Blue Can is the only Emergency Drinking Water certified by Laboratory Testing and Scientific Analysis to have a 50-Year Shelf Life.

EMERGENCY WATER
BLUE CAN
50 YEAR SHELF LIFE

50-Year Shelf Life Basis

& Technical Review of Blue Can Water Stability Testing

UPDATED: SEPTEMBER 2018

Contents

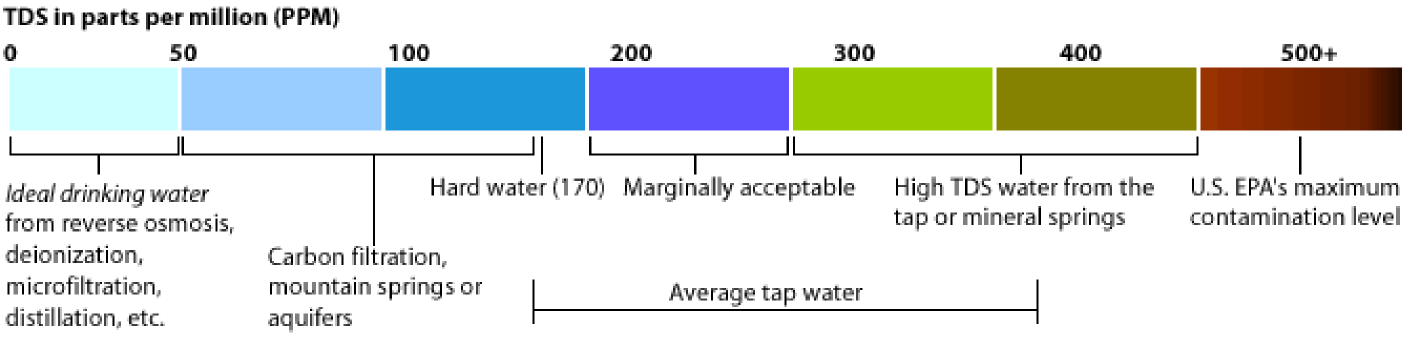
1 Blue Can 50-Year Shelf Life

Blue Can Water, which has a 50-year shelf life, is manufactured to meet and exceed bottled water standards set forth by the U .S. Food and Drug Administration. Blue Can has developed a unique process utilizing 21st century advancement in water filtration, purification, sterilization and hermetically sealing technologies and techniques, bringing together proven methods and technologies into a revolutionary concept. Our process involves multi-stage filtering and ozone disinfection and UV sterilization treatment to eliminate any bacteria. Canning under food-grade approved handling conditions exceeds health code requirements. Our water analysis reports are performed by third-party laboratories using procedures established by EPA, AOAC, APHA, AWWA and WPCF.

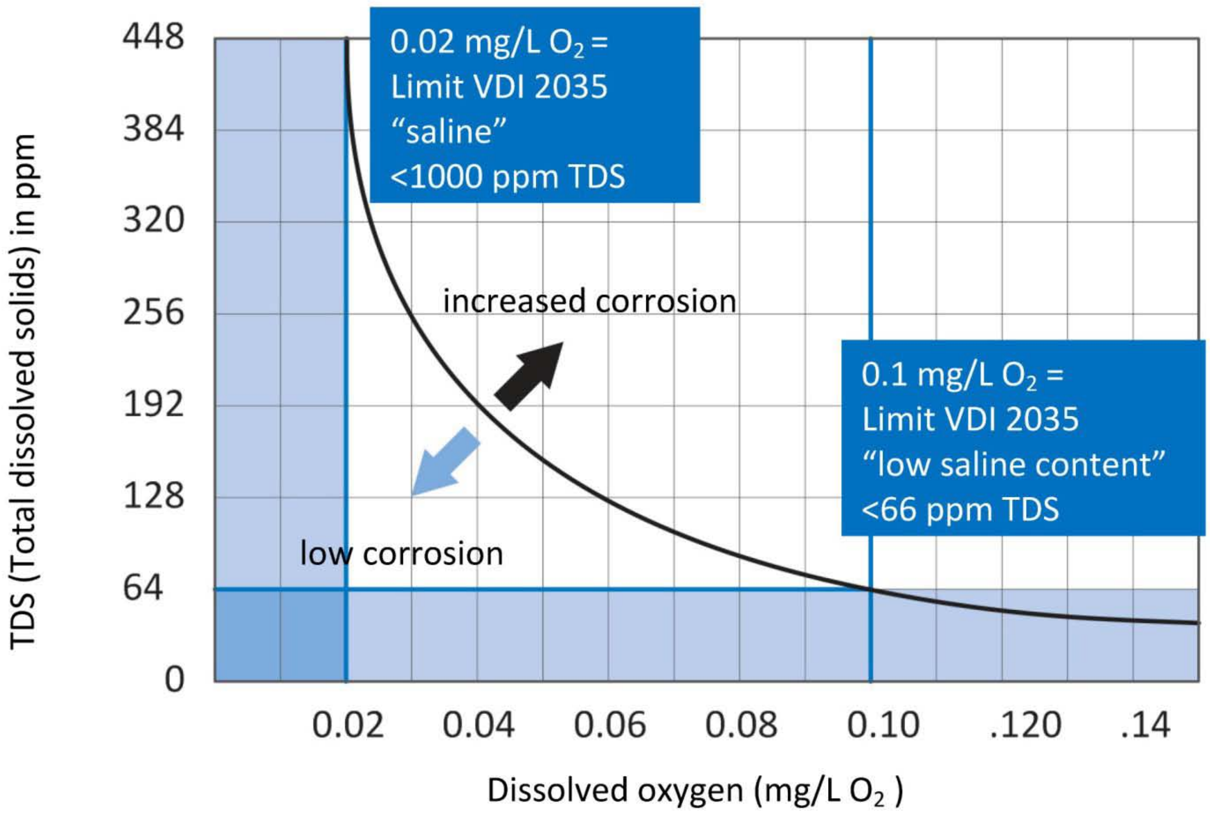
2 WATER

According to the U.S. Food and Drug Administration, only the packaging expires... not the water itself. http://www.fda.gov/Food/FoodborneIllnessContaminants/BuyStoreServeSafeFood/ucm07707 9.htm. “Bottled water is considered to have an indefinite safety shelf life if it is produced in accordance with CGMP and quality standard regulations and is stored in an unopened, properly sealed container. Therefore, FDA does not require an expiration date for bottled water. However, long-term storage of bottled water may result in aesthetic defects, such as off-odor and taste. Bottlers may voluntarily put expiration dates on their labels.”

At Blue Can, water purity is our highest consideration. In fact, it is necessary to meet the special conditions for our long shelf life. Our water has been purified by a unique 12-step process that results in nothing greater than 4 parts per million of any physical, chemical, biological or radiological substance or matter. Removing and reducing organic material to this micro-level, it results in purified water that has nothing that can oxidize or contaminate over time when properly hermetically sealed. *See attachment A for water analysis.



Additionally, Blue Can water has an average pH of 6.8 - 7.1, as well as an extremely low salt content (<4 ppm TDS), which reduces the conductivity of the water, thereby decreasing the corrosion rate. Another effect of this low salt content is the water is less protective and will not form any layer of $CaCO_3$. The corrosion rate of water depends on the oxygen and CO_2 content. Since Blue Can water is in a closed-circuit (hermetically sealed) container that does not come in contact with O_2 in the atmosphere, the corrosion rate is extremely low.



Oxygen, being the great oxidizer, must be reduced to an extremely low percentage to create an environment of low corrosion. The dissolved oxygen in Blue Can is less than .01 ppm. The combination of a neutral pH, low TDS and an exceptionally low dissolved oxygen count, creates the ideal scenario for low corrosion. This allows the increased stability of the water, over time, to be stored with minimal effect on the packaging liner.

STERILIZATION

Another important precursor to long-term water storage is protection from pathogens. Once the can is hermetically sealed, nothing can enter or leave. However, the water inside must be properly sterilized to ensure nothing is left in the water to grow over time. During Blue Can’s 12-step proprietary filtration process, all harmful bacteria, viruses and pathogens are removed. This is achieved with dual Reverse Osmosis membranes. Ozone flooding is then utilized by providing a Log 6 (99.9999%) Kill Ratio for any potential bacteria or pathogens. The water is then delivered through 3 separate UV Sterilizers (Log4 99.99% each light) for added assurance just prior to filling each can.

4 CONTAINER

ALUMINUM

Aluminum beverage cans are used at a rate of over 180 billion per year. Blue Can has chosen aluminum for strength and durability instead of the historically used steel-based cans for emergency water. Steel-based cans have typically used vacuum sealing to remove O 2 from the can to preserve shelf life. However, this methodology often resulted in weakened steel can walls and would cause the cans to collapse. This resulted in the inability to stack pallets of the product that would cause the cans to crush over time.

With Blue Can's unique pressurization technique, we can stiffen aluminum cans against deformation without using the traditional method of carbonation (CO2) which would reduce shelf life. Each container can support 250 pounds itself.

Additionally, aluminum is impermeable to gases, vapors and light.

The Aluminum Association, the industry's leading voice in Washington, D.C., provides global standards, industry statistics and expert knowledge to member companies and policy-makers nationwide. They state...

> "***Aluminum cans provide long-term food quality preservation benefits. Aluminum cans deliver 100 percent protection against oxygen, light, moisture and other contaminants. They do not rust, are resistant to corrosion and provide one of the longest shelf lives of any type of packaging. Aluminum-based food canning has an unparalleled safety record. Tamper-resistant and tamper-evident packaging provides consumers with peace of mind that their products have been safely prepared and delivered.***"

Aluminum, itself, is not harmful. Many over-the-counter medications include aluminum in them. The Canadian Ministry of Health did an exhaustive 10-year research program on the effects of aluminum to human health.1

1. http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/water-aluminum-eau/alt/water-aluminum-eau-eng.pdf

5 CONTAINER LINER

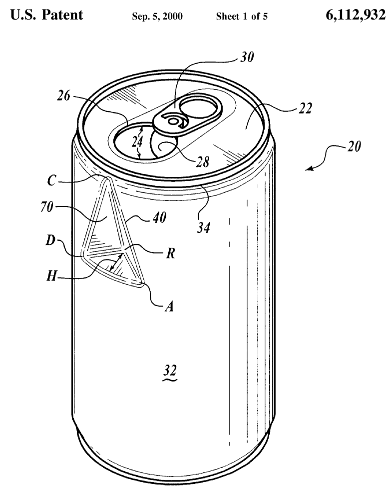


Fig. 1

The liner coating inside each can is a polymer-based epoxy enameling that has been used in aluminum can beverages since the early 1970's. This prevents interaction of aluminum ions with the water.

Corrosive testing has been done by our can manufacturer's engineers. This testing determines the best coating strength and thickness to be used for Blue Can water. For added assurance and shelf life, we have requested that the assessed coating thickness by the engineers be double coated for extra protection in our blue cans.

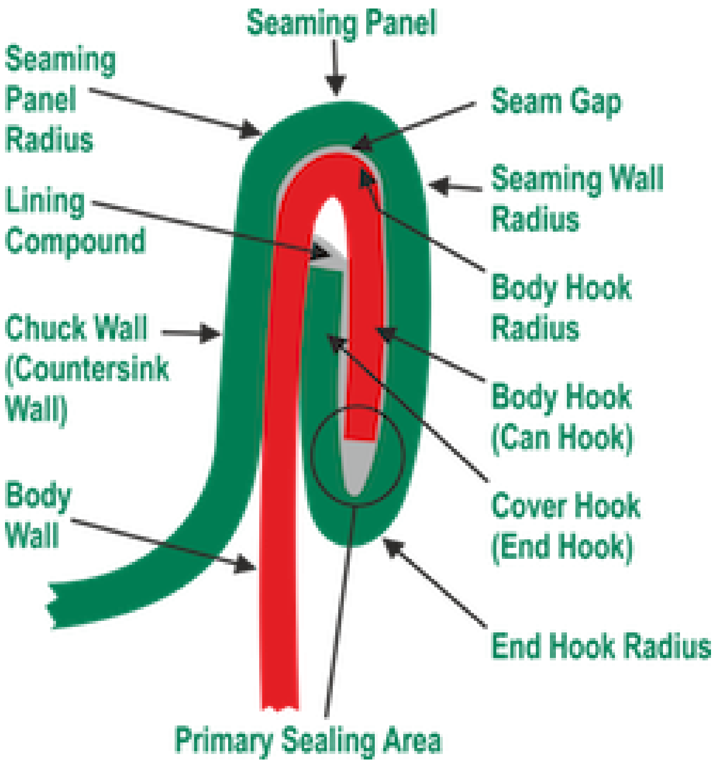
Blue Can water has a neutral pH in the 6.8 - 7.1 range, and there are no acidic organic materials or CO2 to interact with the coating. Although they cannot provide a warranty on any can for more than one year, per their company policy, engineers at the two leading can manufacturing plants (Ball Corporation and Crown Cork and Seal) have assessed the interaction between our water and the container. They concluded that low-dissolved oxygen (.02 ppm) and a neutral pH should result in very minimal breakdown of the can liner coating over an extended period of time if stored at nominal temperatures. Without time-tested analysis, this is a scientific estimated determination based on the parameters provided. However, even with potential liner breakdown, the health effects during an emergency scenario, where cans would be consumed, is extremely minimal or non-existent. The recent State University of New York in Fredonia study on bottled water found microscopic plastic in 90% of bottled waters. Worldwide testing showed that plastic bottles are a far greater risk for storage than aluminum-based products with an epoxy enamel-based liner.

https://orbmedia.org/sites/default/files/FinalBottledWaterReport.pdf

LID CLOSURE

The industry standard 202 (52mm) lids utilized in Europe, North America, Asia and Brazil make up 25% of the total weight of the empty container. It consists of an alloy containing less manganese, but more magnesium, than the body of the container which makes it stronger. Each lid is also coated with the same polymer-based epoxy enameling as the body to prevent interaction between the metal ions and water.

The flange seal is double bent and seamed to create a hermetic seal closure which prevents transmission of O2 and CO2 as well as UV light.



The double seam creates a hermetic seal by interlocking the edges (flanges) both of the cover (lid or end) and body of the can. The body hook, which is also commonly known as the can hook, is the flange of the can body that is curled downward in the formation of the double seam. The cover hook, also called the end hook, is the curled edge of the cover that is curled inward after the end is formed.

7 PACKAGING PROCESS

Vacuum sealing has been the standard practice for long shelf life water in the past. However, this process had its inherent problems with compromised structural integrity of the container by induction of steel can walls via the vacuum process and incomplete removal of O_2 molecules. The "overfill" methodology that has been used does not remove O_2 molecules which leaves a header above the water line and thus decreases shelf life. Additionally, the overfill method does not create structural integrity, so stacking pallets is not recommended.

Blue Can looked for a solution to these problems by creating a packaging solution based on pressurization of the beverage can. By pressurizing our cans to 85 psi using our proprietary pressurization technique, we found a way to have structural integrity, as well as displacing O_2. By the oxygen being displaced, an environment inside the can is created with no oxidization power.

The double-seal process hermetically seals the can. Nothing can go in -- and nothing comes out. By creating this hermetic seal with related pressurization, it is very easy to determine if the seal is broken and has thereby compromised the shelf life of the product.

The cans are packaged in a double-thick cardboard box to protect the cans from dents or breakage in shipping in either single-case units or in stackable pallets. Standard pallets are protected with heavy thickness corner guards and wrapped in multiple layers of plastic and shipped on quality wooden pallets.

Proof of Concept

There are very few products available to test a shelf life of 50 years. However, there is one brand of canned water in existence that was canned over 62 years ago for the Civil Defense in 1952. We purchased some of these cans, which are still available via Ebay, and had them tested by a certified lab for sterility to drink. The question: Is this water safe to drink after 62 years?

The 1952 Civil Defense Emergency water was packaged in a steel can, and there was some visible rust on the outside of the can. The canned water was vacuum packed, which most likely left oxygen in the can due to the inherent flaws in vacuum sealing by removing 02. The water filtration technology we have today did not exist at that time. There was high salinity indicating that additional sat had been placed in the water to act as a preservative. The water tested out as STERILE to drink. * See attachment B for water analysis.

After all these errors in the filtration, purification, sterilization, canning and packaging process, the proof of concept of a long-term shelf life drinkable water, that can be safely stored for 50+ years and still be safe to drink in an emergency, is justified.

FRONT: Property U.S. Gov't; Emergency Drinking Water; Contract No. N383-155s-77754; Specification No. MIL-W_15117A; International Packing Corp. Glendale, CA

ENDS: 52/ JULY

DIMN: Just under 5" tall and 2 5/8" in diameter.

Ubiquitous in official US civil defense fallout shelters and nautical survival kits during the Cold War, these containers were usually packaged with a P38 can opener, manufactured by Walden Inc. The opener was either taped to the top of the can or enclosed in a boxed case. The
“soup-can style” container required an opener for consumption.

The containers were available as emergency supplies for the military through the Korean War, and up to, and through, the Vietnam War. Examples of the product are often attributed exclusively to the US Navy or Coast Guard. Though they were included in life rafts at the time, they were intended for universal use in survival applications by the military and for civil defense preparation.

An example application was in a 1960 “Emergency Life Pack". This product was assembled as a single-person survival kit for eight days. The description on the pack claimed suitability for a number of events including: Atomic War, Bacteria War, Epidemics, Hurricanes, Earthquakes and Baby Formula.

These straight-sided steel cans were manufactured to US government specifications by one of two contractors located on either side of the continental US. In Glendale, CA, the cans were produced by International Packing Corp.; and in Boston, MA, they were produced by McDonald-Bernier Co. All indications are that both companies are now defunct.


PROPERTY U.S. GOV'T
EMERGENCY
DRINKING
WATER
CONTRACT NO. N383-155s-77754
SPECIFICATION NO. MIL-W-151
INTERNATIONAL PACKING CORP.

MEMORANDUM

Via Electronic Mail

TO: Blue Can Water

FROM: Mitzi Ng Clark
Natalie E. Rainer
Kristin P. Wiglesworth, Ph.D.

DATE: June 19, 2018

RE: Technical Review of Blue Can Water Stability Testing; Our File No. BL17100.1

I. Introduction

The purpose of this memorandum is to comment on testing commissioned by Blue Can Water ("Blue Can") to support the 50-year shelf-life claim for its emergency water, which is packaged in an epoxy-lined aluminum can. The testing discussed in this memorandum was conducted by Aspen Research Corporation ("Aspen") to assess the long-term storage of the water using accelerated stability testing.[1] As discussed below, the data from the testing demonstrate that the can is stable under the conditions that are intended to simulate long-term storage. Accordingly, the closed system of the can would not be expected to fail under typical storage and handling conditions (*i.e.*, barring unusual physical stress on the can, such as dropping or freezing). In summary, the results of this analysis demonstrate the following:

1. The total chloroform-soluble extractives are within regulatory limits established for can coatings by the U.S. Food and Drug Administration (FDA) under 21 C.F.R. § 175.300 ("Resinous and polymeric coatings"), even under conditions more exaggerative than those outlined in the regulation; these results support the long-term stability of the cans.

2. The alkalinity of the water is consistently low, which indicates that corrosion due to salt deposits is unlikely and would not impact the long-term stability of the cans.

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[1] *See* Aspen Research Corporation, Blue Can Water Stability Testing—Aspen Project Number A52108 (dated April 26, 2018).

3. The dissolved oxygen in Blue Can water is low, thereby supporting the conclusion that the can seal remains intact after accelerated aging.

4. The salt content (*i.e.*, the metal cations and anions) of the canned water is low and largely unchanged in artificially-aged and control can samples. The low salt content is expected to limit the potential for reaction between the salts and the liner or the aluminum.

An analysis of the analytical work that Blue Can commissioned is provided below.

II. Overview of Testing and Samples

For purposes of this testing, Blue Can provided Aspen with samples of its canned water.[2] A set of cans were stored in a laboratory oven at 60°C for 10 days to simulate long-term room temperature storage. The basis for these test conditions is discussed in Section II.A below. Additional cans were held at room temperature to serve as controls. After the 10-day exposure, the heated cans were allowed to cool. Prior to opening, the tops of the cans were rinsed with deionized water so that dust or other particulates would not impact the results.

A. Total Chloroform-Soluble Extractives

Aspen analyzed the samples for total chloroform-soluble extractives. The basis for this analysis is FDA's food additive regulation under 21 C.F.R. § 175.300, which addresses the regulatory status and suitability of coatings on metal substrates intended for use in contact with food. Paragraph (c) of Section 175.300 requires can coatings to meet certain total chloroform-soluble extractives limits, based on the intended conditions of use. Meeting the total extractives limitation is a general way of ensuring that a can coating is suitable for its intended use, as it provides a rough measure of the gross migration of liner components to the food over time. In this regard, Section 175.300(c) of the regulation specifies that single-use coated cans may have no more than 50 parts per million (ppm) total chloroform-soluble extractives when tested with the appropriate food simulating solvent and under the time and temperature conditions simulating its intended use.

As described in Section 175.300(d), Table 1, the appropriate food simulant in this case is water, as water is an aqueous food falling under FDA's Food Type VI-B ("Nonalcoholic

[2] We note that two sets of samples were provided, one with a more neutral pH consistent with its typical canned water (pH 6.7-6.9) and another set with slightly basic pH (pH 7.5-8.1). The samples with a more basic pH were included for informational purposes only. Accordingly, the information on the more basic samples is of limited relevance.

beverages"). As far as the relevant time and temperatures for the chloroform extractives testing, FDA's Condition of Use E ("Room temperature filled and stored (no thermal treatment in the container)") appropriately characterizes Blue Can's filling conditions. FDA recommends that Condition of Use E be simulated by testing for 24 hours at 120ºF (equivalent to 49ºC).[3]

Given the long shelf-life of Blue Can's products, we also have referenced the test conditions prescribed in the European Union (EU) for simulating ambient filling and long-term storage of food for over six months; these testing parameters are described in the EU's Plastics Regulation No. 10/2011 on plastic materials and articles intended to come into contact with food, as amended.[4] In particular, the EU Plastics Regulation provides that 60ºC for 10 days is sufficient for simulating ambient filling with long-term storage.[5] While the Plastics Regulation does not strictly apply to can coatings in the EU,[6] these test conditions are nonetheless informative for purposes of considering more exaggerative test conditions that may reasonably encompass storage of food in packaging for greater than six months. Thus, testing for chloroform soluble extractives at 60ºC for 10 days should reasonably predict the stability of the cans over an extended shelf-life period.

To evaluate total chloroform-soluble extractives (referred to as total chloroform-soluble residue (TCSR) in the Aspen test report), the laboratory first analyzed the total non-volatile residue (TNR) by taking a sample of water from each can, weighing it, and drying the sample. The weight of the solids left after drying allows the total non-volatile residue to be calculated in µg/can. The solid was then extracted with chloroform and dried to determine the TCSR in µg/can.

Under paragraph (e)(5) of 21 C.F.R. § 175.300, coatings on metal substrates are required to have a TCSR of less than 50 ppm. The results from the Blue Can analysis are summarized in the table below:

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[3] This time and temperature condition is set out in 21 C.F.R. § 175.300(d), Table 2.

[4] The Plastics Regulation is harmonized EU legislation that is binding on EU Member States that includes a positive list of monomers, other starting substances, macromolecules obtained from microbial fermentation, additives, and polymer production aids that are permitted for use in food-contact plastics.

[5] *See* Plastics Regulation (EU) No. 10/2011, Annex V, Chapter 2, Section 2.1.4.

[6] *Id.*, Article 2.3.

Sample	pH	Temperature (°C)	TNR (µg/can)	TCSR (µg/can)	TCSR (ppm)
52108-1	neutral	60	2448	2720	7.66[7]
52108-2	neutral	60	2375	1188	3.35
52108-3	neutral	60	2506	1114	3.14
52108-4	neutral	Control	1883	807	2.27
52108-5	neutral	Control	1755	0	0.00
52108-6	neutral	Control	1532	0	0.00

The results from this testing were somewhat inconsistent between cans held at the same temperature.[8] For the sake of conservatism, we compared the "worst-case" TCSR value, sample 5108-1, to the 50 ppm maximum TCSR limit under Section 175.300(c) of FDA's food additive regulations. ***Specifically, the worst-case observed TCSR of 2720 µg/can (equivalent to 7.66 ppm) meets the TCSR limit prescribed in Section 175.300. The results of the testing demonstrate the stability of the canned water liner during extended room temperature storage.***

B. Other Tests

1. Alkalinity

Alkalinity (*i.e.*, the measurement of calcium carbonate, $CaCO_3$) is relevant as this is a measure of hardness of the water. Hard water can lead to formation of salt deposits that could, in turn, lead to corrosive reactions with aluminum if the liner were to be compromised.

To determine the alkalinity (or hardness) of the water in each can, the water was analyzed for calcium carbonate ($CaCO_3$) by titrating with dilute acid.[9] As anticipated, the neutral cans had no detectable $CaCO_3$ before or after exposure to heat. We note that the levels of calcium

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[7] A sample calculation follows: 2720 µg/can × 1 mg/1000 µg × 1 can/ 0.355 L = 7.66 mg/L (7.66 ppm)

[8] We anticipate that the variation between replicates may be due to the challenges associated with sample preparation because the other analyses indicate more consistency within sample groups.

[9] The titrations were carried out on a Metrohm 904 Titrando Autotitrator. The titrant was 0.10 N hydrochloric acid standardized against sodium carbonate.

carbonate, even in the basic cans, are significantly reduced relative to municipal water.[10, 11] Based on these results, structural damage due to calcium carbonate-related corrosion is unlikely after long-term storage.

2. Dissolved Oxygen

Dissolved oxygen was measured in each can as soon as the seal was broken.[12] Dissolved oxygen did not change with heating and, although it was slightly variable (3-7 ppm), it was consistently low. These results indicate that the can seals remained intact during heating and imply that there are no major reactions consuming the oxygen in the water. If oxygen were reacting with the liner or the aluminum can, then we would expect to see a decrease in oxygen in the heated cans. Similarly, if there was an issue with the seals leaking after exposure to 60°C, then we would expect to see the oxygen content change and potentially increase.

3. Salt Content

The salt content was measured in the water samples with a combination of ion chromatography (IC) to measure the anions in solution[13] and inductively coupled plasma mass spectrometry (ICP-MS) to measure the metal cations in solution.[14]

IC was used to measure fluoride, chloride, nitrite, bromide, nitrate, sulfate, and phosphate in the water samples. In all cases, only chloride, nitrate, and sulfate were detected, and the values were less than 1 ppm — significantly lower than the public water source used to generate

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10 The 2016 Annual Report published by Burbank Water and Power reports alkalinity levels ranging from 92 -200 ppm (mg/L). *See* City of Burbank Water and Power, 2016 Annual Water Quality Report (published June 2017), available at https://www.burbankwaterandpower.com/images/water/downloads/WaterQualityReport_2016.pdf.

11 The only change in alkalinity arose when the more basic cans were exposed to 60°C for 10 days. In these samples, the amount of detected calcium carbonate consistently decreased relative to the controls, indicating a small amount of calcium salt precipitation that would be unlikely to cause damage to the can.

12 The dissolved oxygen was measured with a YSI 5000 dissolved oxygen meter with YSI 5010 BOD probe. The probe was calibrated in the air.

13 Ion chromatography was performed on a Dionex ICS-2100 Ion Chromatograph.

14 ICP-MS was conducted on an Agilent 7700x ICP-MS.

Blue Can water.[15] The anion concentrations were consistent with and without heating. The consistently low numbers highlight two important points: (1) the anions are not being actively consumed by a reaction, and (2) there is a limited potential for reaction between the anions and the liner or aluminum.

ICP-MS was used to measure the content of 34 metals.[16] Sodium (≤ 1 ppm), calcium (≤ 0.26 ppm), magnesium (≤ 0.9 ppm), potassium (≤ 0.15 ppm), and strontium (< 0.012 ppm) were the primary metal ions detected in the samples.[17,18] These levels are notably lower than those found in the tap water from which the Blue Can water is sourced.[19] The low overall metal concentration limits the potential for reaction between metal ions and the liner or the aluminum.

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15 The 2016 Annual Report published by Burbank Water and Power (*supra* at Footnote 10) reports chloride levels of 58-102 ppm, sulfate levels ranging from 108-261 ppm, and nitrate levels of up to 6.8 ppm. *See* page 4 of the report.

16 Specifically, the method was capable of measuring lithium, beryllium, boron, sodium, magnesium, aluminum, phosphorous, potassium, calcium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, strontium, molybdenum, ruthenium, palladium, silver, cadmium, tin, antimony, barium, iridium, platinum, mercury, thallium, and lead.

17 Low levels of manganese, nickel, and iron were detected in a single sample of the more basic water. Aspen states in its report that these aberrant results were likely caused by contamination.

18 The only metal ion concentration that appeared to change with exposure to heat was the calcium content in the higher pH (7.5-8.1) cans, which is consistent with the decrease in alkalinity discussed above at Section II.B.1.

19 The 2016 Annual Report published by Burbank Water and Power (*supra* at Footnote 10) reports the typical metal levels as 54 ppm sodium, 74 ppm calcium, 22 ppm magnesium, 4.3 ppm potassium, and 0.25 ppm strontium in drinking water. *See* page 5 of the report. We note that, while aluminum was detected in the higher pH cans, the content (≤ 0.03 ppm) was constant between heated samples and control (room temperature) samples. Based on the 2016 Water Quality Report for Burbank Water and Power, the source water for the Blue Can product typically contains 0.033 to 0.057 ppm aluminum; thus, we expect the municipal water to be the source of the aluminum detected in the Aspen analysis.

III. Conclusion

The Blue Can data indicate that the cans are stable under accelerated stability testing that is intended to simulate storage for over six months. Thus, barring physical stress on the can (*e.g.*, dropping or freezing the can), we see no reason for the cans to fail during long term storage, including the potential storage of the water for up to 50 years.

-end-

Full water testing can be found online at: www.bluecanh2o.com

For questions please contact: