2009

Pepsi:
Where did it come from;
How did it get here?

BY: [redacted]

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Introduction

In the 21st century, the world sees an abundant field of "stuff". They line the marts, supermarkets, and malls of the world, seemingly to be infinitively replenishing themselves. Probably the most ubiquitous soft drink company that exists, Pepsi Co., employs more than 118,000 employees to sell more than $20.37 billion dollars worth of Pepsi soft drinks per year.[1] Pepsi originated as "Brad's drink" but Bradham later renamed into its modern counterpart, Pepsi Cola.[2] Pepsi's mergers, contract signings, and stock margins (Chart 1) represent some of the most important and innovative ideas in the food and drink world, with headlines of "Pepsi Unveils New Marketing Approach"[3], "Brambles Loses Contract With Pepsi Unit"[4], and "Pepsi Refreshes Soft Drink Portfolio With Three Innovations."[5]

The reason I chose the Pepsi soft drink is because consumers see it on shelves everyday and take it for granted. At Payless, Pepsi occupies one whole section of the refrigerator. Before the Adkins Scholarship Research Project, I had never given thought as toward how much energy and time manufactures spend producing something as simple as a can with some sugar and other ingredients. After I started I soon realized how much shipping, planning, and paperwork is involved to for Guam to receive this soft drink. By tracing this product through its myriad of

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1 PepsiCo, Inc, Fundinguniverse.com <http://www.fundinguniverse.com/company-histories/PepsiCo-Inc-Company-History.html> March 27, 2009.

2 The history of Pepsi Cola, inventors.com <http://inventors.about.com/library/inventors/blpepsi.htm> March 27, 2009.

3 Pepsi unveils New Marketing Approach, April 2008, nowpublic.com <http://www.nowpublic.com/tag/Pepsi-Cola/news> March 27, 2009.

4 Brambles Loses Contract With Pepsi Unit, March 27, 2009, Brisbane Times, <http://news.brisbanetimes.com.au/breaking-news-business/brambles-loses-contract-with-pepsi-unit-20090326-9b4x.html> March 27, 2009.

5 Pepsi Refreshes Soft Drink Portfolio With Three Innovations, March 5, 2009, PR Newswire, <http://sev.prnewswire.com/null/20090305/NY79389050320091.html> March 27, 2009.

manufacturers, distributors, wholesalers, and transportation methods until it ultimately reaches me, I can understand how a product successfully reaches the public from start to end, giving me a tiny glimpse of how the business world works.

Retailer and Store Operations

Whether at Payless or other supermarkets, Pepsi is stored in what is known as Supermarket Refrigerator Showcases[6] with average temperatures set at 1.7-3.3 degrees Celsius to slow the growth of bacteria and to keep those soft drinks cold and enticing[7]. Stores on Guam sell Pepsi in 6 or 12 packs, 12 or 24 cans of Pepsi in cardboard boxes, or plastic 2 liter or 20 oz. bottles[8]. Prices range from 49 cents to $2.95 for different size bottles of Pepsi on Guam[9]. After the consumer picks out their Pepsi product from the refrigerator, they make their way to the employees attending to the cash register. Usually there consists of 8 regular lanes and 1 express lane, each lane with 1 employee handling monetary exchanges for products (Appendix A). The cashier takes the consumers money and in exchange gives the consumer the product in a plastic bag. In some stores, as the consumer leaves, an extra employee checks receipts to make sure goods aren't stolen.

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[6] Thailand Refrigeration Companies, Thai Refrigerator Manu factors, 2002, Bangkok Companies, <http://www.bangkokcompanies.com/categories/thai_companies_p336.htm> March 27, 2009.

[7] What is the Ideal Temperature For a Refrigerator?, HowStuffWorks, <http://home.howstuffworks.com/question121.htm> March 27, 2009.

[8] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.

[9] Supplies or Services, 29 March 2006, <http://www.dscp.dla.mil/subs/pv/centcon/soda/1101-P02.pdf> March 27, 2009.

Shipping from Wholesaler to Retailer

Workers locate Pepsi in the warehouses and then use truck lifts to load the Pepsi onto the Trucks, usually at a "land dock" a few feet from the ground, depending on where the door starts from the ground. Pepsi bottles and cans on Guam use the physical distribution means of truck with either 8 roll down doors, or pull-out doors in the posterior. [10] The cans and bottles lie on pallets and cartons, stacked in rows and columns on each other .[11] These trucks (Appendix B) serve as the shipment method for shipping from wholesalers to retailers and help unload the trucks when they reach the retailers. Employees of the retailers unload the cartons and place the Pepsi in either cold storage or in supermarket refrigerators. The wholesalers usually take back the cartons for the next delivery, which occurs anywhere between weekly to monthly depending on how popular the Pepsi is at the store and how much stock they are willing to have.[12]

Shipping from Distributor to Local Wholesaler

Since Guam is located in the middle of the Pacific, the only way for Pepsi products to arrive consists of shipping, usually by the Matson Company. The drinks are shipped in 20", 30", or 40'' long containers (Appendix C) made of aluminum with wood flooring. The door consists of 2 hinges which have to be pulled in order for them to open backwards.[13] The drinks are again

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[10] Marketing Mix, Encyclopedia of Business and Finance. <http://www.enotes.com/business-finance-encyclopedia/marketing-mix> March 27, 2009.

[11] FAQS, May 2008, Pepsi Co., <http:/www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.

[12] Wholesale and Retail Buyers, Except Farm Products, Tcids, <http://tcids.tbr.edu/career_query2.php?soc=13-1022.00> March 27, 2009.

[13] Matson Shipping Container 2002, Matson Navigation Company, <http://americanhistory.si.edu/ONTHEMOVE/collection/object_845.html> March 27, 2009.

stacked on each other, either in cartons or not, and then placed on pallets. Sometimes they are shrink-wrapped in case the moisture should get in and ruin the cardboard depending on which country or place they are shipped from. Technology now allows importers and exporters to use Radio frequency identification device (RFID), which allows them to track their containers by use of microchips.[14] Once the Pepsi arrive at the shipping dock, cranes are used to lift the containers off one another off the boat and then stack them in the shipping dock. Once shipping fees are paid, the container is then transported by flatbed road trailers to its local wholesaler.[15]

Shipping from Manufacturer to Distributor

After being manufactured, workers in truck lifts stack Pepsi on pallets in warehouses until computers process where different cans go.[16] Then truck lifts transfer the Pepsi onto trucks to different subsidiary distributors, the most common one being the Pepsi Bottling Group, like the one on Guam, with 545 distribution centers worldwide. Trucks again serve as the transportation method from the manufacturer to the distributor.[17]

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[14] The Shipping Dock: A Glossary of Terms, 13 September 2005, Assembly Magazine, <http://www.assemblymag.com/Articles/Web_Exclusive/e6c20a86f06c9010VgnVCM100000f932a8c0____> March 27, 2009.

[15] Horobin, Wendy. How it Works: Science and Technology, <http://books.google.com/books?id=6mIqNakOJiwC&pg=PA931&lpg=PA931&dq=shipping+dock+containers+how+its+works+crane&source=bl&ots=omCrExDzIE&sig=NLtAWFnZCX1tfjtGjTCLP6QelMU&hl=en&ei=y7_MSeWWIlH0sAPe7JGcCg&sa=X&oi=book_result&resnum=1&ct=result#PPA930,M1> March 27, 2009.

[16] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.

[17] Fast Facts, Pepsi Bottling Group, <http://www.pbg.com/press/facts.html> March 27, 2009.

Manufacturing Plant

Pepsi collects the ingredients for its soft drink from many other manufacturing plants, subsidiaries and independents to form one output. According to PepsiCo., subsidiaries manufacture flavor concentrates and then ship them over to standardized bottling facilities in heavy-duty, air-tight containers.[18] Liquid artificial sweeteners such as sucralose, aspartame, and saccharin arrive by special tanker trucks, which are then loaded into huge silos and tanks (Appendix D) until they are needed.[19] Pepsi does not manufacture their cans, bottles, caps, labels or cartons, but buys them from other companies or subsidiaries such as Pure Circle, which supplies Pepsi with the plant stevia, a plant based sugar with no calories[20], Alcun Public Co., which produces aluminum cans[21], and Zhangjiagang Huanyu Beverage Machinery Co., Ltd.[22].

Pepsi subsidiaries first make the aluminum cans from mechanical cold processes using 1 percent manganese to add strength and durability to the aluminum (alloy 3104-H19 or 3004-H19).[23]The sheet of manganese aluminum forms into a flat blank when punched, approximately 5.5 inches in diameter then forms into a cup three inches in diameter, then goes through a process called "ironing" to form the bottom curve of the can with the machine drawing the blank

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[18] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.
[19] Pepsi Ready to Switch to Plant Based Sweetners, 11 November 2008, TriplePundit, <http://www.triplepundit.com/pages/post-17.php> March 27, 2009.
[20] No Calories, Sweet and All Natural: Is Stevia too Good to be True?, Columbia News Service, <http://jscms.jrn.columbia.edu/cns/2009-03-17/solash-steviasweetener> March 28, 2009.
[21] Thailand Can Companies, Thai Can Manufacturers, Alcun Public Co., <http://www.bangkokcompanies.com/categories/thai_companies_p84.htm> March 28, 2009.
[22] Washing Balanced Pressure Filling and Capping Machine, Zhangjiagang Huanyu Beverage Machinery Co., Ltd. <http://www.ecplaza.net/tradeleads/seller/5457861/washing_balanced_pressure.html> March 28, 2009.
[23] Harris, William, How aluminum works, HowStuffWorks, <http://science.howstuffworks.com/aluminum4.htm>, April 5, 2009.

into a "cup" with a diameter of 3.5 inches,[24] with a second machine drawing out the cup and elongating it (Appendix E).[25] These machines produce somewhere between 1,500 to 2,700 cans body's per minute.[26]A machine lubricates the cans with a 202/211 diameter, which means the top the can will be reduced.[27] The final measurements of the can are 2 1/16 inches in diameter for the lid while the can itself is 1/16 of an inch larger in diameter. Each can holds 12 oz. of regulated soft drink.[28]

Like all other products, testing occurs, this time using photocell technology, where a photocell (Appendix F) occupies part of the inside can with bright lights shining through the can. If the photocell can "see" these lights, it means the can has a hole in it. While the photocell can only detect light up to .001 inches in diameter, it stops a significant amount of leaking cans from entering the market.[29] Cans deemed unusable by the photocell are rejected, meaning recycled and made into cans again. After, a machine utilizes a screen printing process with red, blue, black and white dye to create the usual Pepsi can color.[30]

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[24] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.
[25] Beverage Can, New World Encyclopedia. <http://www.newworldencyclopedia.org/entry/Beverage_can> March 28, 2009.
[26] Beverage Can, New World Encyclopedia. <http://www.newworldencyclopedia.org/entry/Beverage_can> March 28, 2009.
[27] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.
[28] PepsiCo, Inc. Answers, <http://www.answers.com/topic/pepsico-inc> March 28, 2009.
[29] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.
[30] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.

Cleaned cans from alkali cleaners or acidic cleaners move down a conveyor belt which cleans them of chemical residue.[31] The cans dip in water and come out of an oven, thus being dried. Finally, a patented printing process occurs, with the cans being first printed/lacquered, after which a water-soluble organic substance sprays on them so a film can form and thus preventing the paint from rinsing away in water.[32] Paint on the can contains a thickness of 3 mg/m^2 to 60 mg/m^2 so it can be waterproof as well as leak free.[33]

Pepsi lids use aluminum alloy 5182-H49 because the lids are needed to be more sturdy than the can body's, therefore aluminum alloy 5182-H49 consists of more magnesium.[34] A machine stamps out Pepsi lids called shells from the scrap metal and then transfers them to presses which make rivets across the aluminum, allowing the separate strip of aluminum to form tabs, after which the conversion press pushes the tab over the now flattened button to attach the tab to the lid.[35] This remarkable machine stamps out 5,500 shells per minute and the conversion press produces around 1,800 can lids per minute.[36] The reason can lids are tabbed is so litter won't accidentally fall in and because soda companies want the consumer to drink it in one sitting. These can lids are wrapped in paper sleeves and then sent out for shipment.[37]

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[31] Process for the production of labeled and/or lacquered aluminum cans, freepantentsonline, <http://www.freepatentsonline.com/EP0413328.html> April 4, 2009.

[32] Process for the production of labeled and/or lacquered aluminum cans, freepantentsonline, <http://www.freepatentsonline.com/EP0413328.html> April 4, 2009.

[33] Process for the production of labeled and/or lacquered aluminum cans, freepantentsonline, <http://www.freepatentsonline.com/EP0413328.html> April 4, 2009.

[34] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.

[35] Beverage Can, New World Encyclopedia. <http://www.newworldencyclopedia.org/entry/Beverage_can> March 28, 2009.

[36] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.

[37] The Aluminum Can Manufacturing Process, Can Central, <http://www.cancentral.com/canc/text/manuf.htm> April 5, 2009.

Pepsi's bottles are made from polyethylene terephthalate from the process of injection stretch blowing.[27] It consists of oil being immersed in a polymerization reaction (Appendix G) between an acid and alcohol to form what the pedestrian knows as "plastic".[28] Bottle caps are made separately and from a different type of plastic known as polypropylene.[29] Caps are not screwed on the bottle until the manufacturer finishes filling the bottle with Pepsi concentrate after it is shipped to the manufacturing plant.[30] Even though these PET bottles are manufactured by Pepsi subsidiaries, stringent checks are made by personal and food scientists to make sure the standards of these items are highest. Random samples of each resource PepsiCo. buys are taken and tested in a laboratory designed to measure durability of aluminum, sugar content of different liquids, and purity of resources shipped from other manufacturing plants.[31]

Then Pepsi personal, equipped with Pepsi's secret formula, mix up batches of flavor concentrate and different sweeteners in large stainless steel mixing tanks (Appendix H) holding thousands of gallons of Pepsi.[32] Although the exact proportions aren't available, Pepsi employees mix up ratios of high fructose corn syrup, caramel color, sugar, phosphoric acid, caffeine, citric acid, kola nuts, Vanilla beans, flavor oils, carbonated water, and natural flavoings.[33] Partner companies also manufacture the ingredients for this phase.

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[27] Process for the production of labeled and/or lacquered aluminum cans, freepantentsonline, <http://www.freepatentsonline.com/EP0413328.html> April 4, 2009.

[28] Process for the production of labeled and/or lacquered aluminum cans, freepantentsonline, <http://www.freepatentsonline.com/EP0413328.html> April 4, 2009.

[29] Why Can't you Recycle Plastic Bottle Caps?, NPR, July 14, 2008, <http://www.npr.org/templates/story/story.php?storyId=92510162> April 6, 2009.

[30] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.

[31] PET Bottles, Design Boom, <http://www.designboom.com/contemporary/petbottles.html> March 28, 2009.

[32] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.

[33] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> March 27, 2009.

The only ingredient that actually begins in the Pepsi manufacturing plant is carbonated water.[30] Pepsi maneuvers with the reverse osmosis process in purifying water. In large coagulation tanks unfiltered water congregates with a tube at the top sticking though the middle of the tank.[31] A semi permeable membrane covers the tube which helps to purify the water. [32]The purifier then constricts osmotic pressure on the tube, creating a Brownian movement and allowing the impurities to pass through the semi permeable membrane.[33] After this the water is poured through a sand filter, where smaller particulates can be trapped between sand and different types of gravel.[34] Sterilization comes next where chlorine is added to the water and let sit for around 2 hours and then an activated carbon filter dechlorinates the water and then again removes particulates (Appendix I)[35]. A pressurizer then passes carbon dioxide($C0_2$) in a process called carbonation which chemically changes the carbon dioxide to carbonic acid(H_2C0_3).[36] Carbonation allows the carbon dioxide to be more soluble in water, thus allowing much more carbonation than were it processed at standardized atmospheric pressure (Appendix J)[37].

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[30] Soft Drink, How Products are Made, <http://www.madehow.com/Volume-2/Soft-Drink.html> April 6, 2009.

[31] Soft Drink, How Products are Made, <http://www.madehow.com/Volume-2/Soft-Drink.html> April 6, 2009.

[32] Soft Drink, How Products are Made, <http://www.madehow.com/Volume-2/Soft-Drink.html> April 6, 2009.

[33] Soft Drink, How Products are Made, <http://www.madehow.com/Volume-2/Soft-Drink.html> April 6, 2009.

[34] Soft Drink, How Products are Made, <http://www.madehow.com/Volume-2/Soft-Drink.html> April 6, 2009.

[35] Carbonated Water, answers.com <http://www.answers.com/topic/carbonated-water> April 3, 2009.

[36] Something Fishy? Counterfeit foods enter the U.S. market, USA TODAY, <http://www.usatoday.com/news/health/2009-01-19-fake-foods_N.htm> March 28, 2009.

[37] How much Carbonization is in my Seltzer Water?, Reseach Program, <http://www.scienceteacherprogram.org/chemistry/ACadette08.html> April 4, 2009

Here, quality control audits perform another series of test determining the purity of the Pepsi and whether the sugar content falls in line with the normalcy by taking a small sample and putting it through an isotope test (Appendix K).[38] This isotope test determines what percentage of sugar and other ingredients make up that batch of Pepsi by chemical experimentation.[39]

Carbonization tests comprise of adding mentos drops to the carbonated water and then testing the water by producing a burning splint.[40] If the concentration falls within range, the batch is given the go ahead to continue into the Pepsi cans and bottles. Only three "ingredients" for the making of Pepsi bottled and canned drinks are explained because Pepsi subsidiaries make these three roducts, but the rest are made by other companies with no management relation to PepsiCo.

The Pepsi concentrate and carbonated water mix together when large tubes carry each part to the assembly line.[41] At this point PET bottles and aluminum carbon cans depalletize from their respective pallets onto a conveyer belt and then men or women first unload the bottles and cans from containers or delivery trucks by using forklifts.[42] The pallets are then placed on a designated area close to a conveyor belt. There consists of a LCD screen with buttons that an operator uses. Almost like a crane, robotic arms begin to pick up pallets and deposit them on the

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[38] Something Fishy? Counterfeit foods enter the U.S. market, USA TODAY, <http://www.usatoday.com/news/health/2009-01-19-fake-foods_N.htm> March 28, 2009.

[39] How much Carbonization is in my Seltzer Water?, Reseach Program, <http://www.scienceteacherprogram.org/chemistry/ACadette08.html> April 4, 2009.

[40] How much Carbonization is in my Seltzer Water?, Reseach Program, <http://www.scienceteacherprogram.org/chemistry/ACadette08.html> April 4, 2009.

[41] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> April 4, 2009.

[42] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> April 4, 2009.

conveyor belt.[43] Then the PET bottles and aluminum carbon cans depalletizer uses magnets or small robotic arms to lift the cans or bottles into the air while on a conveyer belt. The pallets continue to move down the line, with either hooks or robotic arms removing the pallets from the conveyor belt, depending on how high tech the machine is. The machine stacks pallets up to 56 inches or 86 inches, dependent on how heavy the pallets are.[44]

The cans or bottles continue down the conveyor belt where a machine prints an expiration date, freshness date, and/or production code on them.[45] Pepsi uses patent number 6135654 to print on bottles, where first a digital image is constructed, then transferred to the printing site, then transferred directly onto the bottle, sometimes using a dot system.[46] The carbon aluminum cans travel under a machine which directly "prints" and expiration date on the bottom of the can. A dot system is also used, this time courtesy of patent number 20090234853, where tiny or large dots are used as to save ink so that the spaces in between the dots aren't filled.[47]

Machinery then turns the cans upside down, and from the aforementioned water purifier tubes, water is sprayed into the cans for one last clean before reaching the filler. Tubes connecting the Pepsi concentrate and the carbonated water form into one tube and begin filling

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[43] WhallonMachinery, Inc. Products, Whallon Machinery, Inc. <http://my.packexpo.com/CPO-3166948/Whallon-Machinery-Inc-/Product-Overview.aspx>, April 4, 2009.

[44] WhallonMachinery, Inc. Products, Whallon Machinery, Inc. <http://my.packexpo.com/CPO-3166948/Whallon-Machinery-Inc-/Product-Overview.aspx>, April 4. 2009.

[45] US Patent 6135654 - Method and apparatus for printing digital images on plastic bottles, October 24, 2007, Patent storm, <http://www.patentstorm.us/patents/6135654.html> April 5, 2009.

[46] US Patent Application 20080234853 - MARKING AN ITEM WITH AN EXPIRATION DATE, March 20, 2007, Patent storm, <https://www.patentstorm.us/applications/20080234853/fulltext.html> April 5, 2009.

[46] US Patent Application 20080234853 - MARKING AN ITEM WITH AN EXPIRATION DATE, March 20, 2007, Patent storm, <https://www.patentstorm.us/applications/20080234853/fulltext.html> April 5, 2009.

cans at rates of 1,200 cans per minute.[47]

Machinery then turns the cans upside down, and from the aforementioned water purifier tubes, water is sprayed into the cans for one last clean before reaching the filler. Tubes connecting the Pepsi concentrate and the carbonated water form into one tube and begin filling cans at rates of 1,200 cans per minute.[48]

The filler (Appendix L)shoots the Pepsi carbonate down into the cans and bottles, where after either cans or bottle tops are applied onto their respectable outer by screw machines which twist the bottle caps onto bottles. Can lids are now applied put on top of the filled beverage can and the upper flange of the can body is folded back onto the can lid and seamed shut with pressure resistant closures, which is why every time a soda can is opened a fizzing sound occurs, releasing carbon bubbles, unless the soda is expired.[49]

The last stage of the manufacturing process consists of packaging the Pepsi and loading for departure to distributors. As the cans of Pepsi move down the stainless steel belt, a machine with rotating arms scoops Pepsi cans in denominations of 6, 12, and 24 packs of the 12 oz. soft drink.[50] Cans are "dropped" into brown paper boxes with Pepsi information already printed on depending on where they are located in the manufacturing line and then automated shrink-wrap

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[47] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> April 5, 2009.

[48] Aluminum Beverage Can, How Products are Made, <http://www.madehow.com/Volume-2/Aluminum-Beverage-Can.html> April 6, 2009.

[49] FAQS, May 2008, Pepsi Co., <http://www.pepsiusa.com/faqs.php?section=how_pepsi_is_made> April 4, 2009.

[50] Soft Drink, How Products are Made, <http://www.madehow.com/Volume-2/Soft-Drink.html> April 6, 2009.

machines wrap around all the boxes, but not the pallets.[51] Forklifts or truck lifts come and drive the finished products to their designated place in the wharehouse.[52]

As they arrive in their designated space, employees use the PA/4000 labeler (Appendix M) to put stickers with important dates written on them.[53] The manufacturing ship by date denotes the last day the product should leave the manufacturing plant. After this comes the Satellite Warehouse Ship to Trade Date, which connotes by when the distributor/wholesaler should have shipped the product to the retailer. The last date displays the last date a consumer should drink the Pepsi for maximum freshness. Since Pepsi is somewhat considered "preserved". the maximum freshness date is usually set for 39 weeks from the day it was manufactured to the day it touches the consumer's lips.[54]

Natural Resources

Pepsi's main natural resources include aluminum, carbon, sweeteners, water, oil for the plastic, and caramel color. Natural resources materials or substances that occur from nature and can be used for economic gain.[55] Despite common beliefs, natural materials are not just dug up out of the ground and used. Most natural resources must go through some sort of purifying or

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[51] The Clean Cut Look, Packaging, <http://www.diagraph.com/media/pdf/1106945161.pdf> April 6, 2009.

[52] Shrink Wrap Systems, Provincial Paper and Packaging, Ltd. <http://www.provincialpaper.com/shrinkfilm/shrinkwrap_systems.asp> April 6, 2009.

[53] The Clean Cut Look, Packaging, <http://www.diagraph.com/media/pdf/1106945161.pdf> April 6, 2009.

[54] The Clean Cut Look, Packaging, <http://www.diagraph.com/media/pdf/1106945161.pdf> April 6, 2009.

[55] Natural Resource, Dictionary.com, <http://dictionary.reference.com/browse/natural%20resource? April 8, 2009.

extraction process, or else the end product would finish contaminated.

Take aluminum for example, although scientists regard it as the most widely found metal in nature, it doesn't come freely.[56] Scientists suspected it existed from 1787 but no one invented a way to extract it from its bauxite or aluminum oxide until 1825.[57] Charles Martin Hall and Paul L. T. Héroult each invented a process of extraction from the bauxite and aluminum ore, causing aluminum to drop to 60 cents for the kilogram, thereby incidentally allowing Alcoa to bring America into the aluminum era.[58]

Companies use backhoes to obtain bauxite, which looks like a white, brown, or red clay (Appendix N).[59] Bauxite is most found near Les Baux, France and most companies purchase aluminum from that region.[60] To separate aluminum from bauxite, companies use the Bayer process. First, bauxite reacts with a sodium hydroxide solution to form sodium tetrahydroxoaluminate.[61] Bauxite is heated up to degrees from 140°C to 240°C and is pressurized up to 35 atmospheres to keep the water in the diluted sodium hydroxide liquid and not gas.[62] Aluminum becomes a molten liquid and the impurities stay solid, which strain out

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56 The Element Aluminum, Jefferson Lab, <http://education.jlab.org/itselemental/ele013.html> April 8, 2009.
57 The Element Aluminum, Jefferson Lab, <http://education.jlab.org/itselemental/ele013.html> April 8, 2009.
58 The Element Aluminum, Jefferson Lab, <http://education.jlab.org/itselemental/ele013.html> April 8, 2009.
59 How Aluminum is Obtained, Aluminum <http://science.jrank.org/pages/267/Aluminum-How-aluminum-obtained.html> April 8, 2009.
60 Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
61 Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
62 Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.

using filtration units. The impurities form large masses of red mud, which are stored in lagoons.[63]

Then the sodium tetrahydroxoaluminate heats to temperatures around 1200°C so the sodium hydroxide will evaporate off.[64] This gives us aluminum oxide, which will be converted into pure aluminum by the process of electrolysis. [65]Cryolite, Na3AlF6, mixes with the aluminum oxide as the electrolysizer and then causes molten aluminum to collects at the bottom of the cell is siphoned out from time to time, with new aluminum oxide added to the top to replace it.[66] The carbon lining acts as a cathode with and is housed in a steel tank lined with refractory bricks so the molten aluminum won't melt through the cell because temperatures are kept around 1000°C with currents of 100,000 amps or more (Appendix O)[67]. Once finished, the aluminum is made into strips 1/100th of an inch thick and shipped by rail cars or containers.[68]

After aluminum, oil ranks the most important because PET bottles are made from oil and that accounts for the 20 oz. and 2 liter bottles of Pepsi. Surveyors first start off scanning the ocean or ground floors with hydrophones (wavelengths bouncing off one another to report back small changes in density), gravity meter (to measure small electromagnetic changes), sniffers (detect the smell of hydrocarbons), and seismology (shock waves pass through rock layers and

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[63] Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
[64] Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
[65] Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
[66] Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
[67] Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.
[68] Aluminum, <http://www.chemguide.co.uk/inorganic/extraction/aluminium.html> April 8, 2009.

unscramble the waves that come back).[69]

Oil companies get oil from two ways, offshore oil drilling or drilling on land.[70] Drilling on land requires nearby water sources for water. If no water is nearby, an water well is drilled first, then the land is leveled and all trees and grass are cut off. Reserve pits are used to store away the debris from extra rocks or mud. If the area is an ecologically susceptible area debris is hauled away to other sites, while if it isn't plastic is used to line the bottom of the pit.[71] Smaller holes and one main hole are drilled, with the main one fitted with a large-diameter conductor pipe, while the others store rig equipment.[72]

A rig (Appendix P) that looks like a spider is set up, with each leg in one of those small holes dug out before. They begin drilling by putting the drill bit, collar, and drill pipe in the center hole and attach the kelly and turntable and start drilling.[73] A large diesel engine burning diesel fuel and electrical generators work to power the rig's motor and rotating equipment.[74] The drill bit, usually made from tungsten or diamonds, cuts through stone and mud, which flow out

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[69] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling1.htm> April 9, 2009.
[70] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling2.htm> April 9, 2009.
[71] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling2.htm> April 9, 2009.
[72] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling2.htm> April 9, 2009.
[73] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[74] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.

of the pipe and into a "mud hole".[75] Longer sections of drill pipe are continuously added because drilling reaches deeper points in the ground. When the oil company reaches a depth to which they are satisfied, they remove the drill pipe, collar, and bit and place casings, which are cement pipes (Appendix Q) that prevent a hole from collapsing on itself, into the ground with more cement by using a bottom plug, cement slurry, a top plug, and drill mud.[76] The bottom plug goes on the bottom and the cement slurry hardens after the drill mud exerts enough pressure to close the hole.[77] As is with all machines, the rig pipe is tested for harness, vertical straightness, and no leakage.[78]

The rig is removed because it has served its purpose, to produce a hole leading to the oil. A pump (Appendix R) replaces it, comprising of a motor that works a gear box containing a counterbalance to extract the oil and lift the polishing rod, which is attached to the sucker rod, which is attached to the pump to create suction so the oil will come up.[79] If the oil is too dense a second rig is used to drill holes and create a concrete pipe. Then a steam injector injects steam into the hole, creating heat and forming water, thus causing the oil to thin out so the pump can suction it, a process that is used quite often and called enhanced oil refinery.[80] Offshore drill-

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[75] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[76] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[77] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[78] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[79] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling4.htm> April 9, 2009.
[80] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling4.htm> April 9, 2009.

-ing does not differ by much, but is usually drilled with people on metal platforms or barges and is usually more dangerous since drilling sometimes occurs on unknown faults, sometimes causing earthquakes if companies are not careful enough.[81] At the end, oil is transferred using pipelines to huge tanks, then tankers transport oil to where it's needed.[82]

On the interior of Pepsi soda, water and carbon comprise the main natural resources. Water comes from many different sources such as underground reservoirs, dams, lakes, and rivers.[83] As the PepsiCo. company consists also of subsidiaries such as Aquafina, water usage ranks high, driving PepsiCo. to produce their own purified water instead of buying from a city supply source.[84] After locating freshwater sources pipes normally 1.5 meters in diameter carry water to underground service reservoirs or water towers (Appendix S).[85] Pipes usually travel in duos in case one malfunctions so the other can still transport water.[86] As earlier stated, Pepsi then holds water in tanks until the purifying process occurs.

Companies manufacture carbon dioxide in seven ways, with the first step then leading into the same steps after them. They start as a by-product of hydrogen plants, combustion of wood and fossil fuels, by-product of fermentation or sugar in the brewing of alcoholic drinks

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[81] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[82] How Oil Drilling Works, Howstuffworks, <http://science.howstuffworks.com/oil-drilling3.htm> April 9, 2009.
[83] How does your Water Get to Your Taps?, Waterguide.org.uk <http://www.water-guide.org.uk/science.html> April 9, 2009.
[84] Pepsi,co, <http://phx.corporate-ir.net/phoenix.zhtml?c=78265&p=irol-newsArticle_Print&ID=1270013&highlight=> April 9, 2009.
[85] How does your Water Get to Your Taps?, Waterguide.org.uk <http://www.water-guide.org.uk/science.html> April 9, 2009.
[86] How does your Water Get to Your Taps?, Waterguide.org.uk <http://www.water-guide.org.uk/science.html> April 9, 2009.