Important Note: High levels of inorganic materials (such as iron) in water can alter ORP readings. Always double check your target ORP with FREE chlorine test strips. You may have to adjust your target ORP readings to compensate. You can check this by using free chlorine test strips and pH strips in clean filtered water. At pH 7.0, in clean water, 3 ppm of free chlorine corresponds to an ORP of approximately 700 mV and 5 ppm to 750 mV.

There are three basic types of ORP meters:

- Pocket meters are the least expensive, small enough to fit in a pocket, and are reasonably reliable. Generally they need to be replaced after a year or two.
- Hand-held meters offer a high degree of accuracy and reliability and may also provide a temperature and/or pH check. The electrodes of hand-held meters need to be replaced approximately every two years.
- Process meters are mounted in a fixed location and provide continuous monitoring and recording of ORP readings. They are more expensive and most commonly used with automatic chlorine injection systems although they can be used when adding chlorine manually.

ORP meters can cost anywhere from $100 for pocket meters to over $1,000 for process control meters with internal record keeping and can be purchased from some scientific supply companies (Fischer Scientific; Canadawide Scientific, Omega Engineering Inc.) or water treatment supply companies, or suppliers can be found online from manufacturers' web sites (Extech Instruments or Oakton Instruments). (Prices as of January 2008.)

Reference:
Suslow, T. Oxidation-Reduction Potential (ORP) for Water Disinfection Monitoring, Control, and Documentation, 2004. University of California, Publication 8149 [retrieved December 31, 2007]. https://escholarship.org/uc/item/1730p498

b) Using Total and Free Chlorine to Determine Appropriate Chlorine Levels and Monitor Effectiveness

Measuring total and free chlorine through chlorine strips and pH strips (or probes) is another way to monitor the amount of chlorine in wash and flume water. Total chlorine is the total amount that has been added to the water while free chlorine is the amount of chlorine that remains active in the water. Measuring total chlorine is most useful when determining and checking how much chlorine to start with in clean water. Measuring free chlorine is a much more accurate way of monitoring the effectiveness of your chlorination system over time.

Generally, maintaining 2-7 ppm of FREE chlorine and a pH of 6.0-7.5 in wash water at all times is sufficient to kill bacteria in water. However, it is recommended that fresh fruit and vegetable operations add 50-150 ppm of TOTAL chlorine to their wash water to start. This will help ensure the free, active chlorine will not be used up too quickly.

Determining how much total chlorine to start with in your wash and flume water will depend on what type of product you are washing, the amount of organic matter that collects in the wash water and how often you change the water. For example, field tomatoes will have more soil than greenhouse tomatoes and the chlorine will be used up faster.

You will need to determine the initial amount of total chlorine to add to wash or flume water, the frequency at which you need to check chlorine levels, how much chlorine you need to add throughout a typical day and how often you need to change your water:

- Choose a total chlorine level between 50-150 ppm and, using the chorine conversion below, add the required amount of chlorine to your wash water (that contains product).
- Check the chlorine level after a few minutes to ensure that you have added the correct amount (using TOTAL chlorine test strips or probe) or that free chlorine levels are between 2-7 ppm (using FREE chlorine test strips or probe).

- For the first several days (go through several water changes), continue to check the FREE chlorine levels at a relatively high frequency (every hour or every product load) to ensure levels do not drop below 2-7 ppm.
- As chlorine levels start to drop below 2-7 ppm add more chlorine as required.
- If you find that, after an hour, there is no FREE chlorine left, increase the amount of total chlorine you start with and increase how frequently you check the chlorine levels.
- If, after a week or two, you find that FREE chlorine levels do not change much at this frequency you may be able to check less often as you get an idea of how quickly the chlorine is used up in your system. You may find that over time, as the water becomes dirtier, it becomes more difficult to maintain FREE chlorine levels.
- If you can no longer maintain FREE chlorine levels between 2-7 ppm, empty and rinse out the wash or flume tank and refill. Adding a filtration system or scooping out organic matter with a net can also help to maintain the potability of the water.
- Once you have determined how much chlorine to start with, how often to check chlorine levels, how much chlorine you need to add and how often to change your water, WRITE THIS DOWN. This will save you a lot of time later, will help you remember exactly what you were doing from year to year and allow employees to follow the procedure properly.

Note*: High levels of chlorine can cause pitting or burning of the product and can be hazardous to workers.*

Reference:

Guide To Minimize Microbial Food Safety Hazards For Fresh Fruits And Vegetables. U.S. Food and Drug Administration, U.S. Department of Agriculture and the Centers for Disease Control and Prevention. 1998.

c) Chlorine Conversions

Target ppm	ml/L	tsp/5 gal	cup/50 gal
Sodium Hypochlorite 5.25%			
50	0.95	3 ⅔	¾
75	1.43	5 ½	1 1/10
100	1.90	7 ¼	1 ½
125	2.40	9 1/10	1 ⅞
150	2.90	10 ⅞	2 ¼
Sodium Hypochlorite 12.75%			
50	0.39	1 ½	⅓
75	0.59	2 ¼	½
100	0.78	3	3/5
125	0.98	3 ¾	4/5
150	1.18	4 ½	9/10

Reference:

Food Safety Begins on the Farm, A Grower's Guide, Good Agricultural Practices for Fresh Fruits and Vegetables. Anusuya Rangarajan, Elizabeth A. Bihn, Robert B. Gravani, Donna L. Scott and Marvin P. Pritts. 2000.

d) Type of Chlorine to Use

- ONLY use **hypochlorite** (usually 5% or 12%). Carefully read the ingredient label to ensure there are no other chemical additives.

E. Resources for Agricultural Chemical Application Equipment Calibration

NOTE:	**NOTE: The Appendices were originally developed for Canadian operations, and provide examples only, based on Canadian and international resources. If your operation is outside of Canada, the following information may be relevant to you. It is recommended that you check whether country-specific requirements or guidance are available instead.**

Calibration is a test measurement of the output of your application equipment under typical operating conditions.

Calibrating application equipment ensures that:
- The agricultural chemical is being applied at the application rate recommended on the label.
- The agricultural chemical is being applied evenly over the whole field.

There are many different types of agricultural chemical application equipment and each will need to be calibrated following instructions either received with the equipment or those written based on expert recommendations.

Resources for agricultural chemical application equipment can be found at:

<u>Airblast sprayer resources:</u>

Sprayers 101: http://sprayers101.ca/
Washington State University Extension: http://treefruit.wsu.edu/web-article/six-steps-to-calibrate-and-optimize-airblast-sprayers/
BC Ministry of Ag: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agriservicebc/production-guides/berries/sprayer_calibration_2012.pdf
OMAFRA: http://www.omafra.gov.on.ca/english/crops/facts/10-047.htm
University of California Coop Extension: http://www.ipm.ucdavis.edu/training/incorporating-calibration.html
Texas A&M Extension: https://www.yumpu.com/en/document/view/46717367/airblast-sprayer-calibration-worksheet-the-texas-winegrape-

<u>Boom sprayer resources:</u>

OMAFRA: http://www.omafra.gov.on.ca/english/crops/sprayer/ep75.htm
Colorado State University Extension: https://extension.colostate.edu/topic-areas/agriculture/sprayer-calibration-fundamentals-5-003/
Ohio State University Extension:
http://wayne.osu.edu/sites/wayne/files/imce/Program_Pages/ANR/Boom%20Sprayer%20Calibration.pdf
BC Ministry of Agriculture: https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agriservicebc/production-guides/berries/sprayer_calibration_2012.pdf
Louisiana State University: http://www.lsuagcenter.com/NR/rdonlyres/E34233DB-CB3C-45B5-9E6A-82ED5A4A2C70/70220/pub3057calibrationofsprayersJune2010HIGHRES.pdf
New Brunswick (FR):
http://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Agriculture/WildBlueberries-BleuetsSauvages/C120-f.pdf
MAPAQ: https://www.agrireseau.net/agroenvironnement/documents/bsp05-07.pdf

Handheld sprayer resources:

OMAFRA: http://www.omafra.gov.on.ca/english/crops/sprayer/ep75.htm
Virginia cooperative Extension: https://www.yumpu.com/en/document/view/27138986/calibrating-hand-held-and-backpack-sprayers-for-applying-pesticides
MSU Extension: https://archive.lib.msu.edu/DMC/extension_publications/e2048/e2048.pdf

Granular spreader resources:

North Carolina State University Extension: https://onslow.ces.ncsu.edu/2017/03/calibrating-your-spreader/?src=rss
University of Georgia: http://extension.uga.edu/publications/detail.cfm?number=C818
Rutgers New Jersey Ag Experiment Station:
https://profact.rutgers.edu/Documents/ProFACT_Training_Manual.pdf

Other resources:

Ag Canada 1846 Field Guide to Sprayers: http://publications.gc.ca/collections/collection_2013/aac-aafc/agrhist/A43-1849-1990-eng.pdf

G. Water Testing

NOTE:	NOTE: The Appendices were originally developed for Canadian operations, and provide examples only, based on Canadian and international resources. If your operation is outside of Canada, the following information may be relevant to you. It is recommended that you check whether country-specific requirements or guidance are available instead.

Note: *The potable water standards below are from the Canadian Guidelines for Drinking Water Quality (developed by Health Canada);*

1. Testing Well Water

a) When to Test Well Water

It is recommended that existing wells be tested at least two times a year for microbiological contamination. The best time to sample your well water is when the probability of contamination is greatest. This is likely to be in early spring just after the thaw, after an extended dry spell, following heavy rains or after lengthy periods of non-use. In addition to regular testing, test well water after any repairs such as a pump repair or replacement and if there has been a change in water appearance, colour or odour.

b) Procedure for Testing Well Water

Depending on the location, bacteriological testing of well water is done either by the public health laboratory in your area or by a certified private laboratory. Many public health laboratories do not charge for this service. Choose an accredited laboratory for testing microbes in water.

1. Get a proper, sterile sample bottle from an accredited laboratory. Make sure you read and follow the instructions included with the bottle. Do not use any other container to collect the sample because it will not yield meaningful results and will not be accepted by the laboratory.
2. Plan to sample your well water when you're sure you can deliver it to the designated location within 24 hours. Do not let your water sample sit for a long period of time as this can lead to inaccurate results.
3. Remove any aerator, screen or other attachments from your faucet. Don't take a sample from an outside faucet or the garden hose. Take a sample from an inside tap with no aerator, such as the sink.
4. Disinfect the end of the faucet spout with an alcohol swab or dilute bleach solution (1 part household bleach to 10 parts water) before running water to remove debris or bacteria. Disinfecting the tap with a flame is not recommended because this can damage the faucet.
5. Turn on cold water and let it run for three to four minutes to remove standing water from your plumbing system.
6. Remove the sample bottle lid.
   - Don't touch the inside of the lid.
   - Don't put the lid down.
   - Don't rinse out the bottle.
7. Fill the bottle to the level that is marked, as described in the enclosed instructions, and close the lid firmly.
8. Make sure to fill out the enclosed paperwork completely and accurately or you may not get your results back.

9. Keep the sample refrigerated (but not frozen) until it's returned to the drop-off location. Again, deliver the sample within 24 hours or it may not be processed. Remember that proper handling will help to make sure that your test results are accurate! Use a cooler with ice packs to keep the sample cold until it can be refrigerated and while transporting it to the lab.

If you have experienced gastrointestinal illness and suspect that it might be associated with your well water, consult your physician and local health unit.

c) Interpreting the Test Results

The microbiological quality of your water is determined by looking for the presence of bacteria indicative of fecal (sewage) contamination - namely, total coliforms and *Escherichia coli*. Total coliforms occur naturally in soil and in the gut of humans and animals. Thus, their presence in water *may* indicate fecal contamination. *E. coli* are present only in the gut of humans and animals. Their presence therefore indicates *definite* fecal (sewage) pollution.

d) Total Coliforms

The presence of total coliform bacteria in well water is a result of surface water infiltration or seepage from a septic system. According to Health Canada's *Guidelines for Canadian Drinking Water Quality* (Sixth Edition, 1996), the maximum acceptable concentration for drinking water is “0” total coliform bacteria per 100 mL of water. The maximum acceptable concentration for water to be considered potable by in the CanadaGAP Food Safety Manuals is also “0” total coliform bacteria per 100 mL of water. Resample if any total coliforms are found. If the repeat sample contains any coliform bacteria per 100 mL, take corrective action immediately.

e) *E. coli*

Escherichia coli (E. coli) appear in water samples recently contaminated by faecal matter; thus, they indicate the possible presence of disease-causing bacteria, viruses or protozoa. Water containing *E. coli* is not safe to drink. **Corrective action is to be taken immediately.** The maximum acceptable concentration of *E. coli* is "0" per 100 mL of water.

f) Corrective Action

Corrective actions for adverse water tests generally include three steps:
- Identify and correct the source of contamination (e.g., working condition of the well; overland flooding due to improper location of well casing or land grading; drifting or leaching of manure due to improper storage; problems with septic or sewage systems).
- Treat the water (e.g. shock chlorination of wells; batch treatment of cisterns or tanks; installing a permanent treatment system).
- Re-test water.

2. Testing Ice

Testing ice is similar to testing water with a few extra considerations:

1. Most public health units will not test ice. Choose an accredited laboratory for testing microbes in water and call first to arrange shipping and analysis.

2. Use a sterile bottle or container with a tight fitting lid. A large bottle with a wide mouth is ideal; however, if the ice cubes do not fit, then sterile sampling bags can be used. If using bags, be careful during handling and transporting that the melted ice does not leak out. Most laboratories will be able to provide you with bottles and detailed instructions. Be sure to read and follow the instructions closely.

3. Do not touch the inside of the bottle, container or the lid. Do not set the lid down and do not rinse out the bottle.

4. The laboratory will need at least 100 mL of water from the ice. Check with the lab to determine the volume of water required. Depending on the size of the ice cubes/pieces and the container, you may need 3 times the volume of ice to yield sufficient water for testing.

5. Refrigerate the sample immediately after collection and have it transported, under refrigerated conditions (e.g., in a cooler with ice packs), to a lab within 24 hours. It is okay for the ice to melt before reaching the lab.

6. Ask the laboratory to test for *E. coli* and total coliforms.

a) Interpreting Test Results

The microbiological quality of ice is determined in the same manner as water and the applicable drinking water standards apply to ice as well. For example, according to Health Canada's *Guidelines for Canadian Drinking Water Quality* the maximum allowable concentration for drinking water is “0” total coliform bacteria per 100 mL of water and “0” *E. coli* per 100 mL. If any total coliforms per 100 mL are detected, determine the cause of contamination and take corrective action as appropriate.

If test results report the presence of *E. coli* and/or total coliforms, **corrective action is to be taken immediately** and the ice is not to be used until follow-up test results confirm that it is safe to use.

3. Testing Agricultural/Surface Water

The CanadaGAP Food Safety Manuals do not require agricultural water testing. However, the procedures below are provided for those who want to test their agricultural water. These suggestions are based on the Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses developed by (CCME)**.**

a) When to Test Agricultural/Surface Water

Surface water quality varies with both time and location. Sampling is only a small snapshot of the big picture, therefore, it is difficult to establish sample frequencies. However, a baseline can be established by sampling 1-2 times per month to determine what would be normal for your source. Thereafter, sample at least three times per season to detect major changes in water quality.

b) When to Test Other Agricultural Water Sources

Water quality in wells or municipal water used as sources for agricultural water does not change as frequently as surface water and generally does not need to be tested as often. One or two annual tests (at least one pre-season) is recommended. Use the water testing procedures described above for testing well water.

c) Procedure for Testing Agricultural/Surface Water

1. Choose a laboratory and call first to arrange shipping and analysis. Choose an accredited laboratory for testing microbes in water.

2. Use a sterile bottle or container with a tight fitting lid. Most laboratories will be able to provide you with bottles and detailed instructions. Be sure to read and follow the instructions closely.

3. Do not touch the inside of the bottle, cup or the lid. Do not set the lid down and do not rinse out the bottle.
4. When sampling surface water, use a clean, dry weighted pail or a sampling cup mounted on a long handle. Collect the water sample from well below the surface. Alternatively, take the sample at the end of the irrigation line; from the sprinkler or open drip tape.
5. Refrigerate the sample immediately after collection and have it transported, under refrigerated conditions (e.g., in a cooler with ice packs), to a lab within 24 hours.
6. Ask the laboratory to test for *E. coli* and total coliforms.

d) Interpreting the Test Results

Different guidelines exist for agricultural water quality. You may refer to a relevant authority (e.g., provincial government guidelines, CCME, etc.).

- Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses - http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html (click on 'Canadian Environmental Quality Guidelines Summary Table' and then choose 'Coliforms, fecal' and 'Coliforms, total Coliforms')

<u>Provincial government guidelines (where available)</u>
- British Columbia - http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/food-safety/good-agricultural-practices/4-1-water-quality
- Alberta - https://www.alberta.ca/water-quality-guidelines.aspx
- Manitoba - https://www.gov.mb.ca/sd/pubs/water/mb_water_quality_standard_final.pdf
- Nova Scotia - http://novascotia.ca/agri/documents/food-safety/factsheet-water-quality.pdf

If you have consistent problems with agricultural water quality, the best solution is to try and identify and correct the source of the problem. Look for upstream contamination sources such as livestock operations or campsites, or on-site contamination sources such as domestic and wild animals, improper manure or chemical storage and faulty sewage or septic systems. Vegetative buffer zones around ponds and along streams can help by filtering water and slowing down run-off. Ponds can be protected from significant and persistent problems with wildlife by building fences and/or creating steep sides or rocky berms to discourage the nesting of birds.

For serious and persistent water quality problems, site-specific remediation may be possible. Seek advice to avoid harming your crop, your workers or the environment.

4. Composite Water Samples

a) What is a Composite Water Sample?

A composite water sample is simply a physical mixture of individual water samples to form a composite sample, as shown in Figure 1. A single water sample test is performed on the composite, which is used to represent the results of each of the original individual samples.

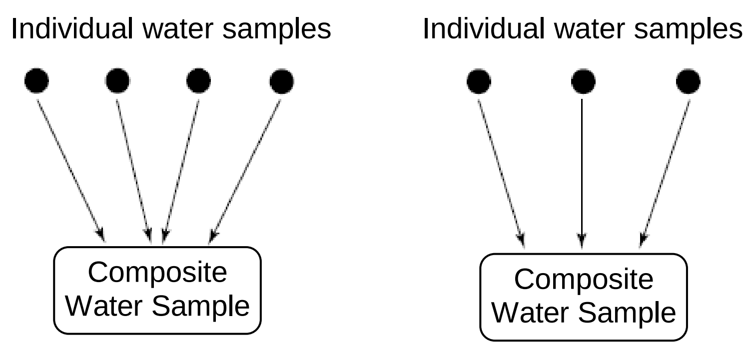


Figure 1: Examples of forming composite water sample from individual water samples.

b) Why Would Composite Samples be Taken?

Composite sampling can substantially reduce costs because the number of required tests are reduced by compositing several samples into one and analyzing the composited sample. By appropriate selection of the composite sample size and retesting of select individual samples, composite sampling may reveal the same information as would otherwise require many more analyses.

The person responsible must show that ALL of their water uses are potable (for water for fluming and cleaning and ice). The only way to do this is to take a water sample test, but this doesn't mean they have to individually test all of them. They can create a composite water sample out of multiple sources (i.e., a variety of storage containers, different packinglines etc.) and test that.

c) How and When Would Composite Samples be Taken?

Individual water sample units would be taken, and a composite sample would be created by physically mixing individual samples. Approximately equal volumes of individual water samples should be used.

Composite samples could be used when there were multiple individual water samples that needed to be tested for potability. For example, for multiple packinglines that each require a potable final rinse, potability would need to be shown for all packinglines. Each packingline could be tested as an individual sample, or one composite sample could be done and potability could be determined using this method.

d) Where Would Composite Samples be Taken From?

The water samples must be taken from specific locations. Final rinse water must be taken from the final rinse equipment. Treated water needs to be taken from where it is being treated to ensure it is being treated appropriately. Water that is being stored needs to be taken from where it is being stored. Water used for all other uses (e.g., to fill ponds, dump tanks, handwashing, etc.) can be taken from the point closest (generally a tap) to the source.

e) When Can Composite Samples NOT be Taken?

When taking composite samples, the sample needs to be a true representation of the water being tested. The sample will need to demonstrate if the water is actually potable or not. Therefore, treated water should not be mixed with untreated water in order to form a composite sample. If this is done, it may create a sample that does not truly indicate the potability of the water. The treated water could react with the untreated water and the composite sample results may show the water to be potable even if it was not. Alternatively, the untreated water could dilute the treated sample and the composite sample results may show the water to be not potable even if it was.

f) What Do the Results from a Composite Sample Mean?

If the results of the composite sample water test show the water is potable, then all individual samples comprising that composite are classified as potable (see Figure 2). When a composite tests positive for total coliforms or *E.coli*, retesting is performed on the individual samples in order to locate the source of contamination.

For example, if multiple individual samples were taken from a number of pieces of final rinse equipment to create a composite sample and sent for water testing, the result would have to show the water was potable. If it was not, one would have to go back to each individual water sample and retest to see which piece of final rinse equipment was contaminated.

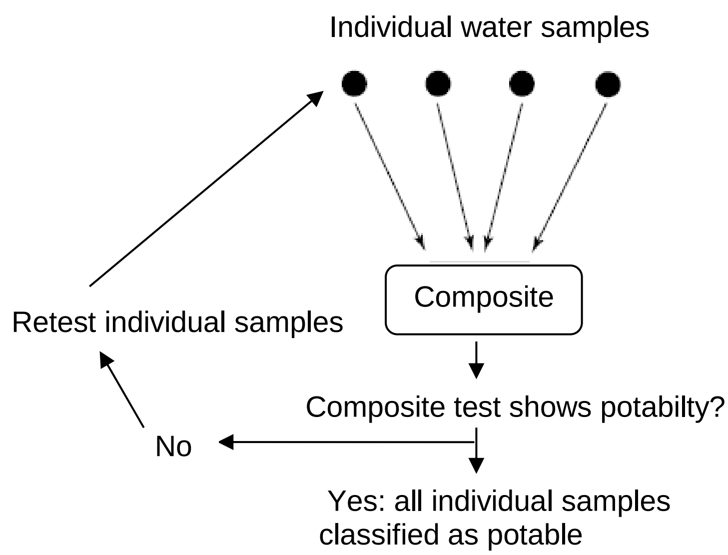


Figure 2: Example of composite sampling

References:

Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses. http://www.ccme.ca

Health Canada's Guidelines for Canadian Drinking Water Quality. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/water-quality/drinking-water/canadian-drinking-water-guidelines.html

Health Canada. What's In Your Well? - A Guide To Well Water Treatment And Maintenance. 2007 [retrieved December 31, 2007]. http://publications.gc.ca/site/eng/92836/publication.html

Ontario Ministry of Food and Rural Affairs. Improving On-Farm Food Safety Through Good Irrigation Practices. April 2010 [retrieved December 31, 2007]. http://www.omafra.gov.on.ca/english/crops/facts/10-037.htm

Patil, G. P. 2002. Composite sampling. Encyclopedia of Environmetrics, Volume 1, A. H. El-Shaarawi and W. W. Piegorsch, eds. John Wiley & Sons, Chichester, pp. 387-391

M. Traceability and Product Identification – Some Examples

NOTE:	**NOTE: The Appendices were originally developed for Canadian operations, and provide examples only, based on Canadian and international resources. If your operation is outside of Canada, the following information may be relevant to you. It is recommended that you check whether country-specific requirements or guidance are available instead.**

1. What is Traceability?

Traceability is the ability to track products up and down a supply chain. It permits the source of the product to be identified at any stage in the distribution system.

2. How is Traceability Achieved?

Traceability is achieved through two mechanisms: product identification and record keeping. Product identification is a way to physically identify the product so that it can be tracked through the supply/production chain. Records carry the information to tell what the physical identifiers mean.

3. What are the CanadaGAP Traceability Requirements?

All market product must be identified with the correct identifying information (i.e., name and address) of:

1) the operation that produced the product, OR

2) the operation that packaged the product, OR

3) the company for whom it was produced/packaged

This company could be a buyer (e.g., when packing private label for a retailer such as Sobeys), or an operation that does not pack product (e.g., they pay someone else to pack their product).

In addition, the product must be labeled with a Pack ID. The Pack ID must identify, at minimum, who produced the product and when the product is packed. For those who do not pack for others, and already have their company name on the packaging, the Pack ID then only includes when the product was packed. This could be done by hour, day or week depending on the operation. However, identifying product by packing day rather than week will help limit the amount of product that needs to be recalled if a problem occurs.

Pack ID's are usually a combination of letters OR figures, or letters AND figures, and are linked with lot ID's for complete traceability. Lot ID's can complete the traceability system by linking to a field or orchard or further defining the pack ID (e.g., by time, building, production line).

To meet the requirements within the Safe Food for Canadians Regulations (SFCR), market ready packaging materials must also be labelled with Lot Code. A definition for Lot Code is found in the CanadaGAP glossary and specific requirements for Lot Code are found in Sections 17 and 22. Refer to CFIA's website for more information on Lot Code https://inspection.gc.ca/food/toolkit-for-food-businesses/glossary-of-key-terms/eng/1430250286859/1430250287405#a104 as well as CPMA's website for further guidance on Lot Code https://cpma.ca/docs/default-source/industry/traceability_guidance_document_for_industry_compliance_with-the_sfcr.pdf

4. Methods for Marking Market Ready Packaging Materials

Different marking methods may be better suited to certain types of packaging. All methods for marking individual packaging materials must contain information identifying who produced the product and when the product was packed. It must resist any stresses the packages may endure (e.g., rinsing, icing) and be appropriate for the type of packaging material used (e.g., permanent marker may not work well with waxed cardboard containers).

a) Permanent Marker

Individuals may create their own coding scheme to identify packages, and manually write this code on each product package using a permanent marker. Most commonly a combination of numbers and letters are used. This can be labour intensive but packing house employees can mark the packaging materials as they fill them with product.

b) Stickers

Stickers are placed on individual packages and may have the code printed from a computer, written manually, be colour coded or any combination of the above. For example, a regular printer could be used to pre-print sheets of dates or date codes. These can then be stuck to each box during packing, palletizing or when wrapping pallets.

c) Stamps

Stamping can be used to place a product code on the individual packages. Date stamps with rotating month, date and year bands can be utilized, or personalized rubber stamps may be used for coding. Colour coded ink can also be used to differentiate between who produced the product or packing dates. For example, a number of operations pack their product into boxes labeled with the name of a different company who sells the product. Each operation is assigned a number and given a rubber stamp with this number. They then stamp each box with the operations number and add a date identifier.

d) Computer Systems and Bar Codes

There are also more sophisticated systems that are tied to computer software packages that are designed for traceability. Often they come with label printers or box printers and the computer will automatically assign codes to a production run. These codes may be bar codes or alphanumeric codes.

A bar code system is a machine-readable method for storing product information. Bar codes are read by barcode scanners or special software, require special printers and are an expensive system to implement.

With automated packing lines, they can be set up by computer to print and automatically attach the codes to the packing materials as they travel along the packing line thus saving employee time. The data tied to each code is then captured and stored in the computer system.

e) Other Methods

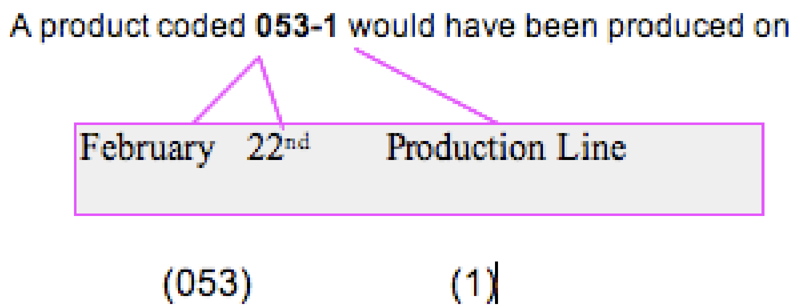
Other systems that have been used are coloured handles on product baskets and colour coded stickers or ties for closing plastic bags for products such as carrots.

3. Examples of Pack ID Systems and Codes

For some, a coded date is preferable so that only the operation knows what the code means.

a) Using a Julian Code

The Julian date or Julian Day Number (JDN) is the integer number of days that have elapsed since January 1^{st} of a particular year. This will vary for leap years (those years that include February 29^{th}). The JDN is often used for product coding, as seen in the example below, where 053 represents the 53^{rd} day of the year, February 22^{nd}. This particular example also includes an additional lot ID to indicate the production line of the product. This could be replaced with an operation code if being used by someone who packs product for others.



b) Colour Coding

A colour-coded system can be used. This involves using selected colours to represent selected packing dates or names of who produced the product. This can be done through coloured stickers, tags, stamp ink or markers. Some different examples are included below.

Example 1: An asparagus operation only packs asparagus for four weeks. They use small coloured circle stickers, have four different colours and assign a different colour to each packing week. In the event of a recall they would have to recall a whole week's worth of production but find this acceptable. If they were to pack for others, they could write the initials or the operations code number on the stickers or add an additional stamp to the boxes.

Example 2: Another operation has picked up coloured return address labels that work on their ink-jet printer. They have managed to get these labels in four colours. They print a few pages of labels ahead of time with the following code AM-3. The "A" indicates who produced the product, the "M" indicates the month as May, the colour (e.g., pink) indicates it is the 2^{nd} week of the month, and the "3" indicates the day of the week.

c) Letter and Number Combinations

The most common coding system used is a combination of letters and/or numbers. These codes can range from simple [e.g., (1M3) for operation number one, packed on May 3)], to more complex (e.g., 012608AX where 01 is the first month of packing, 2 is the second week of the month, 6 is Friday, 08 is the year, A is the operation and X is the lot code which links to the harvest date). Any combination will work as long as records are kept of what the codes mean.

W. Evaluating Food Safety Risks after Flooding Events - Resources

NOTE:	**NOTE: The Appendices were originally developed for Canadian operations, and provide examples only, based on Canadian and international resources. If your operation is outside of Canada, the following information may be relevant to you. It is recommended that you check whether country-specific requirements or guidance are available instead.**

Flooding, an uncontrolled event where water outside of the operation's control, overflows onto the premises, can directly or indirectly contaminate the product. Flood waters can carry various biological, chemical and physical hazards such as sewage, chemicals, heavy metals, pathogenic microorganisms, debris etc. onto the premises. Cross-contamination can also occur from other items such as equipment, packing materials, water sources, etc., that may have come into contact with the flood waters or other areas that have been flooded.

Flooding poses a very high food safety risk for fresh fruit and vegetables as they are grown close to the ground and/or can be eaten raw. The person responsible needs to assess all aspects of the production/packing/storing of fruits and vegetables, including all possible inputs and steps for potential contamination. If flooding has occurred, talk to provincial and/or federal agricultural specialists to discuss safe food options or concerns.

Resources for evaluating food safety risks after flooding events:

British Columbia Ministry of Agriculture:
https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/food-safety/good-agricultural-practices/8-1-soil-environment-evaluation

Government of New Brunswick:
https://www2.gnb.ca/content/gnb/en/news/public_alerts/river_watch/2018flood_recovery/farmers-impacted-by-flooding.html

U.S Food & Drug Administration (FDA):
https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-evaluating-safety-flood-affected-food-crops-human-consumption

California Leafy Green Products Handler Marketing Agreement:
https://lgmatech.com/wp-content/uploads/2017/06/CALGMA-Flooding-Fact-Sheet.pdf

Ohio State University Extension:
https://ohioline.osu.edu/factsheet/anr-27

Produce Safety Alliance:
https://producesafetyalliance.cornell.edu/sites/producesafetyalliance.cornell.edu/files/shared/Food%20Safety%20for%20Flooded%20Farms.pdf

- 3M, Cornell University. Environmental Monitoring Handbook for the Food and Beverage industry. https://multimedia.3m.com/mws/media/1684575O/environmental-monitoring-handbook.pdf
  NOTE: This resource does NOT cover fresh fruits and vegetables, but contains a lot of general information about EMPs, testing information, sampling plans, how to swab, etc.

Information Specific to Sampling and Testing:

- OMAFRA. Environmental Monitoring Programs: Swabbing to Verity Sanitation Effectiveness in Foods of Plant Origin Facilities. http://www.omafra.gov.on.ca/english/food/inspection/environmental.htm

- United Fresh. Microbiological Testing of Fresh Produce (White Paper). https://www.unitedfresh.org/content/uploads/2014/07/FST_MicroWhite-Paper.pdf

Training:

Operations may also require training to help in establishing their EMP. A number of training facilities offer training on setting up EMPs including the following (*Note*: this is not an inclusive list and is subject to change. CanadaGAP does not endorse specific training or training institutions):

- https://www.sgs.ca/en/training-services/industry-based-training/agriculture-and-food/fsma-training/environmental-monitoring-program-emp-training-for-food-facilities
- https://www.nsflearn.com/us/courses/fundamentals-developing-your-environmental-monitoring-program-webinar