

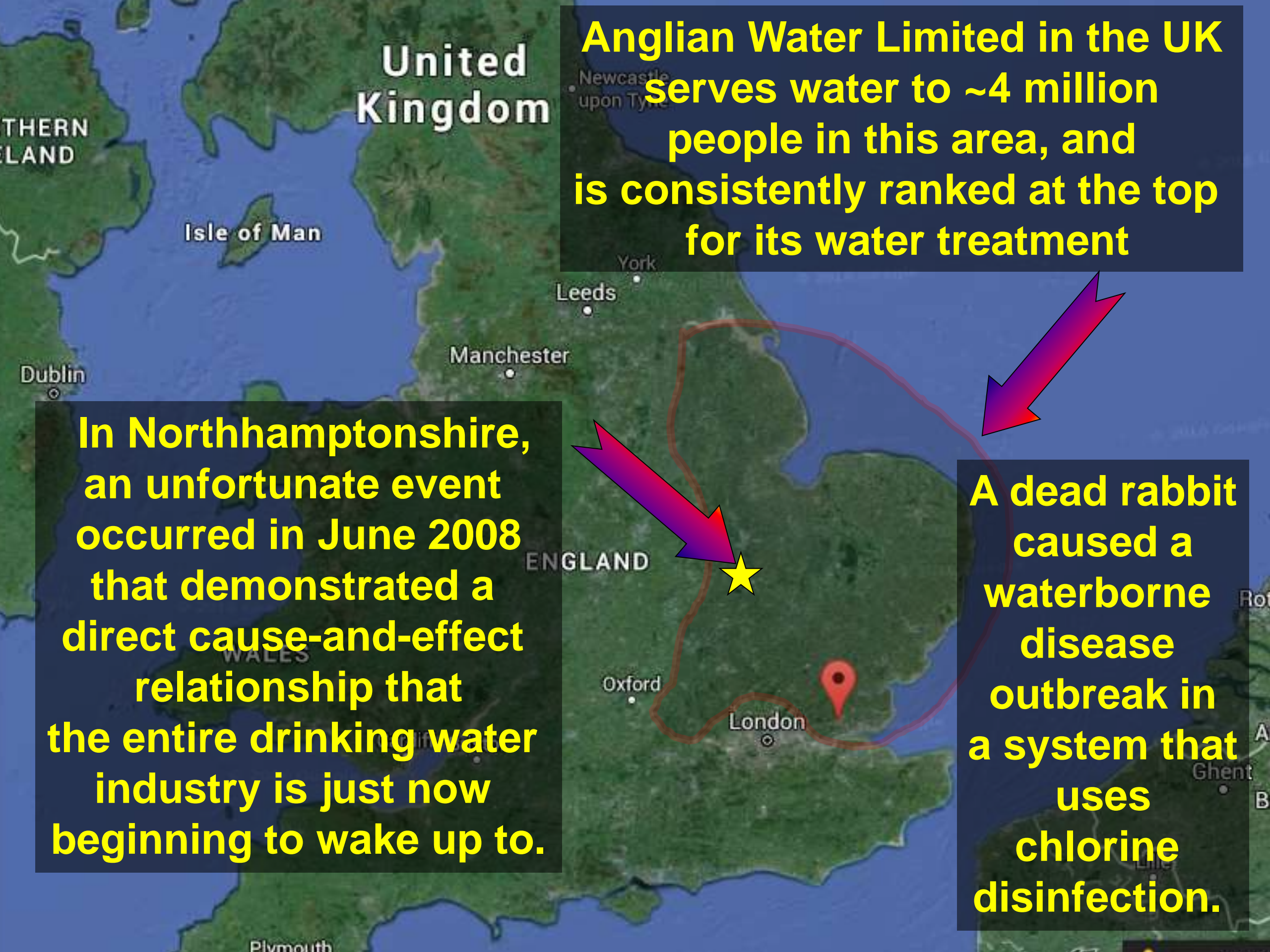
**In June 2008, the drinking water industry observed a direct cause-and-effect link between a dead animal in a tank and a waterborne disease outbreak at a system that disinfects and maintains a residual.**

**Information from the report: Overview and Scrutiny Committee 2, Housing and Environment. Contaminated Water (Phase 2), Task and Finish Group, April 2009. Northampton Borough Council**

Bob Clement, Environmental Engineer M.S., Microbiologist EPA  
Region 8, February 2016

**The views expressed are those of the presenter and do not necessarily reflect the views of the EPA**





**Anglian Water Limited in the UK serves water to ~4 million people in this area, and is consistently ranked at the top for its water treatment**

**In Northhamptonshire, an unfortunate event occurred in June 2008 that demonstrated a direct cause-and-effect relationship that the entire drinking water industry is just now beginning to wake up to.**

**A dead rabbit caused a waterborne disease outbreak in a system that uses chlorine disinfection.**



**Pitsford WTP, one of the WTPs with Anglian Water, continuously monitors for crypto by analyzing a cartridge filter every 4 days.**

**In the early evening of 6/24/08, the lab reported that the filter from 9:29 a.m. 6/19/08 to 11:50 a.m. 6/23/08 had levels of 6 oocysts in 11,848 liters (0.0005 oocysts/L).**

**These were highly unusual results. Crypto had only been detected occasionally in raw water, never in the finished water (874 samples since 2000).**

**The next filter was pulled at 8 p.m. on 6/24/08 (20 hrs. later) and the lab reported in the early hours of 6/25/08 they had levels of 418 oocysts in 5,064 liters (0.08 oocysts/L). The decision to issue a boil water notice was made by 3 a.m. and the press was alerted by 5:30 a.m. on 6/25/08 and lasted till 2 p.m. on 7/4/08. Warning cards were delivered by the evening of 6/25/08.**

**Consumer crypto sampling began from the Pitsford WTP, and fanned out into the storage tanks and the distribution system on 6/26/08 and lasted for 12 days, for a total of 342 crypto samples. Oocysts were detected at both the tanks and distribution system.**





**Investigations on the source began on 6/25/08. No oocysts were found in the raw water.**

**Samples were taken after each major unit process but the only places that positive samples were found were at the outlet of the GAC and disinfection contact basin.**

**Inspection revealed that vent screens were missing on the GAC backwash tank.**

**The disinfection contact basin was isolated and drained. Internal inspection of the basin found one relatively fresh rabbit carcass.**

**The carcass was removed and sent to a lab for analysis.**



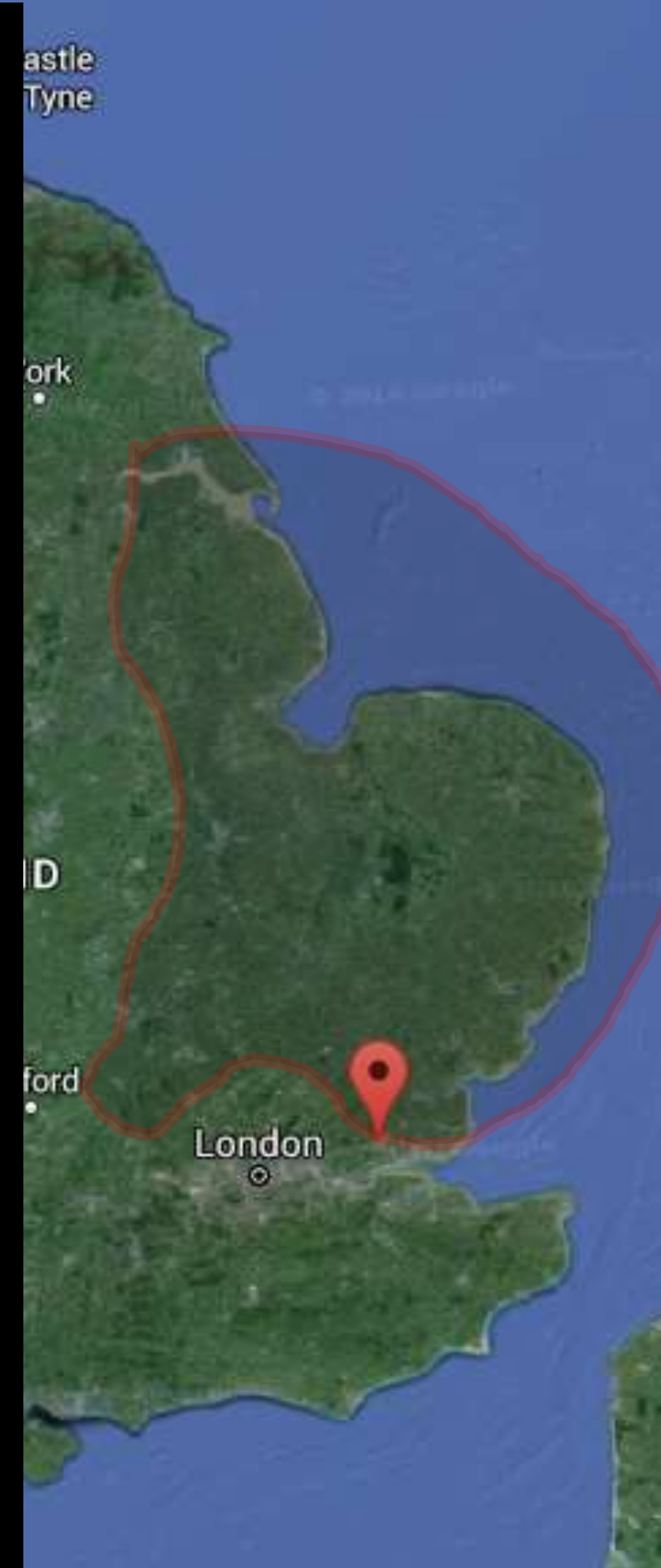
**The UK Reference Laboratory typed oocysts from 7 water samples from the distribution system, the rabbit carcass and stool samples from 9 residents and reported these as all belonging to the same rabbit genotype.**

**A paper was published by the Journal of Water and Health 12/1/14 and demonstrated that this genotype caused disease in humans.**

**This had never been shown before, and the excitement in the research community was focused on this aspect,**

**but it missed the bigger direct cause-and-effect link**

**that a single rabbit carcass caused 22 confirmed cases of cryptosporidiosis.**





**Anglian Water Limited demonstrated the best way to clean and remediate its tanks and distribution pipes by systematically and unilaterally draining and cleaning its tanks then flushing the distribution system.**

**As this cleaning and flushing work progressed, a steady reduction in oocyst numbers were evidenced in samples collected from the tanks and consumers' taps.**





Are there any regulations that require a PWS to report to the state or EPA (Wyoming and Indian Country) when a carcass is found in your tank? EPA Office of General Counsel stated yes; the regulations provide the authority in the Public Notice rule to address this situation. But there is no requirement that states use that authority for this particular case-by-case situation.

The public notice rule states in *Table 1 to 141.202-Violation Categories and Other Situations Requiring a Tier 1 Public Notice*:

*(9) other violations or situations with significant potential to have serious adverse effects on human health as a result of short-term exposure, as determined by the primacy agency either in its regulations or a case-by-case basis.*

This is a situation that can have a short-term adverse effect on human health .

The other question is, does a PWS have to report if a carcass is found in its finished drinking water storage tank within a certain timeframe of learning of this situation. In 141.202 (b)(2) it states, *Initiate consultation with the primacy agency as soon as practical, but no later than 24 hours after the public water system learns of the violation or situation, to determine additional public notice requirements; and...*







**In EPA Region 8's annual mailing for 2016 to all Wyoming and Tribal PWSs it included the following language:**

***SITUATIONS WHEN YOU SHOULD NOTIFY EPA: It is very important to notify EPA Region 8 as soon as possible for certain situations or sample results at your water system, to protect public health and remain in compliance.***

***One of these situations include:***

- When animal contamination is present in finished water storage tanks (see Newsletter article) : <http://www.epa.gov/region8-waterops/wyoming-public-water-systems-newsletter-2016>***





**Newsletter article: *Animal Contamination In Your Storage Tank? We Need To Know About It Within 24 Hours!***

**Excerpts: *Animal contamination in finished water storage tanks presents a serious public health risk as it can carry microbial pathogens, which can cause a waterborne disease outbreak after just a short-term exposure through drinking water. Animal contamination refers to either live animals (e.g. rodents or birds), dead or decomposing animal carcasses, or animal-related debris (feathers, skin, fecal matter, etc)...***

**... When any animal contamination is found in storage tanks, EPA will presume that the potential for serious, adverse human health effects exist from short-term exposure to drinking water. In such situations, we expect you to provide public notice and to consult with the EPA as soon as practical, but within no more than 24 hours.**



**Anglian Water Limited has provided the drinking water industry with an invaluable cause-and-effect link**

**that a carcass can cause a waterborne disease outbreak even at a system that chlorinates. So as embarrassing as it may be to find a carcass in your tank, it is very strongly recommended that you contact your state immediately.**

**The most important reason is because the state may want you to have the carcass tested for pathogens by someone at CDC. So treat the carcass as evidence of a potential waterborne disease outbreak. In addition, the state will want to talk with you about the best way to clean (drain and power wash – not divers) and remediate the affected tank and distribution system. Lastly, the state may want to have you on a boil water notice until remediation is complete.**

**CDC contact to have a carcass analyzed for pathogens:**

**Lihua Xiao, DVM, PhD**

**Division of Foodborne, Waterborne and  
Environmental Diseases National Center for  
Emerging and Zoonotic Infectious Diseases  
Centers for Disease Control and Prevention**

**Mail Stop D66**

**Bldg 23, Rm. 9-168**

**1600 Clifton Road**

**Atlanta, GA. 30329-4018**

**Tel: 404-718-4161**

**E-mail: [lxiao@cdc.gov](mailto:lxiao@cdc.gov)**



**If a carcass has been found in your tank, the best way to clean and remediate the affected tank and distribution system involves the following steps:**

- 1) Isolate the tank while maintaining pressure in dist. system.**
- 2) Find and permanently fix all holes in the tank.**
- 3) Completely drain and scour all surfaces with a high-pressure stream of clean water.**
- 4) Disinfect the tank according to AWWA standards**
- 5) Perform unilateral flushing**

**Yes, that may mean if you find carcasses during a cleaning event using divers, you will need to conduct a second cleaning using the drain and clean method. There is a way to avoid two successive cleanings.**







**If you cannot absolutely and unequivocally verify that the tank you are about to clean has NO HOLES, then you can confidently hire divers. But if you cannot verify there are no holes then be conservative and hire a company that uses the drain and clean method. Finding a carcass in your storage tank is a great, great failing of the sanitary practices that the industry has put in place to protect human health.**

**Typically, if divers are used to clean a tank, they will report the number of carcasses that are found on the floor of the tank.**

**Carcass**





An aerial photograph of a dark, textured surface, possibly a ship's deck or a large body of water. Two arrows, one pointing up and to the left, and another pointing up and to the right, both with a purple-to-red gradient, point to two distinct white, irregular shapes on the surface. These shapes are identified as carcasses in the text below. The background is dark and shows some structural elements like cables or pipes.

**Carcass**

**Carcass  
about to be  
vacuumed out**

**And they will report on the  
number of carcasses that are found floating  
on the surface.**



**Carcass**

**Carcass**

**And they will vacuum  
the carcasses floating and lying on the floor of the tank.**

**The carcasses are potential evidence  
of a waterborne disease outbreak. They should be preserved  
on ice and shipped out to CDC to be investigated  
to see if there are pathogens in their intestinal tissues.**



**Vacuumed**

**Not  
Vacuumed**

**Cleaning by divers does a good job of cleaning these sediments off the floor so the floor can be inspected for rusting, etc.**



**The stains  
that the carcass  
leaves on the floor  
need to be scrubbed.**



**Divers do not typically clean the walls—you can see the difference between the walls and the floor. As a carcass disintegrates, microscopic pieces of its flesh float away, some are carried out in the water column to potentially be ingested, some other pieces of flesh adhere to the walls of the distribution system pipes, and other pieces of flesh adhere to the walls and floor of the storage tank. That's why the tank must be drained, so the walls and floors can be scoured with a high-pressure stream of clean water. Then the tank can be disinfected, and then the distribution system can be unilaterally flushed.**

An underwater photograph showing the interior of a storage tank. The image is somewhat blurry and has a greenish tint. A dark, curved surface on the left is labeled 'Wall', and a lighter, flat surface at the bottom is labeled 'Floor'.

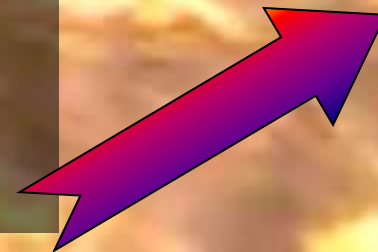
**Wall**

**Floor**

**A wisp of sediment was dislodged as the diver brushed his glove against the wall. This sediment on the walls potentially may have animal flesh and pathogens adhered to it and can be released back into the water column.**

**This is the finished product from diving. This is not sufficient when you are dealing with animal carcasses.**

**The diver purposefully and gently brushed his glove against the wall here.**

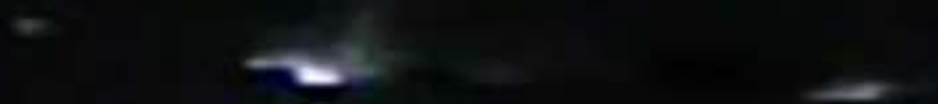




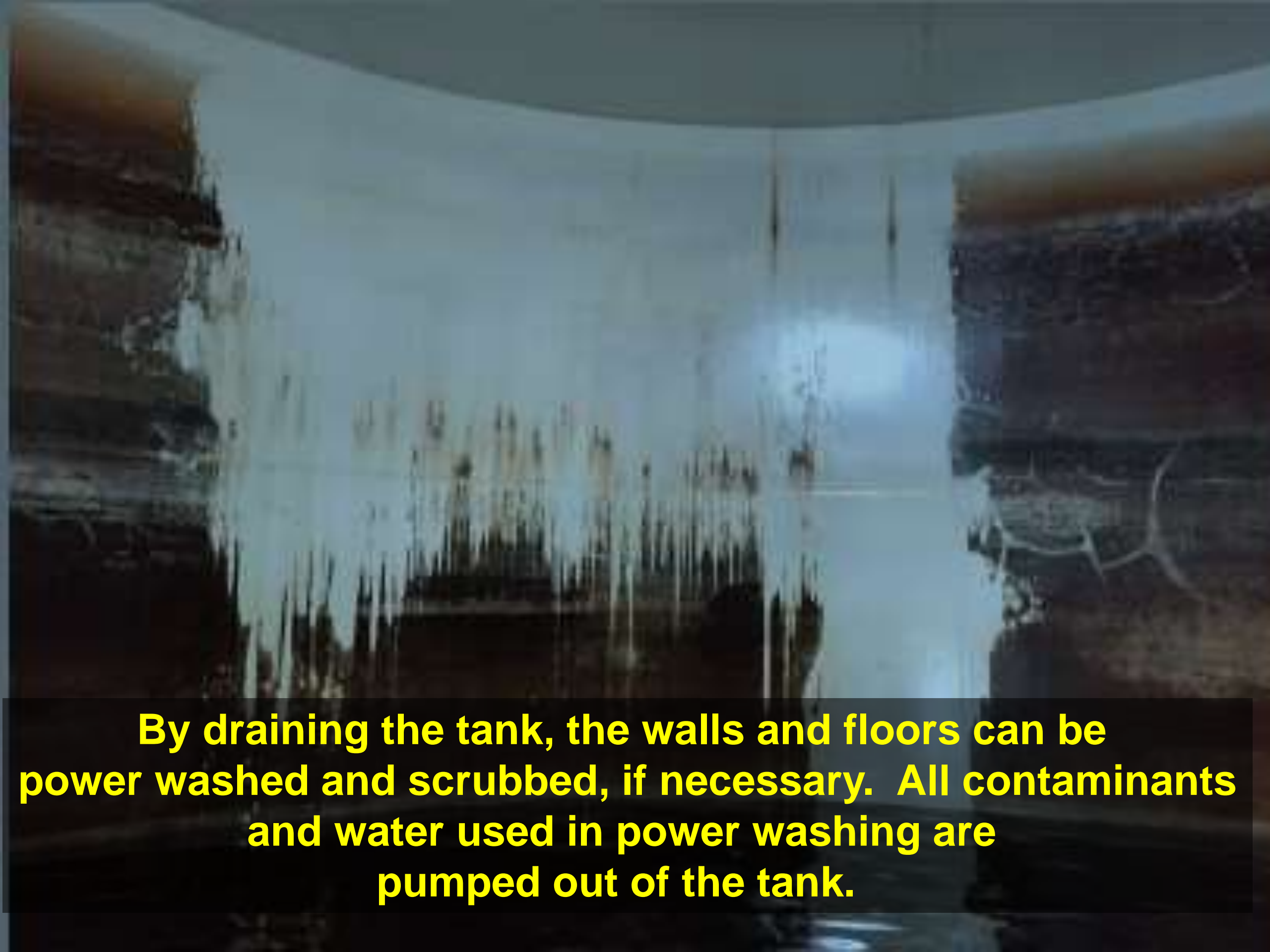


**When carcasses are found, the tank must be isolated. The next step is to find and permanently repair all holes. If something like this flashing is blocking your view of any holes, it must be removed so the roof-to-wall joint can be directly viewed.**

**The holes can be verified by closing the hatch and looking for light. Those are the holes where the rodents entered.**







**By draining the tank, the walls and floors can be power washed and scrubbed, if necessary. All contaminants and water used in power washing are pumped out of the tank.**



**With a drain and clean method, all sediment and pieces of flesh from the decaying carcass are removed from walls and floor. This is the process that Anglian Water used to clean its tanks and it correlated with decreasing cryptosporidium levels.**



**Drain and power wash method**

**Diving method**

**Wall**

**The difference in methods  
is self-evident**

**Floor with carcass  
stains**





**The drinking water industry has been given a very fortunate gift from this example. If the rabbit had drowned in a storage tank where there was no continuous crypto monitoring, we would not have this cause-and-effect link. Luckily, it occurred in a tank at the WTP and Anglian had a very proactive policy of continuously monitoring its finished water for crypto.**



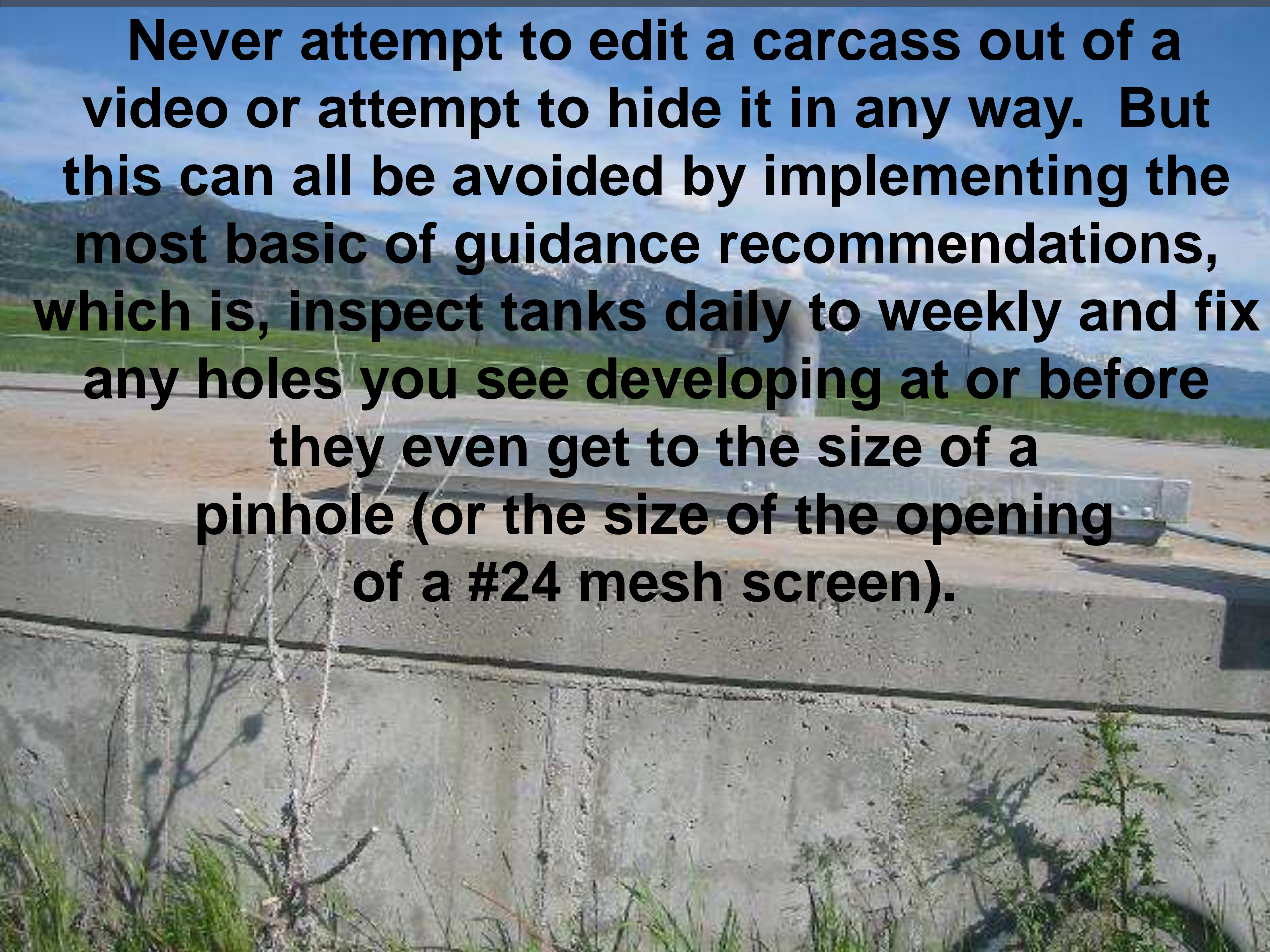
**The report stated, “a small relatively fresh rabbit carcass was found”. This provides other vital pieces of information. If an infected animal drowns, the pathogens are released soon after, when it is in a relatively fresh or intact state. Also a small rabbit produced enough crypto to produce positive results in the storage tanks and distribution system. It only takes one dead animal to cause a waterborne disease outbreak.**



**Typically, carcasses are found during tank cleaning events. Anglian Water in the UK has set a very high bar for doing what is right and acting quickly. Although it is different because we find the carcass first, then search for pathogens but that is no reason to be not be as equally responsible. If animals have been drowning over time, the release of pathogens will be episodic and there may be no clear indication of a waterborne disease outbreak. It only takes two people getting ill from the same water source to be classified as a waterborne disease. For that reason, CDC states that waterborne disease outbreaks are grossly underreported.**





The image shows a concrete structure, possibly a tank or a wall, with a metal mesh screen in the foreground. The background features a landscape with hills and a cloudy sky. The text is overlaid on the image, providing instructions on how to avoid editing a carcass out of a video or hiding it in any way. The text is in a bold, black font and is centered on the image.

**Never attempt to edit a carcass out of a video or attempt to hide it in any way. But this can all be avoided by implementing the most basic of guidance recommendations, which is, inspect tanks daily to weekly and fix any holes you see developing at or before they even get to the size of a pinhole (or the size of the opening of a #24 mesh screen).**