



STANDARD OPERATING PROCEDURE (SOP) PHYSICAL GEOGRAPHY LABORATORY

PREPARED BY,

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1. PROFILE

The Physical Geography Laboratory is an academic facility within the Department of Geography, Faculty of Social Sciences, Padang State University, established to support education, practical training, research, community service, and scientific development in the field of Physical Geography.

The laboratory provides facilities, equipment, materials, and technical support for students, lecturers, researchers, laboratory staff, and authorized external users in conducting laboratory and field-based activities safely, effectively, and professionally.

2. PORTOFOLIO

Laboratory Profile

Laboratory Name : Cartography and Photogrammetry Laboratory
Department Geography
Faculty of Social Sciences
Universitas Negeri Padang

Study Programs : 1. Bachelor Degree of Education Geography (S1)
2. Bachelor Degree of Geography (S1)

Head of Laboratory : Dr. Triyatno, S.Pd., M.Si.

Laboratory

Manager/Technician : Rahmi Kanisa Yusmah

Jabatan : Laboratory Technician

Laboratory Facilities

No	Room Name	Dimensions	Area (m ²)	Description
1	Practical Training Room	4.5x7.7 m	34.65 m ²	Available at: https://bit.ly/RuanganLabGeoFisik
2	Laboratory Management Office	4.4x7.5 m	33 m ²	
	Total Area		67.65 m²	

3. STANDARD OPERATING PROCEDURE (SOP)

A. OBJECTIVES

This Standard Operating Procedure (SOP) is developed to achieve the following objectives:

1. To establish standardized procedures for the management and operation of the Physical Geography Laboratory.
2. To optimize the utilization of laboratory facilities, equipment, and human resources in an effective, efficient, accountable, and sustainable manner.
3. To provide high-quality laboratory services that support teaching, practical sessions, research activities, and scientific innovation in the field of Physical Geography.
4. To serve as a guideline for students, lecturers, researchers, laboratory assistants, and external users in utilizing laboratory facilities and equipment.
5. To ensure the proper supervision, maintenance, inventory control, and security of laboratory equipment and materials.
6. To promote a safe, orderly, and professional laboratory environment that complies with Occupational Health and Safety (OHS) principles and institutional regulations.

B. REFERENCES

This Standard Operating Procedure (SOP) is developed based on the following references:

1. Regulations and Standard Operating Procedures of Padang State University.
2. Laboratory Management Guidelines of Indonesian Higher Education Institutions.
3. Standard Operating Procedures of the Faculty of Mathematics and Natural Sciences, Tanjungpura University.
4. Best practices in laboratory management and Occupational Health and Safety (OHS) standards.
5. Relevant scientific publications and laboratory management references applicable to Physical Geography laboratories.

C. SCOPE

This SOP applies to all laboratory users, including students, lecturers, researchers, laboratory assistants, laboratory staff, and authorized external parties who utilize the facilities and equipment of the Physical Geography Laboratory.

The procedures govern laboratory equipment borrowing, laboratory use, equipment maintenance, safety practices, and administrative requirements.

The following provisions shall apply:

1. Laboratory equipment may only be borrowed after obtaining approval from the Head or Coordinator of the Physical Geography Laboratory.
2. Borrowers must submit an official request letter signed by the responsible lecturer, supervisor, or institution.
3. Borrowers are required to leave a valid identification card (Student ID Card, National Identity Card, or Driver's License) as collateral during the borrowing period.
4. Borrowed equipment must correspond exactly to the items listed in the approved borrowing request.
5. The borrowing period shall follow the duration specified in the approved application letter.
6. Equipment borrowing and return services are available on working days from **09:00 AM to 03:00 PM**.
7. Any delay in returning laboratory equipment without prior notification and approval shall be subject to an administrative penalty of **IDR 100,000 per item per day**, unless otherwise
8. determined by the laboratory management.

D. EQUIPMENT BORROWING PROCEDURE

1. Equipment Borrowing

The procedures for borrowing laboratory equipment are as follows:

- A. The applicant submits an official equipment borrowing request addressed to the Laboratory Coordinator or Head of Laboratory.
- B. The Laboratory Coordinator reviews equipment availability and the requested borrowing schedule.
- C. If the requested equipment is unavailable due to prior reservations or laboratory activities, the applicant shall be notified to revise the schedule or cancel the request.
- D. Upon approval, the applicant submits the signed borrowing request to the Laboratory Assistant.
- E. The applicant provides:
 - A valid identification card;
 - Contact information;
 - The contact information of the supervising lecturer or person responsible for the activity.
- F. The Laboratory Assistant prepares the requested equipment.
- G. The applicant and Laboratory Assistant jointly inspect the equipment to verify its condition before handover.
- H. The applicant receives the equipment and assumes full responsibility for maintaining its condition until it is returned.

2. Equipment Return Procedure

The procedures for returning laboratory equipment are as follows:

- A. The borrower returns all equipment directly to the Laboratory Assistant.

- B. The Laboratory Assistant and borrower jointly inspect the returned equipment.
- C. If the equipment is returned in its original condition, the Laboratory Assistant accepts the return and records the transaction.
- D. If any equipment is lost, damaged, or malfunctioning beyond normal use, the borrower is responsible for repairing or replacing the equipment with an identical or equivalent specification approved by the laboratory management.
- E. After all equipment has been verified and accepted, the borrower's identification card shall be returned.

LABORATORY SAFETY, RESPONSIBILITIES, AND DISCIPLINARY REGULATIONS

A. Laboratory Safety Policy

The Physical Geography Laboratory is committed to providing a safe, healthy, and professional working environment for all laboratory users. Every student, lecturer, researcher, laboratory assistant, staff member, and authorized visitor is required to comply with all laboratory safety regulations and operational procedures.

All laboratory activities shall be conducted in accordance with Occupational Health and Safety (OHS) principles to minimize the risk of accidents, equipment damage, environmental contamination, and injury.

Failure to comply with laboratory safety regulations may result in disciplinary action and the suspension of laboratory access privileges.

B. Laboratory Safety Objectives

The objectives of laboratory safety are:

- 1. To protect laboratory users from potential hazards and accidents.
- 2. To ensure that all laboratory activities are conducted safely, efficiently, and responsibly.
- 3. To protect laboratory equipment, facilities, and research materials from misuse or damage.
- 4. To maintain a safe, clean, and organized laboratory environment that supports teaching, research, and scientific activities.
- 5. To promote a culture of safety awareness and personal responsibility among all laboratory users.

C. General Laboratory Safety Rules

Every laboratory user shall comply with the following regulations:

Personal Safety

- 1. Wear appropriate laboratory attire, including:
 - Laboratory coat
 - Closed-toe shoes
 - Appropriate Personal Protective Equipment (PPE) as required.
- 2. Long hair shall be tied back, and loose clothing or accessories that may interfere with laboratory activities shall be secured.
- 3. Users must be in good physical condition before participating in laboratory activities.
- 4. Laboratory users shall immediately report any illness, injury, accident, or unsafe condition to the Laboratory Assistant or Laboratory Coordinator.

Laboratory Conduct

1. Maintain a professional attitude and follow all instructions provided by lecturers and laboratory staff.
2. Read and understand the operating procedures for all equipment before use.
3. Never operate laboratory equipment without authorization or supervision.
4. Keep work areas clean and organized throughout laboratory activities.
5. Return all equipment and materials to their designated storage locations after use.
6. Report any damaged or malfunctioning equipment immediately.

Prohibited Activities

The following activities are strictly prohibited:

- Smoking inside the laboratory.
- Eating or drinking in laboratory areas.
- Running, joking, or engaging in disruptive behavior.
- Bringing unauthorized hazardous materials into the laboratory.
- Operating laboratory equipment without permission.
- Removing laboratory equipment or materials without official approval.

D. Laboratory Safety Equipment

The following safety equipment shall be available and maintained in proper working condition:

Personal Protective Equipment (PPE)

- Laboratory coats
- Protective gloves
- Safety goggles
- Face masks or respirators (when required)
- Closed-toe safety footwear

Laboratory Safety Facilities

- Fire extinguishers
- First aid kits
- Emergency exits
- Safety signs and warning labels
- Emergency contact information
- Material Safety Data Sheets (MSDS)

E. Responsibilities of Laboratory Users

Every laboratory user is responsible for:

1. Complying with all laboratory regulations and SOPs.
2. Using laboratory equipment only for authorized academic or research purposes.
3. Maintaining cleanliness and orderliness during and after laboratory activities.
4. Reporting damaged equipment, accidents, spills, or unsafe conditions immediately.
5. Returning borrowed equipment in the same condition as received.
6. Protecting laboratory property and ensuring responsible use of all facilities.

F. Responsibilities of Laboratory Personnel

1. Head of Laboratory

The Head of Laboratory is responsible for:

- Developing laboratory policies and operational procedures.
- Supervising laboratory management and services.
- Approving laboratory use and equipment borrowing.
- Ensuring compliance with institutional regulations and safety standards.

2. Laboratory Coordinator

The Laboratory Coordinator shall:

- Coordinate laboratory scheduling and activities.
- Supervise laboratory operations.
- Manage laboratory inventories and documentation.
- Monitor the implementation of laboratory SOPs.

3. Laboratory Assistant

The Laboratory Assistant shall:

- Prepare laboratory equipment and materials.
- Assist users during laboratory activities.
- Inspect borrowed and returned equipment.
- Maintain laboratory cleanliness and safety.
- Record equipment usage, maintenance, and inventory status.

G. Practicum Safety Procedures

Before commencing any practicum or research activity, laboratory users shall:

1. Read and understand the relevant SOP and equipment operating instructions.
2. Verify that all equipment is functioning properly.
3. Inspect all equipment for visible damage before use.
4. Wear the required Personal Protective Equipment (PPE).
5. Ensure that emergency exits and safety equipment are easily accessible.
6. Request assistance from the Laboratory Assistant whenever uncertainties or technical issues arise.

If an emergency or hazardous situation occurs:

- Stop all laboratory activities immediately.
- Switch off electrical equipment if it is safe to do so.
- Leave the laboratory through the designated emergency exit.
- Report the incident immediately to laboratory personnel.

H. Related Parties

The implementation of this SOP involves the following stakeholders:

1. Head of the Department of Geography
2. Head of the Physical Geography Laboratory
3. Laboratory Coordinator
4. Laboratory Assistants
5. Laboratory Staff
6. Lecturers
7. Researchers
8. Students
9. Authorized External Users

I. Disciplinary Regulations and Penalties

To maintain discipline and ensure laboratory safety, the following sanctions shall apply:

1. Laboratory users who fail to comply with laboratory regulations may be denied entry to the laboratory.
2. Users arriving late or failing to bring the required practicum materials may be prohibited from participating in laboratory activities.
3. Unauthorized use or relocation of laboratory equipment may result in the immediate suspension of laboratory activities and cancellation of the practicum session.
4. Students who fail to attend three scheduled practicum sessions without official approval shall be required to repeat the practicum in the following academic semester, unless otherwise authorized by the Head of the Department or the Head of Laboratory.
5. Users who lose or damage laboratory equipment shall be responsible for replacing the equipment with an item of identical or equivalent specifications approved by the laboratory management.
6. If replacement is not possible due to equipment availability or cost, compensation shall be determined through an agreement between the Head of Laboratory, the Department, and the responsible user.

LABORATORY MANAGEMENT AND ADMINISTRATION

A. General Provisions

The management of the Physical Geography Laboratory shall be conducted in a systematic, transparent, accountable, and professional manner to ensure that all laboratory resources are utilized effectively in support of education, research, community service, and scientific development.

Laboratory administration includes the management of facilities, equipment, chemicals, documentation, inventories, borrowing records, maintenance schedules, and laboratory users.

B. Organizational Structure

The management structure of the Physical Geography Laboratory consists of:

1. Head of the Department of Geography
2. Head of the Physical Geography Laboratory
3. Laboratory Coordinator
4. Laboratory Assistants
5. Laboratory Staff
6. Lecturers and Researchers
7. Students and Authorized Laboratory Users

Each member of the laboratory organization shall perform their duties in accordance with the responsibilities assigned by the Department of Geography and the Faculty of Social Sciences.

C. Laboratory Administration System

The laboratory administration system shall include the following documents:

1. Laboratory User Registration Records
2. Equipment Inventory Records
3. Chemical Inventory Records
4. Equipment Borrowing and Return Forms
5. Equipment Maintenance Records
6. Laboratory Activity Logbooks
7. Laboratory Damage Reports
8. Laboratory Safety Inspection Reports
9. Waste Management Records
10. Calibration and Maintenance Reports

All laboratory documents shall be maintained in both printed and electronic formats whenever applicable.

D. Equipment Inventory Management

Every laboratory instrument and supporting facility shall be recorded in the laboratory inventory system.

Each inventory record shall include:

- Equipment name
- Inventory code
- Manufacturer/Brand
- Model or specification
- Quantity
- Acquisition date
- Current condition
- Storage location
- Person responsible
- Maintenance history

Laboratory staff shall update inventory records periodically to ensure the accuracy of laboratory assets.

E. Equipment Borrowing Administration

All equipment borrowing activities shall be documented through an official borrowing procedure.

The borrower shall:

1. Complete the Laboratory Equipment Borrowing Form.
2. Obtain approval from the Head of Laboratory or Laboratory Coordinator.
3. Present a valid identification card.
4. Verify the condition of the equipment together with the Laboratory Assistant before collection.

The Laboratory Assistant shall record:

- Borrower's name
- Student Identification Number (NIM) or Employee ID
- Equipment borrowed
- Quantity

- Date and time of borrowing
- Expected return date
- Equipment condition before borrowing

F. Equipment Return Administration

Upon returning laboratory equipment, the following procedures shall apply:

1. The Laboratory Assistant shall inspect the returned equipment.
2. Equipment condition shall be compared with the initial borrowing record.
3. Any damage, malfunction, or missing components shall be documented.
4. The borrower shall sign the equipment return form after verification.
5. The Laboratory Assistant shall update the inventory and borrowing records.

G. Laboratory Equipment Maintenance

To ensure optimal performance and extend equipment service life, routine maintenance shall be conducted according to the following schedule:

Daily Maintenance

- Cleaning laboratory workspaces
- Cleaning laboratory equipment after use
- Returning equipment to designated storage locations
- Checking electrical power supply

Weekly Maintenance

- Inspection of laboratory equipment
- Cleaning storage cabinets
- Inspection of laboratory safety equipment
- Inspection of laboratory environmental conditions

Monthly Maintenance

- Functional testing of laboratory equipment
- Calibration of measurement instruments where applicable
- Inspection of laboratory inventories
- Review of laboratory documentation

Annual Maintenance

- Comprehensive equipment servicing
- Preventive maintenance
- Calibration by authorized personnel
- Inventory audit and asset verification

H. Chemical Management

Chemical substances shall be managed according to laboratory safety standards and Material Safety Data Sheets (MSDS).

The following principles shall be observed:

1. Every chemical container shall have a clear and permanent label.
2. Chemicals shall be stored according to compatibility classifications.
3. Flammable, corrosive, oxidizing, and toxic chemicals shall be stored separately.
4. Expired or damaged chemicals shall not be used.
5. Chemical inventory records shall be updated after every use.

I. Documentation and Record Management

All laboratory activities shall be documented properly to ensure traceability and accountability.

The documentation shall include:

- Practicum schedules
- Research activities
- Equipment usage
- Equipment maintenance
- Laboratory accidents
- Safety inspections
- Chemical usage
- Waste disposal

Laboratory records shall be retained in accordance with university regulations and may be used for accreditation, audits, research evaluation, and quality assurance purposes.

J. Laboratory Access Control

Access to the Physical Geography Laboratory shall be restricted to authorized personnel.

The following individuals are permitted to access laboratory facilities:

- Laboratory staff
- Lecturers
- Researchers
- Registered students
- Authorized visitors with official permission

Visitors shall be accompanied by laboratory personnel while inside laboratory facilities.

K. Reporting Procedures

Laboratory users shall immediately report the following incidents:

- Equipment malfunction
- Equipment damage
- Chemical spills
- Laboratory accidents
- Fire hazards
- Safety violations
- Missing laboratory equipment

Incident reports shall be submitted to the Laboratory Assistant, who shall forward the report to the Laboratory Coordinator and the Head of Laboratory for further action.

L. Quality Assurance and Continuous Improvement

To maintain high standards of laboratory management, periodic evaluations shall be conducted through:

1. Internal laboratory audits
2. Equipment inspections
3. Safety inspections
4. Inventory verification
5. User satisfaction surveys
6. Documentation reviews

The results of these evaluations shall be used as the basis for continuous improvement of laboratory services, operational procedures, safety management, and quality assurance systems.

LABORATORY EQUIPMENT MANAGEMENT AND OPERATIONAL PROCEDURES

A. General Provisions

Laboratory equipment is an essential resource that supports education, research, community service, and scientific activities within the Physical Geography Laboratory. Therefore, all equipment shall be managed, operated, maintained, and stored in accordance with standardized procedures to ensure safety, accuracy, reliability, and long-term usability.

Every laboratory user is responsible for using laboratory equipment properly and preventing misuse, damage, or loss.

B. Objectives

The objectives of laboratory equipment management are:

1. To ensure that laboratory equipment remains functional, accurate, and safe for use.
2. To extend the service life of laboratory instruments through proper maintenance and storage.
3. To establish standardized procedures for equipment operation, maintenance, inspection, and calibration.
4. To minimize equipment damage caused by improper handling or environmental conditions.
5. To support reliable laboratory teaching, research, and scientific activities.

C. General Principles of Equipment Management

Laboratory equipment shall be managed according to the following principles:

- Safety
- Accountability
- Efficiency
- Traceability
- Preventive Maintenance
- Quality Assurance

Every laboratory instrument shall be uniquely identified and recorded in the laboratory inventory system.

D. Equipment Classification

Laboratory equipment shall be classified according to:

1. Material Composition

Equipment may be manufactured from:

- Glass
- Metal
- Plastic
- Ceramic

- Electronic components
- Composite materials

Each type of material requires specific handling and storage procedures.

2. Equipment Weight

Equipment shall be categorized as:

- Lightweight equipment
- Medium-weight equipment
- Heavy equipment

Heavy equipment shall be stored at ground level or on lower shelves to minimize lifting hazards and reduce the risk of accidents.

3. Environmental Sensitivity

Certain laboratory instruments are highly sensitive to environmental conditions such as:

- Temperature
- Humidity
- Dust
- Magnetic fields
- Direct sunlight
- Vibration

Sensitive equipment shall be stored in controlled environments with appropriate protective measures.

E. Equipment Storage Procedures

Proper storage is essential to maintain equipment quality and functionality.

The following requirements shall be observed:

1. Equipment shall be cleaned before storage.
2. Equipment shall be completely dry before being returned to storage cabinets.
3. Storage areas shall remain clean, dry, and free from excessive humidity.
4. Sensitive instruments shall be stored in protective cases or cabinets.
5. Silica gel or other moisture-absorbing materials shall be used where necessary.
6. Storage cabinets shall be clearly labeled according to equipment categories.

F. Equipment Maintenance Procedures

Daily Maintenance

Laboratory users shall:

- Clean equipment immediately after use.
- Remove dust and contaminants.
- Return equipment to its designated location.
- Report any abnormalities.

Preventive Maintenance

Laboratory staff shall conduct routine inspections to identify:

- Loose components
- Signs of corrosion
- Physical damage

- Electrical problems
- Calibration requirements

Preventive maintenance shall be documented in laboratory maintenance records.

Corrective Maintenance

Equipment that is damaged or malfunctioning shall:

1. Be removed from service immediately.
2. Be labelled "OUT OF SERVICE."
3. Be inspected by laboratory personnel.
4. Undergo repair or replacement before being returned to operational use.

G. Equipment Calibration

Measurement instruments shall undergo periodic calibration to maintain accuracy and reliability.

Calibration shall include:

- Verification of measurement accuracy
- Functional testing
- Adjustment when necessary
- Documentation of calibration results

Calibration intervals shall follow manufacturer recommendations or institutional quality assurance policies.

H. General Equipment Operating Procedures

Before operating any laboratory equipment, users shall:

1. Read the applicable Standard Operating Procedure (SOP).
2. Inspect the equipment for cleanliness and physical condition.
3. Verify that the equipment is functioning properly.
4. Confirm that all accessories are complete.
5. Wear appropriate Personal Protective Equipment (PPE).
6. Operate the equipment only for its intended purpose.
7. Follow instructions provided by laboratory personnel.

I. Special Procedures for Glassware

Glass laboratory equipment requires special handling due to its fragile nature.

Laboratory users shall:

1. Inspect glassware for cracks or defects before use.
2. Handle glassware carefully to prevent breakage.
3. Use heat-resistant glassware for heating applications.
4. Clean glassware immediately after use.
5. Dry glassware thoroughly before storage.
6. Store glassware separately from heavy metal equipment.

Glassware containing chemical residues shall never be stored without cleaning, as prolonged exposure may permanently damage the glass surface.

J. Environmental Protection for Equipment

Laboratory equipment shall be protected from environmental hazards including:

Chemical Exposure

Corrosive chemicals shall be stored separately from metal equipment to prevent corrosion.

Humidity

Microscopes and optical instruments shall be stored in cabinets equipped with silica gel or dehumidifying systems.

Magnetic Fields

Precision instruments such as stopwatches, compasses, and electronic measuring devices shall be stored away from magnets and electromagnetic sources.

Dust

Sensitive instruments shall remain covered or stored inside protective cases when not in use.

K. Battery-Powered Equipment

Battery-operated instruments shall be maintained according to the following procedures:

1. Switch off equipment immediately after use.
2. Remove batteries when equipment will not be used for an extended period.
3. Inspect battery compartments regularly.
4. Replace leaking or damaged batteries immediately.

These procedures prevent corrosion and extend equipment service life.

L. Security and Asset Protection

Laboratory equipment shall be secured according to its value and operational importance.

High-value instruments shall:

- Be stored in locked cabinets.
- Be accessible only to authorized personnel.
- Require documented borrowing procedures.
- Be inspected periodically.

M. Responsibilities of Laboratory Users

Every laboratory user shall:

- Operate equipment according to the relevant SOP.
- Maintain cleanliness and proper handling practices.
- Report equipment damage immediately.
- Return equipment in its original condition.
- Avoid unauthorized repairs or modifications.

N. Responsibilities of Laboratory Personnel

Laboratory personnel shall:

- Maintain equipment inventories.
- Conduct routine inspections.
- Perform preventive maintenance.

- Coordinate calibration activities.
- Document equipment maintenance histories.
- Ensure equipment is available and safe for laboratory activities.

O. Continuous Improvement

The Laboratory Equipment Management System shall be reviewed periodically to improve operational efficiency, safety, and service quality.

Continuous improvement activities include:

- Equipment performance evaluations
- Maintenance effectiveness reviews
- User feedback assessments
- Inventory audits
- Calibration reviews
- Laboratory quality assurance programs

STANDARD OPERATING PROCEDURES FOR LABORATORY EQUIPMENT

A. General Provisions

This chapter establishes the Standard Operating Procedures (SOPs) for the operation, handling, storage, and maintenance of laboratory equipment used in the Physical Geography Laboratory.

All laboratory users shall read and understand the operating instructions before using any equipment. Laboratory equipment shall only be operated by authorized users under the supervision of laboratory personnel when required.

B. Standard Operating Procedure for Geological Compass

1. Purpose

The geological compass is used to determine the **strike and dip orientation of rock formations** and to establish directional references during geological and geomorphological field investigations.

2. Person Responsible

- Head of Laboratory
- Laboratory Assistant
- Authorized lecturers, researchers, and students

3. Operating Procedure

A. Measuring Strike

1. Place the **East (E) side** of the compass firmly against the rock surface.
2. Adjust the circular level until the air bubble is centered.
3. Wait until the magnetic needle stabilizes.
4. Read the compass bearing and record the strike direction using the appropriate geological notation (e.g., N45°E).

B. Measuring Dip

1. Position the **West (W) side** of the compass perpendicular to the strike direction.
2. Rotate the clinometer until the bubble is centered.
3. Read and record the dip angle directly from the clinometer scale.

4. Storage and Maintenance

- Store the geological compass in its protective case after use.
- Protect the instrument from water, dust, strong impacts, and magnetic fields.
- Clean the instrument using a soft, dry cloth.
- Store the compass in the designated Field Equipment Cabinet.

C. Standard Operating Procedure for Geological Hammer

1. Purpose

The geological hammer is used to collect rock samples and examine geological outcrops during laboratory and field investigations.

2. Person Responsible

- A. Laboratory Assistant
- B. Authorized laboratory users

3. Operating Procedure

A. Equipment Inspection

Before use:

- Inspect the hammer head and handle.
- Ensure that the head is securely attached.
- Do not use damaged equipment.

B. Sample Collection

- Identify a fresh and representative rock surface.
- Select a fractured or weathered edge whenever possible.
- Hold the hammer firmly with both balance and control.
- Apply only the force necessary to obtain the sample.

C. Safety Requirements

- Wear safety goggles and protective gloves.
- Maintain a safe distance from other personnel.
- Ensure that rock fragments cannot strike nearby individuals.

4. Storage and Maintenance

- A. Clean the hammer after each use.
- B. Dry thoroughly before storage.
- C. Apply anti-corrosion protection when necessary.
- D. Store in the designated geological equipment cabinet.

D. Standard Operating Procedure for Monocular Polarizing Microscope

1. Purpose

The monocular polarizing microscope is used to observe minerals, rock thin sections, and microscopic geological structures for teaching and research purposes.

2. Person Responsible

- Laboratory Assistant
- Authorized lecturers, researchers, and students

3. Operating Procedure

1. Carry the microscope using both hands, supporting the arm and base.
2. Place the microscope on a stable and level surface.
3. Rotate the nosepiece until the lowest-power objective lens is aligned.
4. Adjust the illumination and diaphragm to obtain adequate light.
5. Position the specimen on the stage and secure it with stage clips.
6. Focus the specimen using the coarse adjustment knob, followed by the fine adjustment knob.
7. Change objective lenses gradually to increase magnification as required.
8. Never force any adjustment mechanism.

4. Shutdown Procedure

- Remove the specimen.
- Return the objective lens to the lowest magnification.
- Switch off the illumination system.
- Cover the microscope with its dust cover.
- Return the microscope to its designated storage cabinet.

5. Storage and Maintenance

- Store in a dry environment.
- Protect from excessive humidity.
- Place silica gel inside the storage cabinet when necessary.
- Clean optical components only with approved lens tissue.

E. Standard Operating Procedure for Metal or Paper Hygrometer

1. Purpose

The hygrometer is used to measure and monitor ambient relative humidity and temperature within laboratory or field environments.

2. Person Responsible

- Laboratory Assistant
- Authorized laboratory users

3. Operating Procedure

1. Place the hygrometer at the measurement location.
2. Ensure adequate air circulation around the instrument.

3. Allow sufficient stabilization time before taking readings.
4. Record: Relative humidity (%RH) and Temperature (°C)
5. Repeat measurements when verification is required.

4. Storage

After use:

- Clean the instrument.
- Store in a dry environment.
- Avoid direct sunlight and excessive humidity.
- Protect against physical shock.

F. General Operating Rules for Laboratory Equipment

Every laboratory user shall:

1. Read the relevant SOP before operating any equipment.
2. Verify that equipment is complete and functioning properly.
3. Use equipment only for its intended purpose.
4. Wear appropriate Personal Protective Equipment (PPE).
5. Report equipment malfunction immediately.
6. Clean equipment after use.
7. Return equipment to its designated storage location.

G. Equipment Damage and Incident Reporting

Any laboratory user discovering equipment damage shall:

1. Stop using the equipment immediately.
2. Notify the Laboratory Assistant.
3. Complete an Equipment Damage Report.
4. Do not attempt unauthorized repairs.
5. Await inspection and approval before reuse.

H. Preventive Maintenance

To ensure operational reliability, laboratory personnel shall perform:

Maintenance Activity	Frequency
Visual inspection	Daily
Cleaning	After every use
Functional testing	Monthly
Calibration (if applicable)	Every 6–12 months
Comprehensive servicing	Annually

I. Quality Assurance

All laboratory equipment shall be operated according to the following principles:

- Safety
- Accuracy
- Reliability
- Traceability

- Preventive Maintenance
- Continuous Improvement

Equipment operation, maintenance, calibration, and repair records shall be documented and retained as part of the Physical Geography Laboratory Quality Management System.

LABORATORY WASTE MANAGEMENT

A. General Provisions

The Physical Geography Laboratory is committed to implementing an effective and environmentally responsible laboratory waste management system. All laboratory users shall manage, segregate, handle, store, and dispose of laboratory waste in accordance with Occupational Health and Safety (OHS) principles, environmental protection regulations, and Good Laboratory Practice (GLP).

Proper waste management is essential to minimize risks to laboratory personnel, protect laboratory facilities, and prevent environmental contamination.

B. Objectives

This Laboratory Waste Management Standard Operating Procedure aims to:

1. Establish standardized procedures for the handling and disposal of laboratory waste.
2. Protect laboratory users from exposure to hazardous materials.
3. Prevent environmental pollution resulting from improper waste disposal.
4. Promote responsible laboratory practices and environmental sustainability.
5. Ensure compliance with institutional policies and applicable environmental regulations.

C. Scope

This SOP applies to all laboratory users, including:

- Students
- Lecturers
- Researchers
- Laboratory Assistants
- Laboratory Staff
- Authorized External Users

It covers the management of laboratory waste generated during:

- Practical classes
- Research activities
- Laboratory testing
- Equipment cleaning
- Chemical handling
- Field sample preparation

D. Waste Classification

Laboratory waste shall be segregated into the following categories:

1. General Waste

Examples include:

- Paper
- Cardboard
- Plastic packaging
- Non-contaminated disposable materials

General waste shall be disposed of in designated general waste containers.

2. Chemical Waste

Examples include:

- Acid solutions
- Alkali solutions
- Organic solvents
- Oxidizing agents
- Laboratory reagents

Chemical waste shall never be disposed of into sinks or regular waste bins unless specifically authorized by laboratory management.

3. Glass Waste

Examples include:

- Broken beakers
- Broken test tubes
- Broken microscope slides
- Broken sample containers

Glass waste shall be collected separately in puncture-resistant containers.

4. Contaminated Waste

Materials contaminated with chemicals shall be treated as hazardous laboratory waste and handled according to Material Safety Data Sheet (MSDS) recommendations.

E. Waste Segregation Procedures

Every laboratory user shall:

1. Separate waste according to its classification.
2. Dispose of waste only into designated containers.
3. Ensure waste containers remain closed when not in use.
4. Never mix incompatible chemical wastes.
5. Report overflowing or damaged waste containers immediately.

F. Standard Waste Disposal Procedure

The laboratory waste disposal procedure shall be conducted as follows:

Step 1

Students, researchers, or laboratory users shall dispose of waste generated during laboratory activities into the designated waste containers provided by the laboratory.

Step 2

Laboratory Assistants shall monitor waste containers throughout laboratory operations.

Step 3

When waste containers reach their designated capacity, Laboratory Assistants shall seal and transport the waste to the temporary laboratory waste collection area.

Step 4

Empty replacement containers shall be installed immediately to ensure uninterrupted laboratory operations.

Step 5

Waste shall be transferred to authorized waste management facilities according to university policies and applicable environmental regulations.

G. Chemical Waste Handling

Chemical waste shall be managed according to the following principles:

1. Every chemical container shall be clearly labeled.
2. Incompatible chemicals shall never be mixed.
3. Strong acids shall be stored separately from alkalis.
4. Oxidizing agents shall be stored separately from flammable substances.
5. Unknown chemical substances shall be isolated until properly identified.
6. Laboratory personnel shall consult the relevant Material Safety Data Sheet (MSDS) before handling chemical waste.

H. Broken Glass Handling Procedure

If laboratory glassware breaks:

1. Secure the affected area immediately.
2. Wear appropriate Personal Protective Equipment (PPE).
3. Use forceps, tongs, or a brush and dustpan to collect broken glass.
4. Never collect broken glass using bare hands.
5. Dispose of broken glass into designated glass waste containers.
6. Clean and disinfect the affected area if chemical contamination is present.
7. Place warning signs until the area is completely safe.
8. Report any injuries immediately.

I. Spill Response Procedure

In the event of a laboratory spill:

Minor Spill

- Restrict access to the area.
- Wear appropriate PPE.
- Contain the spill using absorbent material.
- Collect contaminated material for proper disposal.
- Clean and disinfect the affected surface.

Major Spill

- Stop laboratory activities immediately.
- Evacuate personnel if necessary.
- Notify the Laboratory Assistant and Head of Laboratory.
- Follow the laboratory emergency response plan.

J. Responsibilities

Laboratory Users

Laboratory users shall:

- Dispose of waste correctly.
- Follow laboratory waste segregation procedures.
- Report spills and accidents immediately.
- Maintain cleanliness during laboratory activities.

Laboratory Assistants

Laboratory Assistants shall:

- Monitor waste collection containers.
- Replace full waste containers.
- Maintain waste storage areas.
- Coordinate waste transportation.
- Maintain waste management records.

Head of Laboratory

The Head of Laboratory shall:

- Supervise waste management implementation.
- Ensure compliance with environmental regulations.
- Conduct periodic waste management evaluations.
- Coordinate with authorized waste disposal services.

K. Documentation

The following records shall be maintained:

- Waste Collection Log
- Chemical Waste Inventory
- Waste Transportation Record
- Spill Incident Report
- Laboratory Accident Report

- Waste Inspection Checklist

Documentation shall be retained as part of the laboratory quality management system.

L. Occupational Health, Safety, and Environmental Protection

All waste management activities shall adhere to the following principles:

- Occupational Health and Safety (OHS)
- Good Laboratory Practice (GLP)
- Environmental Sustainability
- Pollution Prevention
- Risk Reduction
- Continuous Improvement

Laboratory users shall prioritize personal safety while minimizing environmental impact throughout all waste management activities.

M. Continuous Improvement

The Physical Geography Laboratory shall periodically evaluate its waste management system through:

- Internal audits
- Safety inspections
- Environmental compliance reviews
- Waste reduction initiatives
- User feedback
- Laboratory quality assurance programs

Recommendations resulting from these evaluations shall be implemented to improve laboratory safety, operational efficiency, and environmental performance.

CHEMICAL SAFETY AND MATERIAL SAFETY DATA SHEETS (MSDS)

A. General Provisions

This chapter provides standardized guidelines for the safe handling, storage, transportation, emergency response, and disposal of chemicals used in the Physical Geography Laboratory.

All laboratory users shall familiarize themselves with the hazards associated with each chemical substance before use and shall comply with the requirements specified in the applicable Material Safety Data Sheet (MSDS).

No laboratory activity involving chemicals may be conducted without appropriate Personal Protective Equipment (PPE) and adequate supervision.

B. Objectives

This SOP aims to:

1. Protect laboratory users from chemical hazards.
2. Prevent laboratory accidents and environmental contamination.
3. Standardize first-aid and emergency response procedures.

4. Ensure the safe storage and handling of laboratory chemicals.
5. Promote compliance with Occupational Health and Safety (OHS) and Good Laboratory Practice (GLP).

C. General Chemical Safety Rules

All laboratory users shall:

1. Read the MSDS before handling any chemical.
2. Wear appropriate PPE, including laboratory coats, gloves, safety goggles, and masks when required.
3. Work in well-ventilated areas or use a fume hood when handling volatile or hazardous chemicals.
4. Never eat, drink, or smoke in laboratory areas.
5. Clearly label all chemical containers.
6. Wash hands thoroughly after handling chemicals.
7. Report spills, leaks, or accidental exposure immediately.

D. Material Safety Data Sheets (MSDS)

1. Hydrochloric Acid (HCl)

Hazard Identification

Hydrochloric Acid (HCl) is a highly corrosive chemical that can cause severe burns to the skin, eyes, respiratory tract, and digestive system. Exposure to HCl vapors may result in respiratory irritation and lung injury.

First Aid Measures

Inhalation

- Move the affected person to fresh air immediately.
- Keep the individual at rest.
- Seek medical attention if symptoms persist.

Skin Contact

- Remove contaminated clothing.
- Flush the affected area with running water for at least 15 minutes.
- Obtain medical evaluation if irritation continues.

Eye Contact

- Rinse immediately with clean water for at least 15 minutes while holding the eyelids open.
- Remove contact lenses if present and easy to do.
- Seek immediate medical attention.

Ingestion

- Rinse the mouth with water.
- Do **not** induce vomiting.
- Give water only if the person is fully conscious.
- Seek immediate medical assistance.

Storage

Hydrochloric Acid shall be stored:

- In a cool, dry, and well-ventilated area.
- Away from heat sources.
- Away from flammable materials.
- In corrosion-resistant containers.
- Away from incompatible chemicals.

Incompatible Materials

Hydrochloric Acid shall not be stored together with:

- Oxidizing agents
- Strong alkalis
- Reactive metals
- Chlorine-containing compounds

Spill Response

Small spills shall be neutralized using an appropriate weak alkaline neutralizing agent before collection and disposal.

Large spills shall be handled only by trained personnel using appropriate PPE.

2. Hydrogen Peroxide (H₂O₂)

Hazard Identification

Hydrogen Peroxide is a strong oxidizing agent capable of causing skin irritation, eye damage, and respiratory irritation.

Concentrated solutions may intensify fire and react violently with combustible materials.

First Aid Measures

Skin Contact

Remove contaminated clothing and wash thoroughly with soap and water.

Eye Contact

Flush eyes continuously with water for at least 15 minutes and seek medical attention.

Inhalation

Move the exposed individual to fresh air and provide oxygen if necessary.

Ingestion

Rinse the mouth with water and obtain immediate medical assistance.

Fire Response

Hydrogen Peroxide itself is non-flammable but supports combustion.

Use **water only** as the recommended extinguishing agent.

Storage

Store in:

- Cool environments
- Dry locations
- Well-ventilated storage areas
- Containers protected from sunlight

Keep away from combustible and organic materials.

3. Sulfuric Acid (H₂SO₄)

Hazard Identification

Sulfuric Acid is a highly corrosive substance capable of causing severe burns and permanent eye damage.

Exposure may occur through:

- Skin contact
- Eye contact
- Inhalation
- Ingestion

First Aid Measures

Skin Contact

Immediately flush with large amounts of water for at least 15 minutes.

Eye Contact

Rinse continuously with water and obtain emergency medical treatment.

Inhalation

Move the person to fresh air and provide respiratory support if necessary.

Ingestion

Do not induce vomiting. Seek immediate emergency medical care.

Storage

Store:

- In corrosion-resistant containers
- In cool and dry environments
- Away from bases and oxidizing agents
- In clearly labelled chemical cabinets

4. Sodium Hydroxide (NaOH)

Hazard Identification

Sodium Hydroxide is a highly corrosive alkali that can cause severe burns to the skin and eyes.

Contact with moisture may generate heat capable of causing additional injury.

First Aid Measures

Skin Contact

Immediately flush with running water for at least 15 minutes.

Eye Contact

Rinse continuously with water and obtain emergency medical treatment.

Inhalation

Move to fresh air and seek medical evaluation if symptoms develop.

Ingestion

Do not induce vomiting. Seek immediate medical attention.

Storage

Store:

- In tightly sealed containers
- In dry conditions
- Away from acids
- Away from moisture

Wash hands thoroughly after handling.

5. Alcohol (Ethanol)

Hazard Identification

Alcohol is a highly flammable liquid and vapor.

Hazards include:

- Respiratory irritation
- Eye irritation
- Skin irritation
- Central nervous system depression
- Fire and explosion risks

First Aid Measures

Eye Contact

Flush with water and seek medical attention.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

Move to fresh air immediately.

Provide oxygen if breathing becomes difficult.

Ingestion

Do not induce vomiting.

Seek immediate medical assistance.

Safe Handling

Laboratory users shall:

- Use alcohol only in well-ventilated areas.
- Keep containers tightly closed.
- Avoid sparks, flames, and ignition sources.
- Use explosion-proof equipment whenever applicable.

Storage

Store:

- Away from heat and ignition sources.
- In approved flammable chemical cabinets.
- Away from oxidizing agents and nitric acid.

6. Magnesium Sulfate Heptahydrate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$)

Hazard Identification

Magnesium Sulphate Heptahydrate may cause:

- Mild skin irritation
- Eye irritation
- Respiratory discomfort due to dust exposure

First Aid Measures

Inhalation

Move the affected person to fresh air.

Skin Contact

Wash thoroughly with water.

Eye Contact

Flush with clean water until irritation subsides.

Ingestion

Provide drinking water if the person is conscious and seek medical advice when necessary.

Storage

Store:

- In tightly closed containers.
- In dry locations.
- Away from moisture and incompatible materials.

E. Emergency Response Procedures

In the event of chemical exposure:

1. Stop laboratory activities immediately.
2. Notify the Laboratory Assistant.
3. Evacuate the area when necessary.
4. Follow emergency evacuation procedures.
5. Seek medical treatment immediately.
6. Document the incident using the Laboratory Incident Report Form.

F. Personal Protective Equipment (PPE)

The following PPE shall be worn whenever hazardous chemicals are handled:

- Laboratory coat
- Chemical-resistant gloves
- Safety goggles
- Face shield (when required)
- Respiratory protection (when required)
- Closed-toe safety footwear

G. Chemical Waste Management

Chemical waste shall:

- Be segregated according to compatibility.
- Be stored in labelled waste containers.

- Never be discharged into sinks without authorization.
- Be disposed of according to laboratory waste management procedures and environmental regulations.

H. Documentation and Review

The Laboratory shall maintain:

- Material Safety Data Sheets (MSDS)
- Chemical Inventory Records
- Chemical Usage Logs
- Spill Incident Reports
- Chemical Waste Records
- Chemical Inspection Checklists

This chapter shall be reviewed periodically to ensure compliance with updated laboratory safety standards, Good Laboratory Practice (GLP), and Occupational Health and Safety (OHS) requirements.

DOCUMENTATION, FORMS, MONITORING, AND CONTINUOUS IMPROVEMENT

A. General Provisions

Documentation is an integral component of the Physical Geography Laboratory Quality Management System. All laboratory activities shall be properly documented to ensure traceability, accountability, transparency, and continuous improvement.

All records generated through laboratory operations shall be maintained accurately and retained in accordance with university regulations.

B. Objectives

This chapter aims to:

1. Standardize laboratory documentation and record management.
2. Ensure the availability of reliable records for operational, academic, and research purposes.
3. Support internal audits, accreditation processes, and quality assurance activities.
4. Facilitate continuous monitoring and evaluation of laboratory performance.
5. Establish a systematic approach to corrective and preventive actions.

C. Scope

This SOP applies to all documentation related to:

- Laboratory administration
- Equipment borrowing and return
- Laboratory practicum activities
- Research activities
- Equipment maintenance and calibration
- Chemical inventory
- Waste management
- Safety inspections
- Incident and accident reporting
- Internal audits

- Quality improvement activities

D. Document Control

1. Document Identification

Each laboratory document shall include:

- Document Title
- Document Code
- Revision Number
- Effective Date
- Approval Authority
- Page Number

2. Document Approval

All official laboratory documents shall be reviewed and approved by:

- Head of Laboratory
- Head of the Department (when applicable)

Only approved versions shall be used for laboratory operations.

3. Document Revision

This SOP shall be reviewed:

- Annually; or
- Whenever significant changes occur in laboratory operations, equipment, safety regulations, or university policies.

Superseded documents shall be archived and clearly marked as "**Obsolete**" to prevent unintended use.

E. Standard Laboratory Forms

The following forms shall be maintained as official laboratory records.

Form 1

Laboratory Equipment Borrowing Form

The form shall include:

- Borrower's Name
- Student/Employee ID
- Department/Institution
- Contact Information
- Equipment Name
- Inventory Code
- Quantity
- Purpose of Use
- Borrowing Date
- Return Date
- Borrower's Signature
- Laboratory Assistant's Signature

Form 2

Laboratory Equipment Return Form

The form shall record:

- Borrower's Name
- Equipment Returned
- Equipment Condition
- Missing Components (if any)
- Return Date
- Inspection Results
- Remarks
- Laboratory Assistant's Approval

Form 3

Laboratory Activity Logbook

The logbook shall contain:

- Date
- Activity
- Course/Research Title
- Lecturer/Supervisor
- Number of Participants
- Equipment Used
- Laboratory Assistant on Duty
- Remarks

Form 4

Equipment Maintenance Record

The maintenance record shall include:

- Equipment Name
- Inventory Number
- Maintenance Date
- Type of Maintenance
- Findings
- Corrective Action
- Technician/Laboratory Assistant
- Next Maintenance Schedule

Form 5

Laboratory Incident Report

The report shall include:

- Date and Time
- Location
- Person(s) Involved
- Description of Incident
- Equipment or Materials Involved
- Immediate Response
- Corrective Action
- Recommendations

Form 6

Chemical Usage Log

The log shall record:

- Chemical Name
- Quantity Used
- User
- Date
- Remaining Stock
- Laboratory Assistant Verification

Form 7

Waste Disposal Record

The record shall include:

- Waste Category
- Quantity
- Collection Date
- Temporary Storage Location
- Disposal Method
- Responsible Personnel

F. Monitoring and Evaluation

The Physical Geography Laboratory shall conduct periodic monitoring of:

- Laboratory utilization
- Equipment availability
- Equipment condition
- Safety compliance
- Chemical management
- Waste management
- User satisfaction
- Documentation completeness

Monitoring activities shall be conducted at least once every semester.

G. Internal Audit

Internal audits shall be performed periodically to verify compliance with:

- Laboratory SOPs
- University regulations
- Occupational Health and Safety (OHS) requirements
- Good Laboratory Practice (GLP)
- Quality Management System requirements

The audit process shall include:

1. Planning
2. Document review
3. Field inspection
4. Interviews
5. Audit reporting
6. Follow-up actions

H. Corrective and Preventive Actions (CAPA)

When non-conformities are identified, the laboratory shall implement:

Corrective Actions

Actions taken to eliminate the cause of an existing problem, including:

- Equipment repair
- Procedure revision
- Additional staff training
- Documentation updates

Preventive Actions

Actions intended to prevent future occurrences, including:

- Routine inspections
- Preventive maintenance
- Safety awareness programs
- Periodic SOP reviews
- Risk assessments

I. User Feedback and Service Evaluation

To improve laboratory services, feedback shall be collected from:

- Students
- Lecturers
- Researchers
- External users

Evaluation indicators include:

- Service quality
- Equipment availability
- Laboratory cleanliness
- Safety implementation
- Staff responsiveness
- Administrative efficiency

Feedback results shall be analyzed and incorporated into annual laboratory improvement plans.

J. Key Performance Indicators (KPIs)

The Physical Geography Laboratory shall monitor the following performance indicators:

Indicator	Target
Equipment Availability	≥ 95%
Equipment Functionality	≥ 95%
Laboratory Safety Compliance	100%
On-Time Equipment Return	≥ 90%
Completion of Preventive Maintenance	100%
User Satisfaction	≥ 85%
Documentation Completeness	100%

K. Record Retention

Laboratory records shall be retained for the following minimum periods:

Document Type	Retention Period
Equipment Borrowing Records	3 Years
Maintenance Records	5 Years
Incident Reports	5 Years
Chemical Inventory Records	5 Years
Waste Management Records	5 Years
Internal Audit Reports	5 Years
SOP Revision History	Permanent

Electronic records shall be regularly backed up and protected against unauthorized access.

L. Closing Provisions

This Standard Operating Procedure shall serve as the official guideline for all operational activities within the Physical Geography Laboratory, Department of Geography, Faculty of Social Sciences, Padang State University.

All laboratory personnel and users are required to understand, implement, and comply with the provisions contained in this document.

This SOP shall become effective upon approval by the Head of the Department and the Head of the Physical Geography Laboratory and shall remain valid until revised or replaced by a subsequent edition.

4. ACTIVITY DOCUMENTATION

[https://bit.ly/ACTIVITY DOCUMENTATION LAB](https://bit.ly/ACTIVITY_DOCUMENTATION_LAB)