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87 GLOSSARY

Aerosolized	The dispersion or discharge of a substance under pressure that generates a suspension of fine particles in air or other gas.
animal by-product	Most parts of an animal that do not include muscle meat including organ meat, nervous tissue, cartilage, bone, blood and excrement.
animals of significant risk	Animals that have been determined by the Centers for Disease Control to have a higher risk of carrying E. coli O157:H7. These animals are cattle, sheep, goats, pigs (domestic and wild), and deer.
adenosine tri-phosphate (ATP)	A high energy phosphate molecule required to provide energy for cellular function.
ATP test methods	Exploits knowledge of the concentration of ATP as related to viable biomass or metabolic activity; provides an estimate of cleanliness.
Biofertilizers	Organisms such as bacteria, fungi, and cyanobacteria that enrich the nutrient quality of soil.
Biosolids	Solid, semisolid, or liquid residues generated during primary, secondary, or advanced treatment of domestic sanitary sewage through one or more controlled processes.
colony forming units (CFU)	Viable micro-organisms (bacteria, yeasts & mold) capable of growth under the prescribed conditions (medium, atmosphere, time and temperature) develop into visible colonies (colony forming units) which are counted.
Concentrated Animal Feeding Operation (CAFO)	A lot or facility where animals have been, are or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. In addition, there must be more than 1,000 'animal units' (as defined in 40 CFR 122.23) confined at the facility; or more than 300 animal units confined at the facility if either one of the following conditions are met: pollutants are discharged into navigable waters through a man-made ditch, flushing system or other similar man-made device; or pollutants are discharged directly into waters of the United States which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.

coliforms	Gram-negative, non-sporeforming, rod-shaped bacteria that ferment lactose to gas. They are frequently used as indicators of process control, but exist broadly in nature.
cross contamination	The transfer of microorganisms, such as bacteria and viruses, from one place to another.
E. coli	<i>Escherichia coli</i> is a common bacteria that lives in the lower intestines of animals (including humans) and is generally not harmful. It is frequently used as an indicator of fecal contamination, but can be found in nature from non-fecal sources.
fecal coliforms	Coliform bacteria that grow at elevated temperatures and may or may not be of fecal origin. Useful to monitor effectiveness of composting processes. Also called “thermotolerant coliforms.”
Flooding	The flowing or overflowing of a field with water outside a grower’s control that is reasonably likely to contain microorganisms of significant public health concern and is reasonably likely to cause adulteration of edible portions of fresh produce in that field.
food contact surface	A surface of equipment or a utensil with which food normally comes into contact, or from which food may drain, drip or splash into a food or onto a surface normally in contact with food.
food safety assessment	A standardized procedure that predicts the likelihood of harm resulting from exposure to chemical, microbial and physical agents in the diet.
food safety professional	Person entrusted with management level responsibility for conducting food safety assessments before food reaches consumers; requires formal training in scientific principles and a solid understanding of the principles of food safety as applied to agricultural production.
geometric mean	Mathematical def.: the n-th root of the product of n numbers, or: Geometric Mean = n-th root of $(X_1)(X_2)...(X_n)$, where X_1, X_2 , etc. represent the individual data points, and n is the total number of data points used in the calculation. Practical def.: the average of the logarithmic values of a data set, converted back to a base 10 number.

Hydroponic	The growing of plants in nutrient solutions with or without an inert medium (as soil) to provide mechanical support.
Indicator microorganisms	An organism that when present suggests the possibility of contamination or under processing.
leafy greens	Iceberg lettuce, romaine lettuce, green leaf lettuce, red leaf lettuce, butter lettuce, baby leaf lettuce (i.e., immature lettuce or leafy greens), escarole, endive, spring mix, spinach, cabbage (green, red and savoy), kale, arugula and chard.
most probable number (MPN)	Estimated values that are statistical in nature; a method for enumeration of microbes in a sample when present in small numbers.
nonsynthetic crop treatments	Any crop input that contains animal manure, an animal product, and/or an animal by-product that is reasonably likely to contain human pathogens.
Ready to eat (RTE) food <i>(excerpted from USFDA 2005 Model Food Code)</i>	(1) "Ready-to-eat food" means FOOD that: (a) Is in a form that is edible without additional preparation to achieve FOOD safety, as specified under one of the following: 3-401.11(A) or (B), § 3-401.12, or § 3-402.11, or as specified in 3-401.11(C); or (d) May receive additional preparation for palatability or aesthetic, epicurean, gastronomic, or culinary purposes. (2) "Ready-to-eat food" includes: (b) Raw fruits and vegetables that are washed as specified under § 3-302.15; (c) Fruits and vegetables that are cooked for hot holding, as specified under § 3-401.13; (e) Plant FOOD for which further washing, cooking, or other processing is not required for FOOD safety, and from which rinds, peels, husks, or shells, if naturally present are removed;
synthetic crop treatments	Any crop inputs that are refined, chemically synthesized and/or transformed through a chemical process (e.g. gypsum, lime, sulfur, potash, etc.).
oxidation reduction potential (ORP)	An intrinsic property that indicates the tendency of a chemical species to acquire electrons and so be reduced; the more positive the ORP, the greater the species' affinity for electrons.
parts per million (ppm)	Usually describes the concentration of something in water or soil; one particle of a given substance for every 999,999 other particles.

Pathogen	A disease causing agent such as a virus, parasite, or bacteria.
pooled water	An accumulation of standing water; not free-flowing.
process authority	A regulatory body, person, or organization that has specific responsibility and knowledge regarding a particular process or method; these authorities publish standards, metrics, or guidance for these processes and/or methods.
risk mitigation	actions to reduce the severity/impact of a risk
soil amendment	Elements added to the soil, such as compost, peat moss, or fertilizer, to improve its capacity to support plant life.
ultraviolet index (UV index)	A measure of the solar ultraviolet intensity at the Earth's surface; indicates the day's exposure to ultraviolet rays. The UV index is measured around noon for a one-hour period and rated on a scale of 0-15.
Validated process	A process that has been demonstrated to be effective through a statistically-based study, literature, or regulatory guidance.
water distribution system	Distribution systems -- consisting of pipes, pumps, valves, storage tanks, reservoirs, meters, fittings, and other hydraulic appurtenances -- to carry water from its primary source to a lettuce and leafy green crop.

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91	ACRONYMS AND ABBREVIATIONS
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93	AFOs: Animal feeding operations
94	AOAC: the Association of Official Agricultural Chemists
95	BAM: Bacteriological Analytical Manual
96	CAFOs: Concentrated animal feeding operations
97	CSG2: <i>Commodity Specific Guidance for Leafy Greens and Lettuce, 2nd Edition</i>
98	CFU: colony forming units
99	cGMP: current good manufacturing practices
100	COA: Certificate of Analysis
101	DL: Detection Limit
102	FDA: Food and Drug Administration
103	GAPS: good agricultural practices
104	GLPs: good laboratory practices
105	HACCP: hazard analysis critical control point
106	MPN: most probable number
107	NGO: nongovernmental organization
108	NRCS: Natural Resources Conservation Service
109	ORP: Oxidation reduction potential
110	PPM: parts per million
111	RTE: ready-to-eat
112	SSOPs: Sanitation Standard Operating Procedures
113	USEPA: United States Environmental Protection Agency
114	UV: ultraviolet
115	WHO: World Health Organization
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127	LIST OF APPENDICES
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129	Appendix A: Sanitary Survey
130	Appendix B: Technical Basis Document
131	Appendix C: Crop Sampling Protocol

132 **INTRODUCTION**

133

134 In 1998, the U.S. Food and Drug Administration (FDA) issued its “Guide to Minimize
135 Microbial Food Safety Hazards for Fresh Fruits and Vegetables.” The practices outlined in
136 this and other industry documents are collectively known as Good Agricultural Practices or
137 GAPs. GAPs provide general food safety guidance on critical production steps where food
138 safety might be compromised during the growing, harvesting, transportation, cooling,
139 packing and storage of fresh produce. More specifically, GAP guidance alerts fruit and
140 vegetable growers, shippers, packers and processors to the potential microbiological hazards
141 associated with various aspects of the production chain including: land history, adjacent land
142 use, water quality, worker hygiene, pesticide and fertilizer use, equipment sanitation and
143 product transportation. The vast majority of the lettuce/leafy greens industry has adopted
144 GAPs as part of normal production operations. Indeed the majority of lettuce/leafy greens
145 producers undergo either internal or external third-party GAP audits on a regular basis to
146 monitor and verify adherence to their GAPs programs. These audit results are often shared
147 with customers as verification of the producer’s commitment to food safety and GAPs.

148

149 While the produce industry has an admirable record of providing the general public with safe,
150 nutritious fruits and vegetables, it remains committed to continuous improvement with regard
151 to food safety. In 2004, the FDA published a food safety action plan that specifically
152 requested produce industry leadership in developing the next generation of food safety
153 guidance for fruit and vegetable production. These new commodity-specific guidelines focus
154 on providing guidance that enhances the safe growing, processing, distribution and handling
155 of commodities from the field to the end user. The 1st Edition of these new voluntary
156 guidelines were published by the industry in April 2006.

157 In response to continued concerns regarding the microbial safety of fresh produce, this
158 edition of the guidelines (which focuses solely on production and harvest practices) was
159 prepared to provide more specific and quantitative measures of identified best practices. A
160 key focus of this revision was to identify, where possible and practical, metrics and measures
161 that could be used to assist the industry with compliance with the guidelines. In preparing
162 this document, metrics were researched for three primary areas: water quality, soil
163 amendments, and environmental assessments/conditions. A three-tier approach was used to
164 identify these metrics in as rigorous a manner as possible:

- 165 1. A comprehensive literature review was conducted to determine if there was a
166 scientifically valid basis for establishing a metric for the identified risk factor or best
167 practice.
- 168 2. If the literature research did not identify scientific studies that could support an
169 appropriate metric, standards or metrics from authoritative or regulatory bodies were
170 used to establish a metric.
- 171 3. If neither scientific studies nor authoritative bodies had allowed for suitable metrics,
172 consensus among industry representatives and/or other stakeholders was sought to
173 establish metrics.

174 In the last 10 years, the focus of food safety efforts has been on the farm, initial cooling and
175 distribution points, and value-added processing operations. Fruit and vegetable processing
176 operations have developed sophisticated food safety programs largely centered on current

177 Good Manufacturing Practices (cGMPs) and the principles of Hazard Analysis Critical
178 Control Point (HACCP) programs. As we develop a greater understanding of food safety
179 issues relative to the full spectrum of supply and distribution channels for fruits and
180 vegetables, it has become clear that the next generation of food safety guidance needs to
181 encompass the entire supply chain.

182 In addition to this document, several supplemental documents have been prepared to explain
183 the rationale for the metrics and assist the grower with activities in the field. These
184 documents include a “Technical Basis Document” that describes in detail and with
185 appropriate citations the bases for the changes made in this edition of this document, a
186 Sanitary Survey document that describes the processes for assessing the integrity and
187 remediation of water systems, and an example product testing plan. All of these items can be
188 found as Appendices to this document.

189 **SCOPE**

190 The scope of this document pertains only to fresh and fresh-cut lettuce and leafy greens
191 products. It does not include products commingled with non-produce ingredients (e.g. salad
192 kits which may contain meat, cheese, and/or dressings). Examples of “lettuce/leafy greens”
193 include iceberg lettuce, romaine lettuce, green leaf lettuce, red leaf lettuce, butter lettuce,
194 baby leaf lettuce (i.e., immature lettuce or leafy greens), escarole, endive, spring mix and
195 spinach. These crops are typically considered lettuce and leafy greens by FDA but may not
196 be similarly defined by other state or federal regulatory bodies. This document is also limited
197 to offering food safety guidance for crops grown under outdoor field growing practices and
198 may not address food safety issues related to hydroponic and/or soil-less media production
199 techniques for lettuce/leafy greens.

200 Lettuce/leafy greens may be harvested mechanically or by hand and are almost always
201 consumed uncooked or raw. Because lettuce/leafy greens may be hand-harvested and hand-
202 sorted for quality, there are numerous “touch points” early in the supply chain and a similar
203 number of “touch points” later in the supply chain as the products are used in foodservice or
204 retail operations. Each of these “touch points” represents a potential opportunity for cross-
205 contamination. For purposes of this document, a “touch point” is any occasion when the
206 food is handled by a worker or contacts an equipment food contact surface.

207
208 Lettuce/leafy greens present multiple opportunities to employ food safety risk management
209 practices to enhance the safety of lettuce/leafy greens. In the production and harvest of
210 lettuce and leafy greens as raw agricultural commodities, GAPs are commonly employed in
211 order to produce the safest products possible. In a processing operation, the basic principles
212 of cGMPs, HACCP, sanitation and documented operating procedures are commonly
213 employed in order to produce the safest products possible. Lettuce/leafy greens are highly
214 perishable and it is strongly recommended that they be distributed, stored and displayed
215 under refrigeration.

216
217 Safe production, packing, processing, distribution and handling of lettuce/leafy greens
218 depend upon a myriad of factors and the diligent efforts and food safety commitment of
219 many parties throughout the distribution chain. No single resource document can anticipate
220 every food safety issue or provide answers to all food safety questions. These guidelines
221 focus on minimizing only the microbial food safety hazards by providing suggested actions

222 to reduce, control or eliminate microbial contamination of lettuce/leafy greens in the field to
223 fork distribution supply chain.

224 All companies involved in the lettuce/leafy greens farm to table supply chain shall implement
225 the recommendations contained within these guidelines to provide for the safe production and
226 handling of lettuce/leafy greens products from field to fork. Every effort to provide food
227 safety education to supply chain partners should also be made. Together with the
228 commitment of each party along the supply chain to review and implement these guidelines,
229 the fresh produce industry is doing its part to provide a consistent, safe supply of produce to
230 the market.

231
232 These guidelines are intended only to convey the best practices associated with the industry.
233 The Produce Marketing Association, the United Fresh Produce Association, Western
234 Growers, and all other contributors and reviewers make no claims or warranties about any
235 specific actions contained herein. It is the responsibility of any purveyor of food to maintain
236 strict compliance with all local, state and federal laws, rules and regulations. These
237 guidelines are designed to facilitate inquiries and developing information that must be
238 independently evaluated by all parties with regard to compliance with legal and regulatory
239 requirements. The providers of this document do not certify compliance with these guidelines
240 and do not endorse companies or products based upon their use of these guidelines.

241 Differences between products, production processes, distribution and consumption, and the
242 ever-changing state of knowledge regarding food safety make it impossible for any single
243 document to be comprehensive and absolutely authoritative. Users of these guidelines should
244 be aware that scientific and regulatory authorities are periodically revising information
245 regarding best practices in food handling, as well as information regarding potential food
246 safety management issues. Users of this document must bear in mind that as knowledge
247 regarding food safety changes, measures to address those changes will also change as will the
248 emphasis on particular issues by regulators and the regulations themselves. Neither this
249 document nor the measures food producers and distributors should take to address food
250 safety are set in stone.

251 Due to the close association between production blocks and environmentally sensitive areas
252 in many locations, it is important to consult environmental regulators when any mitigation
253 strategies that may impact these areas are employed. Growers should implement strategies
254 that not only protect food safety but also support conservation practices, water quality, and
255 habitat protection. All parties involved with implementing the practices outlined in this
256 document should be aware that these metrics are not, in any way, meant to encourage
257 growers to violate environmental regulations.
258

259 Users are strongly urged to maintain regular contact with and utilize information available
260 from their trade associations, the U.S. Food and Drug Administration, the U.S. Department of
261 Agriculture, the U.S. Environmental Protection Agency, the Centers for Disease Control and
262 Prevention, and state agricultural, environmental, academic, and public health authorities.

263 The Sanitary Survey and Technical Basis Documents prepared as Appendices to these
264 guidelines are considered to be additional resources. They are intended to provide
265 clarification, assist with interpretation and provide additional guidance as users develop food
266 safety programs based on these Guidelines. They are not intended for measurement or
267 verification purposes.

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Lettuce/Leafy Greens Commodity Specific Guidance Production & Harvest Unit Operations

271 **1. PURPOSE**

272 The issues identified in this document are based on the core elements of Good Agricultural
273 Practices. The specific recommendations contained herein are intended for lettuce and leafy
274 greens only. If these specific recommendations are effectively implemented this would
275 constitute the best practices for a GAP program for the production and harvest unit operations
276 of lettuce and leafy greens.
277

278 **2. ISSUE: GENERAL REQUIREMENTS**

279 In addition to the area-specific requirements discussed in latter sections, there are several
280 general requirements that are part of an effective best practices program. These requirements
281 are outlined below.
282

283 **2.1. The Best Practices Are:**

- 284 • A written Leafy Greens Compliance Plan which specifically addresses the Best
285 Practices of this document shall be prepared. This plan shall address at least the
286 following areas: water, soil amendments, environmental factors, work practices,
287 and field sanitation.
- 288 • Handlers shall have an up to date growers list with contact and location
289 information on file.
- 290 • The handler shall comply with the requirements of The Public Health Security
291 and Bioterrorism Preparedness and Response Act of 2002 (farms are exempt
292 from the Act) including those requirements for recordkeeping (traceability) and
293 registration.
- 294 • Each grower and handler shall designate an individual responsible for their
295 operation's food safety program. Twenty-four hour contact information shall be
296 available for this individual in case of food safety emergencies.

297

298 **3. ISSUE: ENVIRONMENTAL ASSESSMENTS**

299 This section addresses assessments that shall be completed prior to the first seasonal planting,
300 within one week prior to harvesting and during harvest operations. These environmental
301 assessments are intended to identify any issues related to the produce field, adjacent land
302 uses, or intrusion by animal of significant risk (see Table 5) that might impact produce safety.
303

304 **3.1. The Best Practices Are:**

- 305 • Prior to the first seasonal planting and within one week prior to harvest, perform
306 an environmental assessment of the production field and surrounding area. Focus

307 these assessments on evaluating the production field for possible animal of
308 significant risk intrusion or other sources of human pathogens of concern,
309 assessing adjacent land uses for possible sources that might contaminate the
310 production field, and evaluating nearby water sources for the potential of past or
311 present flooding.

- 312 ○ Assessment of Produce Field
 - 313 ■ Evaluate all produce fields for evidence of animal of significant
 - 314 risk intrusion and/or feces. If any evidence is found, follow
 - 315 procedures identified in the “Production Locations -
 - 316 Encroachment by Animals and Urban Settings.”
- 317 ○ Assessment of Adjacent Land Use
 - 318 ■ Evaluate all land and waterways adjacent to all production fields
 - 319 for possible sources of human pathogen of concern. These
 - 320 sources include, but are not limited to, manure storage, compost
 - 321 storage, CAFO’s, grazing/open range areas, surface water,
 - 322 sanitary facilities, and composting operations (see Table 6 for
 - 323 further detail). If any possible uses that might result in produce
 - 324 contamination are present, follow management practices identified
 - 325 in the sections below related to environmental and land use
 - 326 concerns.
- 327 ○ Assessment of Historical Land Use
 - 328 ■ To the degree practical, determine and document the historical
 - 329 land uses for production fields and any potential issues from these
 - 330 uses that might impact food safety (i.e., hazardous waste sites,
 - 331 landfills, etc.).
- 332 ○ Assessment of Flooding
 - 333 ■ Evaluate all produce fields for evidence of flooding. If any
 - 334 evidence is found, follow procedures identified in the “Flooding”
 - 335 section below.
 - 336

337 **4. ISSUE: WATER**

338 Water used for production and harvest operations may contaminate lettuce and leafy greens if
339 water containing human pathogens comes in direct contact with the edible portions of
340 lettuce/leafy greens. Contamination may also occur by means of water-to-soil followed by
341 soil-to-lettuce/leafy greens contact. Irrigation methods may have varying potential to
342 introduce human pathogens or promote human pathogen growth on lettuce and leafy greens
343 (Stine *et al.*, 2005).

344
345 There are several different approaches and values that can be utilized to ensure that water is
346 of appropriate quality for its intended use. The metrics applied in this edition of the
347 Commodity Specific Guidance should be considered a starting point in industry efforts to
348 continuously improve the quality of water used in production of these commodities.

349
350 The current metrics are intended to provide standards associated with water uses; however, it
351 is known that various water sources have different microbial qualities, and each source
352 should be monitored accordingly. Typical microbial values associated with various sources

353 can be found in the Sanitary Survey document (Appendix A). During the sanitary survey that
354 is performed prior to each growing season expected microbial values and historical
355 monitoring data should be used to evaluate the quality of the water source.
356

357 **4.1. The Best Practices Are:**

- 358 • A water system description shall be prepared. This description can use maps,
359 photographs, drawings or other means to communicate the location of permanent
360 fixtures and the flow of the water system (including any water captured for re-
361 use.).
- 362 • Use irrigation water and water in harvest operations that is of appropriate
363 microbial quality for its intended use; see Table 1 and Decision Trees (1A, 1B
364 and 1C) for specific numerical criteria. Appendix B provides the basis for these
365 water quality metrics.
- 366 • Perform a sanitary survey prior to use of water in agricultural operations and if
367 water quality microbial tests are at levels that exceed the numerical values set
368 forth in Table 1. The sanitary survey is described in Appendix A.
- 369 • Test water as close to the point-of-use as practical, and if microbial levels are
370 above specific action levels, take appropriate remedial and corrective actions.
- 371 • Retain documentation of all test results and/or Certificates of Analysis available
372 for inspection for a period of at least 2 years.

373 Other Considerations for water

- 374 ○ Evaluate irrigation methods (drip irrigation, overhead sprinkler, furrow, etc.)
375 for their potential to introduce, support or promote the growth of human
376 pathogens on lettuce and leafy greens. Consider such factors as the potential
377 for depositing soil on the crop, presence of pooled or standing water that
378 attracts animals, etc.
- 379 ○ When waters from various sources are combined, consider the potential for
380 pathogen growth in the water.
- 381 ○ For surface water sources, consider the impact of storm events on irrigation
382 practices. Bacterial loads in surface water are generally much higher after a
383 storm than normal, and caution should be exercised when using these waters
384 for irrigation.
- 385 ○ Use procedures for storing irrigation pipes and drip tape that reduce or
386 eliminate potential pest infestations. Develop procedures to provide for
387 microbiologically safe use of irrigation pipes and drip tape if a pest
388 infestation does occur.
- 389 ○ Reclaimed water shall be subject to applicable state and federal regulations
390 and standards. Use of this water for agricultural purposes must meet the most
391 stringent standard as defined by the following: state and federal regulation or
392 Table 1 of this document.

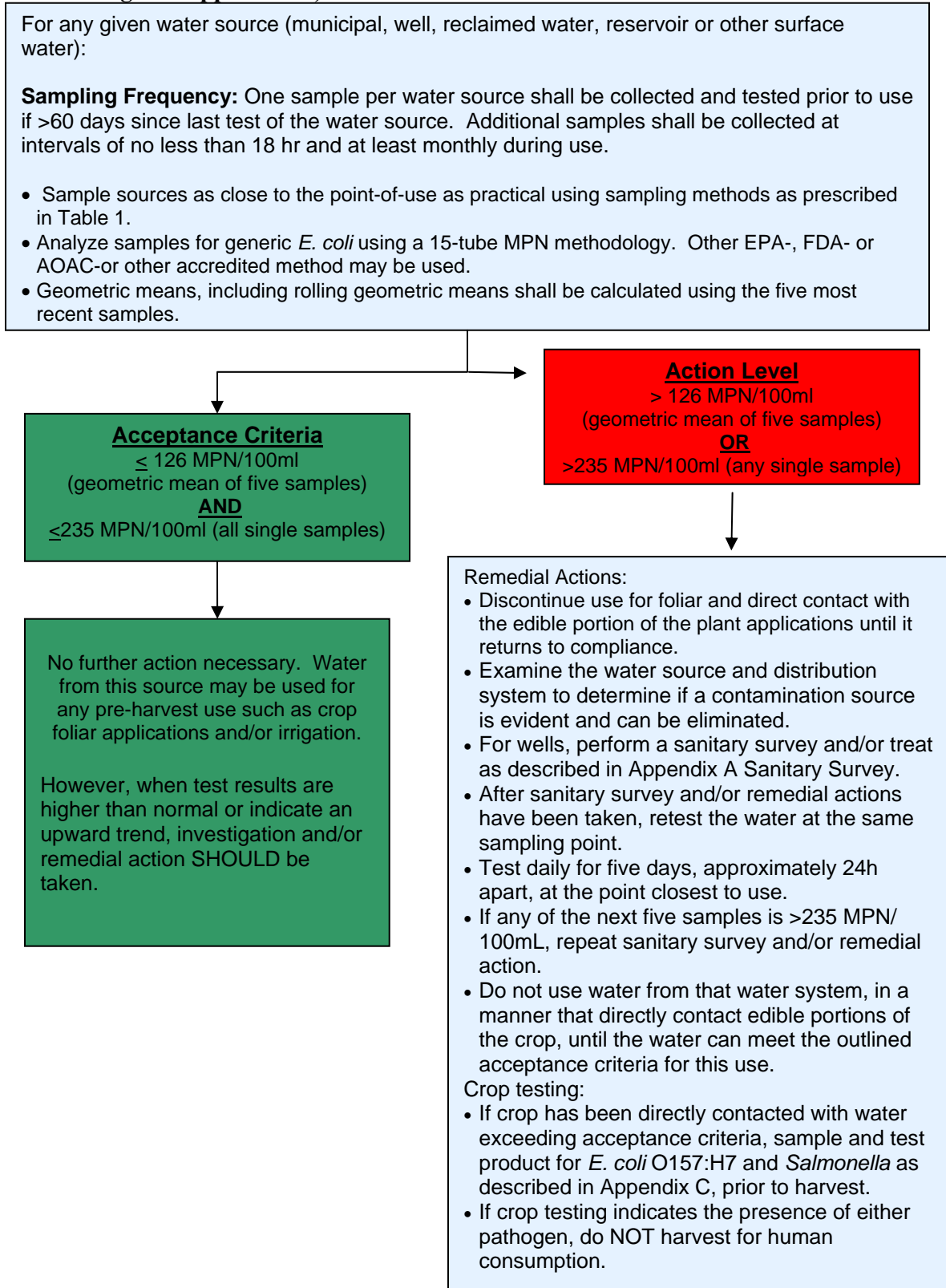
393 TABLE 1. WATER USE

Use	Metric	Rationale /Remedial Actions
<p>PREHARVEST Foliar Applications Whereby Edible Portions of the Crop ARE Contacted by Water</p> <p>(e.g. overhead sprinkler irrigation, pesticides/fungicide application, etc.)</p>	<p>Target Organism: generic <i>E. coli</i>.</p> <p>Sampling Procedure: 100 mL sample collected aseptically at the point of use; i.e., one sprinkler head per water source for irrigation, water tap for pesticides, etc.</p> <p>Sampling Frequency: One sample per water source shall be collected and tested prior to use if >60 days since last test of the water source. Additional samples shall be collected no less than 18 hr apart and at least monthly during use from points within the distribution system.</p> <p>Municipal & Well Exemption: For wells and municipal water sources, if generic <i>E. coli</i> are below detection limits for five consecutive samples, the sampling frequency may be decreased to once every six months and the requirements for 60 and 30 day sampling are waived. This exemption is void if there is a significant source or distribution system change.</p> <p>Test Method: 15 tube MPN (FDA BAM) or other U.S. EPA, AOAC, or other method accredited for quantitative monitoring of water for generic <i>E. coli</i>. Presence/absence testing with a similar</p>	<p>For any given water source (municipal, well, reclaimed water, reservoir or other surface water), samples for microbial testing shall be taken at a point as close to the point of use as practical where the water contacts the crop, so as to test both the water source and the water distribution system. Only one sample per month per distribution system is required under these metrics. If there are multiple potential point-of-use sampling points in a distribution system, then samples shall be taken from different point-of-use locations each subsequent month (randomize or rotate sample locations).</p> <p>Water for preharvest, direct edible portion contact shall meet or exceed microbial standards for recreational water, based on a rolling geometric mean of the five most recent samples. If the water source has not been tested in the past 60 days, the first water sample shall be tested prior to use, to avoid using a contaminated water source. After the first sample is shown to be within acceptance criteria, subsequent samples shall be collected no less frequently than monthly at points of use within the distribution system.</p> <p>Ideally, preharvest water should not contain generic <i>E. coli</i>, but low levels do not necessarily indicate that the water is unsafe. Investigation and/or remedial action SHOULD be taken when test results are higher than normal, or indicate an upward trend. Investigation and remedial action SHALL be taken when acceptance criteria are exceeded.</p> <p>Remedial Actions: If the rolling geometric mean (n=5) or any one sample exceeds the acceptance criteria, then the water shall not be used whereby edible portions of the crop are contacted by water until remedial actions have been completed and generic <i>E. coli</i> levels are within acceptance criteria:</p> <ul style="list-style-type: none"> • Conduct a sanitary survey of water source and distribution system to determine if a contamination source is evident and can be eliminated. Eliminate identified contamination source(s). • For wells, perform a sanitary survey and/or treat as described in Appendix A Sanitary Survey. • Retest the water after conducting the sanitary survey and/or taking remedial actions to determine if it meets the outlined microbial acceptance criteria for this use. This sample should represent the conditions of the original water system, if feasible this test should be as close as practical to the original sampling point. A more aggressive sampling program (i.e., sampling once per week instead of once per month) shall be instituted if an explanation for the exceedence is not readily apparent. This type of sampling program should also be instituted if an upward trend is noted in normal sampling results. <p>Crop Testing: If water testing indicates that a crop has been directly contacted with water exceeding acceptance criteria, product shall be sampled and tested for <i>E. coli</i> O157:H7 and <i>Salmonella</i> as described</p>

	<p>limit of detection may be used as well.</p> <p>Acceptance Criteria: ≤ 126 MPN (or CFU*)/100 mL (rolling geometric mean $n=5$) and ≤ 235 MPN/100mL for any single sample.</p> <p>*for the purposes of water testing, MPN and CFU shall be considered equivalent.</p>	<p>in Appendix C, prior to harvest. If crop testing indicates the presence of either pathogen, the crop shall NOT be harvested for human consumption.</p> <p>Records: All test results and remedial actions shall be documented and available for verification from the grower who is the responsible party for a period of two years.</p>
<p>PREHARVEST Non-foliar Applications Whereby Edible Portions of the Crop are NOT Contacted by Water</p> <p>(e.g., furrow or drip irrigation, dust abatement water; if water is not used in the vicinity of produce, then testing is not necessary)</p>	<p>Target Organism, Sampling Procedure, Sampling Frequency and Test Method: as described for foliar application.</p> <p>Acceptance Criteria: ≤ 126 MPN /100 mL (rolling geometric mean $n=5$) and ≤ 576 MPN /100 mL for any single sample.</p>	<p>Testing and remedial actions for preharvest water that does not come in direct contact with edible portions of the crop are the same as for direct contact water, but acceptance criteria are less stringent because of the reduced risk of contact of the edible portion with contamination from water. Acceptance criteria here are derived from U.S. EPA recreational water standards.</p>
<p>POSTHARVEST Direct Product Contact or Food Contact Surfaces</p> <p>(e.g. re-hydration, core in field, harvest equipment cleaning, bin cleaning, product cooling, product</p>	<p>Microbial Testing Target Organism, Sampling Procedure, and Test Method: as described for foliar application.</p> <p>Sampling Frequency: One sample per water source shall be collected and tested prior to use if >60 days since last test of the water source. Additional samples shall be collected at intervals of</p>	<p>Water that directly contacts edible portions of harvested crop, or is used on food contact surfaces, such as equipment or utensils, shall meet the Maximum Contaminant Level Goal for <i>E. coli</i> as specified by U.S. EPA or contain an approved disinfectant at sufficient concentration to prevent cross contamination. Microbial or physical/chemical testing shall be performed, as appropriate to the specific operation, to demonstrate that acceptance criteria have been met.</p> <p>Single Pass vs. Multiple Pass Systems</p> <ul style="list-style-type: none"> • Single pass use – Water must have non-detectable levels of <i>E. coli</i> or breakpoint disinfectant present at point of entry • Multi-pass use – Water must have non-detectable levels of <i>E. coli</i> and/or sufficient disinfectant to

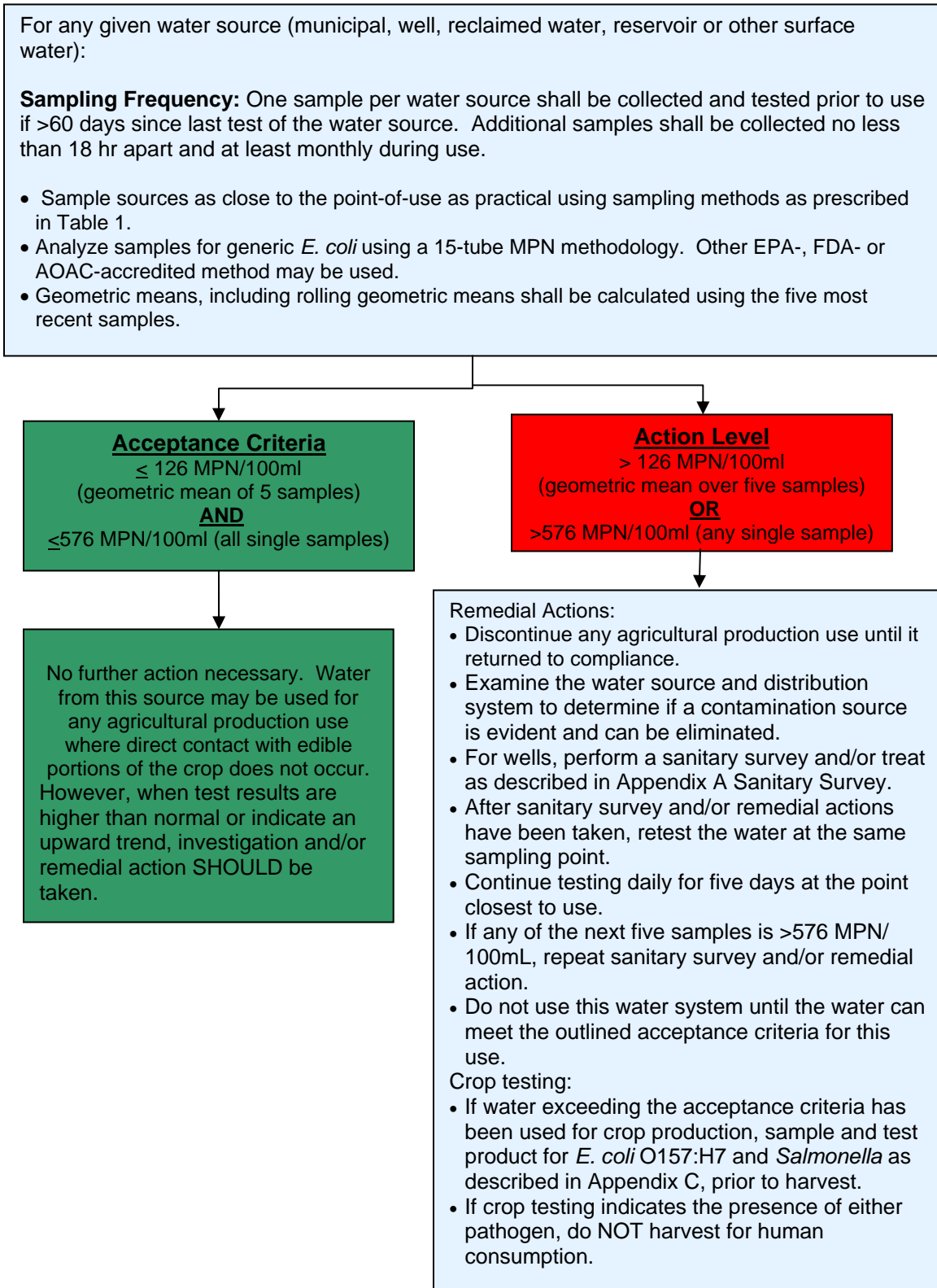
<p>washing)</p>	<p>no less than 18 hr and at least monthly during use.</p> <p>Acceptance Criteria: Negative or below DL for all samples</p> <hr/> <p><u>Physical/Chemical Testing</u> Target Variable: Water disinfectant (e.g. chlorine or other disinfectant compound, ORP)</p> <p>Multi Pass Water Acceptance Criteria:</p> <ul style="list-style-type: none"> • <u>Chlorine</u> ≥1 ppm free chlorine after application and pH 6.5 – 7.5 OR • ORP ≥ 650 mV, and pH 6.5 – 7.5 • <u>Other approved treatments</u> per product EPA label for human pathogen reduction in water. <p>Testing Procedure:</p> <ul style="list-style-type: none"> • Chemical reaction based colorimetric test, or • Ion specific probe, or • ORP, or • Other as recommended by disinfectant supplier. <p>Testing Frequency: Continuous monitoring (preferred) with periodic verification by titration OR Routine monitoring if the system can be shown to have a low degree of variation.</p>	<p>insure returned water has no detectable <i>E. coli</i> (minimally 1 ppm chlorine)</p> <p>Remedial Actions: If any one sample exceeds the acceptance criteria, then the water shall not be used for this purpose unless appropriate disinfectants have been added or until remedial actions have been completed and generic <i>E. coli</i> levels are within acceptance criteria:</p> <ul style="list-style-type: none"> • Conduct a sanitary survey of water source and distribution system to determine if a contamination source is evident and can be eliminated. Eliminate identified contamination source(s). • For wells, perform a sanitary survey and/or treat as described in Appendix A Sanitary Survey. • Retest the water at the same sampling point after conducting the sanitary survey and/or taking remedial actions to determine if it meets the outlined microbial acceptance criteria for this use. <p>For example, if a water sample for water used to clean food contact surfaces has detectable <i>E. coli</i>, STOP using that water system, examine the distribution line and source inlet as described in Appendix A Sanitary Survey, and retest from the same point of use. Continue testing daily for 5 days at the point closest to use, and do not use the water system until it consistently delivers water that is safe, sanitary water and of appropriate microbial quality (i.e. Negative result) for the intended use. If any of the any of the five samples taken during the intensive sampling period after corrective actions have been taken have detectable <i>E. coli</i>, repeat remedial actions and DO NOT use that system until the source of contamination can be corrected.</p> <p>Records: All test results and remedial actions shall be documented and available for verification from the user of the water (e.g., harvester, packing house, cooling facility, processor) for a period of two years.</p>
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394 **Figure 1A. Decision Tree for PRE-HARVEST WATER USE – Foliar Applications**
 395 **whereby edible portions of the crop are contacted by water (e.g. overhead irrigation,**
 396 **pesticide/fungicide applications)**



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Figure 1B. Decision Tree for PRE-HARVEST WATER USE – Non-Foliar Applications whereby edible portions of the crop are NOT contacted by water (e.g. furrow or drip irrigation, dust abatement water)



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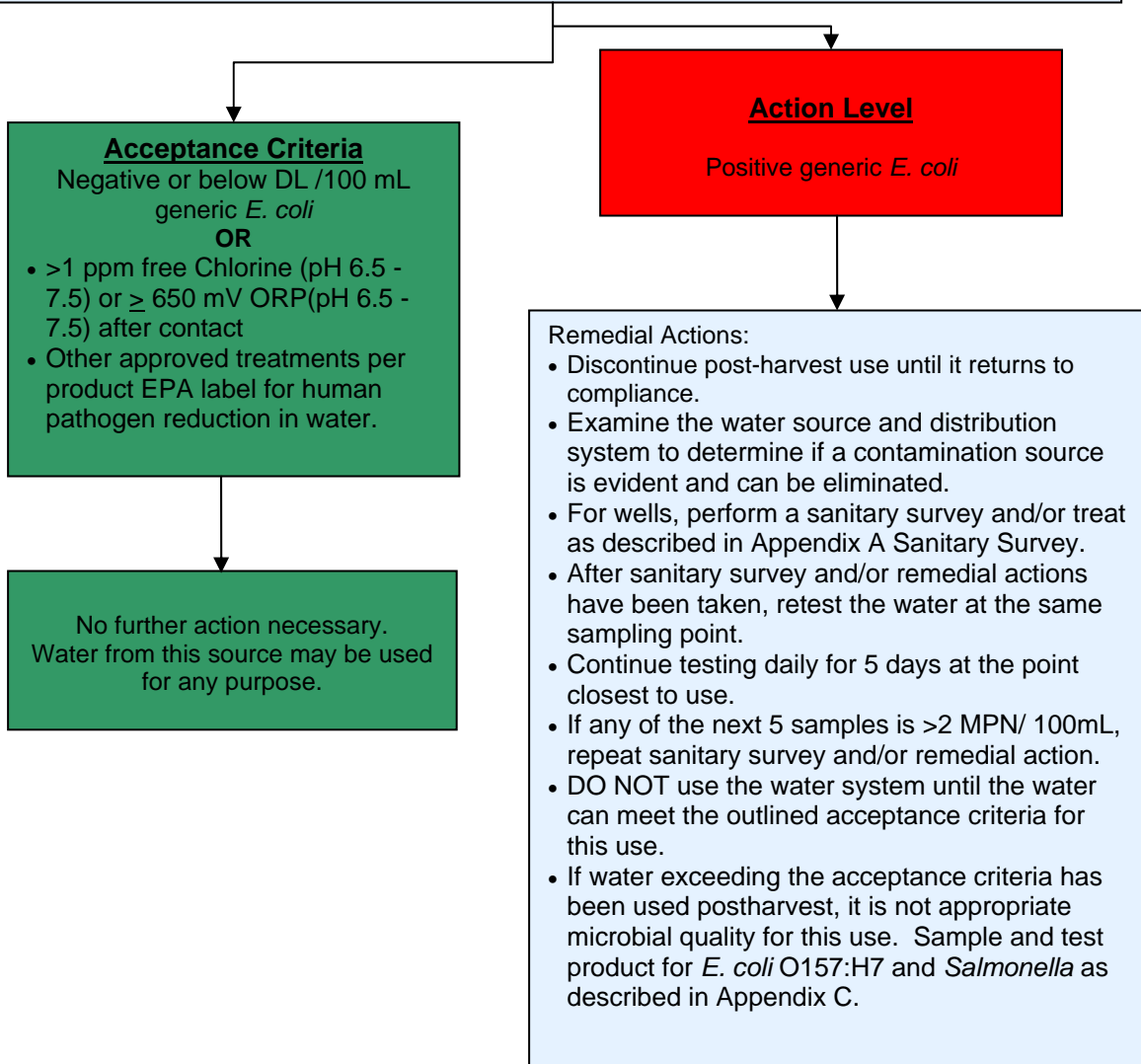
403
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Figure 1C. POSTHARVEST WATER USE – Direct product contact (e.g. re-hydration, core in field, etc.)

For any given water source (municipal, well, reservoir or other surface water):
Water that directly contacts edible portions of harvested crop, shall meet microbial standards set forth in U.S. EPA National Drinking Water Regulations, and/or contain an approved disinfectant at sufficient concentration to prevent cross contamination.

Sampling Frequency: One sample per water source shall be collected and tested prior to use if >60 days since last test of the water source. Additional samples shall be collected no less than 18 hr apart and at least monthly during use.

- Sample sources as close to the point-of-use as practical using sampling methods as prescribed in Table 1.
- Analyze samples for generic *E. coli* using a 15-tube MPN methodology. Other EPA-, FDA- or AOAC-accredited method may be used.
- Geometric means, including rolling geometric means shall be calculated using the 5 most recent samples.



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408 **5. ISSUE: SOIL AMENDMENTS**

409 Soil amendments are commonly but not always incorporated prior to planting into
410 agricultural soils used for lettuce/leafy greens production to add organic and inorganic
411 nutrients to the soil as well as to reduce soil compaction. Human pathogens may persist in
412 animal manures for weeks or even months (Fukushima *et al.* 1999; Gagliardi and Karns
413 2000). Proper composting of animal manures via thermal treatment will reduce the risk of
414 potential human pathogen survival. However, the persistence of many human pathogens in
415 agricultural soils depends on many factors (soil type, relative humidity, UV index, etc.) and
416 the effects of these factors is under extensive investigation (Jiang *et al.* 2003; Islam *et al.*
417 2004).

418
419 Field soil contaminated with human pathogens may provide a means of lettuce and leafy
420 greens contamination. Studies of human pathogens conducted in cultivated field vegetable
421 production models point towards a rapid initial die-off from high pathogen populations but a
422 characteristic and prolonged low level survival. Readily detectable survival is typically less
423 than 8 weeks following incorporation, but has been documented to exceed 12 weeks.
424 Recoverable pathogen populations, using highly sensitive techniques, have been reported to
425 persist beyond this period under some test conditions. The detection of introduced pathogens
426 on mature lettuce plants from these low levels of surviving pathogens was not possible, and
427 the risk was concluded to be negligible. Human pathogens do not persist for long periods of
428 time in high UV index and low relative humidity conditions, but may persist for longer
429 periods of time within aged manure or inadequately composted soil amendments. Therefore,
430 establishing suitably conservative pre-plant intervals, appropriate for specific regional and
431 field conditions, is an effective step towards minimizing risk (Suslow *et al.* 2003).
432

433 **5.1. The Best Practices Are:**

- 434 • DO NOT USE raw manure or soil amendment that contain un-composted,
435 incompletely composted or non-thermally treated animal manure to fields which
436 will be used for lettuce and leafy green production.
- 437 • See Table 2 and Decision Trees (Figures 2A and 2B) for numerical criteria and
438 guidance for compost and soil amendments used in lettuce and leafy greens
439 production fields. The “Technical Basis Document” (Appendix B) describes the
440 process used to develop these metrics.
- 441 • Any soil amendment that does not contain animal manure must have a certificate
442 (e.g., ingredient list, statement of identity, letter of guaranty, etc.) from the
443 producer or seller demonstrating that it is manure free. The manure free
444 certificate must be available for verification before harvest begins and it must be
445 saved and available for inspection for 2 years.
- 446 • Implement management plans (e.g., timing of applications, storage location,
447 source and quality, transport, etc.) that significantly reduce the likelihood that soil
448 amendments being used contain human pathogens.
- 449 • Verify that the time and temperature process used during the composting process
450 reduces, controls, or eliminates the potential for human pathogens being carried
451 in the composted materials, as applicable to regulatory requirements.

- 452 • Maximize the time interval between soil amendment application and time to
453 harvest.
- 454 • Implement practices that control, reduce or eliminate likely contamination of
455 lettuce/leafy green fields in close proximity to on-farm stacking of manure.
- 456 • Use soil amendment application techniques that control, reduce or eliminate
457 likely contamination of surface water and/or edible crops being grown in adjacent
458 fields.
- 459 • Segregate equipment used for soil amendment handling, preparation, distribution,
460 applications or use effective means of equipment sanitation before subsequent use
461 that effectively reduce the potential for cross contamination.
- 462 • Minimize the proximity of wind-dispersed or aerosolized sources of
463 contamination (e.g., water and manure piles) that may potentially contact growing
464 lettuce/leafy greens or adjacent edible crops. Segregate equipment used for soil
465 amendment applications or use effective means of equipment sanitation before
466 subsequent use.
- 467 • Compost suppliers shall have written Standard Operating Procedures to prevent
468 cross-contamination of finished compost with raw materials through equipment,
469 runoff, or wind, and growers shall obtain proof that these documents exist.
- 470 • Compost operations supplying compost to leafy greens crops shall maintain
471 temperature monitoring and turning records for at least two years, and growers
472 shall obtain proof that this documentation exists. This applies to composting
473 operations regulated under Title 14 CCR as well as smaller operations that do not
474 fall under Title 14.
- 475 • Perform microbiological testing of soil amendments prior to application (Table
476 2).
- 477 • Do not use biosolids as a soil amendment for production of lettuce or leafy
478 greens.
- 479 • Retain documentation of all processes and test results by lot (at the supplier)
480 and/or Certificates of Analysis available for inspection for a period of at least two
481 years.
- 482
- 483

484 **TABLE 2. SOIL AMENDMENTS**

Amendment	Metric/Rationale
<p>Raw Manure or Not Fully Composted Animal Manure Containing Soil Amendments (see composted manure process definition below)</p>	<p>DO NOT USE OR APPLY soil amendments that contain un-composted, incompletely composted or non-thermally treated (e.g., heated) animal manure to fields which will be used for lettuce and leafy greens production. If these materials have been applied to a field, wait one year prior to producing leafy greens.</p>
<p>Composted Soil Amendments (containing animal manure or animal products)</p> <p>*Composted soil amendments should not be applied after emergence of plants.</p>	<p>Please see Figure 2A: Decision Tree for Use of Composted Soil Amendments.</p> <p>Composting Process Validation:</p> <p><u>Enclosed or within-vessel composting:</u> Active compost must maintain a minimum of 131°F for 3 days, with a curing/aging period of at least 45 days before application to fields.</p> <p><u>Windrow composting:</u> Active compost must maintain aerobic conditions for a minimum of 131°F for 15 days, with a minimum of five turnings followed by a curing/aging period of at least 45 days before application to fields.</p> <p><u>Aerated static pile composting:</u> Active compost must be covered with at least 12 inches of insulating materials and maintain a minimum of 131°F for 3 days, with a curing/aging period of at least 45 days before application to fields.</p> <p>Target Organisms:</p> <ul style="list-style-type: none"> • Fecal coliforms • <i>Salmonella</i> spp • <i>E. coli</i> O157:H7 <p>Acceptance Criteria:</p> <ul style="list-style-type: none"> • Fecal coliforms <1000 MPN/gram • <i>Salmonella</i>: Negative or < DL (<1/ 30 grams) • <i>E. coli</i> O157:H7: Negative or < DL (<1/ 30 grams)

Amendment	Metric/Rationale
	<p>Recommended Test Methods:</p> <ul style="list-style-type: none"> • Fecal coliforms: 9 tube MPN • <i>Salmonella spp.</i>: U.S. EPA Method 1682 • <i>E. coli</i> O157:H7: Any laboratory validated method for compost sampling. • Other U.S. EPA, FDA, or AOAC-accredited methods may be used as appropriate. <p>Sampling Plan:</p> <ul style="list-style-type: none"> • 12 point sampling plan composite sample (divide each lot/pile into a 3 x 4 grid and extract 12 equivolume samples.) • Sample may be taken by the supplier if trained by the testing laboratory • Laboratory must be certified/accredited for microbial testing by an appropriate process authority <p>Testing Frequency:</p> <ul style="list-style-type: none"> • Each lot before application to production fields. A lot is defined as a unit of production equal to or less than 5,000 cubic yards. <p>Application Interval:</p> <ul style="list-style-type: none"> • Must be applied >45 days before harvest <p>Documentation:</p> <ul style="list-style-type: none"> • All test results and/or Certificates of Analysis shall be documented and available for verification from the grower (the responsible party) for a period of two years. <p>Rationale:</p> <ul style="list-style-type: none"> • The microbial metrics and validated processes for compost are based on allowable levels from California state regulations (CCR Title 14 - Chapter 3.1 - Article 5 2007), with the addition of testing for <i>E. coli</i> O157:H7 as microbe of particular concern. The 45-day application interval was deemed appropriate due to the specified multiple hurdle risk reduction approach outlined. Raw manure must be composted with an approved process and pass testing requirements before an application.

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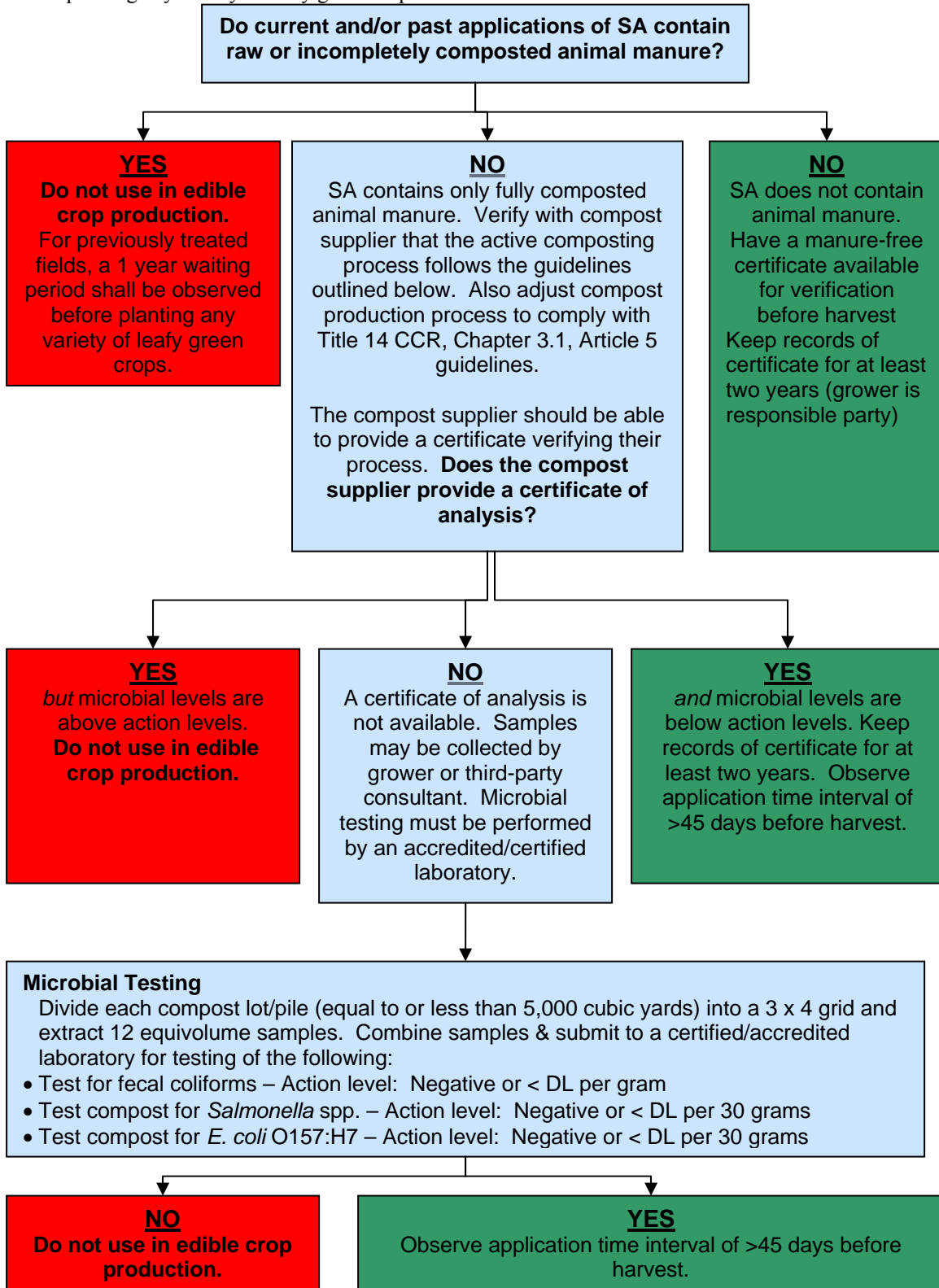
<p>Soil amendments containing animal manure that has been physically heat treated or processed by other equivalent methods.</p>	<p>Please see Figure 2B: Decision Tree for Use of Physically Heat Treated Soil Amendments.</p> <p>Physical Heat Process Validation</p> <ul style="list-style-type: none">• The physical heat treatment processes applied to the soil amendment containing animal manure shall be done via a process validated to assure that the process is capable of reducing pathogens of human health significance to acceptable levels. <p>Target Organism:</p> <ul style="list-style-type: none">• Fecal coliforms• <i>Salmonella</i> spp• <i>E. coli</i> O157:H7 <p>Acceptance Criteria:</p> <ul style="list-style-type: none">• Fecal coliforms Negative or < DL per gram• <i>Salmonella</i>: Negative or < DL (<1/ 30 grams)• <i>E. coli</i> O157:H7: Negative or < DL (<1/ 30 grams) <p>Recommended Test Methods:</p> <ul style="list-style-type: none">• Fecal coliforms: 9 tube MPN• <i>Salmonella</i> spp: U.S. EPA Method 1682• <i>E. coli</i> O157:H7: Any laboratory validated method for testing soil amendments.• U.S. EPA, FDA, AOAC-or other accredited methods may be used as appropriate <p>Sampling Plan:</p> <ul style="list-style-type: none">• 12 point sampling plan composite sample (divide each lot/pile into a 3 x 4 grid and extract 12 equivolume samples)• Sample may be taken by the supplier if trained by the testing laboratory• Laboratory must be certified/accredited by annual review of laboratory protocols based on GLPs by recognized NGO. <p>Testing Frequency:</p> <ul style="list-style-type: none">• Each lot before application to production fields.
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	<p>Application Interval:</p> <ul style="list-style-type: none"> • If the physical heat treatment process used to inactivate human pathogens of significant public health concern that may be found in animal manure containing soil amendments, is validated and meets the microbial acceptance criteria outlined below, then no time interval is needed between application and harvest. • If the physical heat treatment process used to inactivate human pathogens of significant public health concern that may be found in animal manure containing soil amendments is not validated but will likely significantly reduce microbial populations of human pathogens (minimum temperature: 300°F (150°C) for 60 minutes resulting in a moisture content <30% dry weight) and meets that microbial acceptance criteria outlined above, then a 45 day interval between application and harvest is required. <p>Documentation:</p> <ul style="list-style-type: none"> • All test results and/or Certificates of Analysis shall be documented and available for verification from the grower who is the responsible party for a period of two years. The suppliers operation should be validated by a process authority and a record maintained by the grower for a period of two years. <p>Rationale:</p> <ul style="list-style-type: none"> • The microbial metrics and validated processes for compost are based on allowable levels from California state regulations (CCR Title 14 - Chapter 3.1 - Article 5 2007), with the addition of testing for <i>E. coli</i> O157:H7 as the microbe of particular concern. A more stringent level of fecal coliform was also included to address the much more controlled nature of soil amendments produced in this manner. The above suggested application interval was deemed appropriate due to the specified multiple hurdle risk reduction approach outlined. Raw manure must be composted with an approved process and pass testing requirements before application.
<p>Soil Amendments Not Containing Animal Manure</p>	<ul style="list-style-type: none"> • Any soil amendment that DOES NOT contain animal manure must have documentation that it is manure-free. • The documentation must be available for verification before harvest begins. • If there is documentation that the amendment does not contain manure or animal products then no additional testing is required, and there is no application interval necessary • Any test results and/or documentation shall be available for verification from the grower who is the responsible party for a period of two years.

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Figure 2A. Decision Tree for Composted Soil Amendments (SA)

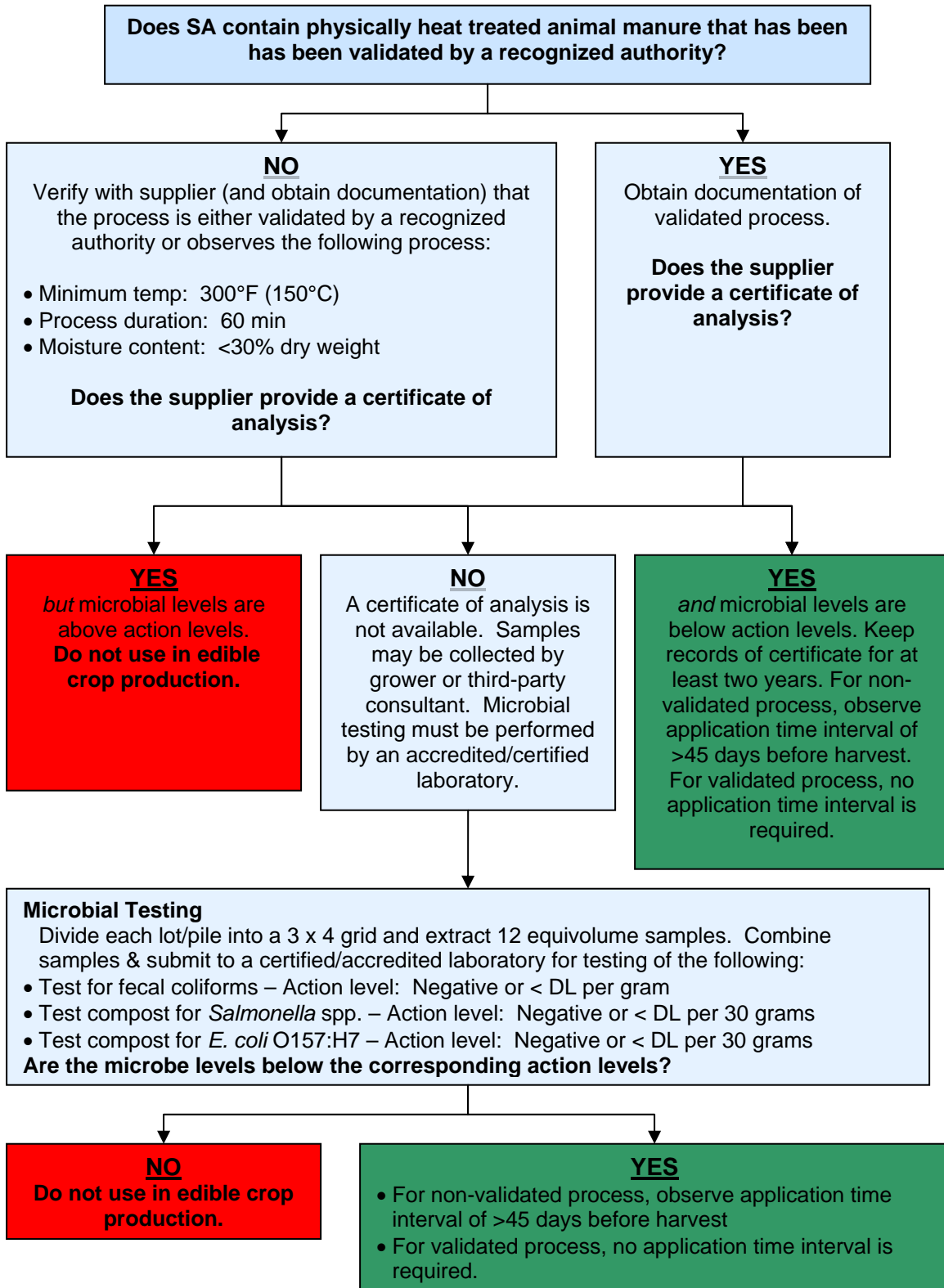
If raw manure has been directly applied to the field in the past, a 1 year waiting period shall be observed before planting any variety of leafy green crops.



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Figure 2B. Decision Tree for Physically Heat Treated Animal Manure Containing Soil Amendments (SA)



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495 **6. ISSUE: NONSYNTHETIC CROP TREATMENTS**

496 Nonsynthetic crop treatments are commonly applied post-emergence for pest and disease
497 control, greening, and to provide organic and inorganic nutrients to the plant during the
498 growth cycle. For the purposes of this document, they are defined as any crop input that
499 contains animal manure, an animal product, and/or an animal by-product that is reasonably
500 likely to contain human pathogens. Due to the potential for human pathogen contamination,
501 these treatments should only be used under conditions that minimize the risk for crop
502 contamination.
503

504 **6.1. The Best Practices Are:**

- 505 • Do not use crop treatments that contain raw manure for lettuce or leafy green
506 produce.
- 507 • Retain documentation of all test results available for inspection for a period of at
508 least two years.
- 509 • Implement management plans (e.g. timing of applications, storage location,
510 source and quality, transport, etc.) that assure to the greatest degree practicable
511 that the use of crop treatments does not pose a significant pathogen contamination
512 hazard.
- 513 • Verify that the time and temperature process used during crop treatment
514 manufacture reduces, controls, or eliminates the potential for human pathogens
515 being carried in the composted materials, as applicable to regulatory
516 requirements.
- 517 • Maximize the time interval between the crop treatment application and time to
518 harvest.
- 519 • Implement practices that control, reduce or eliminate likely contamination of
520 lettuce/leafy green fields that may be in close proximity to on-farm storage of
521 crop treatments.
- 522 • Use crop treatment application techniques that control, reduce or eliminate the
523 likely contamination of surface water and/or edible crops being grown in adjacent
524 fields.
- 525 • Segregate equipment used for crop treatment applications or use effective means
526 of equipment sanitation before subsequent use.
- 527 • See Table 3 and Decision Tree (Figure 3) for numerical criteria and guidance for
528 nonsynthetic crop treatments used in lettuce and leafy greens production fields.
529 The “Technical Basis Document” (Appendix B) describes the process used to
530 develop these metrics.

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534 **TABLE 3. NONSYNTHETIC CROP TREATMENTS**

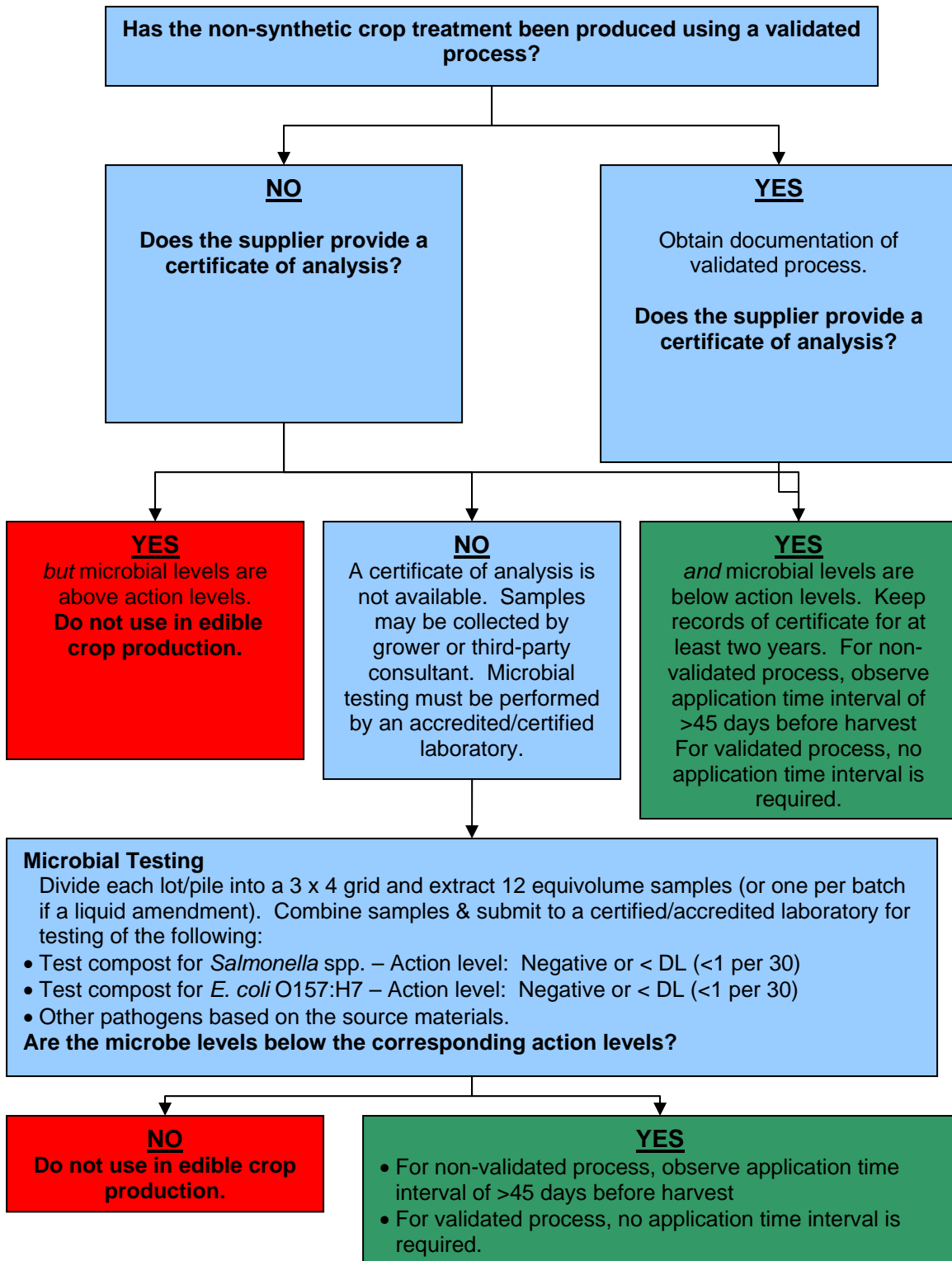
Treatment	Metric/Rationale
<p><i>Any crop input that contains animal manure, an animal product, and/or an animal by-product that is reasonably likely to contain human pathogens.</i></p> <p>Examples include but are not limited to:</p> <ul style="list-style-type: none"> • Compost teas, • Fish emulsions • Fish meal • Blood meal • "Bio-fertilizers" commonly used for pest control, greening, disease control, fertilizing. <p>Suppliers of these products shall disclose on labels, certificates of analysis, or other companion paperwork whether the product contains any animal manure or products.</p>	<p>Non synthetic crop treatments that contain animal products or animal manure that have not been physically heat treated or processed by other equivalent methods shall NOT be directly applied to the edible portions of lettuce and leafy greens.</p> <p>Please see Figure 3: Decision Tree for Use of Nonsynthetic Crop Treatments.</p> <p>Process Validation</p> <ul style="list-style-type: none"> • The physical, chemical and/or biological treatment process(es) used to render the crop input safe for application to edible crops must be validated. <p>Target Organism:</p> <ul style="list-style-type: none"> • <i>Salmonella</i> spp • <i>E. coli</i> O157:H7 <p>Acceptance Criteria (at point of use):</p> <ul style="list-style-type: none"> • <i>Salmonella</i>: Negative or < DL (<1/ 30 grams) • <i>E. coli</i> O157:H7: Negative or < DL (<1/ 30 grams) • Other pathogens appropriate for the source material <p>Recommended Test Methods:</p> <ul style="list-style-type: none"> • <i>Salmonella</i> spp: U.S. EPA Method 1682 • <i>E. coli</i> O157:H7: Any laboratory validated method for the non synthetic material to be tested. • Other U.S. EPA, FDA, or AOAC-accredited methods may be used as appropriate <p>Sampling Plan:</p> <ul style="list-style-type: none"> • 12 point sampling plan composite sample (if solid), one sample per batch if liquid (if liquid-based, then water quality acceptance levels as described in Table 1 should be used) • Sample may be taken by the supplier if trained by the testing laboratory • Laboratory must be certified/accredited by annual review of laboratory protocols based on GLPs by recognized NGO <p>Testing Frequency:</p> <ul style="list-style-type: none"> • Each lot before application to production fields.

Treatment	Metric/Rationale
	<p>Application Interval:</p> <ul style="list-style-type: none"> • If the physical, chemical and/or biological treatment process used to render the crop input safe for application to edible crops is validated and meets that microbial acceptance criteria outlined above, no time interval is needed between application and harvest. • If the physical, chemical and/or biological treatment process used to render the crop input safe for application to edible crops is not validated yet meets the microbial acceptance criteria outlined above, a 45 day time interval between application and harvest is required. <p>Documentation:</p> <ul style="list-style-type: none"> • All test results and/or Certificates of Analysis shall be documented and available from the grower for verification for a period of 2 years. The grower the party responsible party for maintaining the appropriate records. <p>Rationale:</p> <ul style="list-style-type: none"> • The microbial metrics and validated processes for compost are based on allowable levels from California state regulations (CCR Title 14 - Chapter 3.1 - Article 5 2007), with the addition of testing for <i>E. coli</i> O157:H7 as the microbe of particular concern. The above suggested application interval was deemed appropriate due to the specified multiple hurdle risk reduction approach outlined. Any non synthetic crop treatment that contains animal manure must use only fully composted manure in addition to a validated process and pass testing requirements before a application to soils or directly to edible portions of lettuce and leafy greens.

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Figure 3. Decision Tree for Nonsynthetic Crop Treatments That Contain Animal Products



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542 **Note: Mixtures of soil amendment materials**

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544 For soil amendments that contain mixtures of materials each component must meet the
545 requirements of its respective class of materials. The usages allowed will conform to that of the
546 most stringent class of materials utilized in the mixture.

547

548 For example; Soil amendments containing animal manure that has been physically heat treated or
549 processed by other equivalent methods mixed with soil amendments not containing animal
550 manure would require a process certification for the physically heat treated or processed by other
551 equivalent methods materials and the components from non-animal manure would require
552 documentation attesting to its manure free status. The resulting mixture could then be applied in
553 accordance with the guidelines associated with the physically heated treated class of materials
554 (most stringent limits).

555 **7. ISSUE: HARVEST EQUIPMENT**

556 This section addresses harvest and harvest aid equipment used for lettuce/leafy greens.
557 Mechanical or machine harvest has become increasingly prevalent and provides opportunity
558 for increased surface contact exposure. This includes field cored lettuce operations that use
559 various harvest equipment and aids.

560

561 **7.1. The Best Practices Are:**

- 562
- 563 • Prepare an SOP for harvest equipment that addresses the following:
 - 564 ○ Sanitation verification
 - 565 ○ Daily inspection
 - 566 ○ Periodic microbial swabs or other equivalent indicator
 - 567 ○ Proper cleaning, sanitation and storage of hand harvest equipment (knives,
568 scythes, etc.)
 - 569 ○ Control procedures when equipment is not in use, including policy for
570 removal of equipment from the work area or site and the use of scabbards,
sheathes or other storage equipment.
 - 571 • Prepare an SOP for handling and storage of product containers that addresses the
572 following:
 - 573 ○ Over night storage
 - 574 ○ Contact with the ground
 - 575 ○ Container assembly (RPC, fiber bin, plastic bin, etc)
 - 576 ○ Damaged containers
 - 577 ○ Use of containers only as intended
 - 578 • Prepare an SOP for sanitary operation of equipment which addresses:
 - 579 ○ Spills and leaks
 - 580 ○ Inoperative water sprays

- 581 ○ Exclusion of foreign objects (including glass, plastic, metal and other
582 debris)
- 583 • Establish appropriate measures that reduce and control the potential introduction
584 of human pathogens at the cut surface during and after mechanical harvest
585 operations. Due to the cut surface being more vulnerable to microbial
586 contamination, this best practice is extremely important and all practical means
587 should be taken to reduce the possibility of introduction of contamination at this
588 process step.
- 589 • If re-circulated rinse or antioxidant solutions are used on the cut surface, take all
590 practicable precautions to prevent them from becoming a source of
591 contamination.
- 592 • Design equipment to facilitate cleaning by using materials and construction that
593 facilitate cleaning and sanitation of equipment food contact surfaces (e.g.,
594 transportation tarps, conveyor belts, etc.).
- 595 • Establish the frequency of equipment cleaning and sanitation by developing
596 Sanitation Standard Operating Procedures (SSOPs) and a sanitation schedule for
597 machine harvest operations.
- 598 • Evaluate the use of cleaning verification methods for harvesting equipment (e.g.,
599 ATP test methods).
- 600 • Locate equipment cleaning and sanitizing operations away from product and other
601 equipment to reduce the potential for cross contamination.
- 602 • Establish equipment storage and control procedures to minimize the potential for
603 contamination when not in use. Establish policies and sanitary design options that
604 facilitate frequent and thorough cleaning and sanitizing of food contact surfaces.
- 605 • Develop and implement appropriate cleaning, sanitizing, storage and handling
606 procedures of all food contact surfaces to reduce and control the potential for
607 microbial cross contamination.
- 608 • Allow adequate distance for the turning and manipulation of harvest equipment to
609 prevent cross contamination from areas of animal or significant risk intrusion or
610 adjacent land that may pose a risk.

611

612 **8. ISSUE: HARVEST PERSONNEL - DIRECT CONTACT WITH SOIL DURING HARVEST**

613 After manual harvest of lettuce/leafy greens, placing or stacking product on soil before the
614 product is placed into a container may expose the product to human pathogens if the soil is
615 contaminated. Research has demonstrated that microbes, including human pathogens, can
616 readily attach to cut lettuce/leafy green surfaces (Takeuchi *et al.* 2001).
617

618 **8.1. The Best Practices Are:**

- 619 • Evaluate appropriate measures that reduce and control the potential introduction
620 of human pathogens through soil contact at the cut surface after harvest (e.g.

621 frequency of knife sanitation, no placement of cut surfaces of harvested product
622 on the soil, container sanitation, single use container lining, etc.).

- 623 • Do not stack soiled bins on top of each other if the bottom of one bin has had
624 direct contact with soil.
625

626 **9. ISSUE: FIELD AND HARVEST PERSONNEL - TRANSFER OF HUMAN PATHOGENS**
627 **BY WORKERS**

628 Lettuce/leafy greens are handled by harvest crews during harvest in that each lettuce/leafy
629 greens plant is touched/handled as part of the harvest process. It is possible that persons
630 working with produce in the field may transfer microorganisms of significant public health
631 concern. Workers may be asymptomatic.

632 **9.1. The Best Practices Are:**

- 633 • Use appropriate preventive measures outlined in GAPs such as training in appropriate
634 and effective hand washing, glove use and replacement, and mandatory use of
635 sanitary field latrines to reduce and control potential contamination.
- 636 • Establish a written worker practices program (i.e., an SOP) that can be used to verify
637 employee compliance with company food safety policy. This program shall establish
638 the following practices for field and harvest employees as well as visitors.
- 639 ○ Prior to harvest, an individual should be designated as responsible for
640 harvesting food safety
 - 641 ○ Use, storage, record keeping, and proper labeling of chemicals
 - 642 ○ Training on proper sanitation and hygiene practices
 - 643 ○ Requirements for workers to wash their hands before beginning or returning
644 to work
 - 645 ○ Confinement of smoking, eating and drinking of beverages other than water
646 to designated areas.
 - 647 ○ Personal item storage
- 648 • A written physical hazard prevention program should be developed for leafy green
649 products that are intended for further processing. The program must address the
650 following:
- 651 ○ Employee clothing and jewelry (head and hair restraints, aprons, gloves,
652 visible jewelry, etc.)
 - 653 ○ Removal of all objects from upper pockets
 - 654 ○ Foreign objects in the field.
- 655 • Establish a worker health practices program (i.e., an SOP) that address the following
656 issues:
- 657 ○ Workers with diarrhea disease or symptoms of other infectious disease are
658 prohibited from handling fresh produce.

- 659 ○ Workers with open cuts or lesions are prohibited from handling fresh produce
660 without specific measures to prevent cross contamination of product.
- 661 ○ Actions for employee to take in the event of injury or illness.
- 662 ○ A policy describing procedures for handling/disposition of produce or food
663 contact surfaces that have come into contact with blood or other body fluids.
- 664 ● A field sanitary facility program (i.e., an SOP) shall be implemented, and it should
665 address the following issues: the number, condition, and placement of field sanitation
666 units, the accessibility of the units to the work area, facility maintenance, facility
667 supplies (i.e., hand soap, water, paper towels, toilet paper, etc.), facility signage,
668 facility cleaning and servicing, and a response plan for major leaks or spills.
 - 669 ○ Sanitary facilities should be placed such that the location minimizes the
670 impact from potential leaks and/or spills while allowing access for cleaning
671 and service.
 - 672 ○ The location and sanitary design of toilets and hand wash facilities should be
673 optimized to facilitate the control, reduction and elimination of human
674 pathogens from employee hands. Evaluate the location of worker hygiene
675 facilities to maximize accessibility and use, while minimizing the potential
676 for the facility to serve as a source of contamination.
 - 677 ○ Establish the frequency of toilet and hand washing facility
678 maintenance/sanitation.
 - 679 ○ Establish equipment and supply storage and control procedures when not in
680 use.
 - 681 ○ Maintain documentation of maintenance and sanitation schedules and any
682 remedial practices for a period of two years.

683 **10. ISSUE: EQUIPMENT FACILITATED CROSS CONTAMINATION**

684 When farm equipment has had direct contact with raw untreated manure, untreated compost,
685 waters of unknown quality, animals of significant risk, or other potential human pathogen
686 reservoirs it may be a source of cross contamination. Such equipment should not be used in
687 proximity to or in areas where it may contact edible portions of lettuce and or leafy greens.
688

689 **10.1. The Best Practices Are:**

- 690 ● Identify any field operations that may pose a risk for cross-contamination. These
691 include management personnel in the fields, vehicles used to transport workers,
692 as well as many other possibilities.
- 693 ● Segregate equipment used in high-risk operations or potentially exposed to high
694 levels of contamination.
- 695 ● Use effective means of equipment cleaning and sanitation before subsequent
696 equipment use in lettuce/leafy greens production, if it was previously used in a
697 high-risk operation.

- 698 • Develop appropriate means of reducing and controlling the possible transfer of
699 human pathogens to soil and water that may directly contact edible lettuce/leafy
700 green tissues through use of equipment.
- 701 • Maintain appropriate records related to equipment cleaning and possible cross-
702 contamination issues for a period of two years.

703

704 **11. ISSUE: FLOODING**

705 Flooding for purposes of this document is defined as the flowing or overflowing of a field
706 with water outside of a grower’s control, that is reasonably likely to contain microorganisms
707 of significant public health concern and is reasonably likely to cause adulteration of the
708 edible portions of fresh produce in that field. Pooled water (e.g., rainfall) that is not
709 reasonably likely to contain microorganisms of significant public health concern and is not
710 reasonably likely to cause adulteration of the edible portion of fresh produce should not be
711 considered flooding.

712

713 If flood waters contain microorganisms of significant public health concern, crops in close
714 proximity to soil such as lettuce/leafy greens may be contaminated if there is direct contact
715 between flood water or contaminated soil and the edible portions of lettuce/leafy greens
716 (Wachtel *et al.* 2002a;2002b).

717

718 In the November 4, 2005 FDA "Letter to California Firms that Grow, Pack, Process, or Ship
719 Fresh and Fresh-cut Lettuce/leafy greens" the agency stated that it "considers ready to eat
720 crops (such as lettuce/leafy greens) that have been in contact with flood waters to be
721 adulterated due to potential exposure to sewage, animal waste, heavy metals, pathogenic
722 microorganisms, or other contaminants. FDA is not aware of any method of reconditioning
723 these crops that will provide a reasonable assurance of safety for human food use or
724 otherwise bring them into compliance with the law. Therefore, FDA recommends that such
725 crops be excluded from the human food supply and disposed of in a manner that ensures they
726 do not contaminate unaffected crops during harvesting, storage or distribution.

727

728 “Adulterated food may be subject to seizure under the Federal Food, Drug, and Cosmetic
729 Act, and those responsible for its introduction or delivery for introduction into interstate
730 commerce may be enjoined from continuing to do so or prosecuted for having done so. Food
731 produced under unsanitary conditions whereby it may be rendered injurious to health is
732 adulterated under § 402(a)(4) of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 342(a)
733 (4); (US FDA 2004).

734

735 Areas that have been flooded can be separated into three groups: 1) product that has come
736 into contact with flood water, 2) product that is in proximity to a flooded field but has not
737 been contacted by flood water, and 3) production ground that was partially or completely
738 flooded in the past before a crop was planted. The considerations for each situation are
739 described below and presented in Table 4.

740

741 **11.1. The Best Practices For Product That Has Come Into Contact With**
742 **Flood Water Are:**

- 743 • See Table 4 for numerical criteria for lettuce and leafy greens production fields
744 that have possibly come into contact with flood waters. The “Technical Basis
745 Document” (Appendix B) describes the process used to develop these metrics.
- 746 • FDA considers any crop that has come into contact with floodwater to be an
747 “adulterated” commodity that cannot be sold for human consumption.
- 748 • To reduce the potential for cross contamination do not drive harvest equipment
749 through flooded areas reasonably likely to contain microorganisms of public
750 health significance (see previous section).

751

752
753

TABLE 4. FLOODING

When evidence of flooding in a production block occurs.

Practice	Metric/Rationale
Flooding Defined	The flowing or overflowing of a field with water outside a grower’s control that is reasonably likely to contain microorganisms of significant public health concern and is reasonably likely to cause adulteration of edible portions of fresh produce in that field. Additional discussion of this definition and implications for production is provided in the text portion of this document.
Allowable Harvest Distance from Flooding	<ul style="list-style-type: none"> • Buffer and do not harvest any product within 30 ft of the flooding. • Required buffer distance may be greater than 30 ft based on risk analysis by food safety professional. • If there is evidence of flooding, the production block must undergo a detailed food safety assessment by appropriately trained food safety personnel (see Glossary) prior to harvest, as defined in the text of this document.
Verification	<ul style="list-style-type: none"> • Documentation must be archived for a period of two years following the flooding event. Documentation may include photographs, sketched maps, or other means of delineating affected portions of production fields.
Time Interval Before Planting Can Commence Following the Receding of Floodwaters	<ul style="list-style-type: none"> • 60 days prior to planting provided that the soil has sufficient time to dry out. • Appropriate soil testing can be used to shorten this period to 30 days prior to planting. This testing must be performed in a manner that accurately represents the production field and indicates soil levels of microorganisms lower than the recommended standards for processed compost. Suitable representative samples should be collected for the entire area suspected to have been exposed to flooding. For additional guidance on appropriate soil sampling techniques, use the <i>Soil Screening Guidance: Technical Background Document</i> (US EPA 1996). Specifically, Part 4 provides guidance for site investigations. Reputable third-party environmental consultants or laboratories provide sampling services consistent with this guidance. • Appropriate mitigation and mitigation strategies are included in the text portion of the document.
Rationale	<ul style="list-style-type: none"> • The basis for the 30 foot distance is the turn around distance for production equipment to prevent cross-contamination of non-flooded ground or produce.

754
755

756 **11.2. The Best Practices for Product in Proximity to a Flooded Area But**
757 **Not Contacted By Flood Water Are:**

- 758 • Prevent cross contamination between flooded and non-flooded areas (e.g.
759 cleaning equipment, eliminating contact of any farming or harvesting equipment
760 or personnel with the flooded area during growth and harvest of non-flooded
761 areas).
- 762 • To facilitate avoiding contaminated/adulterated produce, place markers
763 identifying both the high-water line of the flooding and an interval 30 feet beyond
764 this line. If 30 feet is not sufficient to prevent cross contamination while turning
765 harvesting or other farm equipment in the field, use a greater appropriate interval.
766 Take photographs of the area for documentation. Do not harvest product within
767 the 30 foot buffer zone.

768

769 **11.3. The Best Practices For Formerly Flooded Production Ground Are:**

- 770 • Allow soils to dry sufficiently and be reworked prior to planting subsequent crops
771 on formerly flooded production ground.
- 772 • Do not replant formerly flooded production ground for at least 60 days following
773 the receding of floodwaters. This period or longer and active tillage of the soil
774 provide additional protection against the survival of pathogenic organisms.
- 775 • If flooding has occurred in the past on the property, soil clearance testing may be
776 conducted prior to planting leafy greens. Soil testing may be used to shorten the
777 clearance period to 30 days. If performed, testing must indicate soil levels of
778 microorganisms lower than the standards for processed compost. Suitable
779 representative samples should be collected for the entire area suspected to have
780 been exposed to flooding.
- 781 • Sample previously flooded soil for the presence of microorganisms of significant
782 public health concern or appropriate indicator microorganisms. Microbial soil
783 sampling can provide valuable information regarding relative risks; however,
784 sampling by itself does not guarantee that crops grown within the formerly
785 flooded production area will be free of the presence of human pathogens.
- 786 • Prior to replanting or soil testing, the designated food safety professional for the
787 grower shall perform a detailed food safety assessment of the production field.
788 This designated professional will be responsible for assessing the relative merits
789 of testing versus observing the appropriate time interval for planting, and also
790 will coordinate any soil testing plan with appropriate third-party consultants
791 and/or laboratories that have experience in this type of testing.
- 792 • Evaluate the field history and crop selection on formerly flooded production
793 ground.
- 794 • Assess the time interval between the flooding event, crop planting, and crop
795 harvest. Comparative soil samples may be utilized to assess relative risk if

796 significant reductions in indicator microorganisms have occurred within this time
797 interval.

798 • Evaluate the source of flood waters (e.g., drainage canal, river, irrigation canal,
799 etc.) for potential significant upstream contributors of human pathogens at levels
800 that pose a significant threat to human health.

801 • Prevent cross-contamination by cleaning or sanitizing any equipment that may
802 have contacted previously flooded soil (also see the section on Equipment
803 Facilitated Cross Contamination above).

804 **12. ISSUE: WATER USAGE TO PREVENT PRODUCT DEHYDRATION**

805 Lettuce/leafy greens may be sprayed with small amounts of water during machine harvest or
806 in the field container just after harvest to reduce water loss. Water used in harvest operations
807 may contaminate lettuce and leafy greens if there is direct contact of water containing human
808 pathogens with edible portions of lettuce/leafy greens.
809

810 **12.1. The Best Practices Are:**

811 • Due to the timing of application of water that directly contacts edible portions of
812 lettuce/leafy greens, assure the water is of appropriate microbial quality (e.g.,
813 meets U.S. EPA microbial standards for drinking water).

814 • Test the water source periodically to demonstrate it is of appropriate microbial
815 quality for its intended purpose (e.g., meets U.S. EPA or WHO microbial
816 standards for drinking water) or assure that it has appropriate disinfection
817 potential as described in Table 1.

818 • Establish and implement cleaning and sanitation schedules for containers and
819 equipment that will be used in hydration.

820 • Maintain logs documenting cleaning and sanitation, and retain these records for
821 at least two years.

822 • Establish policies for the storage and control of water tanks and equipment used
823 for hydration operations when not in use.

824

825 **13. ISSUE: PRODUCTION LOCATIONS - CLIMATIC CONDITIONS AND ENVIRONMENT**

826 Lettuce/leafy greens are grown in varying regions but generally in moderate weather
827 conditions. Cool, humid conditions favor human pathogen persistence (Takeuchi and Frank
828 2000; Takeuchi *et al.* 2000) while drier climates may present other problems such as
829 requirements for additional water that may increase the potential for introduction of human
830 pathogens. Heavy rains in certain areas may also cause lettuce/leafy greens to be exposed to
831 contaminated soil due to rain splashing. It is important to tailor practices and procedures
832 designed to promote food safety to the unique environment in which each crop may be
833 produced
834

835 **13.1. The Best Practices Are:**

- 836 • Consider harvest practices such as removing soiled leaves, not harvesting soiled
837 heads, etc., when excessive soil or mud builds up on lettuce/leafy greens.
- 838 • Take care to reduce the potential for windborne soil, including soil from roads
839 adjacent to fields, water, or other media that may be a source of contamination to
840 come into direct contact with the edible portions of lettuce and leafy greens. Do not
841 allow runoff from adjacent properties to come into contact with produce.
- 842 • Evaluate and implement practices to reduce the potential for the introduction of
843 pathogens into production blocks by wind or runoff. Such practices may include but
844 are not limited to berms, windbreaks, diversions ditches and vegetated filter strips.
- 845 • When soil has accumulated on plants, remove soil during the harvest or further
846 processing.

847

848 **14. ISSUE: PRODUCTION LOCATIONS - ENCROACHMENT BY ANIMALS AND URBAN**
849 **SETTINGS**

850 Lettuce/leafy greens are generally grown in rural areas that may have adjacent wetlands,
851 wildlands, and/or parks harboring wildlife. Some wildlife species are known to be potential
852 carriers of various human pathogens (Fenlon 1985). Specific wildlife species that have been
853 shown to pose the greatest risk are the focus of this section and are listed in Table 5. In
854 addition, extensive development in certain farming communities has also created situations
855 with urban encroachment and unintentional access by domestic animals and livestock which
856 may also pose varying degrees of risk depending on the animal species. Finally, it is possible
857 that some land uses may be of greater concern than others when located near production
858 fields. Table 6 provides a list of these uses and recommended buffer distances.
859

860 **14.1. The Best Practices Are:**

- 861 • See Tables 5 and 6 and Decision Tree (Figure 5) for numerical criteria and
862 guidance applicable to animal encroachment and adjacent land uses. The
863 “Technical Basis Document” (Appendix B) describes the process used to develop
864 these metrics.
- 865 • During the Environmental Assessments discussed in Section 2, the location of
866 any adjacent land uses that may be of potential risk should be documented. In
867 addition, as specified in Table 6, any deviations from the recommended buffer
868 distances due to mitigation factors or increased risk should be documented and
869 explained.
- 870 • Fencing, vegetation removal, and destruction of habitat may result in adverse
871 impacts to the environment. Potential adverse impacts include loss of habitat to
872 beneficial insects and pollinators; wildlife loss; increased discharges of sediment
873 and other pollutants resulting from the loss of vegetative filtering; and increased
874 air quality impacts if bare soil is exposed to wind. It is recommended that
875 producers check for local, state, and federal laws and regulations that protect

- 876 riparian habitat, restrict removal of vegetation or habitat, or restrict construction
877 of wildlife deterrent fences in riparian areas or wildlife corridors.
- 878 • Document any observed encroachment by animals of significant risk during
879 production periods.
 - 880 • Evaluate and monitor animal of significant risk activity in and proximate to
881 lettuce/leafy greens fields and production environments. Conduct periodic
882 monitoring, pre-season, pre-harvest, and harvest assessments. If there are
883 animals of significant risk present, make particular efforts to reduce their access
884 to lettuce and leafy green produce.
 - 885 • Evaluate the risk to subsequent crop production on production acreage that has
886 experienced recent postharvest grazing with or by domesticated animals that used
887 field culls as a source of animal feed.
 - 888 • Locate production blocks to minimize potential access by animals of significant
889 risk and maximize distances to possible sources of microbial contamination. For
890 example, consider the proximity to water (i.e., riparian areas), animal of
891 significant risk harborage, open range lands, non-contiguous blocks, urban
892 centers, etc. Periodically monitor these factors and assess during pre-season and
893 preharvest assessments as outlined in Tables 5 and 6. If the designated food
894 safety professional deems that there is the potential for microbial contamination
895 from adjacent areas, a risk assessment shall be performed to determine the risk
896 level as well as to evaluate potential strategies to control or reduce the
897 introduction of human pathogens.
 - 898 • DO NOT harvest areas of fields where unusually heavy activity by animals of
899 significant risk occurs. If animal of significant risk intrusions are common on a
900 particular production field, consider fencing, barriers, noisemakers, and other
901 practices that may reduce intrusions.
 - 902 • Train harvest employees to recognize and report evidence (e.g., feces) of animal
903 of significant risk activity.
 - 904 • Pooled water (e.g., a seasonal lake) from rainfall may attract animals of
905 significant risk and should be considered as part of any land use evaluation.
 - 906 • Consider controlling risks associated with encroachment by urban development.
907 Risks may include, but are not limited to, domestic animal fecal contamination of
908 production fields and harvest equipment and septic tank leaching.
 - 909 • Growers are encouraged to contact the relevant agencies (e.g., the Regional
910 Water Quality Control Board and state and federal fish and wildlife agencies) to
911 confirm the details of these requirements. In addition, growers may wish to
912 consult with local NRCS to evaluate the food safety risks associated with wildlife
913 of significant risk, livestock, domestic animals and other adjacent land uses and
914 to develop and document strategies to control or reduce the introduction of
915 human pathogens through wildlife of significant risk for each production block.

916 **TABLE 5. ANIMAL OF SIGNIFICANT RISK ACTIVITY IN FIELD (WILD OR DOMESTIC)**
 917 When evidence of animal of significant risk intrusion in a production block occurs.

Issue	Metric	Remedial Actions
Evidence of Intrusion	<p><u>Frequency</u></p> <ul style="list-style-type: none"> • There shall be a periodic monitoring plan in place for production fields. • There shall be Pre Season, Pre Harvest, and Harvest Assessments <p><u>Variables</u></p> <ul style="list-style-type: none"> • Physical observation of animals in the field • Downed fences • Animal tracks in production block • Animal feces or urine in production block • Eaten plants in production block <p><u>Animals of Significant Risk</u></p> <ul style="list-style-type: none"> • Deer • Pigs (wild and domestic) • Cattle • Goats and Sheep 	<ul style="list-style-type: none"> • If there is evidence of intrusion by animals of significant risk, the production block must undergo a detailed food safety assessment by appropriately trained food safety personnel (see Glossary) prior to harvest, as defined in the text of this document. • In developing remedial and corrective actions, consider consulting with wildlife and/or domestic animal experts as appropriate. • If remedial actions cannot be formulated that control or eliminate the identified risk, destroy the block by disking under the crop. • Equipment used to destroy crop must be cleaned and sanitized upon exiting the field. • Investigate potential causes for intrusion by animals of significant risk and assess the extent of intrusion and impact on crop food risk. • Formulate effective corrective actions. Prior to taking action that may affect natural resources, growers should check local, state and federal laws and regulations that protect riparian habitat, restrict removal of vegetation or habitat, or restrict construction of wildlife deterrent fences in riparian areas or wildlife corridors. • Evidence of intrusion by animals of significant risk and corrective actions shall be documented and available for verification for a period of two years.
Allowable Harvest Distance from Evidence of Intrusion	<p>Please see Figure 5. Decision Tree for Conducting Pre-Harvest and Harvest Assessments.</p> <p><u>Monitoring</u> Evaluate and monitor animal of significant risk activity in and proximate to lettuce/leafy greens fields and production environments. Conduct periodic monitoring, pre-season, pre-harvest, and harvest assessments.</p> <p><u>Pre Harvest Assessment:</u> Conduct the pre-harvest assessment not more than one week prior to harvest.</p> <p>Fecal Material</p> <ul style="list-style-type: none"> • Do not harvest any produce that has come into direct contact with fecal material. • If evidence of fecal material is found, conduct a food safety assessment using qualified personnel. Do not harvest any crop found within a minimum 5 foot radius buffer distance from the spot of the contamination unless remedial action can be found that 	

Issue	Metric	Remedial Actions
	<p>adequately control the risk. The food safety professional can increase this buffer distance if deemed appropriate.</p> <ul style="list-style-type: none"> Remove fecal material from the field and dispose of properly. <p>Intrusion</p> <ul style="list-style-type: none"> If evidence of animal of significant risk intrusion is found in a production field, conduct a visual food safety assessment to determine whether the areas of intrusion can be adequately controlled (e.g., solitary deer track with no evidence of feeding), or whether a three foot buffer radius non-harvest area should be applied (e.g., wide areas of wild pig rooting and tracks). <p><u>Harvest Assessment</u></p> <p>If evidence of animal of significant risk intrusion into the production block is not discovered until harvest operations:</p> <ul style="list-style-type: none"> Stop harvest operations. Initiate an intensified block assessment for evidence of further contamination and take appropriate actions per the aforementioned actions. If evidence of intrusion is discovered during production block harvest operations and the harvest rig has been potentially contaminated by contaminated product or feces, clean and sanitize the equipment before resuming harvest operations. Require all employees to wash and sanitize their hands/gloves before resuming harvest operations. If contamination is discovered in harvest containers such as bins/totes, discard the product, and clean and sanitize the container before reuse. 	
Verification	<ul style="list-style-type: none"> Archive documentation for a period of two years following the intrusion event. Documentation may include photographs, sketched maps, or other means of delineating affected portions of production fields. 	
Rationale	<ul style="list-style-type: none"> The basis of these metrics is qualitative assessment of the relative risk from a variety of intrusions. Some animal feces and some signs of intrusion (feces vs. tracks) are considered to be of more concern than others. Because it is difficult to develop quantitative metrics for these types of risks, a food safety assessment is considered appropriate for this issue. 	

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930 **TABLE 6. CROP LAND AND WATER SOURCE ADJACENT LAND USE**

Land Use/Water Source	Metric (This distance may be either increased or decreased depending on risk and mitigation factors.)	Considerations for Risk Analysis*		
		Risk/Mitigation Factors	Increase Distance	Decrease Distance
Composting Operations (manure or animal products)	Due to the lack of science at this time, an interim guidance distance of 400 ft from the edge of crop is proposed. This number is subject to change as science becomes available. The proximate safe distance depends on the risk/mitigation factors listed to the right. Evaluate risk and document consideration of these factors. Research is being proposed to study appropriate distance.	Distance from active compost operation	--	--
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from composting operations	√	
		Opportunity for soil leaching	√	
		Presence of physical barriers such as windbreaks, diversion ditches, vegetative strips		
Concentrated Animal Feeding Operations (as defined in 40 CFR 122.23)	Due to the lack of science at this time, an interim guidance distance of 400 ft from the edge of crop is proposed. This number is subject to change as science becomes available. The proximate safe distance depends on the risk/mitigation factors listed to the right. Evaluate risk and document consideration of these factors. Research is being proposed to study appropriate distance.	Fencing and other physical barriers such as berms, diversion ditches and vegetated strips can be employed to prevent intrusion of domestic animals, control runoff, etc.		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from CAFOs	√	
		Opportunity for soil leaching	√	
		Manure Management Program utilized		
Non-synthetic Soil Amendment Pile (containing manure or animal products)	Due to the lack of science at this time, an interim guidance distance of 400 ft from the edge of crop is proposed. This number is subject to change as science becomes available. The proximate safe distance depends on the risk/mitigation factors listed to the right. Evaluate risk and document consideration of these factors. Research is being proposed to study appropriate distance.	Access and review COA for materials in question.		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from non-synthetic soil amendment storage areas	√	
		Opportunity for soil leaching	√	
		Covering on pile to prevent wind dispersion		

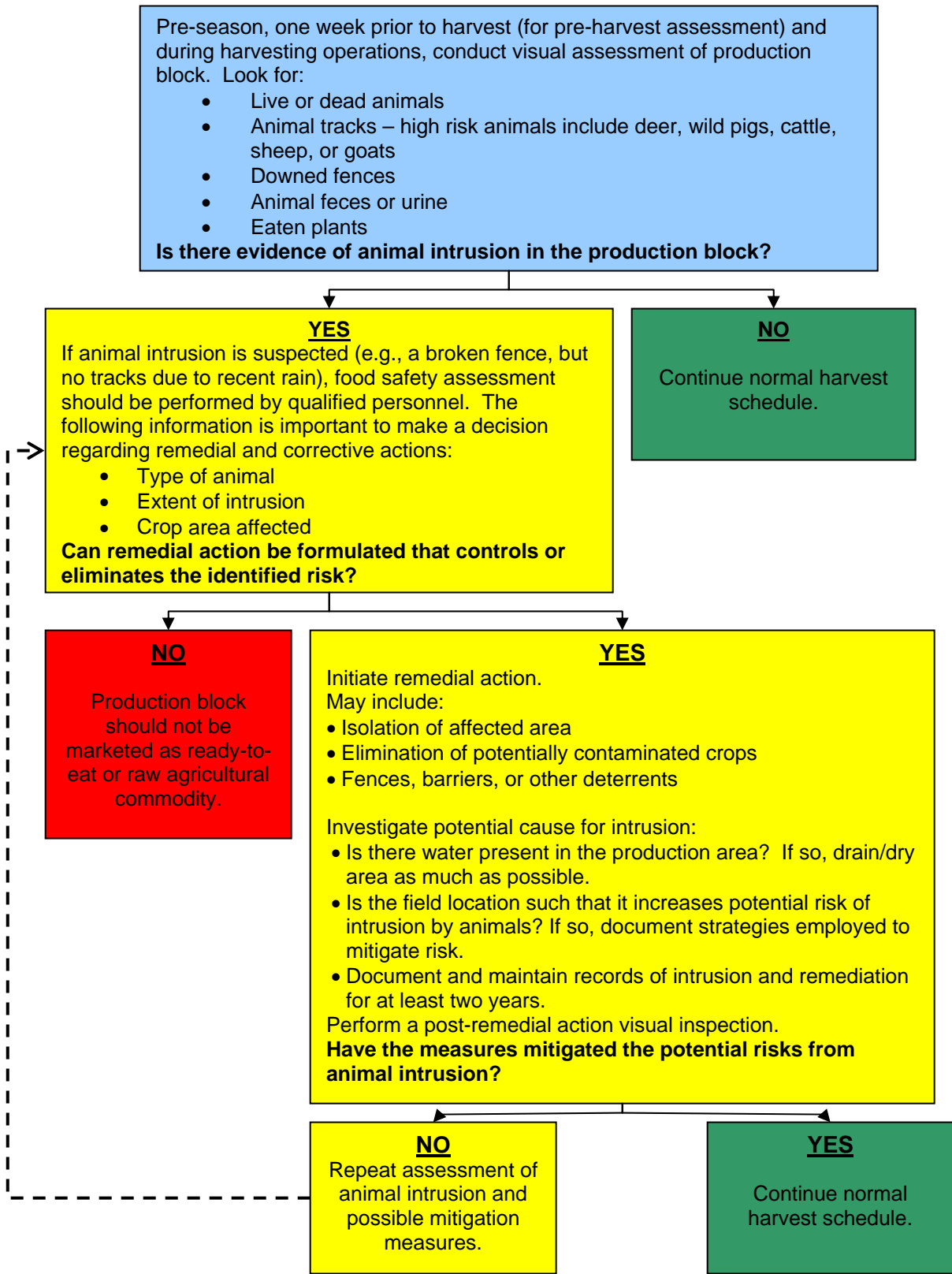
Land Use/Water Source	Metric (This distance may be either increased or decreased depending on risk and mitigation factors.)	Considerations for Risk Analysis*		
		Risk/Mitigation Factors	Increase Distance	Decrease Distance
Grazing Lands/Domestic Animals (includes homes with hobby farms, and non commercial livestock)	30 ft from the edge of crop.	Fencing and other physical barriers such as berms, diversion ditches and vegetated strips can be employed to prevent intrusion of domestic animals, control runoff, etc.		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Opportunity for water run off through or from grazing lands	√	
		Opportunity for soil leaching	√	
Homes or other building with a septic leach field.	30 ft from the edge of crop to the leach field.	Active leach field: < 10 yrs old		√
		Active leach field: > 25 yrs old	√	
		Inactive leach field		√
		Topography: Uphill from crop	√	
		Topography: Downhill from crop		√
		Physical barriers		√
Well Head Distance from Untreated Manure	200 ft separation of untreated manure from wells, although less distance may be sufficient.	Topography: Uphill from manure		√
		Topography: Downhill from manure	√	
		Opportunity for water run off from or through untreated manure to well head	√	
		Opportunity for soil leaching	√	
Surface Water Distance from Untreated Manure	At least 100 feet separation for sandy soil and 200 feet separation for loamy or clay soil (slope less than 6%; increase distance to 300 feet if slope greater than 6%) is recommended.	Presence of physical barriers such as windbreaks, diversion ditches, vegetative strips		√
		Topography: Uphill from manure		√
		Topography: Downhill from manure	√	
		Opportunity for water runoff from or through untreated manure to surface waters.	√	

Land Use/Water Source	Metric (This distance may be either increased or decreased depending on risk and mitigation factors.)	Considerations for Risk Analysis*		
		Risk/Mitigation Factors	Increase Distance	Decrease Distance
		Opportunity for soil leaching	√	
		Presence of physical barriers such as windbreaks, diversion ditches, vegetative strips		√
Rationale	<ul style="list-style-type: none"> The bases for these distances above is best professional judgment of authors, contributors, and expert reviewers to prevent potential cross-contamination from adjacent land uses, taking into consideration the 200 foot distance cited in FDA (US FDA 2001) for separation of manure from wellheads and the 30 foot turn-around distance for production equipment. Because of the numerous factors that must be taken into account to determine appropriate distances, a qualitative assessment of the relative risk from various types of land use and surface waters was used to determine appropriate distances. 			

931 Growers should check for local, state and federal laws and regulations that protect riparian habitat, restrict removal of vegetation or habitat, or restrict construction of
 932 wildlife deterrent fences in riparian areas or wildlife corridors. Growers may want to contact the relevant agencies (e.g., the Regional Water Quality Control Board and
 933 state and federal fish and wildlife agencies) to confirm the details of these requirements.

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Figure 5. Decision Tree for Conducting Pre-harvest and Harvest Assessment of Animal Activity in Field (Wild or Domestic)



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941 **15. DETAILED BACKGROUND GUIDANCE INFORMATION**

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943 **15.1. Required Reference Documents**

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- 945 1. FDA Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables
946 (www.foodsafety.gov/~dms/prodguid.html)
- 947 2. UFFVA Food Safety Auditing Guidelines: Core Elements of Good Agricultural Practices for Fresh
948 Fruits and Vegetables
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