does it require twinning of the pipes to have separate supply/distribution lines? Considering that the wells have been ruled out as a source of contamination, why would chlorine disinfection be done at that location?

Answer:

Chlorine disinfection at the well head is meant to provide a location by means of direct injection to the supply line for mixing, and it is the source of power supply to control equipment. Generally whenever there is flow in the system as noted by a flow sensor or flow meter, the chlorine pump installed on the main line would activate, regardless of the pump operating. Installing at the reservoir would require a power supply.

Question 10:

The VIHA inspection report dated Sept 21, 2023 notes that all remediation projects require permits. Do the remediation/repair estimates include permit fees and the associated work to obtain the permits?

Answer:

Within the consulting fees, we have allocated fees for applications to the Public Health Engineer and obtaining Construction Permits

Question 11:

Having only been able to assess the outside condition of the 12” thick cement walls, how is it possible to assume that a thorough inspection of the interior of the reservoir was not needed? A “GeneralCondition” assessment gives our board little indication of the actual state of the reservoir.

Answer:

Your reservoir is in need of replacement sometime in the next 5-15 years depending on how long you are able to kick the can. A thorough internal inspection will be provided when you consider the internal repairs, as this is most cost effective and highest value being a part of the solution. Going inside the tank will entail considerable costs, that are best expended when you proceed to undertaking the repairs as they require pressure washing, scraping, patching and painting. This will provide time for a thorough examination, which will result in the same conclusion both Herold and I have provided.

Question 12:

How is it possible from your provided pictures and on site inspection to state that “cracks continue to form and expand, and create potential for intrusion of rainwater or overland flow?”

Answer:

The age of the tank, is telling. The 30 years of personal experience tells what happens when there is a continuous pressure on a concrete wall without adequate corner support. Water coming out from the cracks on the external walls provides further support for this and over time will continue to expand the cracks.

Question 13:

You state that both biofilms and sediment can reduce the water quality and increase the risk of contamination. What is the time frame for the growth of biofilms?

Answer:

Biofilms will grow immediately as they exist under most conditions, other than when a disinfectant is used. The time to accumulate depends on many factors unique to the water chemistry and debris accumulation against cleaning and disinfection.

Question 14:

How long will it take for a significant amount of sediment to accumulate at the bottom of the reservoir?

Answer:

Sediment accumulation depends on the water source and well capture zone. I can not comment specifically on your site as I have not looked at the pumps or well logs from construction.

Question 15:

How often should regular cleanings be done to help eliminate the formation and accumulation of biofilms, bacteria and sediment?

Answer:

Reservoir cleaning occurs on disinfected tanks at intervals of 3 – 7 years depending on accumulations, and the size of the reservoir.

Reservoir Replacement

Question 16:

S. LaRoy: If the decision was to replace the reservoir, would the old one have to be decommissioned? Is there a requirement to decommission it? If not, would there be any benefit in keeping the old reservoir full or is it more of a liability?

Answer:

There is not requirement to decommission the existing reservoir, except if a regulatory condition of the Regional District in applying for a construction permit. The next concern is the health and safety risk of people being on the tank. Keeping it full of water serves little purpose as it increases maintenance costs. If you can use the reservoir, keep it as long as possible and when you can afford to proceed.

Question 17:

Who are the representatives that you spoke with from the DBID and how did these discussions deem it reasonable to plan for replacement of the reservoir?

Answer:

I did not have any request from DBID staff or representatives on my decision making process. I came to recommendations independent.

Reservoir feed/discharge pipe

Question 18:

At the end of section 4 of the report, there is a statement: “there is about 900m of 100mm AC Pipe in fair to poor condition”. What type of assessment led to the finding of fair to poor condition? Does the estimated cost of $460K for PVC pipe include twinning of the pipe? (McElhanney has previously provided an estimate for twinning the pipe from the DBID office to the reservoir as part of the AC replacement report)

Answer:

The assessment on the AC Pipe is based on experience of similar water systems and general industry knowledge. The pipe consideration of Fair to Poor Condition is to indicate that it may operate for many years, as I commented on the alkalinity of the water not impacting the cement. This determination is also a consideration of the cost of repairs over time exceeding the cost of replacement, and that has to be considered in your long term planning. I did not provide for a replacement cost of the AC Pipe, as it is not required today. The new supply line is to better address mixing and ability to provide for future operational requirements of any potential treatment system and the ability to keep chlorine disinfection at a very low level if ever deemed necessary.

Question 19:

As noted there is only the one pipe that both feeds and empties the reservoir. Members of the public have asked about how much that factor may contribute to the contamination, so it would be good to report back to them on it. Written reports from the operator indicate that he was able to rule out the pipe as the source of contamination by testing water flowing towards the reservoir from wells 4,5,6,8. It is only when the water is going in the other direction, towards the distribution system, that there are positive tests. Therefore is the motivation for the replacement of AC with PVC related to the condition of the pipe, or its potential contribution to the contamination problem?

Answer:

I am not offering an opinion of the AC pipe and contamination by that means. I am noting the obvious condition, and providing an alternative cost solution which will be supported by VIHA, and is a lower cost than replacing the reservoir today.

Financials

Question 20:

The report indicates that it would take 10 further years to allow for adequate funding of a new reservoir. Funds to construct the new reservoir have been identified in the DBID capital budget for a decade already and there will be $890K in the capital fund for this project as of 2024. In March 2023 McElhanney provided Class B estimate to construct the new reservoir: $1.23M including $108K contingency. If one calculates the MSR stated 6% cost escalation per year, then in 10 years, the project would cost $2.19M. The MSR report indicates that that after 10 years the new reservoir would cost $2.7M. Is the $2.7M a class C or D estimate? Is the MSR reservoir proposal significantly different from the one McElhanney prepared the class B estimate for?

Answer:

The 10 year funding is a consideration and example. I did not examine the financials, or ask about the Reserve Funds as they will be needed for a number of projects, and the ten year horizon for replacement of the reservoir is at your discretion, and recognizing replacement from the decision to proceed to having it commissioned will be a 3-5 year process of support from the community, regulatory approvals, design and construction. I do not have the basis of design from McElhanney and I have provided a Class D estimate based on my experience with systems installed in the past few years, and the anticipated changes to the seismic requirements this December under the Building Code.

General

Question 21:

Is there a way to express the likelihood or probability of each suggested repair, remediation, or maintenance procedure being effective as the one that eliminates the cause of the contamination?

Answer:

From a standpoint of the best and cheapest solution, proceed to disinfection with chlorine immediately and you will not have an ongoing problem. Without disinfection, we recommended the $140k tank sealing and mixing assembly. A sealed tank will significantly reduce the potential for contamination, but not eliminate it

Question 22:

Was this report created to build on previous reports from McElhanney, Herold, the water operator etc? Or is this a standalone report that the board needs to integrate with all those other reports?

Answer:

We did not rely on any of the reports from other consultants as we were asked for an independent response, and Herold recommended us based on our past experience in providing recommendations to them on problem systems. We have provided a number of options to you of which provide value and options to avoid disinfection. Your next step is to have a serious discussion with Island Health and the community on your next best steps, and the willingness to pay the costs.

Question 23:

Have you read and can comment on the most recent Herold Engineering report?

Answer:

I have not read the Herold Engineering report, other than being provided a copy after I submitted my report and found we had made similar observations, and costs from differing perspectives.