UC Kearney Agricultural Research and Extension - IR-4 Field Research Center

9240 S. Riverbend Ave., Parlier, CA 93648

2025 STANDARD OPERATING PROCEDUES – TABLE OF CONTENTS

SOP numbering Format: [Facility ID] - [sop category] - [sop number]. [version number]

*All SOPs have been reviewed prior to signing

SOPs submitted by: _____ 2/7/25
Field Research Director, UCKARE — Date

SOPs submitted by: _____ 2/7/25
Field Research Director, UCKARE — Date

SOPs approved by: _____ 2/11/25
Regional Field Coordinator/Assistant Regional Field Coordinator — Approval Date

SOP Number: UCKARE-10-1.3	Pg. 1 of 1
Title: IR-4 Field Research Center Management	

PURPOSE: To define the responsibilities of the University of California Kearney Agricultural Research and Extension (UCKARE) IR-4 Field Research Center management.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURES:

1.0 Field Research Director Responsibilities

1.1 Assure each study is conducted according to an approved protocol and Standard Operating Procedures (SOPs), and that appropriate documentation is provided. Maintain good communication with the Study Director and the Regional Field Coordinator (RFC).

1.2 Assure that personnel, resources, facilities, equipment, materials and methods are available as scheduled and are adequate for the completion of the project.

1.3 Assure that all personnel involved in study conduct are adequately trained to perform their assigned tasks. Training will include Good Laboratory Practices and Standard Operating Procedures.

1.4 Report all deviations from the protocol, GLPs or SOPs to the Study Director and the RFC. Initiate remedial action when required. Respond in writing to all QAU findings**.**

1.5 Maintain a study list of all IR-4 field research projects. Maintain an IR-4 project organizational chart.

1.6 Maintain on file a current summary of training, education and experience; a job description for all personnel engaged in the conduct of a study.

1.7 Assure that all required records are maintained and archived when appropriate.

SOP Number: UCKARE-10-2.7	Pg. 1 of 2
Title: Standard Operating Procedures	

PURPOSE: To provide guidelines for creating, revising, maintaining and archiving Standard Operating Procedures (SOPs).

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURES:

1.0 Where there is an IR-4 National SOP (found in the eQA system on the IR-4 main website) in conflict with these SOPs, the National SOP shall supercede it.

All SOPs will be uniquely identified by number. Each number will begin with the prefix 'UCKARE' to identify the research facility (UC Kearney Agricultural Research and Extension), followed by SOP category, sequential SOP number and version number.

SOP Categories:	10	Administration
	20	Data
	30	Test System
	40	Test Substance
	50	Test System Samples
	60	Equipment

Format: (Facility ID)- (sop category)- (sop number). (version number)
Example: (UCKARE)-(10) -(1). (1).

2.0 All current, active SOPs will be listed on a Table of Contents. The SOP Table of Contents listing all SOPs will be signed and dated by the author (submitting scientist), and by the Regional Field Coordinator (RFC) or Assistant Regional Field Coordinator (ARFC), signifying approval. SOPs are effective as of the date approved by the RFC/ARFC.

3.0 Each SOP will define its scope and purpose; describe procedures routinely implemented, and the records that may be required by these procedures. Each page will be numbered.

4.0 Original signed SOPs shall be stored in the UCKARE Retention File and copy(s) kept in areas accessible to all study personnel.

5.0 Each SOP should be reviewed approximately annually, and revised to reflect current procedures, if necessary. A record of the dates of review or revision will be maintained. A "revision" provides a substantive change in the meaning of the SOP. Correcting spelling and formatting errors along with making minor changes that clarify the intended meaning of the SOP do not constitute a revision. The current revision SOP Table of Contents "approved by" line will be changed to "reviewed by" and printed. This "Reviewed by" Table of Contents will be signed and dated at the time of review by all personnel. This form will be permanently archived at the IR-4 Headquarters archive. Outdated SOPs will be permanently archived at the IR-4 Headquarters archive and all copies will be destroyed, with the exception of one, to be stored in the UCKARE Retention File.

6.0 Each study protocol shall serve as the standard operating procedure for that study and shall supersede UCKARE SOPs in the event of a conflict with them.

7.0 Common abbreviations used in UCKARE SOPs and raw data generated during the conduct of IR-4 Field Research Center research trials may include the following:

Abbreviation	Definition
ARFC	Assistant Regional Field Coordinator
CAS	Chemical Abstract Number
CV	Curriculum Vitae
E.G.	Example
EPA	(United States) Environmental Protection Agency
FDB	Field Data Book
FID #	Field Identification Number
FRD	Field Research Director
GLP	(EPA) Good Laboratory Practices
GPA	Gallons Per Acre
IR-4	Inter-Regional Research Project #4
MSDS	Material Safety Data Sheet
NIST	National Institute of Standards Technology
PTO	Power Take Off
QAU	Quality Assurance Unit
RH	Relative Humidity
RFC	Regional Field Coordinator
RPM	Revolutions Per Minute
SD	Study Director
SOP	Standard Operating Procedure
TRT	Treated
UCKARE	University of California Kearney Agricultural Research and Extension
UTC	Untreated (control)

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SOP Number: UCKARE-10-3.6	Pg. 1 of 1
Title: Personnel	

PURPOSE: To define requirements for all trial personnel and related records.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURES:

1.0 A copy of a professional resume or curriculum vitae (CV), a job description, and training records for each person engaged in the conduct of a trial will be retained on file.

2.0 All personnel will be adequately trained for their assigned tasks. As appropriate, training curriculum will include SOPs, GLPs, UC policies, and technical training relevant to the magnitude of residue studies.

3.0 Personnel records will be reviewed approximately annually and revised or updated as needed.

4.0 CVs or Personnel Short Forms will not be completed or retained for temporary work crews or other UCKARE personnel that may occasionally be utilized for non-GLP plot maintenance tasks. The aforementioned personnel will be directly supervised and trained by GLP trained staff. A brief summary of temporary personnel training will be recorded on form Part 2C.

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SOP Number: UCKARE-10-4.6	Pg. 1 of 1
Title: Quality Assurance	

PURPOSE: To define Quality Assurance procedures used to ensure that facilities, equipment, personnel, methods, practices, records and controls utilized in GLP studies meet regulatory requirements.

SCOPE: Applies to all GLP research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 The QAU (Quality Assurance Unit) shall be knowledgeable of GLPs, procedures used in conducting IR-4 field studies and preferably familiar with the facility. It will maintain a master schedule sheet of all current studies. QAU shall be entirely separate and independent from any involvement, direction or conduct of the study.

2.0 The QAU should conduct a facility inspection at approximately, every three years, to ensure compliance of facility operations with facility SOPs and regulatory requirements (EPA GLPs).

3.0 The QAU will inspect studies at intervals adequate to ensure the integrity of testing processes. These studies and phases will be selected by the QAU.

4.0 Any deviations discovered during an inspection that may pose a threat to study integrity will be immediately brought to the attention of the Study Director and the RFC. Any deviations discovered during an inspection that do not pose a threat to study integrity will be documented in the inspection report.

5.0 The Field Research Director's written response to the deviations should be a brief explanation as to why the deviation occurred. If the deviations are management corrective, the Field Research Director should explain what future actions will be taken to preclude recurrence. The completed QAU report and Field Research Director’s response will be forwarded to the Study Director, with copies to the RFC and QAU.

6.0 After completion of the field study, QAU will review the FDB and supporting data for accuracy, completeness, conformity to the protocol, and compliance with GLP.

SOP Number: UCKARE-10-5.3	Pg. 1 of 2
Title: EPA Inspections	

PURPOSE: To provide guidance for facilitating audits by the Environmental Protection Agency, Office of Compliance Monitoring.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Prior to Inspection

1.1 When received, the Notice of Inspection will be reviewed to determine the specific intent of the inspection. The Study Director(s), Quality Assurance Unit, and other interested parties will be notified of the pending audit or review as soon as possible.

1.2 Personnel who may be associated with the trial(s) or facilities audit should be briefed and scheduled to be available for the audit.

1.3 Documents that may be required during the inspection may include, but not necessarily be limited to:

1.3.1 QAU Master Schedule
1.3.2 SOPs
1.3.3 Facility and study-related raw data
1.3.4 Personnel Records (training, CVs, job descriptions)

1.4 Information not subject to EPA inspection includes, but may not necessarily be limited to:

1.4.1 QA Inspection Findings
1.4.2 Financial data
1.4.3 Confidential personnel data
1.4.4 Non-GLP research data

1.5 Organizational charts, facility maps and any information specific to the facility or area should also be made available to assist the inspector(s) during the audit.

2.0 During Inspection

2.1 The inspection team will be received at UCKARE following standard facility policy. Name tags will be provided to each inspector and the inspection team will be escorted to a conference or meeting room.

2.2 Each inspector will be asked to provide credentials. The name and badge number of each inspector will be recorded. The inspection team will be asked to provide the proposed inspection agenda and expected duration.

2.3 Personnel shall provide only what is specifically requested by inspectors. Personnel shall not provide extraneous information in order to avoid disrupting the inspection schedule. If personnel are unable to provide requested information, they will refer the inspector to the appropriate personnel and will not speculate what the answer may be.

2.4 Comments, observations and discussions associated with the inspection will be documented.

2.5 In the event that a non-compliance issue is raised during the inspection, every attempt shall be made to correct the deficiency and provide confirmation of that correction to the inspection team.

3.0 Post Inspection

3.1 All personnel involved in the inspection should attend the exit interview. Issues, comments, concerns and suggestions discussed during the exit interview will be documented.

3.2 Any discrepancies or deficiencies shall be discussed and clarified if necessary. It will be verified that any problems that may have been discovered and mitigated during the inspection have been duly noted in the inspection record.

3.3 A complete set of copies of all documents provided to the inspection team will also be retained along with inspection notes.

3.4 After the inspection, all interested parties will be informed of inspection activities and findings. Remedial action for problems that may have been detected during the inspection will be discussed and a plan of action initiated.

3.5 If required, inspection findings will be responded to in a timely manner.

SOP Number: UCKARE-20-1.8	Pg. 1 of 2
Title: Raw Data (Recording)	

PURPOSE: To define methods used to ensure that raw data supporting a study conducted in compliance with GLP guidelines are collected and recorded accurately and promptly.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Data shall be recorded either directly in the electronic field data book (eFDB) or on paper. For eFDBs, follow instructions in the National SOP N-02.1. All paper raw data will be recorded in permanent black or blue ink and will be initialed/ dated by the person recording the data, on the day of entry. Any correction or changes made to raw data shall not obscure the original entry, and reasons for the change, date and initial, will be recorded.

2.0 All information transcribed from original raw data such as recorder charts, logbooks, etc., will be identified as such, and the source of the data noted.

3.0 Whenever a raw data document is copied, it will be clearly identified as a true copy and initialed and dated by the person verifying its authenticity. Also note the location of the original document.

4.0 Study Specific Data

4.1 All study-specific data should be clearly marked with the name of the project, Field I.D. Number, and other information that may be needed to understand the data and its source.

4.2 The study protocol will be carefully referenced to ensure that all data required are collected and recorded promptly. It is the responsibility of the Field Research Director to ensure that all raw data, summaries and other items connected with the study that need to be retained are stored in the study file.

4.3 All study-specific raw data will be recorded on the IR-4 Field Data Reporting Form, or IR-4 approved custom form. Each portion of the form should be filled in as completely and accurately as possible as it pertains to the study after the information is available.

4.4 Unused FDB pages will be lined out and initialed and/or signed and dated. Unused spaces or lines on a page will also be lined out and initialed and/or signed and dated. Entries made to line out unused portions of a page will be made in a manner that clearly distinguishes them from entries that may have been made to indicate repetitive information (i.e. a distinct arrow).

4.5 Extra pages may be photocopied or printed out from the IR-4 website when needed. Alternative forms may be added to the book as needed. Before use, modified Field Data Book pages must first be approved by the RFC or designee. Clearly indicate on

the original form where to find the associated raw data. No pages will be permanently removed from the book.

4.6 The narrative portion of the FDB forms should be used to summarize any findings or provide clarification, if necessary.

4.7 At a minimum, information to be retained in the FDB should include (when applicable):

4.7.1 Copies of applicable facility records and supporting data (chemical and sample storage temperature data, weather, personnel and equipment records, custody logs, correspondence, etc.).
4.7.2 All data required by the protocol.
4.7.3 Performance data (pest counts, yield, phytotoxicity).

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SOP Number: UCKARE-20-2.3	Pg. 1 of 1
Title: Disposition of Field Data Books	

PURPOSE: To provide guidelines for handling study specific raw data at study completion.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 For paper notebooks, uponpon completion of the study, the Field Research Director (FRD) shall make an exact copy of the original raw data including completed FDB and all supporting data (correspondence, protocol deviation forms, facility logs and records, etc.) The FRD will retain the copy and submit the original FDB to the Regional Field Coordinator:

Regional Field Coordinator, Western Region IR-4 Project
University of California
Dept. of Environmental Toxicology
One Shields Ave
4218 Meyer Hall
Davis, California 95616-8588

2.0 The Regional Field Coordinator (RFC) will review the FDB for completeness, accuracy, and follow up with the FRD if necessary to obtain additional information or clarification.

3.0 After review, the RFC will transfer the FDB to the Quality Assurance Unit for audit. After Quality Assurance review, the FDB will be sent to the Study Director.

4.0 For eFDBs, follow the instructions in the National SOP N-02.1 Section 5.C.

SOP Number: UCKARE-20-3.7	Pg. 1 of 2
Title: Archiving Raw Data	

PURPOSE: To define procedures for maintaining, transferring and archiving original facility raw data.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 The official IR-4 Archive is located at IR-4 Headquarters. No original raw data will be permanently archived at UCKARE.

2.0 Prior to archiving, raw data documents will be stored in the UCKARE Field Retention File. The Retention File is stored in a file cabinet located in the office of the Field Research Director that remains locked when unattended.

3.0 The IR-4 Field Research Directors serve as respective primary and back-up administrator of the Retention File. The Retention File may only be accessed by designated administrator, or under their direct supervision.

4.0 The Retention File will contain, at a minimum:

4.1 True copies of historical: SOPs (outdated), facility records (temperature, equipment, maintenance, etc.).

4.2 Current originals: SOPs, current personnel records (CVs, job description, training), facility records (temperature, equipment, maintenance, etc.), equipment calibration data/logs.

4.3 Copies of completed: FDBs less than 1-year-old or older may be held in an electronic retention file, QA inspection reports.

4.4 Copies of all historical records: personnel (CVs, job descriptions, training), equipment calibration data/logs, organization charts, and maps.

5.0 Original documents that will be permanently archived at IR-4 Headquarters will include, at a minimum:

5.1 Historical: SOPs; facility records (temperature, equipment, maintenance. etc.), personnel (CVs, job descriptions, training), equipment calibration data/logs, organization charts, and maps.

6.0 Original documents to be permanently archived will be transferred to IR-4 Headquarters on an approximate annual schedule. Copies of original data that span several years (e.g. instrument calibration records), may be transferred on approximately an annual schedule or as deemed necessary. The archiving schedule will be determined by the FRD and should be based on the frequency of need to reference these original data. Transfer to IR-4 Headquarters can be by hand, through a courier service (Fed EX, DHL, etc.), or by U.S. Postal Service certified mail. Prior to data transfer make a copy of all items being transferred. Also include an inventory of all transferred items, including number of pages for each item and a chain of custody form. These items will be verified at the receiving location. Send a copy of the inventory and Chain of Custody to the Western Region IR4 Office in Davis, California.

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SOP Number: UCKARE-20-4.2	Pg. 1 of 1
Title: Rounding	

PURPOSE: To provide guidelines for the rounding of decimal numbers when calculating any significant digits, in order to promote consistency in the generation of numerical data.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 The method of mathematical rounding shall be applicable in all instances where the rounding of digits are necessary.

2.0 Whenever applicable, all numbers should be rounded to the second number to the right of the decimal point (e.g. 1.257 would be reported as 1.26). When the last digit is a five the number two places to the right of the decimal place will be rounded up. (e.g. 1.255 would be reported as 1.26.) For calculations do not round any numbers within a calculation; round only the final calculation result.

3.0 If the readability of equipment limits the reporting of numbers equal to or less than two digits right of the decimal, then the actual number should be reported (e.g. 1.25 would be reported as 1.25 and 1.2 would be reported as 1.2).

4.0 When using electronic data capture for numerical information such as electronic notebook calculations or weather data, this SOP will default to the limit of detection and rounding of this equipment or programs unless otherwise noted by protocol or specific study SOPs.

5.0 An exception to the above rounding guideline would be when calculating the overage factor for application mixes. The Field Research Director may use as many numbers as deemed necessary (minimum of two) to the right of the decimal point.

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SOP Number: UCKARE-30-1.3	Pg. 1 of 1
Title: Commodity Establishment and Maintenance	

PURPOSE: To provide guidelines to ensure that commodities are grown under good agricultural practices and provide a uniform crop for study.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Site selection will be made in accordance with the accepted horticultural practices for the commodity. Whenever possible, test sites will be located at UCKARE. When necessary test sites will be located: at other UC Research and Extension Center System centers or in commercial production sites (fields, groves, or facilities).

2.0 When field trials are conducted in commercial production sites, accepted grower practices will be considered as standard procedure unless it conflicts with the protocol. Crop establishment and maintenance will usually be the responsibility of the grower.

3.0 In conducting studies off-site with a grower, the FRD will communicate frequently with the grower about agronomic activities in and around the test site. The grower should be kept fully informed of the study requirements for the plots and be able to provide a record of agronomic activities for the site.

4.0 When trials are conducted at UCKARE or other UCREC system centers, agronomic practices shall be performed to bring the production practices within the requirements of the commodity.

5.0 For questions concerning crop production, current published literature may be used for reference, or an extension/horticulture specialist familiar with the subject production practices may be consulted.

6.0 The protocol will define the crop species. If the variety is not defined, those most commonly grown in the area by commercial producers should be used. If a commercial producer is providing transplants, those most uniform will be selected.

SOP Number: UCKARE-30-2.5	Pg. 1 of 2
Title: Test Site (Selection, Design, Maintenance, Destruction)	

PURPOSE: To provide guidelines for test site selection and management.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURES:

1.0 The test site should be located so there is sufficient isolation to preclude contamination from interfering materials from external sources such as commercial operations or other research studies.

2.0 Treated and untreated control plots will be adequately separated to prevent cross-contamination during test substance application. Factors such as the type of application equipment; the type and size of the test system should be considered when determining buffer distances. At a minimum, when possible, untreated and treated plots will be separated by:

2.1 50 ft. in row crops
2.2 100 ft. in permanent crops (trees/vines)

3.0 Experimental design of the plot will be driven by the protocol. If not defined by the study protocol, a commonly accepted experimental design (e.g., complete randomized block, replicated strip, etc.) will be used, when applicable.

4.0 The test site will be large enough: a) to accommodate the required number of replicates, buffer zones and treatments in accordance with an approved protocol, and b) for the commodity to be grown under commercial conditions yielding samples of sufficient size for analysis where required. For residue trials, the test site should be large enough so that no more than 50% of the harvestable crop in the sampling area will be collected.

5.0 Each plot will be established using a suitable measuring device. End boundaries will be clearly defined with visible markers such as stakes or flags. The Field I.D. Number and treatment name, rate and number (if applicable) will be clearly displayed at the test site.

6.0 The test plot boundaries, locations to each other, to established landmarks and to the North azimuth shall be recorded on a plot map. The closest distance between treated and control plots as well as the distance to a permanent landmark from at least two plot corners or from two plot centers for perennial crops shall also be recorded. When applicable, sub-plots and/or replicate plots will be documented.

7.0 Whenever possible, maintenance pesticides should be approved by the Study Director prior to use. No pesticide should be applied to the test system that may interfere with the objectives of the study. When necessary, the analytical laboratory will be contacted for additional information that may be required to determine suitability of a maintenance pesticide.

8.0 After test substance application, plot maintenance activities will proceed from the untreated control plot first before moving progressively into the higher application rate treated plot(s).

9.0 When required, at the conclusion of the field study, crops treated with the test substance will be destroyed in accordance with regulatory requirements. In most cases, row crops will be disked or rototilled into the ground and commodities from permanent crops will be dropped to the ground or removed from the test site. Permanent crops will be destroyed in a manner that will render the crop unusable.

SOP Number: UCKARE-30-3.4	Pg. 1 of 2
Title: Performance Evaluation	

PURPOSE: To define procedures for collecting performance field data.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURES:

1.0 Phytotoxicity Data

1.1 Consult the protocol to determine the method and timing of the phytotoxicity data. If no method is cited proceed as follows:

1.2 Where possible, take phytotoxicity data within 24 hours before the initial pesticide treatment and within one to two weeks after the treatment. If symptoms occur during or after this period that warrant an additional reading, then phytotoxicity data should be taken as necessary. Take pictures of phytotoxicity symptoms whenever possible and notify the Study Director.

1.3 Select five representative plants in the middle row of each subplot and record a phytotoxicity rating of 0 to 10 for each subplot. 0 = no effect, 1-3 slight effect, 4-6 moderate effect, 7-9 severe effect and 10 complete effect. If there is one plant or tree per subplot, record data from each plant or tree in the plot.

2.0 Efficacy/Pest Control Data

2.1 Consult the protocol to determine the method and timing of the pest data. If no method is cited, proceed as follows: where possible, take pest data within 24 hours before the initial pesticide treatment; within two weeks after the treatment; at various intervals thereafter, depending on the pest life cycle; and at the termination of the study.

2.1.1 Disease data: record the name of the disease(s) being observed. Record the symptom(s) for each disease. Select five representative plants in the middle row of each plot and record the severity of each disease in a rating system of 0 to 10 for each plant. 0 = plant healthy; 10 = plant dead. 1 - 9 = the percentage disease appearing on the plant. If there are less than five plants or trees per plot, record data from all plants or trees in a plot.

2.1.2 Insect data: record the name of the insect(s) being observed. Record the damage symptom(s) for each insect. For damage symptoms, select five representative plants in the middle row of each plot and record the severity of damage for each insect in a rating system of 0 to 10 for each plant. 0 = plant healthy; 10 = plant dead. 1 - 9 = the percentage damage appearing on the plant. If there are less than five plants or trees per plot, record data from all plants or trees in a plot. For insect pest population counts, take a random sample of the pest population (i.e. five leaves/plant from five plants/plot, four 3-inch diameter soil cores/plot, 100 apples/tree, etc.) to ensure an accurate reflection of the pest density/unit area.

2.1.3 Weed data: Visually observe each plot and record the names of the five most prominent weed species and the percentage of the area they cover in each plot. Place a grid covering an area of one square foot in representative areas of the plot. Where possible, count the number of weeds in the grid. If weeds are too numerous to make counting the entire area possible within a reasonable period of time, count the number of weeds in one quarter of the grid, multiply by four and record this value as the number of weeds in the grid.

2.1.4 Nematode data: record the name of the nematode(s) being observed. Record the damage symptom(s) for each nematode. For damage symptoms, select ten representative plants in the middle row of each plot and record the severity of damage for each nematode on each plant using one of the rating systems described by the following:

Barker, K.R., J.L. Townshend, G.W. Bird, I.J. Thomason and D.W. Dickson. 1986. Determining nematode population responses to control agents.

Kickey, K.D. (ed.). Methods for evaluating pesticides for control of Plant Pathogens. Pages 283-296.

For nematode population counts, take a representative sample of the pest population (i.e. root system of two plants/plot, four 3-inch diameter soil cores/plot, etc.) to ensure an accurate reflection of the pest density/unit area as described by Barker et al. cited above. Use a method suitable to extract the nematodes from the soil or plant sample and cite the method used. Count and record the number of nematodes by the various live stages/unit of soil or root.

3.0. Yield Data

3.1 Where possible, obtain a reasonably up-to-date copy of the United States standards for grades of the commodity under study from the Agricultural Marketing Service or other sources. If U.S. grade standards do not exist, then consult other sources and document the plant stage, fruit ripeness, or other characteristics needed to determine quality.

3.2 Check the protocol for information on time of harvest. If none, follow commercial practices in the area for the time of harvest for the commodity. These practices should be documented.

3.3 Where grading standards are known or exist, the commodity should be graded accordingly at harvest.

3.4 Each portion of the commodity, divided as to its quality standard, should be weighed or measured to determine yield. Use a certified scale to record weights. Calibrate scale prior to use to ensure accuracy. Written records should be kept of each measurement for each plot.

3.5 The method used to harvest the commodity should be referenced.

SOP Number: UCKARE-30-4.6	Pg. 1 of 2
Title: Greenhouse Facilities	

PURPOSE: To provide guidelines for trials conducted in greenhouse facilities.

SCOPE: Applies to all research trials conducted in greenhouse facilities through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURES:

1.0 Greenhouses should be large enough to contain an entire trial or portion of a trial with sufficient distance between the UTC and TRT plots to prevent contamination. To further prevent contamination when untreated and treated plots are in the same greenhouse, a plastic curtain can be installed up to the eaves of the greenhouse dividing the greenhouse in half.

2.0 If conducting more than one trial at a time in the greenhouse there should be adequate distance between the TRT plots to prevent contamination. When two treated plots are in close proximity to each other the plot not receiving an application can be tented with clear plastic that is a minimum of 2 mils in thickness or a plastic curtain can be raised up between the plots. The plastic will be removed from the plants or dropped down between plots, once the spray solution has dried on the plot receiving the application. Usually this is a period of approximately 30 minutes.

3.0 Temperature and humidity should be uniform at the trial sites within the greenhouse(s) to allow for uniform plant growth throughout the greenhouse. This is especially important if the greenhouse is divided in half with a barrier. When the greenhouse is divided in half with a barrier, electronic temperature and humidity monitoring devices will be placed in each half of the greenhouse to record daily temperature and humidity levels inside the greenhouse. These devices will be contained inside an aspirated box. Monitoring device data will be downloaded approximately once a month when trials are being conducted in the greenhouse.

4.0 Greenhouse should be equipped to allow temperature, humidity, moisture and fertilization to be maintained that closely simulates commercial greenhouse production conditions.

5.0 The walls, floors and ceilings of the greenhouse should be maintained in good condition. The floors and aisles should be well drained and kept clear of any plant debris, weeds or unused equipment.

6.0 At the time of study applications, the shade curtain inside the greenhouse will be closed. All fans/coolers shut off and all vents closed. These items will remain in this condition until the spray application has dried on the plants that were sprayed. Usually this is a period of approximately 30 minutes. When making applications through an irrigation system or to the growing media, the shade curtain can be opened or closed, the fans/coolers can be on or off and the vents can be opened or closed.

7.0 Once an application has been applied to the treated plot, further activity within the greenhouse(s) shall proceed from the UTC plot to the TRT plot.

8.0 After each test substance application in the greenhouse, signs will be posted at entry points to the greenhouse and any shared plenums with the following information: pesticide, date applied, re-entry interval, contact name and contact phone number. Any personnel entering before the re-entry interval has elapsed must wear the appropriate personal protective equipment. Treated plots will be marked with Warning-Crop Destruct, Do Not Pick tape after the first application has been applied.

9.0 At the conclusion of each study the remaining treated crop plants will be cut off near the soil level in pots. The cut off plants, remaining treated crop, root systems, and growing media will be placed into the crop destruct area at UCKARE.

SOP Number: UCKARE-40-1.9	Pg. 1 of 3
Title: Test Substance Receipt, Storage and Disposal/Adjuvant Storage and Disposal	

PURPOSE: To provide guidelines for managing test substances in a manner consistent with GLP requirements.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Test Substance Receipt

1.1 Test substances will be received at the UCKARE front office. The FRD shall be notified on the day of arrival or following day and will transfer the test substance to the IR-4 Field Research Center test substance storage area.

1.2 Upon receipt, the test substance will be logged into the appropriate FDB and the UCKARE IR-4 program test substance inventory sheet (Excel spreadsheet). At each update of the spreadsheet, a list of test substances in custody will be printed out and posted at the test substance storage facility.

2.0 Test Substance Storage

2.1 Test substances will be stored in accordance with label instructions, and current policies and guidelines of UCKARE.

2.2 At a minimum, all test substances must be labeled with:

2.2.1 Name, CAS or code number
2.2.2 Batch/lot number
2.2.3 Expiration date
2.2.4 Storage conditions

In the event that any of this information has not been provided, every effort will be made to secure that information.

2.3 Test substances will be stored in a dry, well-ventilated building that is separate from offices, laboratories, test substance mixing areas or sample storage areas. Test substances will not be stored next to food, feed, seed, fertilizer, or other articles intended for consumption or use by humans or animals; or near food, beverages, tobacco, clothing and eating utensils.

2.4 The test substance storage area is climatically controlled, and storage temperatures are generally in a range of 50 - 98 degrees Fahrenheit.

2.5 The storage temperature will be monitored continuously with a temperature recorder device, backed up by a secondary temperature monitoring method. As a contingency, storage temperatures may be monitored by a minimum/maximum thermometer.

2.6 The test substance storage facility shall be locked when unattended and accessed by authorized personnel only.

2.7 Highly visible, waterproof identification signs shall be posted on doors, gates, buildings, and fences to advise of the hazardous nature of the storage facility's contents.

2.8 Telephone numbers and names of personnel responsible for and knowledgeable of the contents of the storage facility shall be prominently posted.

2.9 Materials such as absorptive clay, granulated activated charcoal, hydrated lime, and sodium hypochlorite shall be readily available for emergency treatment or detoxification of spills or leaks.

2.10 Test substances that could be damaged by moisture or water will be stored in a manner that will not compromise their integrity.

2.11 A current inventory of all test substances in the storage unit shall be posted in an inside location accessible and visible to study personnel. This inventory will include the information required by local regulations.

3.0 Test Substance Disposal

3.1 The original containers for all GLP test substances must be retained until completion of the study and the Study Director has approved disposal of the containers. Study completion can be confirmed by contacting the Study Director or the Regional Field Coordinator, or by searching the IR-4 web site master schedule; select the Stakeholder Resources Menu->Database Food Crops and then the link for Master Schedule https://ir4app.cals.ncsu.edu/Ir4FoodPub/maScheduleSearch

If there is a date listed under "ACT. STUDY COMP." (Actual Study Completion) for the field trial where the test substance was used, the test substance container may be disposed of.

If the same test substance was used in another trial, that trial must also have a date listed under "ACT. STUDY COMP." for it to be disposed of.

3.2 When specifically requested, the test substance and containers should be returned to the manufacturer or designee. When returning the test substance, include a Chain of Custody with shipment container which includes shipper and recipient information. Transportation must be according to all Federal, State, and local laws and regulations.

3.3 Test substance and/or containers not returned to the manufacturer or designee may be transferred to the UCKARE chemical warehouse after completion of the field study.

4.0 Adjuvants Used for GLP Studies Storage

4.1 Adjuvants will be stored in accordance with label instructions, and current policies and guidelines of UCKARE.

4.2 At a minimum, adjuvants used for GLP studies, will be labeled with:

4.2.1 Name and concentration of adjuvant
4.2.2 Batch or lot number if available
4.2.3 Expiration date if available, if no expiration date is available from the manufacturer assign an expiration date two years from the date of purchase
4.2.4 Date received
4.2.5 Date placed in storage
4.2.6 Recommended storage conditions from label or SDS

4.3 Adjuvants will be stored as per label or SDS recommended conditions. The location of adjuvant storage is at the discretion of the Field Research Directors but typically inside a building or inside a utility box on the back of a pickup truck.

5.0 Adjuvant Disposal

5.1 The original adjuvant container, if no longer used for GLP studies, may be transferred to UCKARE chemical warehouse for maintenance use.

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9240 S. Riverbend Ave., Parlier, CA 93648

SOP Number: UCKARE-40-2.8	Pg. 1 of 3
Title: Test Substance Application	

PURPOSE: To provide guidelines for test substance application methods that ensures study integrity and compliance with regulatory requirements.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Safety

1.1 All UCKARE pesticide safety policies will be followed by all personnel involved in handling pesticides.

1.2 All personal protective equipment and clothing as required by the label or study protocol shall be worn in the handling of pesticides for storage, mixing and application. Emergency personal protective equipment (e.g. coveralls, respirator, eye protection, gloves) must be available when handling hazardous pesticides such as restricted use pesticides.

1.3 A supply of soap/detergent and water should be readily accessible for cleanup in the case of an emergency.

1.4 When applicable, re-entry restrictions will be observed following pesticide applications. For persons who regularly handle organophosphates and/or large quantities of carbamates, a cholinesterase level should be established, and monitored on at least an approximate annual basis.

2.0 Measuring

2.1 Liquid

2.1.1 Graduated Measurement Devices

2.1.1.1 When measuring with a device marked in graduated increments, volume should not be estimated. The increment nearest the actual volume level should be the reported volume so that a greater degree of accuracy is not implied.

2.1.1.2 Exact measurements should be made by measuring to an exact increment, and cylinders or pipettes with greater accuracy used when necessary. For the carrier (e.g. water), record only to the level of

accuracy of each measuring device used. For example, if a 1000 ml graduated cylinder with 10 ml increments and a 250 ml graduated cylinder with 2 ml increments are both used, the amount of carrier may only be recorded in 2 and 10 ml increments.

2.1.2 When measuring chemicals, tank mix additives or tank mix carrier, all measurements must be the exact volume as recorded in the data.

2.1.3 When measuring spray system discharge volume during calibration, measurements from each nozzle must be made with the same cylinder to eliminate any variance in the accuracy between cylinders used.

2.2 Dry

2.2.1 Calibration of the weighing instrument should be verified prior to weighing the quantity for use in the study using weights that bracket the target weight of test substance.

2.2.2 Weighing instruments shall have readability to at least 0.1 gram.

2.2.3 When weighing dry or liquid materials into a secondary container for transport to the field test site, the secondary container will be labeled at a minimum with the following information:

2.2.4 Signal Word
2.2.5 Test substance active ingredient
2.2.6 Test substance batch or lot number
2.2.7 Field ID number
2.2.8 Treatment number
2.2.9 Weight of test substance (solid or liquid)
2.2.10 Expiration date
2.2.11 Name and telephone number of the FRD

3.0 Mixing

3.1 The method of mathematical calculations used to determine test substance usage shall be the choice of the FRD. Tank mixes will be prepared in a volume appropriate for optimal spray system operation and plot coverage, which avoids excessive tank mix remainder after application.

3.2 Part or the entire volume of carrier will be added to the spray tank before the test substance is added. The volume of carrier for R&D sprayers will be measured with an appropriate graduated cylinder and the volume of carrier for air blast sprayers will be measured with a calibrated flowmeter. When possible, part of the pre-measured carrier will be used to thoroughly rinse chemical containers and/or measuring utensils into the spray tank.

3.3 If deemed necessary, a homogenous slurry will first be prepared by blending the pre-measured test substance with a small amount of the pre-measured carrier, and then add the slurry to the spray tank.

3.5 Spray mixtures will be sufficiently agitated prior to use, and will be applied to the test plot no more than two hours after preparation, and generally within 5 to 10 minutes.

4.0 Application

4.1 Application will be made when environmental conditions such as wind or rain will not interfere with uniformity. If adverse conditions prevail, and a critical timing is affected, the Study Director should be contacted for guidance. The RFC and/or ARFC should also be notified.

4.2 All precautions should be taken to avoid applying pesticides on or near sensitive areas or where drift to these areas may occur.

4.3 When making applications at different treatment rates with the same test substance, applications should be made in order from the lowest to highest treatment rate. When making applications at the same treatment rates but different application volumes per acre (GPA), applications should be made in order from the highest (dilute) to the lowest (concentrate) GPA.

4.4 Where the application of restricted use pesticides is required in a study, the applicator must be certified or under the direct supervision of a certified applicator.

4.5 After application, excessive tank mix shall be safely discarded by one of the following methods:

4.5.1 Spraying over a non-crop area at the field site in a manner that prevents contamination of the plot(s).

4.5.2 Spraying on a crop with a registered use.

4.5.3 Spraying an area of the same crop which will not be used in the study.

4.5.4 Pouring the remainder of the tank mix into a suitable container and allow UCKARE Farm Operations to dispose of the excess material in an appropriate manner.

4.6 The actual application rate shall be considered acceptable if it is within the range of -5% to +10% of protocol specified application rate. If the application did not meet this range, the Study Director, RFC and/or ARFC must be notified of this deviation before proceeding with the trial.

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9240 S. Riverbend Ave., Parlier, CA 93648

SOP Number: UCKARE-50-1.8	Pg. 1 of 2
Title: Residue Sample Collection	

PURPOSE: To provide guidelines for collection of residue samples that ensures compliance with regulatory requirements.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 The study protocol will establish specific dates for the collection of samples. If these dates are based on uncontrolled events (plant size, fruit maturity, etc.) then tentative dates should be established and refined as necessary. If requested, the Quality Assurance Unit will be kept informed of these dates. If the date changes are greater than approximately one month, notify the RFC of the change.

2.0 Residue sampling supplies should not be stored with or near pesticides or application equipment. Whenever possible, plastic laminated cloth bags will be used for residue samples.

3.0 Prior to sampling, the tag on the exterior of each sample bag will be labeled in waterproof ink with at least the following information:

3.1 Project and/or Field ID Number
3.2 Crop Fraction
3.3 Test Substance
3.4 Sample ID
3.5 Trt No.
3.6 Harvest Date and Sample Date
3.7 Field Research Director: Name and Phone No.

4.0 Additionally, prior to sampling, the exterior of each bag will be labeled in waterproof ink with at least the following information:

4.1 Field ID Number
4.2 Sample ID
4.3 Trt No.

5.0 The study protocol should establish sample quantity. In the event that it does not, samples will be collected that shall be adequate to fulfill the analytical requirements in order to support the objectives of the study.

6.0 Representative samples will be collected from the sampling area in each plot, unless a unique sampling scheme is required by the protocol. Plot edges and ends will be avoided during sampling, unless those areas are an integral part of the sampling scheme.

7.0 Samples will first be collected from the untreated control plot(s) prior to the treated plot(s). Sampling of the treated plot(s) will progress in order from the lowest to the highest treatment rate. Plots may be sampled simultaneously by different personnel. After sample collection, the samples will be weighed on a scale to ensure that the minimum protocol sample weight requirement was met.

8.0 Contamination of the sample in any way shall be avoided during the sampling, labeling, storage and shipping processes. Special care taken during sample collection and handling will include:

8.1 Diseased or undersized crop parts will be avoided
8.2 Care will be taken to avoid removal of surface residues
8.3 Disposable gloves will be worn
8.4 Tools will be cleaned prior to use and between samples. When separate tools are used for separate samples all equipment will be cleaned prior to use and after sample collection.
8.5 Soil or plant parts will not be removed from the raw agricultural commodity, or the commodity trimmed, unless required by the protocol

9.0 Residue samples should be removed from heat and direct sunlight as soon as possible to minimize degradation of the test substance. In the event that the time from collection to frozen storage is expected to exceed one (1) hour, 1) Control and treated samples should be placed in separate containers with ice or ice substitute to preserve the samples prior to frozen storage, if possible, and 2) Temperatures of the samples will be monitored with an appropriate device such as a min/max thermometer or a hobo data logger. Exceptions might include crop samples that must be dried or processed such as grains, beans, nuts and cotton or fresh fruit that is dried (i.e. plums) that are placed into ~60°C dryers to dry for one day.

SOP Number: UCKARE-50-2.9	Pg. 1 of 3
Title: Residue Sample Storage and Shipment	

PURPOSE: To provide guidelines for the proper storage and shipment of residue samples that ensures sample integrity and regulatory compliance.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Storage

1.1 All samples will be frozen as soon as possible following their collection or as soon as any processing requirements have been met, unless other storage requirements are specified by the study protocol. Samples of different treatments and/or doses will be stored in a manner that will avoid the potential of cross contamination of samples.

1.2 Samples identified for post-harvest processing should be processed or shipped to the processor as soon as possible after collection.

1.3 The freezers, in the freezer room, where samples are stored shall be locked when unattended.

1.4 Frozen samples will be stored at generally less than 0 degrees Fahrenheit (-18 degrees centigrade) and temperatures will be monitored with a calibrated device. Temperature spikes which occur during defrost cycles and freezer loading or unloading do not affect sample integrity.

1.5 An inventory log will be maintained of samples stored in the freezer. This log shall contain a description of the sample (sample type), study number, date/time samples stored in freezer or removed from freezer and the initials of the person storing or removing samples.

2.0 Shipping

2.1 At the time of sample shipment, the Residue Sample Chain of Custody Form and Sample Arrival Check Sheet will be completed, signed and dated. A copy of these forms must be placed in a waterproof container (e.g. plastic zip lock bag) and included in each sample box. The original Residue Sample Chain of Custody Form and Sample Arrival Check Sheet shall be kept in the field data notebook.

2.2 When possible, and less than 75 pounds total weight, all samples should be placed in the same shipping box. The untreated samples should be separated from any treated samples by double bagging both the untreated and treated samples in large plastic bags. Alternately if samples weigh over 75 lbs. the untreated and treated samples will be placed into separate boxes. Once samples are removed from the freezers for shipping preparation every effort will be made to expedite placement into the ACDS freezer truck.

2.3 After shipment of samples, the residue laboratory will be contacted by phone, fax or e-mail with notification of shipment date and method. For overnight shipments (e.g. Fed Ex etc.) the notification will occur prior to or on the day of shipment.

2.4 All residue samples will be shipped in suitable containers of sufficient size and strength to hold the residue samples.

2.5 For all shipping containers:

2.5.1 Address labels (sender and recipient) must be affixed to the exterior.
2.5.2 Must be weighed and the weight recorded on the exterior.
2.5.3 Must be numbered in a way that indicates the total number of containers being shipped for a given study. (e.g. - 'Box 1 of 1; or 'Box 1 of 6, etc.)
2.5.4 Untreated and treated samples shipped in separate containers, should be marked UTC or TRT.
2.5.5 Chain of Custody and Sample Arrival Check Sheet should be placed inside each box.

2.6 When shipping with dry ice:

2.6.1 Insulated containers (boxes or coolers) must be used.
2.6.2 Boxes will be packed with a sufficient quantity of dry ice to maintain sample integrity during shipment.
2.6.3 Dry ice should be packed in several locations within the container to maintain an even temperature, when possible.
2.6.4 Container lids and seams should be securely taped. Address labels must be covered with clear tape.
2.6.5 DOT approved hazardous (dry ice) shipping label must be affixed to the exterior.

2.7 Sample shipping will be conducted by commercial overnight air service (FedEx or other comparable company) or by Agricultural Chemical Development Services (ACDS) freezer truck service. If necessary, arrangements will be made with the carrier for pick-up and shipment of the samples. Commercial overnight shipments should not be initiated after Wednesday to avoid weekend delivery. In some cases, the samples will be picked up in person by laboratory personnel or delivered in person by the field research director. For these situations, the sample receiving laboratory will notify the field research director of sample pickup or the field research director will notify the laboratory of sample delivery. Regardless of method of pickup or delivery the samples will always be transported with sufficient amounts of dry ice to maintain samples in a frozen state.

2.7.1 Federal Express (FedEx):

2.7.1.1 For same day pick-up, carrier must be contacted before 12 p.m.

2.7.1.2 When shipping Fed EX onsite from UCKARE: After samples are prepared for shipment in coolers with dry ice, the sample coolers will be taken to the Fed EX pickup location at UCKARE.

2.7.1.3 For samples delivered to the airport Fed-Ex office for overnight service, samples must be delivered by 5 p.m.

2.7.2 ACDS (Agricultural Chemical Development Services)

2.7.2.1 Typically ACDS informs the IR-4 field research center with the date of their next sample pickup date by telephone.

SOP Number: UCKARE-50-3.7	Pg. 1 of 4
Title: Drying Commodities	

PURPOSE: To provide guidelines for collection of residue samples for drying commodities (e.g. plums, grapes (raisins), stevia, etc.) that ensures compliance with regulatory requirements and will be followed in conjunction with SOP UCKARE 50-1.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 General Drying Procedures

1.1 Preparing the Raw Agricultural Commodity (RAC)

1.1.1 Adequate amounts of the commodity will be collected first from the untreated plot and then from the treated plot to ensure that the protocol minimum weights for the dried commodity are obtained.

1.1.2 Samples will be kept separate to prevent contamination, and maintained according to the protocol specifications between harvesting and drying

1.2 Moisture Verification

1.2.1 Prior to drying the RAC samples, pre-sample determination lots will be completely dried down (until consecutive weight readings are within approximately 1%) to determine the dry weight of the commodity. This dry weight will be used to calculate the target weights for the actual RAC samples according to the procedure in 4.0 below). The raw data will be included in the Field Data Notebook.

1.3 Drying

1.3.1 Samples will be dried in separate areas to prevent contamination. If using forced air dryers, the untreated and the treated samples will be dried in separate dryers.

1.3.2 Drying areas will be cleaned appropriately before use (e.g. dryers will be swept out and the metal trays will be rinsed off with water or wiped down with a damp towel).

1.3.3 Samples will be dried according to protocol specifications. Weights will be recorded before drying, at appropriate intervals, and at completion of drying. Drying temperatures will be monitored and recorded. The raw data will be included in the Field Data Notebook.

2.0 Dried Plums

2.1 The plums are generally dried to a moisture content of 25-30% or whatever percentage the protocol requires.

2.2 Prior to, or a few days prior to the day of sample collection, collect ~500 grams pitted plum fruit, three times. These will be used as the three-pre-sampling determination fruit lots to determine the moisture content of the plums. Record the starting weight (wet weight) for each determination fruit lot. Dry the fruit until they appear to be dried plums and weigh the fruit. Then completely dry the plum fruit until there is no moisture in the fruit. Weigh each determination fruit lot on a scale. Repeat until the following has occurred. The sample is considered completely dry when two consecutive readings within approximately 1% of preceding weight are obtained. Record all weight readings taken and include the data in the Field Data Book.

2.3 Calculate the desired % moisture target weight for the RAC fruit samples and monitoring subsamples according to the procedure outlined in 4.0.

2.4 Collect an adequate amount of fruit so that the final dried plum RAC sample weights can be obtained. This is generally 30 pounds of fresh plums per RAC sample. Collect the fruit into plastic-lined 5-gallon buckets. The buckets will be labeled at a minimum with the study number and treatment number.

2.5 Remove pits from all fresh plums before drying.

2.6 If the fresh plums are not dried on the same day of collection, the pitted fruit will be chilled and processed within 36 hours of harvest.

2.7 After pitting, place the fruit onto metal drying trays lined with paper (i.e. butcher paper, newspaper etc. The trays are 30 inches by 35 inches and the bottom of trays are perforated with holes. Use these trays or equivalent. There will be one separate tray for each UTC and TRT RAC sample. The dryers are empty at time of use so the trays can be put on any shelf deemed appropriate by study personnel. The paper will be labeled at a minimum with the study number and treatment number.

Each RAC fruit sample will be weighed on a scale to check if the desired moisture weight has been reached. If not, the RAC fruit sample will be returned to the dryer and this process will be repeated until the correct moisture weight has been obtained.

2.8 The UTC and TRT RAC fruit samples will be dried in separate forced air dryers. The dryers are usually started the day before or several hours before the intended use day so that they can equilibrate to the desired temperature. The dryers are maintained at approximately 60º C which can be monitored on an external digital readout and/or hobo temperature data logger probe inside the dryers. Prior to placing fruit in dryers, the temperature can be verified by observing the external digital readout. The external digital temperature will be recorded in the study notebook for the duration of the drying period at intervals deemed appropriate by study personnel.

2.9 Prior to use, the dryers will be swept out and the metal trays will be rinsed off with water or wiped down with a damp towel.

3.0 Dried Grapes (Raisins)

3.1 The grapes are generally dried to a moisture content of 10-15% or whatever percentage the protocol requires.

3.2 Prior, or a few days prior to the day of sample collection, collect ~500 gram of fresh grape fruit, three times. These will be used as the three-pre-sampling determination fruit lots to determine the moisture content of the grapes. Record the starting weight (wet weight) for each determination fruit lot. Dry the fruit until they appear to be raisins and weigh the fruit. Then completely dry the raisins until there is no moisture in the raisins. Weigh each determination fruit lot on a scale. Repeat until the following has occurred. The sample is considered completely dry when two consecutive readings within approximately 1% of preceding weight are obtained. Record all weight readings taken and include the data in the Field Data Book.

3.3 Calculate the desired % moisture target weight for the RAC fruit samples and monitoring subsamples according to the procedure outlined in 4.0.

3.4 Collect an adequate amount of fruit so that the final dried raisin sample weights can be obtained. This is generally 40-45 pounds of fresh grapes per sample. Collect the fruit into plastic-lined 5-gallon buckets. The buckets will be labeled at a minimum with the study number and treatment number.

3.5 After collecting the fresh grapes into 5-gallon buckets, lay the fresh fruit out onto paper trays to dry in a suitable place outdoors (typically not in the test plot area). The trays are 2 feet by 3 feet brown paper trays. Use these or other suitable trays as deemed necessary. Leave the fruit drying on the trays until the correct percent moisture content is reached. Document the drying location used in the Field Data Book. About half way through the drying process turn the grapes over one time.

Each RAC fruit sample will be weighed on a scale to check if the desired moisture weight has been reached. If not, the RAC fruit sample will be returned to the drying location and this process will be repeated until the correct moisture weight has been obtained.

3.6 The UTC and TRT fresh grape RAC samples will be separated by a sufficient distance to prevent cross contamination. The paper trays will be labeled at a minimum with the study number and treatment number.

3.7 If rainfall is predicted during the drying period, the samples may be moved indoors (i.e. greenhouse). Obtain Study Director approval prior to doing this.

3.8 Monitor the indoor or outdoor air temperature for the duration of the drying period and record this in the Field Data Book.

4.0 Calculating % Moisture and Target Weights

For this example, three pre-sampling determination fruit lots were completely dried down:

Determination Lot	Wet Weight (gr)	Completely Dry Weight (gr)
1	500	128.1
2	500.2	129
3	500.1	129.2
Average	500.1	128.8

To extrapolate the dry weight of a RAC sample from the pre-sampling determination fruit lots:

$$\frac{\text{Ave dry wt. pre-sampling determination lots}}{\text{Ave wet wt. pre-sampling determination lots}} = \frac{\text{dry wt. RAC sample}}{\text{wet wt. RAC sample}}$$

Wet weight = weight of fruit prior to drying

RAC extrapolated dry wt. = RAC sample wet wt. * (ave. determination lots dry wt./ wet wt.)

Using the average weight from the determination lots above, for a RAC sample with a starting wet weight of 10,065 gr:

RAC sample dry wt. = 10,065 gr * (128.8 gr dry wt./500.1 gr wet wt.)
= 2592.2 gr

To calculate for required % moisture target weight:

% Solids = 100% - % desired moisture
Dry weight / desired % solids = target weight

In this example, the protocol requires 25% moisture, and using the extrapolated dry weight 2592.2 gr of the RAC fruit sample from above:

% Solids = 100% - 25% moisture = 75% solids

2592.2 gr/0.75 (75% solids) = **3456.3 gr dried fruit target weight**

Confirm moisture for actual weight of RAC sample:

(actual weight-dry weight)/actual weight = % moisture

Actual weight = weight of the dried RAC sample
Dry weight = weight of the completely dried down fruit (extrapolated)

Using the weights from the example above, with a final RAC sample weight of 3470 gr:

$$\frac{\text{3470 gr actual wt.} - \text{2592.2 gr extrapolated dry wt.}}{\text{3470 gr}} \times 100 = 25.30\% \text{ moisture}$$

Maintain this data so it can be included in the study notebook.

SOP Number: UCKARE-60-1.5	Pg. 1 of 2
Title: Flowmeter – Scienco	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation (SCIENCO)

1.1 The instrument is turned on by depressing the on button which displays current total.

1.2 To reset current total to 0.00 press and hold for 2 seconds the reset button. This allows measurement for a single use.

1.3 To display the cumulative total press and hold down the button that says Total 2.

2.0 Calibration Verification

2.1 Calibration will be verified prior to each use by metering water through the flowmeter into a calibrated container to the 5-gallon mark. If the readout indicates a variation of 2% or more (or ~380 ml.), the flowmeter will be recalibrated. Containers used for this purpose will be calibrated either volumetrically with graduated cylinders or gravimetrically on a calibrated scale.

2.2 If it is determined that the instrument accuracy varies more than 2% from the known value then the flowmeter will be recalibrated. Refer to flowmeter operation manual.

3.0 Cleaning and Maintenance

3.1 Flowmeters are only used for metering water and do not require cleaning.

3.2 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing worn seals and batteries on an as needed basis, no scheduled maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, calibration, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration and maintenance will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-2.7	Pg. 1 of 2
Title: Freezers	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 The freezer thermostat should be set to maintain a temperature of generally less than 0^0 F (-18^0 C).

2.0 Calibration

2.1 None required.

3.0 Cleaning and Maintenance

3.1 Routine cleaning of the freezer is not considered necessary. On an approximate annual basis, usually during a period when field trials are completed for the season and the freezer can be decommissioned for a short time, the exterior and interior surfaces will be thoroughly cleaned with soap and water.

3.2 Maintenance required as a result of normal wear defines routine maintenance. No scheduled routine maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 In the event of freezer malfunction, a qualified service representative will be immediately summoned. If the malfunction exceeds 6 hours, the contents of the freezer will be transferred to alternate frozen storage areas (e.g. UCKARE freezers or offsite freezers).

4.2 The freezers are on a power backup generator system in the event of a power outage. The freezers are also connected to a webctrl alarm system in the event that the freezer temperature goes below -50 F or above 10 F. Both of these systems are not maintained under GLP guidelines. The systems are only intended for monitoring freezer conditions. The systems are maintained by UCKARE physical plant operations.

Approximately yearly the freezer alarm system will be tested to ensure that the alarm system is working and fully functional. This is done by removing the temperature probes from the UTC and TRT freezers. UCKARE personnel are alerted by email and text message of the freezers alarms. IR-4 personnel will then be notified by UCKARE personnel that the freezer alarms have been activated. UCKARE physical plant personnel will test the auto switch gear for natural gas backup generator in the event of a power failure under a load. The system switches automatically from main electrical power to backup generator power in approximately 2 minutes after a power failure. This is done once or twice a year based on physical plants schedule. The freezer alarm test will be documented on the UCKARE IR-4 freezer alarm test form which will be maintained in UCKARE records.

In the event of a freezer malfunction, the alarm system will be tested following repair or replacement to confirm that it is working properly.

4.3 If the malfunction results in a deviation from a study protocol, the deviation will be documented, and the Study Director will be notified.

5.0 Responsible Personnel

5.1 Equipment inspection, cleaning (when required) and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

6.2 The sample freezer storage temperature will be monitored continuously when residue samples are present in freezers with a temperature recording device backed up by a secondary temperature monitoring method. As a contingency, storage temperatures may be monitored by a minimum/maximum thermometer.

SOP Number: UCKARE-60-3.5	Pg. 1 of 3
Title: Sprayer - Croplands Handgun	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Prior to use, a general inspection will be made of the sprayer for visual damage or potential problems.

1.2 Bypass valves must be open when the engine is operating to avoid blowing seals and hoses.

1.3 Calibrated spray pressure shall be verbally confirmed with the equipment operator prior to spraying. Actual spray pressure during application will be recorded and should remain unchanged from calibration. Pressure may be adjusted after calibration if verification of the flow rate is made and it is deemed necessary, in order to achieve the calibrated discharge volume.

1.4 If application is made based on calibrated speed, sprayer speed shall be timed through a test run in the test field prior to application to verify travel time and will be recorded.

1.5 The actual rate of test substance applied will be calculated based on the calibrated discharge over the known actual spray time.

2.0 Calibration

2.1 Calibration of the sprayer will occur or be verified prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

2.1.1 Constant pressure will be set.

2.1.2 The nozzle output will be measured, and each measurement shall not vary more than 5% from the average of at least 3 consecutive measurements. Nozzle output will be measured by a method which is accurate and reproducible, which may include, but not necessarily be limited to the following:

2.1.2.1 Volume discharged from nozzle for a specific time (e.g. 30 secs).

2.1.2.2 Time required to discharge a known volume.

2.2 The flow rate, in milliliters and/or gallons per minute, will then be calculated and application will be made based on a timed spray, either to each tree or vine, or over a known distance. Alternately, the volume required to spray one tree or vine can be mixed and applied.

2.3 If calibration does not occur on the day of use, sprayer discharge must be verified and documented at least once on the day of use and must be within 5% of the calibrated value(s) or the sprayer must be re-calibrated.

2.4 The method of mathematical calculations used will be the choice of the Field Research Director and shall be recorded in the raw data.

3.0 Cleaning

3.1 After use, and between treatments with different chemicals or different formulations of the same chemical, the spray system will be thoroughly cleaned by rinsing with water, rinsing with soap and water, then a final rinse with water.

3.2 The spray apparatus exterior will be hosed off with clean water.

3.3 Exceptions to these cleaning requirements may include:

3.3.1 Equipment used in applying chemicals that may require specific solvents to remove chemical residues. In this case, cleaning methods must be thoroughly documented in the trial raw data.

4.0 Maintenance

4.1 Maintenance required as a result of normal wear defines routine maintenance. Routine maintenance that shall occur at least once a year includes:

4.1.1 Engine and pump lubricants changed, if needed (based on seasonal use).

4.2 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel and Study Director shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

6.0 Responsible Personnel

6.1 Equipment inspection, calibration, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

7.0 Records

7.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Calibration results can be accessed by reference of the study number recorded in the Equipment Log at the time of these operations. Historical records will be retained in the archives.

SOP Number: UCKARE-60-4.4	Pg. 1 of 3
Title: Sprayer - R & D Model T Backpack	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Prior to calibration, a general inspection will be made of the sprayer for visual damage or potential problems. The spray system will then be operated to verify that the nozzles provide the desired pattern and that the pressure regulator is operating properly.

1.2 The spray system which consists of a CO_2 tank, valves, spray bottle or spray tank, spray wand and related hoses, may be uniquely adapted to an assortment of application requirements and may either be hand carried or mounted on a variety of application equipment such as a bicycle sprayer, tractor or helicopter.

1.3 Before operating the sprayer, the regulator valve should be set at the low-pressure position before opening the CO_2 valve. The regulator valve can then be adjusted to the desired pressure.

1.4 Calibrated spray pressure, RPM (if applicable) and speed information shall be verbally confirmed with the equipment operator prior to spraying. Actual spray pressure, RPM (if applicable) and speed during application will be recorded and should remain unchanged from calibration.

1.5 If the spray system is mounted on application equipment, the equipment will be timed through a test run in the test field prior to the application to verify speed. If the spray system is hand carried, the applicator will be timed through a test run in the test field, to confirm that travel time is accurate. Verification pass time will be recorded.

1.6 Each spray pass through the plot during the application will be timed and recorded to verify the actual application rate.

1.7 After use, the CO_2 valve should first be closed. If the sprayer is fitted with a pressure relief valve, the excess pressure should then be released from the spray system. The air supply hose should first be disconnected from the spray bottle or spray tank, and then the spray boom hose can be disconnected. This sequence will prevent the possibility of expulsion of spray solution from the spray bottle or spray tank.

2.0 Calibration

2.1 Calibration of the sprayer will occur or be verified prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

2.1.1 Constant pressure will be set.

2.1.2 Discharge volume of liquid from each nozzle shall be measured and each individual measurement from 3 or more consecutive measurements shall not vary more than 5% from the average of all measurements. Any nozzle which varies greater than 5% should be cleaned or replaced. The averaged measurement will be used in the final calculations made to determine the actual application volume.

2.1.3 The sprayer speed shall be timed over a known distance, and each individual measurement shall not vary more than 5% from the average of 3 or more consecutive measurements. The averaged measurement will be used in the final calculations made to determine the actual application volume.

2.2 If calibration does not occur on the day of use, sprayer discharge must be verified and documented at least once on the day of use and must be within 5% of the calibrated value or the sprayer must be re-calibrated.

2.3 The method of mathematical calculations used will be the choice of the Field Research Director and shall be recorded in the raw data.

3.0 Cleaning

3.1 After use and between treatments with different chemicals or different formulations of the same chemical, the spray system will be thoroughly cleaned by rinsing with water, rinsing with soap and water, then a final rinse with water.

3.2 The spray apparatus exterior (tanks and boom) will be rinsed off with clean water.

3.3 Exceptions to these cleaning requirements may include:

3.3.1 Equipment used in applying chemicals that may require specific solvents to remove chemical residues. In this case, cleaning methods must be thoroughly documented in the trial raw data.

3.4 For trials with multiple treatments of the same test substance at varying rates, applications should be made in order from the lowest to the highest treatment rate, in which case:

3.4.1 It will not be necessary to clean the spray system between treatments. The spray system can be completely drained, and the next tank mix prepared. The next application should then proceed only after the spray system has been fully charged.

3.4.2 It is preferable to use separate spray tanks. If separate spray tanks are used, all tank mix solution may be drained from the spray system back into the spray tank and the spray system connected to the next spray tank for application. The next application should then proceed only after the spray system has been fully charged.

4.0 Maintenance

4.1 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing worn regulator seals or pressure gauges on an as needed basis, no scheduled maintenance is required.

4.2 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken. However, malfunction of a pressure regulator is considered a result of normal wear, and its repair is considered routine maintenance.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel and Study Director shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

6.0 Responsible Personnel

6.1 Equipment inspection, calibration, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

7.0 Records

7.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Calibration results can be accessed by reference of the study number recorded in the Equipment Log at the time of these operations. Historical records will be retained in the archives.

SOP Number: UCKARE-60-5.7	Pg. 1 of 2
Title: Temperature Measurement Instruments - Thermometers	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Regardless of type, any temperature sensing instrument must be positioned in the target area in a location that is representative of the area and allowed sufficient time to equilibrate before reading.

1.2 If situated in an outdoor or greenhouse area, the instrument should be placed out of direct sunlight and with adequate ventilation to prevent absorbed or reflected heat from affecting its accuracy.

1.3 If present, minimum/maximum temperature indicators must be reset between readings.

2.0 Verification

2.1 Verification will be checked at least once a year.

2.2 Thermometers will be verified against a NIST certified thermometer at two temperature reference points covering the intended working range. The instruments should be allowed to equilibrate for at least 5 minutes before readings are taken and recorded for both test and reference thermometers at any reference point. The NIST thermometer will be recertified approximately every other year by the manufacturer or other qualified service vendor. The NIST thermometer will be replaced when the thermometer fails recertification.

If temperature variation from the certified thermometer is greater than 3 degrees, the thermometer should be replaced or adjusted, if possible.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 No scheduled routine maintenance is required for non-digital thermometers. Other than replacing batteries when necessary, no scheduled maintenance is required for digital thermometers.

3.3 Non-routine maintenance should not be required. Thermometers which have been determined to not be functioning properly will be replaced.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-6.6	Pg. 1 of 2
Title: Temperature/Humidity Monitoring Instruments - Psychrodyne	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 The instrument should be placed in a shaded location and preferably a minimum of one foot above the soil surface.

1.2 The wick covering the end of the wet bulb must be moistened with de-ionized water and the instrument fan operated until both thermometers have equilibrated.

1.3 The relative humidity can then be determined with the humidity calculator provided with the instrument.

2.0 Verification

2.1 Verification of both thermometers will be checked at least once a year.

2.2 The equipment will be verified against a NIST certified thermometer at two temperature reference points covering the intended working range. The thermometers should be allowed to equilibrate for at least 5 minutes before readings are taken and recorded for both test and reference thermometers at any reference point. The NIST thermometer will be recertified approximately every other year by the manufacturer or other qualified service vendor. The NIST thermometer will be replaced when the thermometer fails recertification.

If temperature variation from the certified thermometer is more than 3 degrees, the thermometer should be replaced or adjusted, if possible.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing batteries and the wet bulb wick when necessary, no scheduled maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-7.7	Pg. 1 of 2
Title: Temperature/Humidity Monitoring Instruments - Thermo-Hygrometer	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 The instrument should be placed in a shaded location and preferably a minimum of one foot above the soil surface.

1.2 The instrument should be operated for approximately 5 minutes to allow readings to equilibrate before documenting displayed temperature and humidity results.

2.0 Verification

2.1 Verification will be checked at least once a year.

2.2 Humidity accuracy will be verified against a Psychro-Dyne that has been verified. Temperature will be verified against a NIST certified thermometer across the intended working range. The NIST thermometer will be recertified approximately every other year by the manufacturer or other qualified service vendor. The NIST thermometer will be replaced when the thermometer fails recertification.

2.3 Temperature will be verified at two reference points, and humidity checked at one reference point. The instrument should be allowed to equilibrate for at least 5 minutes before readings are taken and recorded for both test and reference instruments at both reference points.

If variation from the reference instrument is more than 3 degrees in temperature or 12% in humidity, the instrument should be repaired or replaced.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing batteries when necessary, no scheduled maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-8.9	Pg. 1 of 2
Title: Temperature or Temperature/ Humidity Recording Instruments-HOBO (Onset)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 While connected to the computer, the instrument is launched (set to record at specified intervals for a specified duration), and battery status checked.

1.2 Unless auxiliary sensory probes are used, the instrument should be placed in a location representative of the area being monitored whenever possible.

1.3 Data will be downloaded on an approximate monthly schedule, or as needed. At each download interval, data should be printed out and filed.

2.0 Verification

2.1 Verification will be checked at least once a year.

2.2 Humidity accuracy, for instruments that record both temperature and humidity, will be verified against a Psychro-Dyne that has been verified. Temperature will be verified against a NIST certified thermometer across the intended working range. The NIST thermometer will be recertified approximately every other year by the manufacturer or other qualified service vendor. The NIST thermometer will be replaced when the thermometer fails recertification.

2.3 Temperature will be checked at two reference points, and humidity checked at one reference point. The instrument should be allowed to equilibrate for at least 5 minutes before readings are taken and recorded for both test and reference instruments at both reference points or one reference point for humidity.

2.4 The instrument will be launched and set to record for a pre-determined time (30 minutes minimum), and placed at the testing location for that period. Resulting data will be downloaded and compared to the certified thermometer temperature and for units that record humidity compared to the Psychro-Dyne readings.

If temperature or humidity variation from the reference instrument is more than 6 degrees, for more than 1 data point, for the temperature or RH of 12%, respectively, the instrument should be tested again 3 times and if the unit is still out of range it should be repaired or replaced.

3.0 Cleaning and Maintenance

3.1 The instrument will be cleaned when necessary.

3.2 Maintenance required as a result of normal wear defines routine maintenance. Other than replacing batteries when necessary, no scheduled maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-9.7	Pg. 1 of 1
Title: Weights (Calibration)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Weights should be stored in a closed container and should be handled as carefully as possible.

1.2 The weight should be visually inspected prior to use to confirm that it is undamaged.

1.3 The weight will be placed on a weighing instrument that has been cleaned and tared.

1.4 The weighing instrument will first be allowed to stabilize, and then the results recorded in the appropriate FDB.

2.0 Verification

2.1 Certified verification shall be performed on an approximate annual schedule by a qualified professional.

2.2 Verification weights will be checked against certified weights on an approximate annual schedule and weights replaced if not within 1% of the certified weight.

3.0 Cleaning and Maintenance

3.1 None required.

4.0 Contingency Procedures

4.1 If a weight is suspected to be faulty, it should be checked against another weight and replaced if necessary.

5.0 Responsible Personnel

5.1 Equipment inspection, verification, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, verification, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-10.6	Pg. 1 of 2
Title: Weighing Instruments	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 If the instrument is capable of reporting data in more than one type of unit of measurement (i.e. grams, ounces, grains, etc.), the measurement mode should be checked prior to use and adjusted if necessary. Also, if so equipped, the leveling bubble should be centered before weighing commences. This can be checked by visual assessment.

1.2 The instrument must first be tared (set to zero) and the digital readout should be observed for any fluctuations which might indicate potential problems that may affect instrument performance, such as an improperly situated weighing plate, or, for more sensitive instruments, air currents.

1.3 Once the instrument has been determined to be functioning properly, weighing may commence.

1.4 When weighing into a container, the instrument must again be reset to zero after a container has been placed on it, and before weighing procedures begin.

2.0 Calibration

2.1 Certified calibration shall be performed on an approximate annual schedule by a qualified professional.

2.2 Calibration will be verified prior to use. For this purpose, certified weights will be used, and whenever possible, this should be achieved with weights which bracket the desired target weight. If the accuracy of the instrument varies more than ±1% from the target weight, it should be adjusted in accordance with the instructions provided by the manufacturer. If the accuracy problem persists, the instrument shall be serviced by the factory service department or other qualified service personnel. If necessary, the instrument will be replaced.

3.0 Cleaning and Maintenance

3.1 The instrument should be cleaned when necessary with water or soap/water solution.

3.2 Maintenance required as a result of normal wear defines routine maintenance. The following routine maintenance will be performed as necessary:

3.2.1 If present, batteries will be replaced when necessary.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-11.3	Pg. 1 of 2
Title: Wind Speed Measurement Instrument - Turbometer (Davis)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 If the instrument is capable of reporting data in more than one type of unit of measurement (i.e. miles per hour, knots, feet per minute, meters per second, etc.), the measurement mode should be checked prior to use and adjusted if necessary.

1.2 Prior to use, the turbine should be checked to see that it is revolving freely, and the instrument is functioning properly.

1.3 The instrument should be held at eye level, away from any objects that may alter the wind speed and read the indicated wind speed. For best results, the axis of the turbine should be within 20^{o} of the wind direction and approximately 5 seconds should be allowed for an accurate measurement. If possible, readings prior to an application should be taken at approximately the same height as the sprayer boom.

2.0 Calibration

2.1 Certified calibration shall be performed approximately every 24 months by a qualified professional.

3.0 Cleaning and Maintenance

3.1 The instrument exterior should be cleaned when necessary with a damp cloth.

3.2 Maintenance required as a result of normal wear defines routine maintenance. However, with the exception of the following, no routine scheduled maintenance is required.

3.2.1 If present, batteries will be replaced when necessary.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Contingency Procedures

4.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

5.0 Responsible Personnel

5.1 Equipment inspection, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

6.0 Records

6.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Historical records will be retained in the archives.

SOP Number: UCKARE-60-12.5	Pg. 1 of 4
Title: Sprayer – Air blast (Tractor-Mounted)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Prior to use, a general inspection will be made of the sprayer and tractor for visual damage or potential problems.

1.2 Pressure hoses and fittings will be inspected.

1.3 The pressure gauge will be checked to ensure it operates properly.

1.4 The PTO must be engaged slowly at low RPM and then slowly increased until desired operating speed is reached.

1.5 If an in-line flowmeter is in use, it should be re-set to zero before spray application begins.

1.6 Calibrated spray pressure, RPM and speed information shall be verbally confirmed with the equipment operator prior to spraying. Actual spray pressure, and speed (pass times) during application will be recorded and should remain unchanged or similar to calibration. Pressure may be adjusted after calibration if verification of flow rate is made and it is deemed necessary, in order to achieve the calibrated discharge volume. If pressure is adjusted, a full output calibration will be performed, and recorded.

1.7 The sprayer will be timed through a test run in the actual test plot prior to the application to verify travel time and the verification pass time will be recorded.

1.8 Each pass through the plot during an application will be timed, recorded and used to determine the actual amount of test substance applied.

1.9 The actual rate of test substance applied may also be confirmed by an in-line flowmeter, if present.

2.0 Calibration

2.1 Calibration shall either be performed or verified prior to each use.

2.2 Prior to calibration:

2.2.1 The spray system will be operated to verify that pressure is constant and that the nozzles provide the desired pattern.

2.2.2 Calibration of the in-line flowmeter (if present) will be performed or verified. To verify calibration, liquid shall be metered through the flowmeter into a calibrated container to the 5-gallon mark. If the LCD meter indicates a variation of ±2% (or ~380 mL), the flowmeter must be recalibrated (refer to instrument operation manual).

2.2.3 Constant pressure and RPM will be set.

2.3 The spray volume per acre can then be calibrated, and/or verified, by an acceptable method that is accurate and reproducible. These methods will be documented, and may include, but not necessarily be limited to, the following:

2.3.1 Operating and timing the sprayer over a known area while measuring the output of water. The output volume can be measured with an attached in-line flowmeter (if available) or other method that is accurate and reproducible.

2.3.2 Filling the sprayer with an unknown volume of water, then operating the spray system for a pre-determined period of time, usually 30 seconds, and measuring the output volume for that period with an attached in-line flowmeter or other method that is accurate and reproducible; and b) timing the sprayer over a known distance.

2.3.3 Filling the sprayer with a known volume of water, then measuring the time required to discharge that volume from the spray system; and b) timing the sprayer over a known distance.

2.4 Minimally, the sprayer output will be measured three times and sprayer speed will be measured three times, and the average of each consecutive like measurement will be used in the final calculations made to determine the actual application volume. Each like measurement (volume or speed) used for final calculations, must not vary more than 5% of the mean value of each individual measurement.

2.5 Calibration is preferred on the day of application. If not performed on the day of application, calibration could occur on the day prior to application, but sprayer discharge must be verified and documented at least once on the day of use and must be within ±5% of the calibrated value or the sprayer must be re-calibrated.

2.6 The method of mathematical calculations used will be the choice of the Field Research Director and shall be recorded in the raw data.

2.7 After calibration and prior to use the sprayer must have the tank and spraying system drained of all water. The following method should be used:

2.7.1 With the PTO off, open the tank drain valve, remove all water and leave drain valve open.

2.7.2 Open bypass valve to the short relief hose. Start the PTO and turn on spray control valve. Shut spray valve off and stop PTO when water no longer is pumped from relief hose. Close relief hose valve.

2.7.3 Drain the filter canister on the right side of the sprayer, check the screen and clean if necessary, then return to position.

2.7.4 Verify spray tank is empty, then close drain valve.

3.0 CLEANING

3.1 After use, and between treatments with different chemicals or different formulations of the same chemical, the spray system will be thoroughly cleaned by rinsing with water, rinsing with soap and water, then a final rinse with water

3.2 When making applications at different treatment rates with the same chemical, if applications are made in order from the lowest to the highest treatment rate, it will not be necessary to clean the spray system between treatments. When making applications at the same treatment rate but at different gallons per acre (GPA), if applications are made in order from the highest (dilute) to the lowest (concentrate) GPA, it will not be necessary to clean the spray system between treatments. In these cases, at a minimum, the spray tank shall be completely drained, and the next tank mix prepared.

3.3 The sprayer exterior and the tractor will be hosed off with clean water.

3.4 Exceptions to these cleaning requirements may include:

3.4.1 Equipment used in applying chemicals that may require specific solvents to remove chemical residues. In this case, cleaning methods must be thoroughly documented in the trial raw data.

4.0 MAINTENANCE

4.1 Maintenance required as a result of normal wear defines routine maintenance. The following routine maintenance will be performed at least once every three years during heavy use years or less frequently during light use years.

4.1.1 Pump lubricant changed.

4.1.2 Driveline and shaft bearings (if present) greased.

4.1.3 Drive belts (if present) checked and replaced if necessary.

4.2 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

5.0 CONTINGENCY PROCEDURES

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel and Study Director shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

6.0 RESPONSIBLE PERSONNEL

6.1 Equipment inspection, calibration, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.

7.0 RECORDS

7.1 A record of the dates of equipment inspection, calibration, maintenance and cleaning will be kept in an equipment logbook. Calibration results can be accessed by reference of the study number recorded in the Equipment Log at the time of these operations. Historical records will be retained in the archives.

SOP Number: UCKARE-60-13.4	Pg. 1 of 1
Title: Liquid Measurement – Bulk Containers (Flowmeter Calibration or Calibration Verification, Tank Mix Preparation)	

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Bulk Containers (Flowmeter Calibration or Calibration Verification, Tank Mix Preparation)

1.1 For optimum accuracy, it is preferable to use a container with a narrow diameter at the point where the calibrated volume is marked. For the most commonly used volume of measurement (5-gallon) a 5-gallon plastic factory made/calibrated container is ideal.

1.2 Factory made calibrated dedicated containers will be verified with water either volumetrically with graduated cylinders, or preferably gravimetrically with a calibrated balance when put into service

1.3 Each container will be uniquely numbered, and a record of the date and units of measurement used (gallons, quarts, or liters) will be kept for each container.

1.4 After calibration, the calibrated volume will be made on the container with a waterproof marker.

1.5 Re-calibration should not be necessary unless the container is re-calibrated for a different unit of measurement.

2.0 RESPONSIBLE PERSONNEL

2.1 Equipment inspection, calibration, and cleaning shall be performed or supervised by the Field Research Director.

3.0 RECORDS

2.1 A record of calibration for bulk containers will be maintained. Historical records will be retained in the archives.

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 The post-harvest treater at UC Kearney Agricultural Research and Extension is a non-GLP piece of equipment.

1.2 Prior to calibration, a general inspection will be made of the treater for visual damage or potential problems. The treater system will then be operated to verify that the application equipment provides the desired spray pattern and that the system is operating properly.

1.3 The spray system which consists of an input table, wash/rinse brush bed, sponge bed, treatment brush bed, cross-over conveyer belt (which serves as the input table if the brush beds are not used or the output table if the PVC rollers are not used), PVC rollers, output table, and specific application equipment. Specific application equipment consists of a T-jet nozzle, CDA applicator, wig-wag applicator, and drench systems. The treater or portions of the treater may be uniquely adapted to an assortment of application requirements.

1.4 Before operating the treater, the specific equipment to be used should be adjusted to approximately the desired settings to enable calibration.

1.5 Treater output volume and speed setting information shall be recorded at the time of calibration. Actual settings and pass time during application will be recorded to verify the actual application rate and should remain unchanged from calibration.

1.6 After use, the treater equipment should be cleaned.

2.0 Calibration

2.1 Calibration of the treater will occur prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

2.1.1 Typically, calibration requires recording the weight of each container of fruit to be treated. Prior to recording, each container weight will be adjusted by sorting fruit between container so that each container weight will not vary by more than 2% of the average weight of each container to be treated for the same sample set.

2.1.2 Constant pressure or pump settings will be set when it affects the application system.

2.1.3 Discharge volume of liquid from each nozzle or the CDA applicator shall be measured and each individual measurement from 3 or more consecutive measurements shall not vary more than 5% from the average of all measurements. Any nozzle or CDA applicator which varies greater than 5% should be cleaned or replaced. The averaged measurement will be used in the final calculations made to determine the actual application volume.

2.1.4 The sprayer speed shall be timed over a known distance, and each individual measurement shall not vary more than 5% from the average of 3 or more consecutive measurements. The averaged measurement will be used in the final calculations made to determine the actual application volume.

2.2 The method of mathematical calculations used will be the choice of the Field Research Director and shall be recorded in the raw data.

3.0 Cleaning

3.1 Prior to use, after use and between treatments with different chemicals, the spray system will be thoroughly cleaned with soap and water. After the system has been operated and thoroughly flushed with soap and water, it will be thoroughly rinsed with clean water.

3.2 Prior to use, after use and between treatments with different chemicals, the treater surfaces that may impact the samples will be cleaned with soap and water and thoroughly rinsed with clean water. A high pressure hot water spray system and/or high alkali solution should be used to help remove chemical residues when waxes are used.

3.3 For trials with multiple treatments of the same test substance at varying rates, applications should be made in order from the lowest to the highest treatment rate, in which case:

3.3.1 It will not be necessary to clean the spray system between treatments. The spray system can be completely drained, and the next treatment prepared. The next application should then proceed only after the spray system has been fully charged.

4.0 Maintenance

4.1 As a non-GLP piece of equipment, maintenance records are also non-GLP. Copies of these records will be requested each year the treater is used.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel and Study Director shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the non-GLP equipment log describing the repair.

6.0 Responsible Personnel

6.1 During the application process, equipment inspection, calibration, and cleaning shall be performed or supervised by the Field Research Director.

7.0 Records

7.1 Equipment records are non-GLP and are maintained by UCKARE. A record of trial-specific activities will be maintained in the appropriate field data book.

PURPOSE: To describe the procedures to follow for equipment rented or borrowed for use in GLP studies. This is for equipment not routinely available at the field test site facility.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Obtaining Equipment Procedure

1.1 Contact the appropriate source for the equipment to be borrowed or rented.

1.2 Determine whether there is an operation manual available for the equipment. Request a copy of the equipment manual if it is available.

2.0 Documentation

2.1 This information should be documented for borrowed or rented field equipment.

2.1.1 Owner/Source
2.1.2 Description of equipment, e.g., type, make, and model
2.1.3 Year manufactured (when available)
2.1.4 Year acquired (when available)
2.1.5 Purpose
2.1.6 Study identification
2.1.7 Condition upon receipt e.g., good, needed repair
2.1.8 Maintenance performed (when applicable)
2.1.9 Modifications required (when applicable)
2.1.10 Cleaning/decontamination procedures performed
2.1.11 Field Research Director statement of suitability for use
2.1.12 Date of use
2.1.13 Time procedure initiated and completed

2.2 The above information is maintained in the field notebook. A copy of the equipment manual, when available, will be kept in facility files.

PURPOSE: To ensure that equipment utilized for the generation, measurement or assessment of GLP data is properly operated and maintained.

SCOPE: Applies to all research trials conducted through the University of California Kearney Agricultural Research and Extension IR-4 Field Research Center.

PROCEDURE:

1.0 Operation

1.1 Prior to calibration, a general inspection will be made of the irrigation system for visual damage or potential problems. The irrigation system will then be operated to verify that the emitters or nozzles provide the desired pattern and that the pressure gauge, if present, is operating properly.

1.2 Injection of the test substance may be done through overhead irrigation sprinklers, micro-sprinklers, and drip tape or drip line. The test substance may be injected into the watering system using a Mazzei injector or other suitable injection system that is accurate and reproducible. Prior to injecting, operate the system to ensure that there is no off-target leakage in the irrigation system. Regardless of the type of irrigation system used, there should be a backflow valve present to prevent the test substance from flowing into the water source.

1.3 The injector system is made up of the Mazzei injector, 2 flow valves, metering valve, and plastic tube with end filter.

1.4 Typically, the protocol will dictate the amount of irrigation water to be applied with the test substance and the amount of irrigation water to apply to test plots after application of test material.

1.5 Monitor the pressure gauge during the calibration and application and readjust to the target pressure as needed.

2.0 Calibration

2.1 Prior to use, the irrigation system output will be timed and recorded to obtain the actual output using an inline flowmeter or by catching the output of a minimum of one emitter/sprinkler at the beginning of the drip line or irrigation line and one emitter/sprinkler at the end of the drip line or irrigation line (2 per line) for a minimum of three times, or other method that is accurate and reproducible.

2.2 After obtaining the system output, calculations can be done to obtain how long to operate the system during and after application to obtain the correct amount of test substance/water and post application irrigation water stated in the protocol. If the amount of water to apply after application is not stated in the protocol, generally apply 0.5 acre inches of water to the test plot for row crops, which includes the amount of water needed to inject the test substance. For permanent crops, generally apply test substance in approximately 0.5 acre inches of water followed by additional irrigation to move the test product into the root zone.

2.3 Calibration of the Mazzei injection system will occur prior to each use by a method which is accurate and reproducible. This method will be documented and may include, but not necessarily be limited to, the following:

A known amount of water will be measured into a graduated cylinder (i.e. 4000 ml). The injection system will be operated and will draw down a known volume from the graduated cylinder (i.e.1000 mls). The time required to draw down the known volume will be measured with a stopwatch. This will produce the flow rate of the injector. The calibration will be done a minimum of three times total. After obtaining the average flow rate the amount of water needed to mix with the test substance can be calculated to obtain the desire acre inches of water to apply the test substance in.

3.0 Cleaning and Maintenance

3.1 After completion of injecting the test substance into the irrigation system, water will be run for a minimum of 10 minutes through the irrigation system to ensure that all test substance has been purged from the irrigation lines.

3.2 No scheduled routine maintenance is required.

3.3 Maintenance required as a result of equipment malfunction, not normal wear, defines non-routine maintenance. In the event of non-routine repair, a record will be kept which will describe the nature of the defect, how and when the defect was discovered, and remedial action, if any, taken.

4.0 Records

4.1 A record of the dates of equipment inspection, calibration, and cleaning will be kept in an equipment logbook. Calibration results can be accessed by reference of the study number recorded in the Equipment Log at the time of these operations. Historical records will be retained in the archives.

5.0 Contingency Procedures

5.1 If during the generation, measurement or assessment of data, an equipment malfunction occurs, the supervising personnel and Study Director shall be advised of the malfunction. The equipment will be replaced or repaired and, if possible, the study will continue. Documentation of the malfunction shall be described in the study raw data and an appropriate entry made in the equipment log describing the repair.

0 RESPONSIBLE PERSONNEL

6.2 Equipment inspection, calibration, cleaning and maintenance (routine and non-routine) shall be performed or supervised by the Field Research Director.