GOOD BINES

Hazard Analysis of Critical Control Points

(HACCP)

DRIED WHOLE CONE HOP BALES

USAHOPS
HOP GROWERS OF AMERICA

Developed by M2-Ag Assurance, LLC. on behalf of Hop Growers of America

Reviewer Signature:			First Review Date: 08.01.20
Reviewer Signature:			Annual Review Date:
CHANGE RECORD			
Rev:	**Date:**	**Approvals**	Description of Change

I. INTRODUCTION TO HACCP

Hazard Analysis Critical Control Point, or HACCP, is a system, which gives us a pro-active common-sense application to the safety management of our food products. HACCP is a systematic, scientific approach to the identification, evaluation, and control of food safety hazards. The benefits of the HACCP system are as follows:

- A Preventative System
- A Systematic Approach
- Helps demonstrate 'Due Diligence'
- Internationally accepted
- Strengthens Quality Management Systems
- Facilitates regulatory inspection/external audits
- Demonstrates Management commitment

This HACCP Plan has been prepared in accordance with CODEX Alimentarius Guidelines for HACCP, and the International HACCP Alliance "Development and Implementation of HACCP For Food Processors and Food Related Industries."

II. SEVEN PRINCIPLES OF HACCP

1. Conduct a hazard analysis: *Identify potential hazards – documented validated control*
2. Determine the critical control points (CCP's): *Hazard analysis risk assessment*
3. Establish critical limits: *Must be scientific and absolute - not a range*
4. Establish monitoring procedures: *Define what, how, who and frequency*
5. Establish corrective actions: *Root cause analysis*
6. Establish verification procedures: *Documentation, visual inspection/observation, and verify instrument calibration*
7. Establish record-keeping and documentation procedures: *Policies, procedures, SOP's, forms - document control*

III. SCOPE

This HAACP Plan is to identify, control, prevent and/or eliminate potential food safety hazards during the standard industry practice of producing of dried whole cone hop bales. This Plan provides a generic overview of:

- Growing
- Harvesting
- Picking
- Drying
- Cooling
- Baling
- Transportation

IV. HACCP TEAM

The HACCP Team is comprised of members from the HGA Best Practices Committee and certified third-party consultants. This Plan is to be reviewed annually and/or when significant changes occur in the process.

V. DEFINITIONS

Codex Alimentarius Commission: Develops harmonized international food standards, guidelines, and codes of practice to protect the health of the consumers and ensure fair practices in the food trade. The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations

Control: To manage the conditions of an operation to maintain compliance with established criteria, and the state where correct procedures are being followed and criteria are being met

Control Measure: Any action or activity that can be used to prevent, eliminate, or reduce a significant hazard

Control Point (CP): Any step at which biological, chemical, or physical factors can be controlled

Corrective Action (CA): Procedures followed when a deviation occurs

Critical Control Point (CCP): A step at which control can be applied and is ESSENTIAL to prevent or eliminate a food safety hazard, or reduce it to an acceptable level

Critical Limit (CL): A maximum and/or minimum value to which a biological, chemical, or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard

Deviation: Failure to meet a critical limit

HACCP: Hazard Analysis Critical Control Point. A systematic approach to the identification, evaluation, and control of food safety hazards

HACCP Plan: The written document describing the procedures to control food safety to be followed based on HACCP principles

HACCP System: The result of implementation of a HACCP Plan

HACCP Team: The group of people who are responsible for developing, implementing, and maintaining the HACCP System

Hazard: Any biological, chemical, or physical contaminant that is reasonably likely to cause illness or injury in the absence of control

Hazard Analysis: The process of collecting and evaluating information on hazards associated with the food under consideration to decide which are significant and must be addressed in the

HACCP Plan Monitoring: To conduct a planned sequence of observations or measurements to assess whether a CCP is under control, and to produce an accurate record for future use in verification

Prerequisite Programs: Procedures (SOP's), including Good Manufacturing Practices (GMP's), that address operational conditions providing the foundation for the HACCP system

Severity: The seriousness of the effect(s) of a hazard

Step: A point, procedure, operation, or stage in the food system from primary production to final consumption

Validation: That element of verification focused on collecting and evaluating scientific and technical information to determine if the HACCP Plan, when properly implemented, will effectively control the hazards
Verification: Those activities, other than monitoring, that determine the validity of the HACCP plan, and that the system is operating according to plan

VI. METHODOLOGY

The method used to establish CP's and CCP's within this HACCP Plan have been based on the significance of each hazard as determined by the risk analysis table.

Hazards which can be controlled, prevented, or eliminated by the implementation of Pre-Requisite Programs are identified in the risk analysis and have not been identified in the HACCP table as CCP's, but as Control Points (CP's).

All other hazards not controlled by PRP's and defined as highly significant within the Risk Analysis Table have been carried over to the HACCP table as a CCP's. These hazards are all monitored and a record of that activity maintained.

Hazards defined as less than significant within the Risk Analysis Table are not carried over to the HACCP Table and may not be monitored or a record maintained.

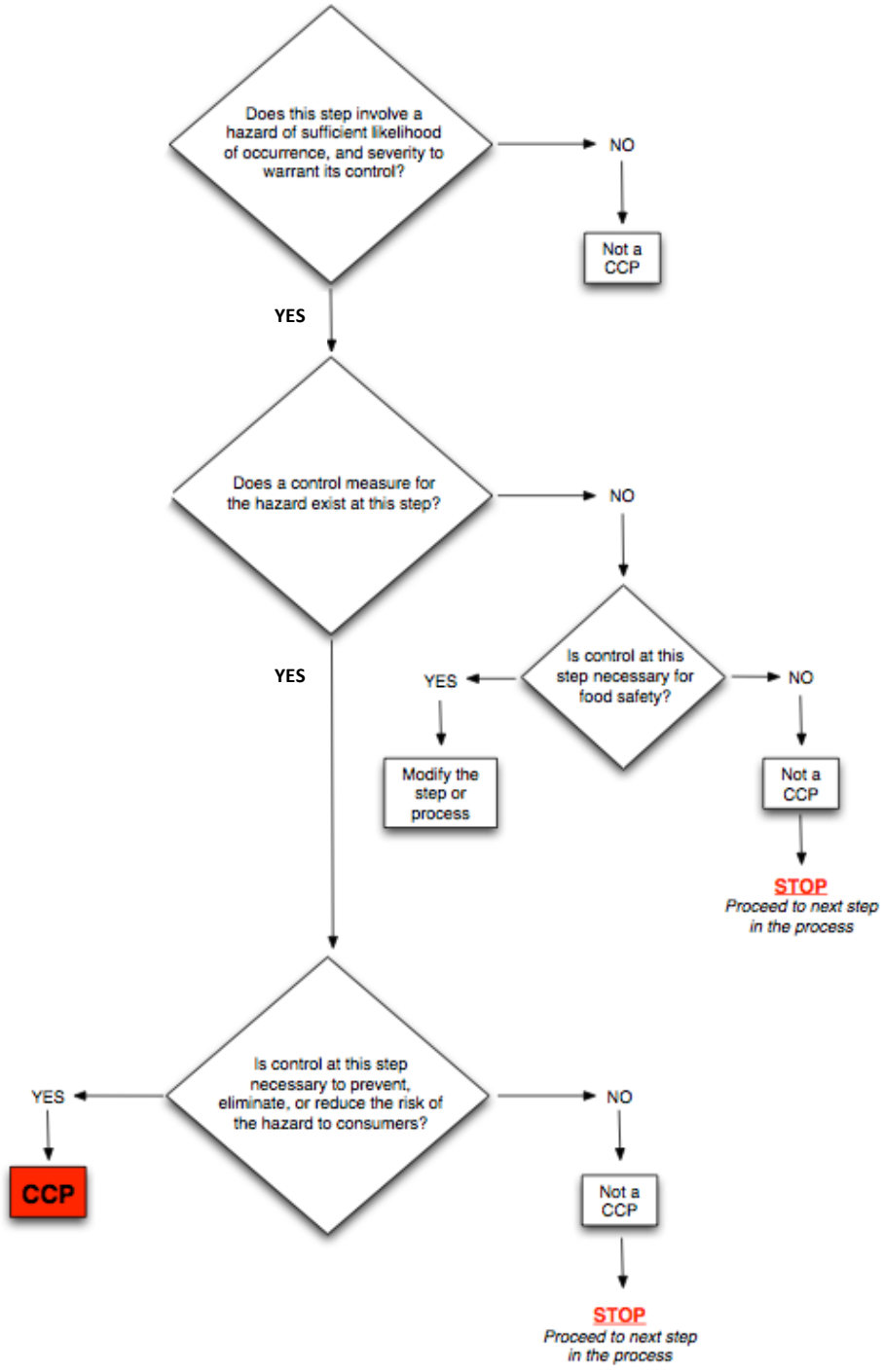
- **TOTAL RISK = LIKELIHOOD x SEVERITY**

LIKELIHOOD *The likelihood of potential harm from the process/product*	**SEVERITY** *The severity of potential harm from the process/product*
3 = Probable	3 = Critical
2 = Possible	2 = Major
1 = Unlikely	1 = Minor

LIKELIHOOD	**SEVERITY**			**SCORE**		
	1	**2**	**3**			
1	1	2	3	**1-3**	=	**Not Significant (no action/low priority)**
2	2	4	6	**4-6**	=	**May Require Control (medium action)**
3	3	6	9	**9**	=	**Significant (urgent action)**

VII. RISK CATEGORY DECISION TREE

The HACCP Decision Tree is a sequence of questions to assist in determining whether a hazard control point is a critical control point (CCP) or not (CP):



VIII. PRODUCT IDENTIFICATION & INTENDED USE

- **Identification:**
  Hop bales are identified per the Hop Growers of America's authorized lot coding standard which is comprised of the following information and stenciled or ink jet labeled onto bale.

  <two-digit crop year - two letter state ID + HGA issued grower # - grower lot#>/
  3 letter variety code

  EXAMPLE:
  20-WA123-001
  CIT

- **Intended Use:**
  Hops are used as an ingredient for the brewing of beer and distributed to both domestic and international brewers and marketers for further processing. Hops are typically added to the brew kettle or used for dry hopping at a later stage during fermentation.

IX. PRODUCT DESCRIPTION SHEET

Product Name:	Whole Hop Cones
Product Appearance:	Hop cones are typically light to dark green in color, depending on variety. Compressed dried hop cones are oval or round in shape.
Relevant Safety Information:	Predominantly used as an ingredient in the brewing of beer. Grown above ground, outside.
Process Method:	Hop cones are grown from certified plant stock as single varieties. Cones are removed from the hop bine, dried, cooled, and compressed into a ~200 lb bale. According to variety, hops are typically categorized as; aroma, bitter, and dual purpose. The mixing of varieties is not allowed.
Food Additives:	None
Preservatives:	None
Allergens:	*None
Processing Aids:	Propane, Natural Gas are used in the drying process. Mineral oil and/or other food grade oil(s) used as lubricant/cleaner on cooling floor and conveyor belts.
Packaging:	Bulk packaged compressed into a 150-200 lb (approx.) polycloth or food grade burlap bale.
Labeling:	Crop Year, State ID+Grower Number, Lot Number, Variety Abbreviation EXAMPLE: 20-WA123-001 CIT
Storage Conditions:	Store in a cool, dry place at 26-34° F.
Shelf Life:	Best used within 1 year from production.
Method of Distribution:	Typically transported on flatbed trucks to processor and/or brewer for further processing and storage. Not to be shipped with non-food products, hazardous materials, chemicals, and/or products which exude strong aromatic characteristics.
Expected Uses:	Predominantly further processed and used as an ingredient for the brewing of beer. Typically added to the brew kettle, or used for dry hopping at a later stage during fermentation. Distributed to brewers and processor/marketers for further processing.
Vulnerable Groups of Population:	Not a common practice to consume whole cone hops by any group as a stand alone food product. No known allergens or high risk category concern if consumed raw.
Potential For Abuse:	Poor drying and/or storage may lead to product quality issues.

**None: The USFDA identifies major food allergens as; milk, eggs, fish, crustacean shellfish, tree nuts, peanuts, wheat and soybeans. Historically, there have been no known confirmed allergens used in the standard production of dried hops.*

X. PRODUCT FLOW DIAGRAM FOR GROWING, HARVESTING & HANDLING

MATERIALS & INPUTS

TRELLIS:
Poles
Anchors
Wire Cable
Twine
Clips
Yard Signage

IRRIGATION:
Delivery System
(drip tube/tape
sprinklers, pumps, etc.)
Water Fertigation/
Chemigation/Moisture Meters
(optional)

PLANTING MATERIALS:
Weed mat (optional)
Plant Stock
Cover Crop Seed (optional)

FERTILIZERS
COMPOST (optional)

PLANT PROTECTION PRODUCTS
FUMIGANTS (optional)

FUEL:
Natural Gas
Propane
Diesel
Gasoline

PROCESSING AIDS:
Mineral Oil
Food Grade Oils/Lubricants
Hydraulic Oil

KILN CLOTH

PACKAGING MATERIALS:
Bale Cloth (polycloth, burlap)
Polystring (plastic twine)
Ink

POTABLE DRINKING WATER

PROCESS

1. SOIL PREPARATION
Fumigation (optional), addition of compost and/ or soil amendments, tilling ground

2. TRELLIS & PLANTING
New yards only or replacement materials and/or plants from previous season

3. IRRIGATION
Application of water, fertilizers and/or plant protection products to plants

4. BURN DOWN
Chemical and/or physical burning of first growth for pest control, plant health and harvest timing

5. TWINING
Twine is anchored to ground for stability

6. TRAINING
Bines are trained onto twine

7. GROWING
PPP/Fertilizer Applications, Irrigation, Rouging (removal of buck vines/males) Pest Scouting

8 & 9. FIELD HARVEST & TRANSPORTATION
Mechanically removing bines from trellis and transporting to picking facility

10. PICKING/CLEANING
Mechanically separating cones from bine, stems and leaves

11. DRYING
Cones are dried for 8-10 hrs. using forced air at 125-130F until targeted moisture of ~9-11%. Potable water used in misting (optional)

12. COOLING
Cones are piled on floor to cool for 12-24 hrs. until temperature and moisture are stabilized

13. BALING
Cones are compressed into ~200 lb. bale, sewn into bale cloth and stenciled/labeled

14. TRANSPORTATION
Finished bales are transported to customer for further processing

WASTE

PLANTING POTS
Recycled, Reused or Disposed

EMPTY FERTILIZER/PPP CONTAINERS
Recycled or Disposed

FOREIGN MATERIAL
Rocks, wood, metal, glass, etc. from rock drops, fans, separators, magnets are disposed of

BALE CLOTH WASTE
Recycled, Reused or Disposed

HOP WASTE
Bines, stems, leaves and twine mulched and spread onto yard rows and/or roads (by variety)

FOREIGN MATERIAL CONTROL

SCREENS
FANS
MAGNETS
ROCK DROPS
VISUAL/MANUAL

Depending on facility design, various methods of foreign material detection are in place throughout the process to reduce and/or eliminate contaminates in finished product.

Based on the risk assessment of producers equipment, most facilities have a minimum of one magnet prior to baling for metal control

XI. RISK ANALYSIS

HAZARD ANALYSIS									
PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
Fertilizers & Plant Protection Products	BIOLOGICAL	Y	Microbiological contamination from fertilizer source.	1	2	2	Contaminated products applied to soil and/or crop	NO	Fertilizers are recommended by an accredited consultant and sourced from approved suppliers. Fertilizers have certificates of analysis. Animal based fertilizers are used according to label. Raw manures are applied under strict USDA Organic and/or FDA Food Safety Modernization Act (FISMA) regulations to ensure proper UV exposure to potential pathogens present. Most compost and fertilizers are applied when there is no presence of harvestable crop.
	CHEMICAL	Y	Chemical contamination from plant protection products exceeding MRL limits. Residues from non-approved products.	1	2	2	Contaminated products applied to soil and/or crop	NO	Only approved plant protection products are applied on an "as-needed" basis and under the direction of an authorized consultant or farm manager with proper licenses and experience with farm history. Application equipment is calibrated annually to ensure accurate applications. All applications are recorded under state department of agriculture requirements. Residue testing is conducted by buyers, and often times by the producer to ensure compliance with country of destination MRL limits. HGA distributes current USHIPPC MRL Tracking Chart by approved product and country quarterly, at minimum.
	PHYSICAL	Y	Physical contamination of foreign material in granular fertilizers or plant protection products.	1	1	1	Contaminated products applied to soil and/or crop	NO	Fertilizers are recommended by an accredited consultant and sourced from approved suppliers. Fertilizers have certificates of analysis and are manufactured under strict requirements. Foreign material found in fertilizers and/or plant protection products are rare and not commonly found.
Processing Aids	BIOLOGICAL	N							
	CHEMICAL	Y	Food grade mineral oil used in the lubrication of equipment. Possible cross contamination due to spill or leak, if stored near packaging materials and/or dried hop cones. Possible incorrect processing aids that are not food grade or approved for process.	2	1	2	Contaminated products applied to crop and/or crop contact surfaces	NO	Routine preventative maintenance and inspection on all equipment is performed daily/weekly for faulty equipment and leaks. All processing aids are stored separately from hops and finished product. Specs on all chemicals including labels and SDS from all processing aids are current and kept on file. Strict cleaning and maintenance procedures in place to monitor and verify programs to prevent product contamination.
	PHYSICAL	N							
1. Soil Preparation	BIOLOGICAL	Y	Microbiological contamination from fertilizer source.	1	2	2	Contaminated products applied to soil and/or crop	NO	Fertilizers are recommended by an accredited consultant and sourced from approved suppliers. Fertilizers have certificates of analysis. Animal based fertilizers are used according to label. Raw manures are applied under strict USDA Organic and/or FDA Food Safety Modernization Act (FISMA) regulations to ensure proper UV exposure to potential pathogens present. Most compost and fertilizers are applied when there is no presence of harvestable crop.
	CHEMICAL	Y	Possible contamination from not adhearing to planting dates after fumigation. Potential over applying of fertilizers, composts and/or biostimulants.	2	1	2	Contaminated products applied to soil	NO	Fumigation commonly takes place in late Fall after harvest and months before Spring planting. Complete application and planting records kept on farm. Applications of approved products according to label recommendations. No application of raw manure based composts directly to harvestable portion of crop.
	PHYSICAL	N							

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
2. Planting (could include installation of trellis)	BIOLOGICAL	Y	Possible disease in planting stock or soil.	1	2	2	Contaminated planting stock and/or products applied to soil	NO	All planting stock is sourced from an approved supplier or certified nursery. Suppliers issue a quality statement ensuring proper propagation, handling and storage practices. Soil analysis conducted by an accredited laboratory prior to planting.
	CHEMICAL	Y	Possible contamination from dipping planting stock into unapproved product during planting.	1	2	2	Contaminated planting stock and/or products applied to soil	NO	Planting stock treatment is prepared by trained personnel only using approved products. Employees are trained on proper handling and safety of fertilizers used in the process. Strict policies in place to monitor and verify programs.
	PHYSICAL	Y	Potential misc. trellis materials left in yard and picked up during harvest. Varieties may be different than listed. Possible rodent and/or pest damage to plant.	2	1	2	Wrong variety supplied or damage to planting stock	NO	Visual inspection of fields prior to and daily during harvest.Planting stock is either sourced from on-farm or purchased from a certified nursery and/or approved supplier. Planting stock purchased from certified nursery or approved supplier is accompanied with quality statement ensuring variety is true to type. Employees are trained to visually inspect plants for any damage that could be caused by rodents and pests.
3. Irrigation	BIOLOGICAL	Y	Pathogen contamination from wildlife feces and dirt, from irrigation source, from faulty or broken water delivery equipment, or from over saturation of soil.	3	2	6	Contamination to crop from pathogens from irrigation water source or over saturation of soil	CP 1	Irrigation water is analyzed for E.coli by a certified 3rd party laboratory annually, at a minimum and/or as needed during the irrigation season. Protocols in place to resample, treat water, or divert to alternate irrigation source if analysis results are consistently higher than acceptable limits. Majority of producers utilize drip irrigation methods that prevent over saturation of soil and water from coming in contact with harvestable portion of crop. Irrigation typically ceases prior to harvest, depending on weather and soil needs. Ample UV exposure to crop occurs during that time. The anti-microbial properties of hops are due to various resin constituents of the hops including the alpha-acids, beta-acids and hop essential oils. Hop bittering acids have been shown to inhibit various bacteria, including; species of Bacillus, Micrococcus, Staphylococcus, Streptococcus, E. coli, Listeria, Clostridium and others. Inhibitory activity has also been reported for certain fungi. Private wells are inspected and analyzed annually, at minimum, for pathogens and chemical residue contamination.
	CHEMICAL	Y	Contamination from over application of fertilizer or plant protection products in fertigation application. Potential high chemical residues from irrigation water source.	2	2	4	Contamination to crop and/or soil	CP 2	The choice to administer nutrition or plant protection products via fertigation is made by authorized personnel trained in fertilizer and chemical application. Delivery equipment is inspected and calibrated annually, at minimum. Irrigation water is analyzed for Nitrates and Heavy Metals annually. Routine communication between producers and irrigation districts on water quality and timing. Private wells are inspected and analyzed annually, at minimum, for pathogens and chemical residue contamination.
	PHYSICAL	Y	Contamination from faulty or broken irrigation equipment that may pose a physical risk that may lead to potential biological or chemical risk.	1	2	2	Contamination to crop and/or soil	NO	Irrigation delivery equipment is inspected annually, at minimum. Broken or faulty equipment is repaired or replaced to prevent contamination.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
4. Burn Down	BIOLOGICAL	N							
	CHEMICAL	Y	Contamination from over application of chemicals used in burn down process.	2	1	2	Contamination to crop and/or soil	NO	Only approved products by authorized personnel trained in proper handling and application of chemicals used in the burn down process. Where physical burning by fire, employees are provided proper PPE and trained on safety protocols.
	PHYSICAL	N							
5. Twining	BIOLOGICAL	N							
	CHEMICAL	Y	Potential contamination from hydraulic fluid, oil, diesel, and other equipment fluids from tractors or other equipment used in process.	1	1	1	Contamination to crop and/or soil	NO	Routine maintenance and inspection of equipment used in the field to prevent leaks and contamination. Broken or faulty equipment is repaired or replaced. When and where a producer is able to, food grade oils and lubricants are used.
	PHYSICAL	Y	Clips used to hold down twine can become a physical hazard if they are not inserted properly. Foreign material from employees may be left in field during twining process.	2	1	2	Contamination to crop and/or soil	NO	Employees are trained on how to properly conduct job task. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material that may have been picked up in field during harvest.
6. Training	BIOLOGICAL	Y	Possible pathogen (E.coli) contamination from employees by; not following proper handwashing protocols after eating and using toilets, and from bodily fluids due to illness or injury.	1	1	1	Contamination to crop and/or soil	NO	Very low risk due to training taking place prior to cone burst. Employees are trained on proper hygiene and food safety policies. Employees are encouraged to stay home if they are sick (especially when experiencing vomiting and diarrhea), cover open wounds before starting work, and trained to notify a supervisor immediately if they become ill and contaminate crop or equipment with vomit and/or blood. Hand washing and toilet stations are placed away from harvestable portion of crop.
	CHEMICAL	Y	Potential contamination from hydraulic fluid, oil, diesel, and other equipment fluids from tractors or other equipment used in process.	2	1	2	Contamination to crop and/or soil	NO	Employees are trained on how to properly conduct job task. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material that may have been picked up in field during harvest.
	PHYSICAL	N							

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
7. Growing	BIOLOGICAL	Y	Possible pathogen (E.coli) and disease contamination from excessive wildlife and/or domestic animal waste, or dead animals.	2	1	2	Contamination to crop and/or soil	NO	Risk level is based on producers site assessment to where fields are located and prior history with presence of excessive wildlife or domestic animals. The anti-microbial properties of hops are due to various resin constituents of the hops including the alpha-acids, beta-acids and hop essential oils. Hop bittering acids have been shown to inhibit various bacteria, including; species of Bacillus, Micrococcus, Staphylococcus, Streptococcus, E. coli, Listeria, Clostridium and others. Employees are trained to inspect for excessive contaminants by wildlife and domestic animals, and to remove any waste and/or dead animals prior to harvesting crop.
	CHEMICAL	Y	Potential application of unapproved plant protection product when treating for pests and mildews. Potential for exceeding Maximum Residual Limit (MRL) of country of destination. Potential of spray drift from (and to) closely neighboring crops.	3	2	6	Contamination to crop and/or soil	CP 3	Only approved plant protection products are applied on an "as-needed" basis and under the direction of an authorized consultant or farm manager with proper licenses and experience with farm and crop history. Application equipment is calibrated annually to ensure accurate applications. All applications are recorded under state department of agriculture requirements. Residue testing is conducted by buyers, and often times by the producer to ensure compliance with country of destination MRL limits. HGA distributes current USHIPPC MRL Tracking Chart by approved product and country quarterly, at minimum. Two-way communication with neighbors who have closely planted crops on the importance of avoiding spray drift. Buffer zones are increased, where applicable.
	PHYSICAL	N							
8. Field Harvest	BIOLOGICAL	Y	Possible pathogen (E.coli) contamination from employees by; not following proper handwashing protocols after eating and using toilets, and from bodily fluids due to illness or injury. Possible pathogen (E.coli) and disease contamination from excessive wildlife and/or domestic animal waste, or dead animals.	2	1	2	Contamination of crop	NO	Employees are trained on proper hygiene and food safety policies. Employees are encouraged to stay home if they are sick (especially when experiencing vomiting and diarrhea), cover open wounds before starting work, and trained to notify a supervisor immediately if they become ill and contaminate crop or equipment with vomit and/or blood. Hand washing and toilet stations are placed away from harvestable portion of crop. Employees, harvesting equipment, crop transportation vehicles, portable toilet and handwashing stations are inspected daily for cleanliness and supplies.
	CHEMICAL	Y	Possible contamination from hydraulic fluid, oil, diesel, and other equipment fluids from harvesting equipment and/or crop transportation vehicles.	2	1	2	Contamination of crop and/or soil	NO	Inspection and cleaning of harvesting equipment and crop transportation vehicles prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. When and where a producer is able to, food grade oils and lubricants are used.
	PHYSICAL	Y	Possible foreign material contamination from maintenance parts (nuts, bolts, etc.), faulty equipment, and employee personal items (clothing, jewelry, cell phones, etc.). Possible damage to hop bines and trellis posts by harvesting equipment and crop transportation vehicles.	2	2	4	Contamination of crop	NO	Preventative maintenance, and inspection and cleaning of harvesting equipment and crop transportation vehicles prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. Employees are trained to visually inspect harvest areas for any foreign material that may contaminate product. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material that may have been picked up in field during harvest.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
9. Crop Transportation From Field	**BIOLOGICAL**	Y	Possible pathogen (E.coli) and disease contamination from excessive wildlife waste, or dead animals in bed of hop trucks. Possible contamination from excessive dirt lifted by other equipment and employee footwear.	2	1	2	Contamination of crop	NO	Risk is low due to transportation vehicles in constant use during harvest and not parked for excessive amount of time. Inspection and cleaning of crop transportation vehicles prior to harvest and regularly during harvest. Drivers who are also bine hangers are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes where applicable. Bines with noticeably excessive animal/wildlife waste contamination are discarded.
	CHEMICAL	Y	Possible contamination from hydraulic fluid, oil, diesel, and other equipment fluids. Potential contamination if vehicle is used to transport plant protection chemicals and/or fertilizers during harvest.	2	1	2	Contamination of crop	NO	Inspection and cleaning of crop transportation vehicles prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. When and where a producer is able to, food grade oils and lubricants are used. Crop transportation vehicles used to transport anything other than hops must be cleaned and inspected prior to use to avoid potential contamination of chemicals or other non-food grade products.
	PHYSICAL	Y	Potential cross contamination between varieties during variety change over. Possible contamination from excessive dirt lifted by other equipment and employee footwear.	2	1	2	Contamination of crop	NO	Crop transportation vehicles cleaned using pressurized air and sweeping after unloading at picking machine and prior to returning to the field to avoid possibility of cross-contamination of varieties. Drivers who are also bine hangers are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes where applicable.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
10. Picking /Cleaning	BIOLOGICAL	Y	Possible pathogen (E.coli) and disease contamination from excessive wildlife and/or domestic animal waste, wildlife nesting, and dead animals due to common open air design construction of picking facilities. Possible pathogen contamination from employees by; not following proper handwashing protocols after eating and using toilets, from bodily fluids due to illness or injury, and by employee footwear contaminated with excessive dirt and/or animal waste.	2	2	4	Contamination of crop	NO	Inspection and cleaning of picking facilities prior to harvest and regularly during harvest. Bird netting/screening is typically installed around building openings where applicable. Due to loud machinery when in operation, the presence of excessive animals and wildlife are not common during harvest. Additional netting/screening is installed during off-season to prevent excessive animal/wildlife activity and nesting. Pest control measures in place by installing traps and bait stations to control rodents. Employees are trained on proper hygiene and food safety policies. Employees are encouraged to stay home if they are sick (especially when experiencing vomiting and diarrhea), cover open wounds before starting work, and trained to notify a supervisor immediately if they become ill and contaminate crop or equipment with vomit and/or blood. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes where applicable before walking on catwalks or above open belts containing hops. Break areas and toilet stations are placed outside of picking facility and inspected for cleanliness and supplies. Handwashing stations are available and stocked with soap, water and single use towels. Lidded garbage cans are available and clearly marked.
	CHEMICAL	Y	Possible contamination from hydraulic fluid, oil, diesel, lubricants and other equipment fluids. Possible contamination from processing aids that are not food grade or approved for process use.	2	1	2	Contamination of crop	NO	When and where a producer is able to, food grade oils are used in the lubrication and cleaning of equipment. Mineral oil is commonly used to clean excessive build up on conveyor belts, equipment and floors. Routine preventative maintenance and inspection is performed for faulty equipment and leaks. All maintenance and processing aids/products are stored in a location away from hops to avoid contamination. Safety Data Sheets (SDS) from all maintenance and processing aids are current and kept on file. In off season, facilities are commonly used to store equipment and crop transportation vehicles. Measures taken to prevent contamination from excessive fuel and oil leaks.
	PHYSICAL	Y	Possible foreign material contamination from maintenance parts (nuts, bolts, etc.), faulty equipment, broken lights, and employee personal items (clothing, jewelry, cell phones, etc.). Potential cross contamination between varieties during variety change over. Possible contamination from excessive dirt lifted by other equipment and employee footwear.	3	2	6	Contamination of crop	CP 4	Preventative maintenance, and inspection and cleaning of facility prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. Lights are shatterproof and/or covered to prevent broken bulb glass from contaminating crop. Employees are trained on food safety, and to visually inspect areas for any foreign material that may contaminate product. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material that may have accidently dropped onto conveyor belts or picked up in field during harvest. Facility is purged between varieties to avoid cross-contamination of varieties. Lupulin is removed when build up on conveyor belts and floors is observed.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
11. Drying	**BIOLOGICAL**	Y	Possible pathogen (E.coli) and disease contamination from excessive wildlife and/or domestic animal waste, wildlife nesting, and dead animals due to common open air design construction of drying facilities (kiln). Possible pathogen contamination from employees by; not following proper handwashing protocols after eating and using toilets, from bodily fluids due to illness or injury, and by employee footwear contaminated with excessive dirt and/or animal waste.	2	2	4	Contamination of crop	NO	Inspection and cleaning of drying facilities prior to harvest and regularly during harvest. Bird netting/screening is typically installed around building openings/ceilings where applicable. Additional netting/screening is installed during off-season to prevent excessive animal/wildlife activity and nesting. Pest control measures in place by installing traps and bait stations to control rodents. Employees are trained on proper hygiene and food safety policies. Employees are encouraged to stay home if they are sick (especially when experiencing vomiting and diarrhea), cover open wounds before starting work, and trained to notify a supervisor immediately if they become ill and contaminate crop or equipment with vomit and/or blood. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes before walking on catwalks, and especially when entering a kiln bed. Break areas and toilet stations are placed outside of drying facility and inspected for cleanliness and supplies. Handwashing stations are available and stocked with soap, water and single use towels. Lidded garbage cans are available and clearly marked.
	CHEMICAL	Y	Possible contamination from hydraulic fluid, oil, diesel, lubricants and other equipment fluids. Possible contamination from processing aids that are not food grade or approved for process use.	2	1	2	Contamination of crop	NO	When and where a producer is able to, food grade oils are used in the lubrication and cleaning of equipment. Mineral oil is commonly used to clean excessive build up on conveyor belts, equipment and floors. Routine preventative maintenance and inspection is performed for faulty equipment and leaks. All maintenance and processing aids/products are stored in a location away from hops to avoid contamination. Safety Data Sheets (SDS) from all maintenance and processing aids are current and kept on file.
	PHYSICAL	Y	Possible foreign material contamination from maintenance parts (nuts, bolts, etc.), faulty equipment, broken lights, employee personal items (clothing, jewelry, cell phones, etc.) and excessive dirt from employee footwear. Potential cross contamination between varieties during variety change over.	3	2	6	Contamination of crop	CP 5	Preventative maintenance, and inspection and cleaning of facility prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. Lights are shatterproof and/or covered to prevent broken bulb glass from contaminating crop. Employees are trained on food safety, and to visually inspect areas for any foreign material that may contaminate product. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes before walking on catwalks, and especially when entering a kiln bed. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material. Facility is purged between varieties to avoid cross-contamination of varieties. Lupulin is removed when build up on conveyor belts and floors is observed. Kiln cloth is inspected prior to harvest and during harvest for any holes or contaminates. Kiln cloth too worn to repair is replaced.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
12. Cooling	BIOLOGICAL	Y	Possible pathogen (E.coli) and disease contamination from excessive wildlife and/or domestic animal waste, wildlife nesting, and dead animals due to design of facility. Possible pathogen contamination from employees by; not following proper handwashing protocols after eating and using toilets, from bodily fluids due to illness or injury, and by employee footwear contaminated with excessive dirt and/or animal waste.	2	2	4	Contamination of crop	NO	Inspection and cleaning of cooling facilities prior to harvest and regularly during harvest. Bird netting/screening is typically installed around building openings/ceilings where applicable. Additional netting/screening is installed during off-season to prevent excessive animal/wildlife activity and nesting. Pest control measures in place by installing traps and bait stations to control rodents. Care is taken to avoid accidental contamination from trap to cooling pile when moving or turning pile. Employees are trained on proper hygiene and food safety policies. Employees are encouraged to stay home if they are sick (especially when experiencing vomiting and diarrhea), cover open wounds before starting work, and trained to notify a supervisor immediately if they become ill and contaminate crop or equipment with vomit and/or blood. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes before walking on catwalks, and especially when entering a pile on cooling floor. Break areas and toilet stations are placed outside of cooling facility and inspected for cleanliness and supplies. Handwashing stations are available and stocked with soap, water and single use towels. Lidded garbage cans are available and clearly marked.
	CHEMICAL	Y	Possible contamination from hydraulic fluid, oil, diesel, lubricants and other equipment fluids. Possible contamination from processing aids that are not food grade or approved for process use.	2	1	2	Contamination of crop	NO	When and where a producer is able to, food grade oils are used in the lubrication and cleaning of equipment and floors. Mineral oil is commonly used to clean excessive build up on conveyor belts, equipment and floors. Routine preventative maintenance and inspection is performed for faulty equipment and leaks. All maintenance and processing aids/products are stored in a location away from hops to avoid contamination. Safety Data Sheets (SDS) from all maintenance and processing aids are current and kept on file.
	PHYSICAL	Y	Possible foreign material contamination from maintenance parts (nuts, bolts, etc.), faulty equipment, broken lights, employee personal items (clothing, jewelry, cell phones, etc.) and excessive dirt from employee footwear. Potential cross contamination between varieties during variety change over.	3	2	6	Contamination of crop	CP 6	Preventative maintenance, and inspection and cleaning of facility prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. Lights are shatterproof and/or covered to prevent broken bulb glass from contaminating crop. Employees are trained on food safety, and to visually inspect areas for any foreign material that may contaminate product. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes before walking on catwalks, and especially when entering a pile. Care is taken to avoid accidental contamination from pest control trap to cooling pile when moving or turning pile. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material. Facility is purged between varieties to avoid cross-contamination of varieties.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
13. Baling/Labeling	BIOLOGICAL	Y	Possible pathogen (E.coli) and disease contamination from excessive wildlife and/or domestic animal waste, wildlife nesting, and dead animals due to design of facility. Possible pathogen contamination from employees by; not following proper handwashing protocols after eating and using toilets, from bodily fluids due to illness or injury, and by employee footwear contaminated with excessive dirt and/or animal waste. Possible mold contamination due to improperly dried hop cones in kiln prior to baling. Possible contamination of packaging material (polycloth, burlap/jute, etc.) from improper handling and storage practices.	2	2	4	Contamination of crop	NO	Inspection and cleaning of baling facilities prior to harvest and regularly during harvest. Bird netting/screening is typically installed around building openings/ceilings where applicable. Additional netting/screening is installed during off-season to prevent excessive animal/wildlife activity and nesting. Pest control measures in place by installing traps and bait stations to control rodents. Care is taken to avoid accidental contamination from trap to cooling pile when moving to baler. Employees are trained on proper hygiene and food safety policies. Employees are encouraged to stay home if they are sick (especially when experiencing vomiting and diarrhea), cover open wounds before starting work, and trained to notify a supervisor immediately if they become ill and contaminate crop or equipment with vomit and/or blood. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes before walking on catwalks above exposed hops and/or around baler. Break areas and toilet stations are placed outside of cooling facility and inspected for cleanliness and supplies. Handwashing stations are available and stocked with soap, water and single use towels. Lidded garbage cans are available and clearly marked. In the kilning process, hops are dried using forced air at 125-130°F to less than 10% total moisture. Water activity (Aw) of dried, baled hops is approximately 0.65. Products at this water activity will not support the growth of foodborne bacteria. Drying equipment and moisture meters are calibrated annually. Packaging material is sourced from an approved supplier and kept in a clean area, up off of ground and covered during the off-season when not in use. When burlap/jute material is used, it must be approved for use in food products.
	CHEMICAL	Y	Possible contamination from hydraulic fluid, oil, lubricants and other equipment fluids. Possible contamination from processing aids that are not food grade or approved for process use. Possible contamination of packaging and labeling materials (polycloth, burlap/jute, ink, etc.) from improper handling and storage practices.	2	1	2	Contamination of crop	NO	When and where a producer is able to, food grade oils are used in the lubrication and cleaning of equipment. Mineral oil is commonly used to clean excessive build up on conveyor belts, equipment and floors. Routine preventative maintenance and inspection is performed for faulty equipment and leaks. All maintenance, processing aids/products and labeling materials are stored in a location away from hops to avoid contamination. Safety Data Sheets (SDS) from all maintenance and processing aids are current and kept on file. Packaging and labeling materials are sourced from an approved supplier. Materials are kept in a clean area, up off of ground and covered during the off-season when not in use. When burlap/jute material is used, it must be approved for use in food products. Food grade ink is used in laser printers and handheld/manual stencils.
	PHYSICAL	Y	Possible foreign material contamination from maintenance parts (nuts, bolts, etc.), faulty equipment, broken lights, employee personal items (clothing, jewelry, cell phones, etc.) and excessive dirt from employee footwear. Sewing equipment and may break off and contaminate the product. Potential cross contamination between varieties during variety change over. Under drying and excessive moisture can cause spontaneous combustion of compressed bales.	3	2	6	Contamination of crop	CP 7	Preventative maintenance, and inspection and cleaning of facility prior to harvest and regularly during harvest. Broken, faulty or leaking equipment is repaired or replaced. Lights are shatterproof and/or covered to prevent broken bulb glass from contaminating crop. Employees are trained on food safety, and to visually inspect areas for any foreign material that may contaminate product. Employees are trained to avoid excessive build-up of dirt on footwear and to remove large dirt clods, or use boot brushes before walking on catwalks above exposed hops and/or around baler. Where applicable, magnets, fans and rock drops are located throughout picking, drying and, baling facilities to remove foreign material. Facility is purged between varieties to avoid cross-contamination of varieties. Temperature and moisture is taken frequently throughout the baling process to ensure proper ranges are within specification.

PROCESS STEP/INGREDIENTS	RISK TYPE	Y/N	POTENTIAL HAZARD	LIKELIHOOD	SEVERITY	SIGNIFICANCE	REASONS FOR SIGNIFICANCE	CP/CCP	PREVENTATIVE MEASURES
14. Transportation of Finished Bales	**BIOLOGICAL**	N						NO	
	CHEMICAL	Y	Possible contamination from transportation equipment hydraulic fluid, oil, diesel and other fluids. Possible contamination of bales if shipped with other non-food grade products such as; plant protection products, fertilizers, etc.	1	1	1	Contamination of crop	NO	Risk is low due to dedicated vehicles used to transport bales. Routine preventative maintenance and inspection is performed for faulty equipment and leaks. Bales are commonly transported on flatbed truck/trailers, and not combined with any other products.
	PHYSICAL	Y	Integrity of finished bales could be compromised and/or damaged due to excessive exposure to inclement weather and mis-handling during transportation from producer to processor/marketer or brewer for further processing and storage.	1	2	2	Contamination of crop	NO	Risk is low due to producers transporting finished bales as trucks are filled and/or lots are complete. Finished bales rarely sit outside exposed to environment for long periods of time. Hops are commonly shipped within 48-72 hours from day of harvest. Employees handling and transporting finished bales are trained on food safety, and to visually inspect bales as they are being loaded for transport. Compromised bales are removed from shipment and either reworked or disposed of.

XII. VERIFICATION

VERIFICATION TABLE				
ACTIVITY	**DESCRIPTION**	**FREQUENCY**	**RESPONSIBILITY**	**RECORDS**
Review Certification Records	All food safety certifications, letter of guarantees, product labels, etc. must be current to ensure that system is followed and limits are adhered to	Annually	Technical Manager/Internal Audit	Annual certificates, LOG, supplier labels, etc. on file
Verify Flow Chart	Follow flow chart through the production process	Annually	Technical Manager/Internal Audit	Updated Flow Chart - HACCP Plan
Review Hazards	HACCP Team	Annually or when significant change to process occurs	HACCP Team	Hazard Analysis Report
Review Trade Requirements	HACCP Team reviews requirements	Annually or when significant change to process occurs	HACCP Team	USHIPPC MRL Chart, Marketer/Processor Guidelines, HGA letters, etc.
Review Industry Research	Documented scientific research/studies on biological, chemical, physical and allergens in hops used in brewing	Annually	HACCP Team/Technical Manager	Scientific Papers
Review Customer Complaints & Rejections	Assess customer complaint records to highlight deficiencies in system	Annually or when significant change to process occurs	Technical Manager	Customer complaints, management review documentation
Validate Critical Limits	Review current critical limits literature	Annually	HACCP Team	Scientific Papers
Review Training Records	HACCP Team training on HACCP and food safety to ensure training is up to date	Annually or new member added to HACCP Team	HACCP Leader/Technical Manager	Training Records

XIII. VALIDATION

INDEX OF REFERENCES	
CRITICAL CONTROL POINTS FOR FOREIGN MATERIALS	
DOCUMENT/ARTICLE	**SUMMARY**
FDA Chapter 20 Metal Inclusions	Determining whether a processing step is a critical control point (CCP) for metal inclusion via HACCP approach.
FDA CPG Sec. 555.425	Foods, Adulteration involving hard or sharp foreign objects; 0.7mm (0.3") to 25mm (1")
PATHOGEN STUDIES IN HOPS	
DOCUMENT/ARTICLE	**SUMMARY**
GRAS Notice for Specified Uses of Hops Beta Acids	FDA Recognition of Hop Antimicrobial Activity
Microbiological analyses of leaf hops and pellets	A study includes 60 samples that were analyzed, all samples were free of pathogenic bacteria.
Institute of Brewing & Distilling "125th Anniversary Review: Bacteria in brewing; The good, the bad and the ugly" 02.12.2013	Antimicrobial benefits of the total resins in hops used in the brewing process; alpha acids (humulone and its isomers) and beta acids (lupulin and its isomers).
HACCP Study - John I. Haas "Microbiological Hazards in Hops & Hop Products"	Antimicrobial properties of hop bitter acids used in the brewing process
J. Delves-Broughton "Natural Food Additives, Ingredients & Flavourings" 2012	The antimycotic effect of hops against fungi influenced by low water activity
K. Suzuki "Brewing Microbiology" 2015	Gram-positive spoilage bacteria in brewing the principle antimicrobial effects of hop bitter acids
Journal of Experimental Food Chemistry "Hop extracts - A Natural Antimicrobial for Ensuring Food Safety" - Carolin Hauser 08.11.2016	Antimicrobial hop extracts could be used as natural preservatives in food applications to extend the shelf-life and to increase the safety of fresh products
OTHER REFERENCES USED	
DOCUMENT/ARTICLE	**SUMMARY**
Hop Growers of America (HGA) "Treatment of Hops Under the FSMA Produce Safety Rule" 04.15.18	HGA's request to Federal Drug Administration (FDA) to implement enforcement discretion over the growing, processing and importation of hops under the Produce Safety Rule, Preventive Controls for Human Food Rule, and the Supplier Verification Program Rule
USHIPPC - International Hop MRLs Tracking Chart	A comparison of Maximum Residue Levels (MRLs) for Pesticides approved for hops

XIV. EXECUTIVE SUMMARY

This Plan was developed for Hop Growers of America by M2-Ag Assurance, LLC to provide a generic overview to identify, control, prevent and/or eliminate potential food safety hazards in the standard industry practice of producing dried baled hops. This Plan does not take into consideration the unique and innovative practices of each producer and their individualized risk. Hop Growers of America is providing this Plan as an educational tool to help Members evaluate their current farming practices and develop their own, personalized set of best practices for their particular operation. Producers using this Plan as industry reference for must verify that they have prerequisite programs in place to control and/or eliminate potential risks.

The information derived from this Plan is to be used as a guidance tool only and does not reflect completion of any official food safety certification or HACCP training. Each farm and business operation is unique, therefore the guidance provided by this module should be customized to reflect your specific goals and particular circumstances. Ultimately, Members must comply with all local, state, federal and international laws and practices and you should consult with the appropriate professionals if you have questions or concerns related thereto.

Based on the results of a hazard analysis exercise of potential biological, chemical and physical risks, it was determined that there are no Critical Control Points (CCP's) in the standard industry practice of growing, harvesting, handling and transportation of dried whole hop cones. Control Points (CP's) identified throughout the process are primarily related to foreign material contamination. Each producer's facility and equipment design, preventive maintenance, food safety practices and prerequisite programs will determine the control and/ or elimination of the risk.

Summary of Control Points (CP's) Identified:

CP1 and CP2: Potential Biological and Chemical Risk in Irrigation Process
CP3: Potential Chemical Risk in Growing Process
CP4 - CP7: Potential Foreign Material Contamination in Picking, Drying and Baling Processes

Documented scientific studies of the antimicrobial benefits of hops validates the conclusion that environmental monitoring and further prerequisite programs for biological risk control are not warranted at this time. Various kill steps throughout the brewing process are in place and must be considered as additional means of microbiological control of the finished product. This conclusion does not excuse the need for food safety practices and prerequisites programs identified as control measures in the hazard analysis results of the Plan.

A complete evaluation of the Plan should be conducted annually and/or when:

- Manufacturing process is changed
- Harvesting process is changed
- Equipment directly impacting the crop is modified or changed
- Materials and processing aids are changed
- There are changes in storage or distribution
- There are changes in industry that directly impact the crop

Overall, a successful HACCP Plan relies on continued engagement and communication between hop producers, processor/marketers, equipment manufacturers, and brewers.