SOP Log Sheet

ID # S00394

Received: 10/21/25

Region: NCR

City: Fennville **State:** MI

FRD/LRD: Celeste Wheeler
Submitter

Effective Date: 3/3/25

Description of Material (s): 2025 SOPs

File Format: E-mail ☒ **Hard Copy** ☐

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(Circle one)

Date Post to Website: 10/17/25 **Archive Date:** 11/17/25

Archive Location: 63-2

Sign: ☒

Comment: ✓

NC STATE

Juliet Thompson <jthomp24@ncsu.edu>

New File Uploaded from ir4project.org

1 message

ir4-webapps@ncsu.edu <ir4-webapps@ncsu.edu> Tue, Oct 21, 2025 at 11:34 AM
To: jmazlo@ncsu.edu, jthomp24@ncsu.edu

If you don't know the sender of this email, please don't click the link below. Instead, contact: ir-4_project@ncsu.edu
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You have new file(s) waiting for you from:
Name: Nicole Soldan
Email: schroe65@msu.edu

https://ir4.cals.ncsu.edu/uploads/2025%20SOPs%20TNRC%20Wheeler%20rev1.pdf

Subject for Email: Wheeler 2025 SOP
Comment:

File(s) will stay online until 11/21/2025

MICHIGAN STATE
UNIVERSITY

TO: Celeste Wheeler
Michigan State University
Trevor Nichols Research Center
6237 124th Ave
Fennville, MI 49408

FROM: Nicole Soldan, IR-4 NC Regional Field Coordinator

SUBJECT: STANDARD OPERATING PROCEDURE APPROVAL

DATE: March 3, 2025 (Approval date) Nicole Soldan

Per 40CRF160 Good Laboratory Practice Standards (GLP), this is to notify you that your Standard Operating Procedures (SOPs) in use are approved. Please retain this document with your SOP to fulfill GLP requirements.

SOP	Review date	Revision date	SOP	Review date	Revision date
A.000.04	2-27-25	2-27-25	M.001.17	2-27-25	2-27-25
A.001.16	1-24-24	1-24-24	M.003.14	2-27-25	2-27-25
A.003.13	2-27-25	2-27-25	M.004.15	2-27-25	2-27-25
A.004.14	2-27-25	2-27-25	M.005.20	2-27-25	2-27-25
A.006.13	2-27-25	2-27-25	M.013.11	1-31-24	1-31-24
A.010.13	2-27-25	2-27-25	M.016.09	1-31-24	1-31-24
A.011.03	2-27-25	2-27-25	M.019.08	2-27-25	2-27-25
A.012.11	2-27-25	2-27-25	M.20.02	2-27-25	2-27-25
A.013.10	2-27-25	2-27-25	M.21.01	2-2-24	2-2-24
A.014.10	2-15-24	2-15-24	M.22.02	2-27-25	2-27-25
A.016.11	1-29-24	1-29-24	M.23.02	2-27-25	2-27-25
A.018.09	2-27-25	2-27-25	M.24.01	2-5-24	Retired
A.020.03	2-27-25	2-27-25	X.001.08	2-27-25	2-27-25
A.021.02	2-27-25	2-27-25	X.002.07	2-27-25	2-27-25
C.001.23	2-27-25	2-27-25			
C.002.13	2-27-25	2-27-25			
C.003.15	2-27-25	2-27-25			
C.004.14	2-27-25	2-27-25			
C.005.06	2-27-25	2-27-25			
R.001.12	2-1-24	2-1-24			
R.002.13	2-27-25	2-27-25			
R.004.09	2-1-24	2-1-24			

IR-4 North Central Region Field Coordinator's Office

Department of Entomology

1066 Bogue St.
Rm A448
East Lansing, MI 48824

The following are the current Standard Operating Procedures used by Trevor Nichols Research Center Staff in compliance with Good Laboratory Standards.

Standard Operating Procedures

February 27, 2025

Section A – Archiving and Data Gathering

A.000.04	Standard Operating Procedure for Writing Standard Operating Procedures
A.001.16	Raw Data Archiving and Quality Control Review
A.003.13	Soil Sampling for Soil Characteristics
A.004.14	Recording of Raw Data
A.006.13	Measuring Wind Speed and Direction
A.010.13	Curriculum Vitae
A.011.03	Job Description
A.012.11	Master Trial Schedule
A.013.10	Weather Data
A.014.10	EPA Audit or Inspection
A.016.11	Rounding Numbers
A.018.09	Calculation of Amount of Test Substance Required for Rates Specified in Protocol – Airblast Application
A.020.03	Using Borrowed Equipment
A.021.02	Site Selection for GLP Field Trials

Section C – Chemical Related

C.001.23	Receipt, Storage, and Disposal of Test Substance
C.002.13	Measuring Liquid Chemicals

C.003.15	Balance Calibration
C.004.14	Measuring Non-Liquid Chemicals
C.005.06	Receipt, Storage, Use, and Disposal of Adjuvants

Section M – Maintenance and Calibration

M.001.17	Maintenance and Cleaning of Airblast Sprayers
M.003.14	Verification of Electronic Digital Water Meter
M.004.15	Maintenance of Tractors
M.005.20	Calibration of Airblast Sprayers
M.013.11	Application of Test Material with an Airblast Sprayer
M.016.09	Measurement of pH and Water Temperature for Test Substance Application
M.019.08	Maintaining Freezer Storage and Temperature Monitoring System
M.020.02	Maintaining Test Substance and Adjuvant Storage and Temperature Monitoring System
M.021.01	Calibration of Hand Carried CO_2 Pressurized Boom Sprayers
M.022.02	Application of Test Material with Boom Sprayer
M.023.02	Maintenance and Cleaning of Boom Sprayers

Section R – Residue Samples

R.001.12	Collecting Residue Samples
R.002.13	Packing and Shipping of Residue Samples
R.004.09	Residue Test Plot Design

Section X – Miscellaneous

X.001.08	Safety Inspection
X.002.07	Treated Crop Destruct

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Standard Operating Procedure for Writing Standard Operating Procedures

SOP Number: A.000.04
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that Trevor Nichols Research Center (IR-4 Research Center) staff will have standard written SOP's in place, for field residue trials study methods, to ensure the quality and integrity of a study.

EQUIPMENT DESCRIPTION:

A copy of the Good Laboratory Practice Standards must be used.

PROCEDURES:

1. A standard operating procedure, or SOP, is a document that describes how routine activities are to be performed. The IR-4 Field Research Director will develop standard operating procedures (SOPs) for all phases of research conducted in support of chemical registration.

2. The protocol always takes precedence over any SOP.

3. An SOP should exist for all routine procedures and regularly used equipment. Individuals familiar with the process or equipment should write the SOPs. The SOP should include enough detail so that someone with the appropriate education, training, and experience can perform the procedure correctly.

4. The individual SOPs, together with an Index and SOP Review Log, will constitute SOPs for IR-4 chemical residue studies conducted by the field research director of Trevor Nichols Research Center.

5. SOPs will be reviewed annually and revised as needed. The review and revisions will be recorded on the SOP Review Log, which will be maintained as part of the SOPs. All earlier versions of SOPs must be sent to IR-4 Headquarters to archive.

6. Each individual SOP will be approved by the Regional Field Coordinator.

7. Any deviations from the SOPs that would affect the results of a study must be documented in writing and signed by the Study Director.

8. In the SOPs, the following terms will have the meanings specified.

    a. Batch – a specific quantity or lot of a test substance that has been adequately characterized
    b. Test Initiation Date – the first date the test substance is applied to the test system (crop).
    c. Test Termination date – the last date on which data are collected directly from a study
    d. Good Laboratory Practices (GLP) – a set of guidelines mandated by Congress to which researchers must adhere to assure the integrity of research data. All IR-4 studies are conducted under GLP guidelines.
    e. Master Timetable – a list of trials which is maintained by the Field Research Director. It must be indexed by chemical and crop, and contain type of trial, approximate experimental start dates, and termination dates.

f. Master Schedule – a list, maintained by the quality assurance unit, of all studies conducted at the testing facility indexed by test substance, and containing the test system, nature of study, date study was initiated, current status of each study , identity of the sponsor, and name of the study director.
g. Protocol – a document provided by the sponsor that contains details for accurate completion of a trial.
h. Quality Assurance Unit (QAU) – any person or organizational element as per 40CFR 160.35, who is designated to perform the monitoring duties to assure that the research is conducted according to standard operating procedures and good laboratory practices. Regional IR-4 representatives will designate the Quality Assurance Officer (QAO) for IR-4 trials.
i. Raw Data – worksheets, records, memoranda, notes, etc., that are the results of original observations and activities of a study. This includes photographs and computer printouts.
j. Sponsor – the individual, corporation, association, scientific or academic establishment, government agency or other organizational unit who initiates and supports, by provision of financial or other resources, a study.
k. Standard Operating Procedures (SOP) – written documentation of routine activities utilized in research studies.
l. Trial – an experiment in which a test substance (pesticide) is applied to a test system to determine or help predict its effect, metabolism, environmental and chemical fate, or other characteristics.
m. Frequently Used Acronyms –
    i. Michigan State University (MSU)
    ii. Trevor Nichols Research Center (TNRC)
    iii. Clarksville Research Center (CRC)
    iv. West Central Michigan Research and Extension Center (WCMREC)
    v. Horticulture Teaching and Research Center (HTRC)

9. The original copy of the previous years SOPs will be shipped to IR-4 Headquarters for archiving within one year of the updated version being signed by the Field Research Director.

10. Each SOP will contain a title page, which will include: the facility name, the title of the SOP, SOP number, revision date, and the effective date.

11. Each SOP shall have a unique classification letter and a unique numbering system. The letter classification will be as follows: A. = Archiving and Data Gathering; C. = Chemical Related; R. = Residue Samples; M. = Maintenance and Calibration; X. = Miscellaneous

12. The unique numbering system will start following the initial of the classification letter; a series of three numerical digits, followed by a period, then a series of two numerical digits will be used to identify each SOP. The first set of three numerical digits will indicate the number of the SOP and the second set of two numerical digits indicates the number of approved revisions to the original SOP. For example, this SOP is A.000.02.

13. Each SOP will contain a purpose and procedure.

14. The SOP's will be made available to all personnel involved in the residue trial process.

STANDARD OPERATING PROCEDURES REVIEW – REVIEW LOG

SOP NUMBER	DATE REVIEWED	REVISED (Yes, No, New, Retired)	REVISED SOP NUMBER	REVISION DATE
A.000.03	2/27/2025	Yes	A.000.04	2/27/2025
A.001.16	2/27/2025	No	-	-
A.003.12	2/27/2025	Yes	A.003.13	2/27/2025
A.004.13	2/27/2025	Yes	A.004.14	2/27/2025
A.006.12	2/27/2025	Yes	A.006.13	2/27/2025
A.010.12	2/27/2025	Yes	A.010.13	2/27/2025
A.011.02	2/27/2025	Yes	A.011.03	2/27/2025
A.012.10	2/27/2025	Yes	A.012.11	2/27/2025
A.013.09	2/27/2025	Yes	A.013.10	2/27/2025
A.014.10	2/27/2025	No	-	-
A.016.11	2/27/2025	No	-	-
A.018.08	2/27/2025	Yes	A.018.09	2/27/2025
A.020.02	2/27/2025	Yes	A.020.03	2/27/2025
A.021.01	2/27/2025	Yes	A.021.02	2/27/2025
C.001.22	2/27/2025	Yes	C.001.23	2/27/2025
C.002.12	2/27/2025	Yes	C.002.13	2/27/2025
C.003.14	2/27/2025	Yes	C.003.15	2/27/2025
C.004.13	2/27/2025	Yes	C.004.14	2/27/2025
C.005.05	2/27/2025	Yes	C.005.06	2/27/2025
M.001.16	2/27/2025	Yes	M.001.17	2/27/2025
M.003.13	2/27/2025	Yes	M.003.14	2/27/2025
M.004.14	2/27/2025	Yes	M.004.15	2/27/2025
M.005.19	2/27/2025	Yes	M.005.20	2/27/2025
M.013.11	2/27/2025	No	-	-
M.016.09	2/27/2025	No	-	-
M.019.07	2/27/2025	Yes	M.019.08	2/27/2025
M.020.01	2/27/2025	Yes	M.020.02	2/27/2025
M.021.01	2/27/2025	No	-	-
M.022.01	2/27/2025	Yes	M.022.02	2/27/2025
M.023.01	2/27/2025	Yes	M.023.02	2/27/2025
M.024.01	2/27/2025	Retired	-	-
R.001.12	2/27/2025	No	-	-
R.002.12	2/27/2025	Yes	R.002.13	2/27/2025
R.004.09	2/27/2025	No	-	-
X.001.07	2/27/2025	Yes	X.001.08	2/27/2025
X.002.06	2/27/2025	Yes	X.002.07	2/27/2025

Celeste E. Wheeler 2-27-25

Signature and Date

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Raw Data Archiving and Quality Control Review

SOP Number: A.001.16
Revision Date: 1/24/2024
Effective Date: See approved by RFC date

PURPOSE:

To ensure that all records and raw data, both recorded electronically and on paper, generated as a result of a study shall be logged and retained in an appropriate method.

EQUIPMENT DESCRIPTION:

Fire-retardant file cabinets will be used to temporarily store all data recorded on paper generated from studies performed by the Trevor Nichols Research Center Field Research Director. The file cabinets must have a locking mechanism to ensure the integrity of the data.

PROCEDURES:

1. The official archive for original raw data (both electronic and on paper) will be located at IR-4 headquarters.

2. All original raw data not included in a Field Data Book (logs, weather data, personnel forms, etc) will be archived at IR-4 Headquarters.

3. All completed Field Data Books will be submitted to the Regional Field Coordinator for review. The Regional Field Coordinator or designee will follow up to obtain any missing data or to correct deficiencies in the Field Data Book with The Field Research Director's consent.

4. The Field Research Director will add any additional or changed pages to the Field Data Book copy on file and these updated pages will be used for all subsequent Quality Assurance audits.

5. Data to be archived will be sent to Headquarters within one year of completion of a study.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Soil Sampling for Soil Characterization

SOP Number: A.003.13
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that representative soil samples are obtained and handled properly when gathering information on the general nutrient level and physical properties of soils.

EQUIPMENT DESCRIPTION:

A suitable tube-type soil sampler, long enough to sample at the appropriate depth. A container large enough to hold soil samples. A soil sample box or bag to hold soil samples during delivery to the laboratory and a map of the orchard or area you are sampling.

PROCEDURES:

1. Using a map of the orchard or area, locate the test site that requires soil sampling for soil characterization records specifically required in IR-4 field trial protocols.

2. Using a tube-type soil sampler, take a minimum of 5 core samples within the test plot area. Make sure all debris are removed from the spot of the soil sample to ensure the integrity of the samples.

3. Place all samples in a clean bucket or clean Ziploc bag and mix all the sample material together to ensure the composite sample is representative of the entire plot. The sample size should be large enough for the lab to run an accurate test.

4. Place the sample in the laboratory box or bag and mark the container to correspond with the sample area. Fill out all the requested information needed on the container and send a list of soil analyses needed to ensure the sample will get processed correctly. Ex. (% sand, % clay, % silt, soil type, pH....).

5. The sample should be sent out as soon as possible to the appropriate lab.

6. Document the day the samples were taken, the location where the soil was sampled (example: Tart Cherry 4 TNRC), Name of who collected the sample, date the sample was sent to the lab and the name of the lab used, and date lab results were received.

7. Soil Sample data and logs will be archived at IR-4 Headquarters.

8. Electronic soil sample data and logs can be archived in the electronic Facility Files.

Soil Sample Log

Name (Person who collected sample)	Date Sampled (Date soil sample was taken)	Location (where soil was sampled Example: Tart Cherry 4 TNRC)	Date Sent/ Name of Lab Used (Date soil sample was sent to lab/Name of Lab)	Lab Results Received Date

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Recording of Raw Data

SOP Number: A.004.14
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the recording of raw data is done in compliance with Good Laboratory Practices.

PROCEDURES:

1. Raw data must always be recorded in blue or black ink pen if recorded on paper.

2. Where appropriate, the name of the person making the entry will be signed or initialed and dated.

3. White-out is not to be used. Original entries should be used. If transcriptions are used the location of the original data will be noted.

4. To make corrections on paper, the error is crossed-out with a single line, initialed, dated, and a Correction Code is noted. Correction Codes are listed in the instructions and changes section of the Field Data Book or the Electronic Field Data Book. Correction Codes can be circled so as not to be confused with initials of person making the correction.

5. An appropriate logbook will be used for recording of data for site-specific logs. That logbook will be retained at the facility and archived within one year of completion of the study.

6. Data recorded in sponsor provided notebooks or by electronic field data notebooks will be documented according to instructions for notebooks.

7. Sponsor provided notebooks and logbooks will be kept in a locked fire-proof cabinets when not in use.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Measuring of Wind Speed and Direction

SOP Number: A.006.13
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the wind speed and direction recorded represents the actual weather at the test site.

EQUIPMENT DESCRIPTION:

- BTMETER BT-100 Handheld Anemometer Digital Wind Speed Meter: Temperature, wind speed
- Kestrel 3000 Weather Meter: Dew Point, Heat Stress Index, Relative Humidity, Temperature, Wind Chill, Wind Speed.
- A standard compass will be used when necessary to find the correct wind direction.

PROCEDURES:

1. Turn on the wind meter and check that the batteries are working.

2. Prior to the application of a test material to a trial site, the wind speed and direction must be taken.

3. Standing in the center of the trial site, decide which way the wind is coming from, if necessary, use a compass to obtain the direction of the wind. Hold the wind meter at eye level perpendicular to the wind direction. Note the wind speed from the digital screen.

4. The wind speed and direction will be recorded.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Curriculum Vitae

SOP Number: A.010.13
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

Trevor Nichols Research Center (TNRC) will maintain curriculum vitae of all personnel involved in IR-4 residue trials to assure that procedures are done by qualified participants.

PROCEDURES:

1. Curriculum Vitae will contain name, title, education, work experience and special training or qualifications, or accomplishments. The CV document will be signed and dated by appropriate TNRC personnel.

2. The Curriculum Vitae will be reviewed and updated annually or as needed by TNRC personnel involved in IR-4 residue trials.

3. Hard copy paper CVs will be archived at IR-4 Headquarters within one year of completion of a study.

4. Electronic CVs can be maintained in the electronic Facility Files.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Job Description

SOP Number: A.011.03
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

Trevor Nichols Research Center IR-4 Personnel will have a job description on file describing their role in IR-4 GLP trials.

PROCEDURES:

1. Include Name, Title, and brief description of key duties in the IR-4 GLP system.

2. The job descriptions will be reviewed and updated annually.

3. Original signed/dated Job Descriptions will be archived to IR-4 Headquarters within one year of completion of a study.

4. Electronic Job Descriptions can be maintained in the electronic Facility Files.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Master Trial Schedule

SOP Number: A.012.11
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To provide a master schedule that shows all trials being conducted by Trevor Nichols Research Center's FRD.

PROCEDURES:

1. The Master Trial Schedule shall contain the following information: (see the attached sheet)
    - Test Substance
    - Trevor Nichols Research Center assigned residue number (Field Trial #)
    - Sponsor identity number (PR#)
    - Test system (crop)
    - Nature of study (R)
    - Sponsor Study Director
    - Current status – Active (A); Inactive (I); Field portion completed (FPC)
    - Test initiation date (First Application Date)

2. The Master Trial Schedule will be maintained by Trevor Nichols Research Center personnel.

3. A copy of the original Master Trial Schedule will be available at the Trevor Nichols Research Center for the contracted Quality Assurance Unit.

4. Any updating of information to the Master Trial Schedule will be given to the Quality Assurance Unit, so they may update their schedule.

5. Hard copy paper Master Trial Schedule will be archived at IR-4 Headquarters within one year of trial completion.

6. Electronic Master Trial Schedule can be maintained in the electronic Facility Files.

Trevor Nichols Research Center

Master Trial Sheet

Test Substance	PR No.	Field Trial No.	Test System (Crop)	Nature of Study (R = Residue)	Current Status A = Active I = Inactive FPC = Field Portion Completed	Study Director	Test Initiation Date (1st App. Date)

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Weather Data

SOP Number: A.013.10
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To provide weather data that is necessary as raw data for GLP field residue trials.

EQUIPMENT DESCRIPTION:

Enviroweather is an on-site weather station at various locations throughout Michigan.
Website: https://enviroweather.msu.edu/
Version 1.154.2

PROCEDURES:

The designated personnel that will conduct the weather monitoring for field residue studies will refer to the following outlined SOP to ensure the integrity of the weather data.

WEATHER DATA PROCEDURES:

1. Weather data will be obtained from Enviroweather Station located closest to the trial location (Example: Trevor Nichols Research Center located in Fennville, and Clarksville Horticultural Experiment Station located in Clarksville). The weather data is downloaded from the Enviroweather website and included in the field data book or the electronic field data book.

2. The weather station at the closest location will reasonably reflect the climatic conditions of the residue trials that are conducted on orchards and plantings.

3. Enviroweather is a collaborative project between the Michigan Climatological Resources Program and the MSU Integrated Pest Management Program. They maintain, repair, and archive all weather records.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

EPA Audit or Inspection

SOP Number: A.014.10
Revision Date: 2/15/2024
Effective Date: See approved by RFC date

PURPOSE:

To establish a procedure, to be followed when the EPA provides an advance noticed of an inspection/audit of contracted study done at Trevor Nichols Research Center, Michigan State University.

PROCEDURES:

Prior to an EPA Inspection/Audit:

1. Notify the Study Director, Regional Field Coordinator, Quality Assurance Officer, and other pertinent personnel of the pending audit/inspection as soon as possible.
2. Arrange to make available, as much as possible, all personnel directly involved in IR-4 trials at Trevor Nichols Research Center.
3. Make sure that someone who is authorized to accept the Notice of Inspection will be present at the start and finish of the inspection.
4. Prepare personnel for the inspection.
    a. Discuss position descriptions with technical personnel so they understand and can explain their role in the trial.
    b. Discuss possible questions that may likely come up abut the trial or facility and make sure everyone understands what to expect.
    c. Instruct personnel to respond specifically to the questions asked and not to provide extraneous information. Do not provide any information unless asked.
    d. Be certain all documents relevant to the trial and facilities are available including:
        i. Master Schedule for the Field Research Director
        ii. Study Protocol and current and historical Standard Operating Procedures
        iii. Raw Data, correspondence, and logs
        iv. Training Records and CVs of personnel involved in the audited trial.
        v. Documentation of test substance characterization, receipt, and handling.
        vi. Maintenance/Calibration logs on equipment.
5. Have available the organizational charts and a map of the facility.

During an EPA Inspection/Audit:

1. Greet the inspection team and follow any institutional procedures for signing in. Escort the entire group to the meeting room.
2. At the opening of the conference ask the lead inspector for their credentials and for any opening statements.
3. Introduce the facility personnel present and state their function in the facility or trial. Identify the person who will accept the Notice of Inspection.
4. Ask the lead inspector for their agenda for the inspection.
5. Proceed with the inspection.
    a. Provide documents requested and provide explanations as needed.
    b. Keep notes of observations and of all interviews
    c. Keep IR-4 management informed of the progress of the inspection and the findings.
6. If a non-compliance issue is raised by the EPA inspector that can be readily resolved, then the study personnel should take steps to correct the deficiency and to inform the inspectors.

After an EPA Inspection/Audit:

1. The Field Research Director or designated representative must be present for the closeout conference.
2. If the inspector's comments are in error, call this to the inspector's attention.
3. If you have corrected any problems during the inspection, make sure that the corrections are also noted in the inspector's logbook.
4. Have someone present to take accurate notes.
5. Obtain a copy of the list of documents/other materials that may be taken as exhibits by the inspector(s).
6. Debrief site personnel, Regional Field Coordinator, and the Study Director(s) of any problems found. Assign responsibility for preparation of possible solutions to the problems and obtain time estimates for implementation.
7. Respond to deficiencies as required.
8. Keep Study Director(s) and other interested parties informed of any activity related to the inspection.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Rounding Numbers

SOP Number: A.016.11
Revision Date: 1/29/2024
Effective Date: See approved by RFC date

PURPOSE:

To ensure there is a number rounding procedure.

PROCEDURES:

1. If the first digit to be dropped is less than 5, round down. For example, 0.434 is rounded to 0.43.
2. If the first digit to be dropped is 5 or greater, round up. For example, 0.435 is rounded to 0.44.

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Calculation of Amount of Test Substance Required for Rates Specified in Protocol – Airblast Application

SOP Number: A.018.09
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To assure accurate calculation of the amount of test substance needed per plot or mix size as required by the protocol for Airblast Application.

PROCEDURES:

The following calculations can be used to determine the test substance required by the protocol for airblast applications using the calculation sheet.

1. Determine the amount of formulated test substance to be used per acre (Form. Prod./Acre) by one of the following:
    A. Use the amount of Form. Prod./Acre specified in the protocol.
    B. If the rate is specified as amount of active ingredient per acre, calculate the Form. Prod./Acre as follows:

$$\textbf{Form. Prod./Acre} = \left(\frac{\textbf{Rate of Active Ingredient per Acre}}{\textbf{Amount of Active Ingredient per Unit of Form. Prod.}}\right)$$

2. Determine the gallons per minute per side (GPM):
    A. The Average Amount of water to refill sprayer tank (Ave. Amount to Refill), Average time sprayed (Ave. Time Sprayed) and 60.0 seconds.
    B. All values are transcribed from the most recent Calibration Sheet and for the appropriate application and treatment.

$$\textbf{GPM} = \left(\frac{\textbf{Ave. Amount to refill tank (gal)}}{\textbf{Ave. time sprayed (sec)}}\right) \textbf{x 60.0 seconds}$$

3. Determine gallons per Acre (GPA):
    A. The Average Amount to refill, Average Time Sprayed, Square Feet per Acre, Swath width, Course length and Average Time to Travel the Course.
    B. All values are transcribed from the most recent Calibration Sheet and for the appropriate application and treatment.

$$\textbf{GPA} = \textbf{Ave. Amount to refill tank (gal) x Ave. Time Sprayed (sec) x 43560 (sqft / acre)} \div \textbf{swath width (ft)} \div \textbf{course length (ft)} \div \textbf{Ave. time traveled (sec)}$$

4. Determine the amount of water in the spray tank (Tank Solution) to be used for this application form:

A. The Gallons per Acre (GPA), Plants per Treatment (Plants/Trt.), Row Width, Plant Spacing, and Square Feet per Acre.
B. All values are transcribed from the most recent Calibration Sheet and the Residue Calculation Sheet for the appropriate application and treatment.
C. Primer is the amount of water over the minimum needed to keep the sprayer in operation during the application.

Minimum Gallons Needed for Tank Solution
= Calibrated GPA x Plants/Trt x Row Width (ft)x Plant Spacing (ft)
÷ 43560 (sqft / acre)

Then determine the Tank Solution:

Minimum Gallons Needed for Tank Solution (gal) + Primer (gal)
= Tank Solution (gal)

5. Determine the amount of product to be used for the appropriate treatment:
   A. The Formulated Product per Acre (Form. Prod./Acre), gallons of water in tank and the Gallons per Acre (GPA).
   B. All Values are transcribed from the most recent Calculation Sheet and for the appropriate application and treatment.

Amount of Product
= Formulated Product Per Acre (found in the protocol) x Tank Solution (gal)
÷ Calibrated GPA

6. The researcher or calibrator will check all the values and calculations to verify the accuracy. The researcher or calibrator will sign and date the Calculation Sheet and the day of completion, and include the calculation sheet in the Field Data Book.

Calculation Sheet Trial Number:_____

Test Substance Name:_____

Target Rate of Formulated Product/Acre:_____

Treatment Number:_____ Application Number:_____

Plot Information:

Plants/Trt.		Crop:
Row Width	(ft)	Orchard:
Plant Spacing	(ft)	Target GPA:

Information from Calibration Sheet (One Side Delivery)

Spray Rate:

GPM = Ave. Amount to Refill_____(gal) ÷ Ave. Time Sprayed_____(sec) x 60.0 (sec)=_____GPM

GPA = Ave. Amount to Refill _____(gal) x Ave. Time Sprayed_____(sec) x 43560 (sqft/acre) ÷ Swath Width_____(ft) ÷ Course Length_____(ft) ÷ Ave. Time Traveled_____(sec)

=GPA_____

Tank Solution:

GPA_____ x Plants/Trt._____ x Row Width_____(ft) x Plant Spacing_____(ft) ÷ 43560(sqft/acre)

=_____(gal) minimum needed + Primer _____(gal) = _____(gal) Tank Solution

Amount of Product:

Trt. #_____ App. #_____:

Formulated product per acre _____ x Tank Solution _____ (gal) ÷ Calibrated GPA_____

= Amount of Product_____

Signature:_____ **Date:**_____

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STANDARD OPERATING PROCEDURES

Using Borrowed Equipment

SOP Number: A.020.03
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

Procedures for borrowing or leasing any equipment for use in IR-4 GLP trials.

PROCEDURES:

1. Prior to use, visually inspect the equipment to assess that it is in good working order. Any problems discovered prior to use should be corrected and documented.

2. If the current piece of equipment is not working properly, disabled, broken, or is in a location of desired field location for trial (differentiation between trials), a similar or equivalent piece of adequate equipment may be borrowed or leased from another source.

3. Make sure that the proper GLP equipment form is filled out to include the: equipment ID (serial #, brand, and make/model) and trial ID which the equipment is used for. This form (or equivalent) will be placed in the logbook or maintained in the electronic Facility Files.

4. Any maintenance and calibrations will be recorded in the appropriate SOP forms and in the field data book or electronic field data book.

Date equipment borrowed /Initials of Borrower	
Date equipment borrowed/ Initials of whom borrowing from	
Equipment ID (Serial #, Make/ Model)	
Trial ID the Equipment is used for	
Use of the equipment	
Date equipment returned/ Initials of Borrower	
Date equipment returned/ Initials of whom borrowing from	

Date equipment borrowed /Initials of Borrower	
Date equipment borrowed/ Initials of whom borrowing from	
Equipment ID (Serial #, Make/ Model)	
Trial ID the Equipment is used for	
Use of the equipment	
Date equipment returned/ Initials of Borrower	
Date equipment returned/ Initials of whom borrowing from	

Date equipment borrowed /Initials of Borrower	
Date equipment borrowed/ Initials of whom borrowing from	
Equipment ID (Serial #, Make/ Model)	
Trial ID the Equipment is used for	
Use of the equipment	
Date equipment returned/ Initials of Borrower	
Date equipment returned/ Initials of whom borrowing from	

Date equipment borrowed /Initials of Borrower	
Date equipment borrowed/ Initials of whom borrowing from	
Equipment ID (Serial #, Make/ Model)	
Trial ID the Equipment is used for	
Use of the equipment	
Date equipment returned/ Initials of Borrower	
Date equipment returned/ Initials of whom borrowing from	

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Site Selection for GLP Field Trials

SOP Number: A.021.02
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the test site is appropriate and adequate to obtain the required data or samples with sufficient uniformity to meet EPA and protocol requirements.

PROCEDURES:

1. The IR-4 facility in Fennville, Michigan is located at the Trevor Nichols Research Center (TNRC), a research center of Michigan State University's College of Agriculture and Natural Resources. The outlying agricultural research stations provide facilities for MSU scientists to conduct field experiments under the state's various agricultural conditions. The following sites are available for (but not limited to) use in IR-4 field research trials:
    a. Trevor Nichols Research Center (TNRC)
    6237 124th Ave.
    Fennville, MI 49408
    b. Clarksville Research Center (CRC)
    9302 Portland Rd
    Clarksville, MI 4881
    c. West Central Michigan Research and Extension Center (WCMREC)
    5185 N. Oceana Dr.
    Hart, MI 49420
    d. Horticulture Teaching and Research Center (HTRC)
    3291 College Rd.
    Holt, MI 48842
2. Site selection will be made in accordance with the agronomic practices acceptable for the crop and capacity to simulate commercial conditions.
3. Trials may be conducted off Michigan State University property if necessary.
4. Each site shall be large enough to accommodate the required number of samples, buffer zones and treatments in accordance with an approved research protocol and for the commodity to be grown under simulated commercial conditions yielding samples of sufficient size for analysis where required.
5. Locate site with sufficient isolation to minimize contamination from external sources such as commercial operations or other research studies. Minimum distance between plots of similar chemistries and/or untreated plots shall be followed as per protocol.
6. If the commodity is not to be newly established, a site shall be selected that has a uniform stand for production.
7. Standard cultural practices shall be performed prior to plot layout and marking.
8. The experimental design, if specified by the research protocol, shall be used.
9. Lay out each plot on the site using a suitable measuring device to accurately locate plots on the site. Measure from a permanent field marker to the closest corner of the plot. From there, measure to the next corner of the plot and then to another permanent marker. Measure the length of the plot. Measure the buffer zones between plots to assure acceptable space will exist between plots. Record the date the plots were laid out and the initials of the individual responsible for laying out the plots.
10. Prepare a plot map showing the location of each plot on the GLP trial site, approximate direction and degree of slope, and the north direction. The map should show the number of rows/beds

and their direction, row spacing, tree spacing if applicable, row length, overall plot dimensions, distance from treated and untreated plot, and the distance from the farm entrance to the plot and location and dimensions of the buffer zones. The plot map shall contain distance from plots to permanent markers.

11. The plots involved in GLP field trials shall be identified with a unique number and marked at the beginning and ending of each row used in the trial with a labeled stake or similar.
12. Identify each treatment plot as per the protocol including the IR-4 field ID number and treatment number or treatment name. The marker shall be made in such a manner that it will be visible throughout the life of the trial.
13. The location of the trial will have current (no older than 5 years) soil characterization.

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Receipt, Storage, and Disposal of Test Substance

SOP Number: C.001.23
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the GLP test substance is received, stored to ensure integrity, and disposed of properly.

PROCEDURES:

1. Upon the receipt of a GLP test substance, personnel will initial and date the container, and assign a container ID (example: 12972.21-MI193) and record it on the container and in the field data book test substance receipt log. If the trial has multiple test substance containers, each container will be identified with a different container ID (example: 12972.21-MI193 Cont. #1, 12972.21-MI193 Cont. #2).Personnel will verify that the test substance GLP status, expiration date, and storage conditions are known, and if not known, immediately contact the study director.

2. If test substance arrives before a temperature monitoring system is activated in the IR-4 Chemical Storage Cabinet, the test substance will be placed in the facility office and kept at room temperature (up to 2 days) until the temperature system is activated, at which time the test substance will be placed in the IR-4 Chemical Storage Cabinet.

3. All test substance information will be logged into the IR-4 Field Data Book or eFDB.

4. Shipping papers (ex: COA, SDS) received with test substance will be placed in Field Data Books. Electronic Field Data Books will include a scanned copy and the original shipping papers will be archived at IR-4 Headquarters.

5. All test substances will be kept in the IR-4 Chemical Storage Cabinet in their original containers. The IR-4 Chemical Storage Cabinet is inside the Pesticide Storage Room. The Pesticide Storage Room is heated and properly ventilated. The IR-4 Chemical Storage Cabinet is locked and temperature monitored.

6. Refer to the test substance label, COA, or SDS for specific handling and storage conditions.

7. Temperature monitoring system will be activated in the IR-4 Chemical Storage Cabinet within 2 days of test substance receipt. Temperature monitoring system will be programmed to record constant real time temperatures at least once every hour.

8. Empty containers can be disposed of if a study was canceled or the report has been signed by the Study Director, unless test substance was used in a study that has not yet been completed.

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Measuring Liquid Chemicals

SOP Number: C.002.13
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure accurate measurement of liquid chemicals prior to mixing and use for a GLP residue trial.

EQUIPMENT DESCRIPTION:

Use appropriate graduated cylinder, or disposable syringe to measure liquid chemicals. Chemical resistant gloves should be worn.

PROCEDURES:

1. The measuring device should be graduated in increments small enough to read to accuracy within +/- 2.0% of the total volume being measured.

2. Make sure the graduated cylinder is level. Always wear chemical resistant gloves when measuring out test material.

3. Measure the required amount of liquid into the graduated cylinder to where the bottom of the meniscus is at the desired amount. Record the amount removed from the test substance container to the Field Data Book or eFDB.

4. If using disposable syringe, draw the liquid up the barrel past the desired amount, and push on the syringe plunger until the test substance meniscus is at the desired amount. Make sure the reading is taken at the bottom of the meniscus. Record the amount removed from the test substance container to the Field Data Book or eFDB.

5. Clean graduated cylinder with soap, water, and bottle brush after use.

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Balance Calibration

SOP Number: C.003.15
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

Procedures to calibrate the Sartorius ENTRIS3202-1SUS Balance and general maintenance for the balance.

EQUIPMENT NEEDED FOR CALIBRATION:

1. Calibrated and verified Standard Mass Set
2. Forceps or tweezers
3. Latex gloves

PROCEDURES:

Before weighing chemicals for a GLP residue trial application, complete the following calibration procedure. Professional calibration occurs yearly, and the calibration certificate is included in Field Data Book, eFDB, or in the electronic Facility Files when the balance is required.

1. The balance should be operated on a level, vibration free, solid support surface away from drafts. The balance and weighing pan should be kept clean. Never weigh chemicals directly onto pan. If the balance is stored, make sure it is placed in a case designed to protect it from damage.

2. Turn on balance and allow machine to reach internal equilibrium according to manufacturer's manual.

3. Select the weighing unit by hitting the MODE key. Choose the weighing unit (example g = grams) that is appropriate for the product that will be weighed.

4. Select two Standard Masses in the range of the chemical to be weighed. Always use forceps or tweezers when handling Standard Masses.

5. Record the following information in the Balance Log: (see attached sheet) Date, test number being weighed. Weight set number, weight of Standard Mass set used, weight measured for each Standard Mass and the initials of the person doing the calibration.

6. If the measured weights of both Standard Masses are within +/- 2% of the Standard Mass Size, proceed with weighing the test chemical.

7. If the measured weight of either of the two Standard Masses differs by more than+/-2% Standard Mass Size, recalibrate the balance according to manufacturer's operation manual.

8. If after recalibration the measured weight of both Standard Masses is within +/-2% of the Standard Mass Size, record the weight in the Balance Log and proceed with weighing the chemicals.

9. If after recalibration the measured weights of both Standard Masses are not with +/-2%, weigh a third Standard Mass to determine if the problem is the Standard Mass, rather than the

balance. If the measured weight if the third Standard Mass is within +/-2% of the Standard Mass Sizes, record the weights in the Balance Log and proceed with the chemical weighing.

10. If after calibration, the measured weights of two of the three standard masses differ by more than +/-2% from the standard mass size, then do not use the balance for weighing chemicals until it has been professionally repaired.

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BALANCE LOG

Initials/ Date	PR Number, Application #	Weight Set ID	Standard Weight Size	Measured Weight Use Brackets [ ]	Standard Weight Size	Measured Weight Use Brackets [ ]	Within +/- 2%? (Y/N)

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STANDARD OPERATING PROCEDURES

Measuring Non-Liquid Chemicals

SOP Number: C.004.14
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure the accurate measurement of non-liquid chemicals prior to mixing and use for a GLP residue trial.

EQUIPMENT DESCRIPTION:

The Sartorius ENTRIS3202-1SUS Balance is the standard balance powered by an AC adapter. All disposable containers used in the weighing of residue trials will be clean and have a secure lid for transport to the designated mixing area.

PROCEDURES:

1. Before weighing chemicals for a GLP residue trial application, complete the calibration procedure.

2. The balance should be operated on a level, vibration free, solid support surface away from drafts. The balance and weighing pan should be kept clean. Never weigh chemicals directly onto pan. If the balance is stored, make sure it is placed in a case designed to protect it from damage.

3. Turn on balance and allow machine to reach internal equilibrium according to manufacturer's manual.

4. Select the weighing unit by hitting the MODE key. Choose the weighing unit (example g = grams) that is appropriate for the product that will be weighed.

5. Place the container in which the non-liquid test substance will be measured on the balance, then press the re-zero control to zero the display.

6. After the display shows 0.0, measure the appropriate test substance until the required amount is reached. Record the amount removed from the test substance container into the Field Data Book or eFDB.

7. Seal the container with a lid until ready to mix. The container will be labeled with the PR number, amount of test substance, and the name of the test substance.

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STANDARD OPERATING PROCEDURES

Receipt, Storage, Use, and Disposal of Adjuvants

SOP Number: C.005.06
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that adjuvants used in GLP residue trials are received, stored to ensure integrity, and disposed of properly.

PROCEDURES:

1. All adjuvants for GLP studies will meet GLP labeling requirements including, but not limited to:
    a. Adjuvant Name
    b. Concentration
    c. Batch or Lot Number
    d. Storage conditions
    e. Date of purchase or initial opening of container
    f. Expiration date – If no expiration date is available, the FRD will assign an expiration date of no longer than 5 years from the date of receipt

2. Secondary containers are permitted for storage but must be properly labeled as per the original container and shall take on all the requirements of the original container. Adjuvant dispensed into a secondary container shall not be returned to the original container.

3. Adjuvants shall be in good condition. The physical characteristics should not have changed since purchase or be compromised. Color, consistency, and odor should be unchanged from purchase. If there are any concerns about the integrity or condition of an adjuvant, it shall be removed from use in GLP studies.

4. Adjuvant storage conditions are in a dry, well-ventilated building, which is separate from offices and laboratories and where fire protection is provided and protected from freezing or overheating with access limited to authorized personnel. Adjuvants are stored at Trevor Nichols Research Center, Pesticide Mixing Room, IR-4 Chemical Storage Cabinet and that is kept locked, and temperature is monitored.

5. Adjuvants shall be handled in a manner to prevent cross-contamination with any other substances. Adjuvants shall be dispensed form the original container or secondary container using a factory sealed disposable syringe or pipette or by pouring directly into a measuring device such as a beaker or graduated cylinder. Syringes or pipettes shall not be used again for adjuvant or test substance and shall be properly disposed of. It is imperative that no measuring device will be used to dispense from an original or secondary adjuvant container, placed onto a mix tank and used to dispense from the adjuvant container again. Measuring devices such as beakers and graduated cylinders shall be cleaned with soap and water.

6. Empty containers will be properly disposed of by triple rinsing and rendering the container unusable.

Trevor Nichols Research Center

Adjuvant Receipt and Disposal Log

Date Adjuvant Received and Initials of Recipient	Expiration Date On Container or Assigned by FRD (5 years)	Amount Received	Adjuvant Name, Concentration, Batch/Lot Number, type of adjuvant (NIS, COC, MSO)	Initials/Date

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Maintenance and Cleaning of Airblast Sprayers

SOP Number: M.001.17
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the airblast sprayers are free from contaminates and running at optimum performance for accurate application.

PROCEDURES:

CLEANING OF THE AIRBLAST SPRAYERS PROCEDURES:

1. Before applying any test substance or when changing compounds or formulations, the spray tank will be cleaned by triple rinsing with clean water.
2. The spray system will be flushed with clean water. Whirl plates and ceramic disks will be checked for debris and cleaned if necessary.
3. If necessary, the exterior of the sprayer will be cleaned with a high pressure washer and soap.
4. Record all procedures done to the sprayer in the Application Equipment and Maintenance Log Sheet (see attached sheet).

ROUTINE MAINTENANCE OF THE AIRBLAST SPRAYERS PROCEDURES:

1. A visual inspection will be conducted of the airblast sprayer to ensure it is functioning properly.
2. The designated personnel conducting routine maintenance of the airblast sprayer will record all routine procedures done to the sprayer in the Application Equipment and Maintenance Log Sheet (see attached sheet).

NON-ROUTINE MAINTENANCE OF THE AIRBLAST SPRAYERS PROCEDURES:

1. In case of non-routine maintenance to the airblast sprayer, action will be taken first at the research facility to repair the airblast sprayer.
2. If the repairs cannot be corrected at the research facility, then an outside source will be contacted to repair the airblast sprayer at the research facility.
3. If repairs cannot be done at the research facility, the equipment will be transported to an outside source for repair.
4. Record all non-routine procedures done to the sprayer in the Application Equipment and Maintenance Log Sheet (see attached sheet).

Application Equipment and Maintenance Log Sheet

Type of Equipment: Airblast Sprayer (Models: FMC 1029, FMC 1030, PAK BLAST, ETC.)

Routine Maintenance Activity

A. Spray tank triple rinsed with clean water
B. Exterior cleaned with power washer and soap
C. Whirl plates and ceramic disks will be checked for debris and cleaned if necessary
D. Visual inspection of airblast sprayer to ensure it is functioning properly
E. Lubrication
F. Nozzles and/or screens cleaned or replaced
G. Valves and gauges checked for proper operation
H. Fittings checked for tightness, elimination of leaks

Maintenance Activity Performed

DATE	INITIALS	AIRBLAST MODEL (FMC 1029, FMC 1030, PAK BLAST, ETC.)	CIRCLE MAINTENANCE TYPE	CIRCLE ROUTINE MAINTENANCE ACTIVITY PERFORMED	IF NON-ROUTINE MAINTAINIANCE ACTIVITY: RECORD NATURE OF DEFECT AND REMEDIAL ACTION TAKEN
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	
			ROUTINE NON-ROUTINE	A B C D E F G H	
			ROUTINE or NON-ROUTINE	A B C D E F G H	

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Verification of GPI Electronic Digital Water Meter

SOP Number: M.003.14
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure the GPI Electric Digital Water Meter is calibrated and operating as expected throughout use during GLP residue trials.

EQUIPMENT DESCRIPTION:

- GPI Electronic Digital Water Meter is a battery powered meter that is designed for measuring water flow.
- 5 gallon Calibration Container is a calibrated container use to measure the amount of water that has flowed out of the digital meter.
- Equipment manuals in the black equipment manuals folder located in the TNRC archive office or equivalent online.

PROCEDURES:

Field Calibration of the GPI Electronic Digital Water Meter will be done yearly prior to the beginning of GLP residue trials that will utilize the GPI Electronic Digital Water Meter throughout that trial. Recheck Calibration of the GPI Electronic Digital Water Meter will be done the day of any residue trial application that utilizes the GPI Electronic Digital Water Meter.

FIELD CALIBRATION PROCEDURES:

Field Calibration of the GPI Electronic Digital Water Meter will be done yearly prior to the beginning of GLP residue trials that will utilize the GPI Electronic Digital Water Meter throughout that trial.

1. Place the 5 gallon calibration container on a level surface.
2. Run water through the meter to check for any leaks and to ensure meter is working properly. Refer to the electronic digital water meter owner's manual for field manufacture calibration procedures. Start filling the 5 gallon calibration container, and stop the water flow at the 5 gallon mark.
3. Record the actual reading from the GPI digital display into the Field Calibration Water Meter Verification Sheet (see attached sheet). The original Field Calibration Water Meter Verification sheet will be logged into the on-site logbook and archived at IR-4 Headquarters, or electronic Field Calibration Water Meter Verification sheet can be maintained in the electronic Facility Files.
4. Clear the water meter readout and empty the container and place it back on the level surface.
5. Repeat procedures 2. – 4. twice more to achieve field calibration average output.
6. During the field calibration procedure, if any one data point is more than ±5% from the average (mean), a new field calibration will need to be performed.

RECHECK CALIBRATION PROCEDURES:

Recheck Calibration of the GPI Electronic Digital Water Meter will be done the day of any residue trial application that utilizes the GPI Electronic Digital Water Meter.

1. Place the large 5 gallon calibrated container on a level surface.
2. Using the calibrated GPI Electronic Digital Water Meter, fill the 5 gallon Calibration Container, read the digital display from the meter, stopping the flow exactly at 5 gallons.
3. Record the measured amount on the GPI digital display to the Recheck Calibration log sheet (see attached sheet). If the recheck is within ±5% of the calibrated meter then no further re-checks are needed. If the re-check is out of the ±5% range, a new field calibration will be done.
4. Record the date, initials, target volume, and the amount to refill on the Recheck Calibration Log Sheet.

Field Calibration
Water Meter Verification Sheet

Date:_____

Meter Name: GPI Electronic Digital Water Meter

Calibrated Container Volume:_____

Reading from the GPI Electronic Digital Water Meter:

Reading 1:_____

Reading 2:_____

Reading 3:_____

Average:_____

Is each reading within ±5% of the average? (Circle one) **YES or NO**
(4.75-5.25gal or 17978.75-19871.25ml)

Error and Percent Error Calculations:

$$\textbf{Error} = \textbf{Average reading from water meter} - \textbf{Calibrated Container Volume}$$

Error =

Average_____ - Calibrated Container Volume or Target Value_____

= _____ Error

$$\textbf{Percent Error} = (\textbf{Error} \div \textbf{Calibrated Container Volume}) \times \textbf{100}$$

Percent Error=

Error_____ ÷ Calibrated Container Volume or Target Value_____ * 100

= _____ Percent Error

_____

Signature and Date

Recheck Calibration Log Sheet

Date	Initials	Target Volume (units) (measuring container volume)	Actual Reading (units) (From GPI Electronic Digital Water Meter Display)	Within ±5% of Target 4.75-5.25gal or 17978.75-19871.25ml (Circle Yes or No)
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No
				Yes or No

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Maintenance of Tractors

SOP Number: M.004.15
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the tractors are running at optimum performance for accurate application.

PROCEDURES:

ROUTINE MAINTENANCE OF TRACTORS:

1. A visual inspection of the tractor will be conducted to ensure mechanical parts are in satisfactory condition. (Examples: belts, hoses, tire pressure, PTO drive, and 3-point hitch)

2. A visual inspection of the cab will be conducted to ensure all gauges, controls, and all safety equipment is in satisfactory condition.

3. The exterior of the tractor will be cleaned as needed.

4. Record all procedures done to the tractors in the Tractor Maintenance Log Sheet (see attached sheet).

NON-ROUTINE MAINTENANCE OF TRACTORS:

1. In case of non-routine maintenance to the tractor, action will first be taken at the research facility to repair the tractor.

2. If the repairs cannot be corrected at the research facility, then an outside source will be contacted to repair the tractor at the research facility.

3. If repairs cannot be done at the research facility, the equipment will be transported to an outside source for repair.

4. Record all non-routine procedures done to the Tractor Maintenance Log Sheet (see attached sheet).

Tractor Maintenance Log Sheet

Type of Equipment: Tractor (John Deer 5510N, John Deere 5520N, McCormick, etc.)

Routine Maintenance Activity

A. Cleaning by use of power washer
B. Check oil level
C. Gauges checked for proper operation
D. Fittings checked for tightness
E. Tire pressure checked if applicable
F. Safety equipment checked and in good operating condition
G. Fuel level checked

Maintenance Activity Performed

DATE	INITIALS	TRACTOR MODEL (John Deere 5510N, John Deere 5520N, McCormick, etc.)	CIRCLE MAINTENANCE TYPE	CIRCLE ROUTINE MAINTENANCE ACTIVITY PERFORMED	IF NON-ROUTINE MAINTAINIANCE ACTIVITY: RECORD NATURE OF DEFECT AND REMEDIAL ACTION TAKEN
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	
			ROUTINE NON-ROUTINE	A B C D E F G	

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Calibration of Airblast Sprayers

SOP Number: M.005.20
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To provide a uniform procedure for the calibration of Airblast Sprayers to ensure accurate application.

PROCEDURES:

DISCHARGE CALIBRATION OF AIRBLAST SPRAYERS:

1. Use the appropriate airblast sprayer manual to select the optimum pressure setting, tips, whirl plate, nozzle positions, and RPM to obtain the GPA needed per protocol. The nozzle selection should be targeted for adequate coverage. Ceramic disk and whirl plate numbers will be selected and recorded on the calibration worksheet (see the attached sheet).

2. One tank will be used throughout the calibration and application. Use the calibrated water meter to fill the tank to the level full and record the amount of water to fill the tank on the calibration worksheet (see the attached sheet). Drive the sprayer away from the spray pad, and park with the parking brake on to begin the calibration sequence. Select the appropriate RPM.

3. The tank and return line are used for discharge calibration and application. With the tank ready and at the proper RPM, the manifold is engaged and timed for 60.00 seconds, or per protocol. While the sprayer is running, the pressure gauge is monitored. When the desired time is reached, the manifold is switched off, RPM's are lowered, and the sprayer is driven back to the spray pad to record the PSI, RPM, and the amount of time sprayed on the calibration worksheet.

4. Use the calibrated water meter to fill the tank to the level full. Record this amount of water needed to refill the tank on the calibration worksheet (see attached sheet).

5. A total of three discharge calibration runs are preformed to get an average discharge rate. If there are any equipment malfunctions during any of the calibration runs or if the discharge rate of any one run is outside of +/-5% of the mean, then action must be taken to correct the problem and a new 3 run discharge calibration is required.

Discharge Rate Calculations:

GPM = (Amount to Refill Tank_____gal_ /Time Sprayed_____sec__)x 60.0 sec/min =

_____GPM

SPEED CALIBRATION:

1. Determine target MPH (often 2.5 MPH). Measure a course of 220 feet (or distance needed per protocol). The course will be measured and a marker will be placed at each end of the course. The course should represent similar terrain of the actual plot.

2. Tractor is driven to the pre-measured course and gear (often 1st gear B) and RPM are selected. The course is driven, and the timer is started at the first marker and stopped when reaching the second marker.

3. Record the time, gear selection, distance of course, and RPM's used onto the calibration worksheet (see attached sheet). Calculate the speed as follows:

$$\text{Speed = (MPH)} = \frac{\text{(distance in feet for pre-measured course)}}{\text{(time in seconds recorded to travel course)}} \times \frac{3600\text{sec}}{1\text{ hour}} \times \frac{1\text{ mile}}{5280\text{ ft}}$$

6. A total of three calibration runs are required to get an average speed calibration rate. If there are any equipment malfunctions during any of the calibration runs or if the speed MPH of any one run is outside of /-5% of the mean, then action must be taken to rectify the problem and a new 3 run discharge calibration is required.

7. The original calibration worksheet will be placed into the appropriate Field Data Book or eFDB.

Airblast Sprayer Calibration Worksheet

Trial ID: Appl. #: Date: Time: Initials:

1. Select the optimum pressure, whirl plate, ceramic disk, nozzle positions, and RPM to obtain the target GPA and to ensure good coverage.

2. Ceramic disks/whirl plates: (one side, top to bottom)

3. Pressure = 1._____psi
   2._____psi
   3._____psi

4. Terrain of calibration course (example: grassy field):
   _____

Nozzle #	Ceramic Disk	Whirl Plate
1		
2		
3		
4		
5		
6		
7		

Speed

1. Tractor RPM _____

2. Tractor gear_____

3. Distance of course – marker to marker_____(feet)

	Run 1	Run 2	Run 3	Average
4. Time to drive course in seconds	(sec)	(sec)	(sec)	(sec)
5. Speed Calculation (MPH) (use calculation below)	(mph)	(mph)	(mph)	(mph)

Speed (MPH) = $\frac{\text{(distance in feet for pre-measured course)}}{\text{(time in seconds recorded to travel course)}} \times \frac{3600 \text{ sec}}{1 \text{ hour}} \times \frac{1 \text{ mile}}{5280 \text{ ft}}$

Discharge Rate

	Run 1	Run 2	Run 3	Average
1. Gallons to fill tank	(gal)	(gal)	(gal)	
2. Time Sprayed	(sec)	(sec)	(sec)	(sec)
3. Gallons needed to refill tank	(gal)	(gal)	(gal)	(gal)
4. GPM = (Amount to refill tank ÷ Time Sprayed) x 60 sec	(gpm)	(gpm)	(gpm)	(gpm)

Calibration Performed By (Initials and Date):_____

Recording/Calculations Performed By (Initials and Date): _____

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Application of Test Chemical with an Airblast Sprayer

SOP Number: M.013.11
Revision Date: 1/31/2024
Effective Date: See approved by RFC date

PURPOSE:

To provide a uniform procedure for the application of GLP test chemicals to a GLP designated plot with an airblast sprayer to ensure an accurate application.

APPLICATION PROCEDURES:

1. Using the calibrated water meter, fill the tank of the calibrated sprayer with the amount of water as determined by the calculation worksheet. Add calculated chemical amount to the tank, and add the calculated adjuvant if necessary according to the label or per protocol. Secure the tank lid, start the tractor, and engage the PTO to start the mechanical agitation.

2. Drive the tractor to the designated test plot. Position the tractor so that the calibrated side manifold is in position to spray one side of the plot row. To achieve MPH and the proper pressure setting, set the tractor to the pre-determined gears and RPMs. Allow sufficient distance before the plot stake to drive the tractor to assure correct MPH and pressure setting.

3. Drive the tractor towards the plot. Begin timing (via stopwatch) and spraying when the sprayer reaches the stake in the beginning of the row. Monitor the pressure gauge and spray pattern to ensure proper coverage. Continue timing and spraying until the sprayer reaches the stake at the other end of the row. Record the pass time in the Field Data Book.

4. Repeat procedure 3 until all sides of all rows of the test plot are sprayed and pass times are recorded.

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Measurement of pH and Water Temperature for Test Substance Application

SOP Number: M.016.09
Revision Date: 1/31/2024
Effective Date: See approved by RFC date

PURPOSE:

To provide a process for taking the temperature and pH of the water used for test substance application.

EQUIPMENT DESCRIPTION:

- Yacumama Digital Thermometer: electronic digital thermometer instant read and waterproof.
- pHhydrion test strips: instant check dip stick pH tester.

PROCEDURES:

WATER TEMPERATURE:

1. Using a Yacumama Digital Thermometer that has been factory calibrated, turn on and place the temperature probe in the same water that will be used to carry the test substance.

2. Wait 2-3 seconds for temperature reading. Record the reading that is displayed on the digital screen in the Field Data Book, or eFDB.

3. Press off button to turn off.

4. The Yacumama Thermometer will be recalibrated following the manuafacturer's instructions upon battery replacement.

WATER pH:

1. Take a small quantity of water from the source that will be used to make the test substance solution.

2. Tear off a strip of the pHydrion test strip and dip into the water solution and remove quickly.

3. Shake off excess water and match with the provided color chart immediately.

4. Enter the pH reading into the Field Data Book, or eFDB.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Maintaining Freezer Storage and Temperature Monitoring System

SOP Number: M.019.08
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To maintain the integrity of frozen IR-4 GLP residue samples held as part of IR-4 GLP residue studies.

EQUIPMENT DESCRIPTION:

- Temp Stick WiFi Temperature and Humidity sensor- Main temperature monitoring devices placed in Untreated Freezer 3 and Treated Freezer 1.
- Hobo Pro Tempearture dataloggers can be in place as backup.
- Minimum/Maximum Thermometers will be used as backup.
- A generator provides backup power.

PROCEDURES:

1. To maintain the integrity of frozen IR-4 GLP residue samples, freezer storage is monitored with Temp Stick WiFi Temperature and Humidity Sensors, placed in Treated Freezer 1 and Untreated Freezer 3. If the freezer temperature rises above freezing, a notification email or text message will be sent to the Field Research Director.

2. In the event of a notification email or text message, the Field Research Director will promptly address the issue and take measures to restore freezer functionality.

3. If the freezer cannot be repaired in a timely manner, any samples will be moved to a backup freezer along with the Temp Stick.

4. In case of power outage, a backup generator will automatically provide immediate short-term power for the freezers to continue running. Coolers and ice will be used as backup.

5. Hobo Pro Temperature dataloggers can be placed in the freezers and used as backup temperature dataloggers.

6. Minimum/Maximum thermometers will be in the treated and untreated freezers to ensure temperature range integrity. The Minimum/Maximum thermometers will be re-set after they are placed into the freezers and reach current temperatures.

7. If the temperature does manage to fall out of range of the Protocol, the Study Director will be informed.

8. At the beginning of each field season:

    a. The Temp Stick notification system will be tested. If there are no samples being stored in the freezer, then the Temp Stick can be removed from the freezer to room temperature until a notification is received. Alternately, the system can be tested in the Temp Stick app by going to Alerts>Create New Alert>Send Test Alert. The date of Temp Stick notification system testing along with any other maintenance or repairs to freezer or temperature monitoring system will be documented in the Freezer Storage and Temperature Monitoring System Log.

b. The battery status will be checked for each temp stick. Batteries will be changed as needed using batteries recommended by the manufacturer. These activities will be documented in the Freezer Storage and Temperature Monitoring System Log.
c. The Temp Stik temperature reading will be tested against a NIST certified thermometer to be within 5% of the NIST thermometer reading. If the Temp Stik reading is outside of these parameters, then the Temp Stik will need to be Calibrated. These activities will be documented in the Freezer Storage and Temperature Monitoring System Log.
    i. How to Calibrate Temp Stick Directions from tempstick.com:
    "To do so, simply navigate to the "Sensors" section of the app/website and toggle the option for "Add an offset to your temperature or humidity readings" under the "Sensor Data Calibration" section. From there, you can adjust the sliders for temperature and humidity readings to add an offset for your data"

Trevor Nichols Research Center

Freezer Storage and Temperature Monitoring System Log

Type of Equipment: Freezer, Temperature Logger

Routine Maintenance Activity

A. Temp Stick Notification Test
B. Battery status Checked
C. Temperature reading within 5% of NIST thermometer
D. Installed new Batteries
E. Cleaned Freezer
F. Calibrated Temp Stick

Maintenance Activity Performed

DATE	INITIALS	Freezer ID/ Temperature Logger ID	CIRCLE MAINTENANCE TYPE	CIRCLE ROUTINE MAINTENANCE ACTIVITY PERFORMED	IF NON-ROUTINE MAINTAINIANCE ACTIVITY: RECORD NATURE OF DEFECT AND REMEDIAL ACTION TAKEN
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	
			ROUTINE or NON-ROUTINE	A B C D E F	

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Maintaining Test Substance and Adjuvant Storage and Temperature Monitoring System

SOP Number: M.020.02
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To maintain the integrity of Test Substance and Adjuvants for IR-4 GLP residue studies.

EQUIPMENT DESCRIPTION:

- Temp Stick WiFi Temperature and Humidity sensor- Main temperature monitoring device
- Hobo Pro Temperature dataloggers can be in place as a backup
- Minimum/Maximum Thermometers will be in place as a backup

PROCEDURES:

1. To maintain the integrity of Test Substance and Adjuvants used in IR-4 GLP studies, pesticide storage is monitored with Temp Stick WiFi Temperature and Humidity Sensors, placed in the IR-4 Chemical Storage Room. The Pesticide Storage Room is heated, therefore, if the temperature falls below freezing, a notification email or text message will be sent to the Field Research Director.

2. In the event of a notification email or text message, the Field Research Director will promptly address the issue and take measures to restore heating functionality. If heat cannot be repaired in a timely manner, any test substance for unfinished trials will be moved to a backup location along with the Temp Stick to continue monitoring.

3. Hobo Pro temperature dataloggers can be placed in the IR-4 Chemical Storage Room as a backup.

4. Minimum/Maximum thermometer will be placed in the IR-4 Chemical Storage Room as a backup to ensure temperature range integrity.

5. If the temperature does manage to fall out of range of the storage conditions required on the Test Substance or Adjuvant Label prior to the completion of the applications for the ongoing trial, the Study Director will be informed.

6. At the beginning of each field season:

    a. The Temp Stick notification system will be tested. The Temp Stick can be removed from the IR-4 Storage Cabinet and placed in a freezer until a notification is received. Alternately, the system can be tested in the Temp Stick app by going to Alerts>Create New Alert>Send Test Alert. The date of Temp Stick notification system testing along with any other maintenance or repairs to the temperature monitoring system will be documented in the IR-4 Chemical Storage Cabinet Temperature System Monitoring Log.
    b. The battery status will be checked. Batteries will be changed as needed using batteries recommended by the manufacturer. These activities will be documented in the IR-4 Chemical Storage Cabinet Temperature System Monitoring Log.
    c. The Temp Stik temperature reading will be tested against a NIST certified thermometer to be within 5% of the NIST thermometer reading. If the Temp Stik reading is outside of

these parameters, then the Temp Stik will need to be Calibrated. These activities will be documented in the IR-4 Chemical Storage Cabinet Temperature System Monitoring Log.

i. How to Calibrate Temp Stick Directions from tempstick.com:
"To do so, simply navigate to the "Sensors" section of the app/website and toggle the option for "Add an offset to your temperature or humidity readings" under the "Sensor Data Calibration" section. From there, you can adjust the sliders for temperature and humidity readings to add an offset for your data"

Trevor Nichols Research Center:
IR-4 Chemical Storage Cabinet Temperature Monitoring System Log

Type of Equipment: Temperature Logger

Routine Maintenance Activity

A. Temp Stick Notification Test
B. Battery status Checked
C. Temperature reading within 5% of NIST thermometer
D. Installed new Batteries
E. Calibrated Temp Stick

Maintenance Activity Performed

DATE	INITIALS	Temperature Logger ID	CIRCLE MAINTENANCE TYPE	CIRCLE ROUTINE MAINTENANCE ACTIVITY PERFORMED	IF NON-ROUTINE MAINTAINIANCE ACTIVITY: RECORD NATURE OF DEFECT AND REMEDIAL ACTION TAKEN
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	
			ROUTINE or NON-ROUTINE	A B C D E	

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Calibration of Hand Carried CO_2 Pressurized Boom Sprayers

SOP Number: M.021.01
Revision Date: 2/2/2024
Effective Date: See approved by RFC date

PURPOSE:

To set the delivery rate of the sprayer to ensure accurate application of the pesticide.

PROCEDURES:

1. Hand Carried CO2 Pressurized Boom Sprayer should be calibrated daily prior to use, or as required by trial protocols. Calibration will be recorded in the appropriate Field Data Book.
2. Visually inspect equipment for obvious wear or potential leaks and repair or replace as necessary.
3. Choose the appropriate nozzle tips to deliver the volume, pressure, and spray pattern required.
4. Pressurize the spray tank with sufficient CO2 to maintain the desired pressure throughout the application. Set the pressure regulator on the CO2 tank to deliver the desired volume and pressure at the nozzle.
5. To determine that all nozzles are discharging uniformly, place each nozzle in a graduated cylinder and open the trigger valve for a given length of time. Replace nozzle tips that vary more than +/-5% from the average. Repeat the above procedure until all nozzles are discharging uniformly.
6. When spraying with a single nozzle boom, use even spray nozzles and measure the desired band width before spraying the treatment plots.
7. When spraying with a multiple nozzle boom, hold boom at desired height over target to obtain an approximate 30% overlap on each side of each nozzle.
8. Calibrate the boom as follows:
    a. Calibration calculations are based on information provided in the Spraying Systems Co. Catalog. All fluid delivery calculations are based on the assumptions:
        i. XX02 nozzle delivers 0.2000gal of water per min at 40psi
        ii. XX04 nozzle delivers 1.0000gal of water per min at 40psi

    To extrapolate to 30 psi, the following formula is used:

$$\frac{GPM\ 1}{GPM\ 2} = \frac{\sqrt{PSI\ 1}}{\sqrt{PSI\ 2}}$$

Thus, for our applications with 8002 abd 11002 nozzles, the GPM at 30psi (GPM) calculation is as follows where X= GPM 30 (Solve for X):

$$\frac{X}{0.2000} = \frac{\sqrt{30}}{\sqrt{40}} \rightarrow \frac{X}{0.2000} = \frac{5.48}{6.32} \rightarrow X = 0.1734\ GPM\ at\ 30psi$$

3785.3 ml/gal x 0.1734 gpm = 656.4 ml/min
656.4 ml/min x 60sec/min = 10.94 ml/sec per nozzle at 30 psi

The delivery of an XX04 nozzle is double the delivery of an XX02.
10.94ml/sec x 2 = 21.88 ml/sec

The delivery of an XX10 is five times the delivery of XX02.
10.94ml/sec x 5 = 54.70 ml/sec

b. To calibrate the boom and CO2 pressure regulator, the tank is filled with water and pressurized. The nozzles are placed into graduated cylinders and the trigger valve is opened for 15-30 seconds (depending on nozzles selected).
   i. 8002 and 11002 nozzles should deliver 328 ml in 30 seconds.
   ii. 8004 nozzles should deliver 328 ml in 15 seconds.
   iii. 8010 nozzles should deliver 820.5 ml in 15 seconds.

c. If delivered volume is not correct, the CO2 regulator is adjusted, and the process is repeated until the delivery is within 5% the desired amount. The pressure readings on the CO2 regulator and spray boom are recorded for each test. When the correct amount has been delivered three consecutive times, the boom is considered calibrated. Calibration results (pressure readings and nozzle discharge volumes are recorded in the Field Data Book. The first calibration of the season, or those calibrations requiring maintenance or repair of sprayer equipment will be recorded on the Equipment Maintenance and Calibration Form.

9. Calculate walking speed as follows:
   a. Walking speed is calibrated by marking out a 50 foot strip and walking it with a full sprayer and timing each trip with a stopwatch until the correct time for 50 feet is achieved. Time for 50ft is calculated with the following formula:

$$\frac{\mathbf{a} \times 50\text{ft}}{43560\text{ sqft/acre}} \times \mathbf{b}\text{ gpa} \times \frac{3785.3\text{ml/gal}}{\mathbf{c}\text{ ml/sec}} = \text{time in sec for 50ft}$$

a = effective band width in ft, or plot width for directed applications
b = desired volume per acre in gallons
c = volume of boom in ml/sec at desired pressure

   b. The four nozzle boom consists of four nozzles mounted 16in apart with band width of 64in. With 8002 nozzles, it delivers 43.76ml/sec (four 8002 nozzles x 10.94 ml/sec). Thus:

$$\frac{\mathbf{5.33ft} \times 50\text{ft}}{43560\text{ sqft/acre}} \times \mathbf{20\text{ gpa}} \times \frac{3785.3\text{ml/gal}}{\mathbf{43.76}\text{ ml/sec}} = \mathbf{10.60}\text{ sec for 50ft}$$

   c. The four nozzle boom with xx04 nozzles (8004, 9504, 11004, or OC04) delivers 87.52ml/sec (four xx04 nozzles x 21.88 ml/sec). Thus:

$$\frac{\mathbf{5.33ft} \times 50\text{ft}}{43560\text{ sqft/acre}} \times \mathbf{40\text{ gpa}} \times \frac{3785.3\text{ml/gal}}{\mathbf{87.52}\text{ ml/sec}} = \mathbf{10.60}\text{ sec for 50ft}$$

The four nozzle boom may be adjusted so that the outside nozzles spray the sides of the plants while the center nozzles spray the top of the plants. This boom is used for small to moderate sized fruit trees and plants.

d. Wider or narrower bands can be obtained by adding or deleting nozzles from a boom and recalibrating as above.

e. The two nozzle boom consists of two nozzles mounted 16 inches apart with a band with of 32 inches. It delivers 21.88ml/sec (2 nozzles x 10.94ml/sec). Thus:

$$\frac{\textbf{2.67ft} \times 50\text{ft}}{43560\ \text{sqft/acre}} \times \textbf{20 gpa} \times \frac{3785.3\text{ml/gal}}{\textbf{21.88}\ \text{ml/sec}} = \textbf{10.60}\ \text{sec for 50ft}$$

f. The two nozzle tandem boom consists of two nozzles (8010) mounted 12 inches apart in tandem (the second nozzle is behind the first nozzle). It delivers 109.4ml/sec from two nozzles and has a band width of 16 inches. Thus:

$$\frac{\textbf{1.33ft} \times 50\text{ft}}{43560\ \text{sqft/acre}} \times \textbf{200 gpa} \times \frac{3785.3\text{ml/gal}}{\textbf{109.4}\ \text{ml/sec}} = \textbf{10.60}\ \text{sec for 50ft}$$

g. Speed in miles per hour is calculated as follows:

5280 ft/mile / 50 ft	=	105.6 miles	x	10.6 sec	=	1119.36 sec/mile

1119.36 sec/mile / 3600 sec/hour	=	0.311 hr/mile

1 hr / 0.311 hr/mile	=	3.2 MPH

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Application of Test Chemical with Hand Carried CO2 Pressurized Boom Sprayer

SOP Number: M.022.02
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To provide a uniform procedure for the application of GLP test chemicals to a GLP designated plot with Hand Carried CO2 Pressurized Boom Sprayer to ensure an accurate application.

APPLICATION PROCEDURES:

1. Record weather data such as air temperature, soil temperature, wind direction and speed, relative humidity, sky conditions, soil and plant surface moisture in the field data book.
2. Water will be used as a carrier for applications. Where possible, make a minimum of 1 gallon spray mix for each treatment. In some cases, less than one gallon of spray mix can be used. Increase the amount mixed as needed in increments of 1 gallon if possible.
3. Measure water using a clean graduated cylinder or other measuring devise. If using a liquid pesticide, discard an amount of water equal to the volume of the test chemical to be added.
4. The pH of the mix water will be determined with pH test strips and recorded.
5. Pour about half of the water into the spray tank. Add the test substance and adjuvant according to protocol or adjuvant label. Rinse the graduated cylinder or other measuring devise at least three times with remaining water and pour into spray tank. Then add the rest of the water to the tank.
6. Apply the material beginning with the lowest concentration and continuing with higher concentrations to the highest concentration.
7. Proceed at the correct speed toward the plot and turn on the sprayer upon entering the plot, or slightly before. Maintain the correct speed throughout the plot. Turn off the sprayer at the end of the plot and record pass times and directions.
8. Empty the excess pesticide mix at an approved location, preferably approximately 50 feet from the experimental area and triple rinse the tank with clean water.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Maintenance and Cleaning of Boom Sprayers

SOP Number: M.023.02
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure that the boom sprayers are free from contaminates and running at optimum performance for accurate application.

PROCEDURES:

CLEANING OF THE BOOM SPRAYER:

1. Before applying any test substance or when changing compounds or formulations, the spray tank will be cleaned by triple rinsing with clean water.
2. The spray system will be flushed with clean water. Nozzles will be checked for debris and cleaned if necessary.
3. The designated personnel conducting the cleaning of the sprayer will record all procedures done to the sprayer in the Application Equipment and Maintenance Log Sheet (see attached sheet).

ROUTINE MAINTENANCE OF THE BOOM SPRAYER:

1. A visual inspection will be conducted of the sprayer to ensure it is functioning properly.
2. The designated personnel conducting routine maintenance of the boom sprayer will record all routine procedures done to the sprayer in the Application Equipment and Maintenance Log Sheet (see attached sheet).

NON-ROUTINE MAINTENANCE OF THE BOOM SPRAYER:

1. In case of non-routine maintenance to the sprayer, action will be taken at the research facility to rectify the malfunction or failure.
2. If repairs cannot be done at the research facility, outside professionals will be contacted and the equipment will be transported to such professionals for repair.
3. The designated personnel conducting non-routine maintenance of the sprayer will record all non-routine procedures done to the sprayer in the Application Equipment and Maintenance Log Sheet (see attached sheet).

Application Equipment and Maintenance Log Sheet

Type of Equipment: Boom Sprayer

Routine Maintenance Activity

- A. Spray tank triple rinsed with clean water
- B. Exterior cleaned
- C. Nozzles checked for debris
- D. Visual inspection of boom sprayer to ensure it is functioning properly
- E. Nozzles cleaned or replaced
- F. Valves and gauges checked for proper operation
- G. Fittings checked for tightness, elimination of leaks

Maintenance Activity Performed

DATE	INITIALS	BOOM ID	CIRCLE MAINTENANCE TYPE	CIRCLE ROUTINE MAINTENANCE ACTIVITY PERFORMED	IF NON-ROUTINE MAINTAINIANCE ACTIVITY: RECORD NATURE OF DEFECT AND REMEDIAL ACTION TAKEN
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	
			ROUTINE or NON-ROUTINE	A B C D E F G	

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Collecting Residue Samples

SOP Number: R.001.12
Revision Date: 2/1/2024
Effective Date: See approved by RFC date

PURPOSE:

To ensure that samples taken for residue analysis will represent the protocol requirements and the integrity of the samples will remain intact during the samples process.

EQUIPMENT DESCRIPTION:

Clean buckets or Ziploc bags large enough to accommodate the crop. Coolers will be used when necessary with ice. The equipment used will vary depending on the sample type. Disposable Nitrile gloves or similar should be used. IR-4 sample bags or bags that are provided by individual sponsors should be used when appropriate.

PROCEDURES:

1. Specific samples requested, including growth stage, sample size, sample amount, and pre-harvest intervals are outlined in the protocols.

2. Samples will be typical of a commercially grown commodity, where possible.

3. Except when specified from individual protocols, samples will be taken from at least 4 individual plants, collected in a manner to ensure impartial sample that represents the entire plot (except from plot ends). Collect samples from high/ low, exposed/ sheltered, and inside/ outside of the plant canopy.

4. Clean Nitrile gloves will be worn during sampling and changed between sampling to prevent contamination. Where possible sample the untreated plots first, or have separate personnel sample different treatments. Then sample the treated plot, starting with the lowest rate to the highest rate. Use the appropriate PPE when harvesting the fruit.

5. Samples will be harvested in clean buckets, Ziploc plastic bags, or plastic-lined IR-4 cloth bags. Place samples into their appropriate freezer as soon as possible. If samples cannot be placed into a freezer within approximately one hour, then the samples will be placed into coolers with ice to ensure the integrity of the sample. Min/Max thermometers will be used to monitor temperature. Avoid contamination from vehicles, clothing, or other samples.

6. All samples will be labeled according to individual protocols.

7. For 0 day sampling, allow the fruit and plant to dry before harvest.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Packing and Shipping of Residue Samples

SOP Number: R.002.13
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure frozen residue samples are removed from freezer storage and shipped to the appropriate analytical laboratory without loss of sample integrity.

EQUIPMENT DESCRIPTION:

- Cardboard boxes large enough to accommodate sample size and weight.
- Plastic Ziploc bags should be used when it is needed to ensure integrity of the samples.
- Packing tape strong enough to secure boxes for transport.
- Freezer truck Bill of Lading forms; Location of Bill of Lading forms is the IR-4 residue storage area and freezer storage room.

PROCEDURES:

1. Generally, frozen residue samples will be transported to the designated analytical lab by way of freezer truck. It is the responsibility of the Field Research Director or staff to arrange the time and date the residue samples will be picked up by freezer truck company. If samples are to be shipped with dry ice, the Field Research Director or staff will follow the protocol for proper shipping requirements to ensure the integrity of the samples.

2. Prior to freezer truck arrival, boxes should be constructed using packaging tape and outside of boxes properly labeled with the following information: treated and untreated identification, sample ID, lab address, shipping numbers, and box numbers (ex. 1 of 2, 2 of 2).

3. All chain of custody paperwork for Freezer Trucks should be filled out prior to arrival, if possible.

4. Samples will be packed according to individual trials. Untreated and treated samples will be packaged in separate boxes. Samples can be packed into labeled boxes with the required documentation (COC true and exact copies) and taped shut and then placed back in the appropriate freezer prior to the arrival of the freezer truck if there is enough space in the freezers.

5. Prior to or upon arrival of freezer truck, remove frozen samples and place them into the properly labeled boxes.

6. If required, place exact copies of the Field Data Book shipping paperwork into the appropriate boxes and tape shut for transport.

7. Receive shipping invoice from driver and place into the appropriate FDB or eFDB.

8. Once samples are given to the transporter (or earlier if required by the protocol), fill out the appropriate FDB paperwork and inform the appropriate analytical lab to inform them the samples have been sent. Follow the protocol for any other shipping instructions.

TREVOR NICHOLS RESEARCH CENTER

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STANDARD OPERATING PROCEDURES

Residue Test Plot Design

SOP Number: R.004.09
Revision Date: 2/1/2024
Effective Date: See approved by RFC date

PURPOSE:

To ensure that all of the protocol guidelines for a GLP test system design will be met.

EQUIPMENT DESCRIPTION:

- Durable large markers/stakes: stakes should be large enough to write out all appropriate information and durable enough to persist for the duration of the trial.
- Permanent maker.
- A tape measure long enough to measure the plot length.

PROCEDURES:

1. The test system site will be selected in the geographic area where the crop is commercially grown.

2. Each test system site will consist of: one untreated and one or more treated plots. The untreated plot should be placed up-wind (based on prevailing winds) of the treated plot to reduce the risk of contamination from drift. Employ adequate buffer zones between each plot to prevent contamination from drift.

3. Each test system site will be adequate in size to ensure that no more than 50% of the sampled area will be needed to provide the necessary plant material. Select a test site that had been maintained following good agricultural practices for the production of the necessary plant material.

4. The test system design plot should be adequate in size to accommodate the application equipment to be used.

5. Using the markers/stakes, write all the appropriate information needed, which includes the minimum of: Field ID, treatment, and the test material to be applied. Stakes will be placed at the plot row ends.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Safety Inspection

SOP Number: X.001.08
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure the health and safety of the Trevor Nichols Research Center Personnel.

PROCEDURES:

Management will provide and maintain safe and healthy working conditions and will promote safe work practices to protect the health of the employees.

Both Trevor Nichols Research Center and Clarksville Research Center are off-campus research facilities under the direction of Michigan State University. Safety inspections are a part of Michigan State University's responsibility.

a. Safety inspections are conducted yearly by Michigan State University through the Department of Environmental Health and Safety (EHS).

b. The inspections may include, but are not limited to, the monitoring of the working environment of the employees, controlling and eliminating safety, health, fire, and other hazards, and preserving/ improving environmental factors, which contribute to improved health and safety protection.

c. After the inspection, the Department of Environmental Health and Safety provides a report to the farm manager of Trevor Nichols Research Center citing any violations that may have been found.

d. A written response to the Department of Environmental Health and Safety will be given with a plan of action to rectify any violations that were cited.

TREVOR NICHOLS RESEARCH CENTER

MICHIGAN STATE UNIVERSITY

STANDARD OPERATING PROCEDURES

Treated Crop Destruct

SOP Number: X.002.07
Revision Date: 2/27/2025
Effective Date: See approved by RFC date

PURPOSE:

To ensure the leftover treated crop is handled in such a way that it cannot be consumed as a human food or animal feed.

PROCEDURES:

1. Field residue trials are conducted on private University property, not permitted to be used by the public.

2. After all treated and untreated samples have been harvested, the remaining crop load is left on the plant to drop to the ground and decompose by natural means.

3. All treated and untreated crop will remain on the University property. No fruit from the study will enter the commercial food market.