FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA

Inspiring Trust, Assuring Safe & Nutritious Food

Ministry of Health and Family Welfare, Government of India

Mobile Food Testing Laboratory

FOOD SAFETY ON WHEELS

Operational Manual

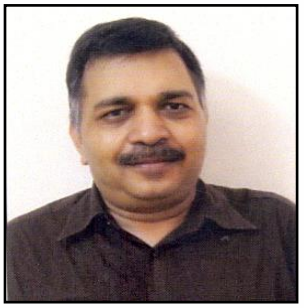
PREFACE

Testing of food to instil confidence amongst consumers that food is safe to eat is important part of the food safety ecosystem. However, number and spread of food testing labs in the country is grossly inadequate. While, Food Safety and Standards Authority of India (FSSAI) is working towards having more food testing labs both in the public as well as private sector, it has also initiated a scheme to provide mobile units for food testing to reach out to consumers through as many touch points as possible.

These mobile units are called "*Food Safety on Wheels*". Apart from conducting simple tests for common adulterants in milk, water, edible oil and other items of food of daily consumption, these mobile units would also be used for awareness building around food safety, hygiene and promoting healthy eating habits in citizens at large and for conducting training and certification programme for food handlers and supervisors in food businesses, particularly petty food businesses. In addition, these mobile units would help the field functionaries in the States to enhance their outreach and conduct surveillance activities even in far-flung areas.

It is hoped that with passage of time, services provided through these mobile units, '*Food Safety on Wheels'* would become popular amongst all stakeholders, namely, the citizens, the consumers, the food businesses and the field functionaries of the Food Safety Departments in the States. This would help to bring about a paradigm shift in food safety ecosystem in the country.

18 August, 2017
New Delhi



Pawan Agarwal
Chief Executive Officer
Food Safety and Standards Authority of India

CONTENTS

I- Food Safety on Wheels (FSW)

A comprehensive and sustainable approach towards food safety and hygiene is the most imperative component to achieve a healthy and happy India. Food safety and hygiene is a shared responsibility and needs to be practiced in every aspect of a food lifecycle, from production, to manufacturing, transportation, storage and consumption. We need to have a holistic approach where everyone come together and contributes as a stakeholder. FSSAI, in an attempt to bring the agenda of food safety and hygiene for everyone and everywhere, provides "Food Safety on wheels" (FSW), a multipurpose vehicle which will help in dissemination of information and act as a platform for getting food safety training and food testing.

"Food Safety on wheels" can perform 3 key activities:

1. **Training**: - Food businesses needs to be trained on various procedures and best practices to be followed to ensure food safety and hygiene. FSW will become a platform for training of food businesses ensuring the widest outreach of the training program, especially in villages, towns, remote areas. This will help in reaching out to unorganised sector involved in street food vending, catering, retail and distribution, storage and transport, manufacturing, bakery, oil, packaged water, fish and seafood, meat and poultry, milk and milk products, and others along with organized food businesses.
2. **Testing**: - Factors like rising inflation rate and competitive market strategies has lead many food processors to get involved in malpractices like using inferior quality raw materials or adulterate the food products providing unsafe, impure and unwholesome food to the consumers. These adulterated foods can have adverse effect on human health. Increasing instances of food adulteration in the country necessitates testing of these adulterants for the health and safety of the people. FSW is fully functional mobile laboratory, equipped with basic infrastructure for quick qualitative testing for detection of adulteration in various food commodities which can ascertain the presence or absence of specific adulterants in food sample.
3. **Awareness**: - Simple and easy steps can be inculcated in our daily routine to make sure that safe and nutritious food becomes a way of life. To ensure a sustainable model, FSSAI has adopted a 360* approach for citizen guidance and bring about a behavioural change in every sphere - @home, school, workplace or eating out. FSW will help in consumer education through interactive media as well as through distribution of flyers and booklets.

II- Details of Vendor, Vehicle, Fixtures & Fitting and Equipment

FSSAI has awarded the contract to M/s Asian Scientific Industries (Delhi) for body building, interior fabrication of FSW, fixtures/furniture and supply, installation and commissioning of equipments. The office of the firm is located at 6 UA/3, Jawahar Nagar, Delhi-110007. Dr. Ratik Kholi and/or Shri R.K. Kohli, Managing Partners may be contacted at Landline No.011-23856685, Mobile No. (s) 09999368809 (Dr Ratik), 09810313685 (Mr R.K. Kohli) and email id - asian_industries1959@yahoo.in, for any matter related to FSW including maintenance, service schedule of the vehicle/equipment, etc.

The complete Mobile Food Testing Laboratory referred to as "Food Safety on wheels" (FSW) will have the following –

1. Vehicle, Body Building and Interior Fabrication-

Vehicle	Force Motors's Traveller Delivery Van (BS-IV) Model – T2 4020 DV Warranty: 36 months or 100000 Km
Vehicle Design	The vehicle should have following items– i. An additional Exhaust fan. ii. A carrier and a ladder. iii. All three sides of the body should have insulator material (as coating or a material) on the inside. iv. One set of a radio and an amplifier along with two movable loud speakers with fixtures on the roof. v. Foot step at the back end of the vehicle for entering/climbing. vi. The exterior of the vehicle should be branded (either painted or stickered with the logo of FSSAI along with other pictures that will be provided by FSSAI to the Contractor. vii. The Interior should have- • Workbenches on both sides with adequate moving space of a minimum three feet in the central area. • Workbenches should have storage below and above the working platforms • Space for safely fixing the generator, refrigerator and also securing the gas cylinder(s). • Chemical resistant vinyl/PVC flooring or any suitable material.

	• Provision to safely securing the equipments under vibration free, cushioned and fitting separations in order to prevent any damage during the vehicle is under movement. • Sliding windows on both the walls of the vehicle. • Collapsible/retractable ledge of 9 inch depth x 30 inch outside one of the windows for acceptance of samples. This ledge should be such that it can be secured flat on the body of the vehicle when the MFTL is on the move. • Stowing area/room for accommodating the stools after working. • Tissue paper roll holder, hand wash holder, towel holder, spatula holder, tweet pipette holder, test tube stand holder, separating funnel holder etc should be placed inside the lab in such a way that it can be accessed by sitting on the stool itself. • The door having full length grab rail that is not projecting outside from the door front surface. The grab rails should be made of powder coated Aluminium. • Dedicated space for keeping two 10 litres carboys to be provided. • Appropriate space and easily accessible positioning for placing fire extinguisher.
Water Tank and Sink	• Water tanks (acid and alkali resistance) of total minimum capacity of 100 litres. • Waste water collection tank (acid and alkali resistance); with outside drain – minimum 100 litres capacity. • Sink of Polypropylene, moulded as one piece. The minimum dimension of the sink is 32x32x20 cms. The sink should not have any sharp corners inside. Sink colour shall be black.
Generator/battery operated	• GASTECH Model-GE9000RS) - 8.5 kVA • UNILINE 5 kVa UPS
A.C Unit	A minimum of 1.5 tonne split AC with the outdoor unit.
Electrical fitting and wiring	Minimum six power points on each side shall be given on two work benches to make equipments operable. The power supply of these points shall be from the generator. Each of these power points shall have both 5A and 15 A (12 nos of 5A & 5nos of 15A).

Lightings	LED lights in the lab for adequate illumination.
Eye wash pump	Suitable eye wash pump shall be provided near the wash basin.
Fire extinguisher	ABC type
Refrigerator	Double door refrigerator (0- 4 degree C and freezer of -18 degree C) 190-250 litres capacity.
Television	Brand - Philips Model Name 32PFL3931/V7 Type LED Screen Size 32 Inches/80 cm Screen Resolution 1366 x 768 (HD Ready)
Computer	Model No: hp 20- c020il aio Processor generation: 6th generation Processor: Intel core i3-6100(3.7 GHz, 3MB Cache, 2 Cores) Operating system: Windows 10 Professional Graphics: Integrated Type of Hard disk drive: SATA RAM: 4GB (Expandable to 16 GB) Hard disk Drive size: 1000 GB OR Model No: Lenovo 310 zAIO Processor generation: 7th generation Processor: Intel core i3-7100(3.9 GHz, 3MB Cache, 2 Cores) Operating system: Windows 10 Professional Graphics: Integrated Type of Hard disk drive: SATA RAM: 4GB (Expandable to 16 GB) Hard disk Drive size: 1000 GB
Printer	hp LaserJet m1136 pro multifunction (Print, Copy & Scan) monochrome printer
Other Equipment / tools	• Basic tools for simple repairs (screwdrivers, wrenches etc.) • Emergency kit (extinguisher, towing cable, emergency sign, emergency light) • First-aid kit

2. Furniture's and Fixtures-

Workbenches and Cabinets	• Laboratory work bench with storage racks for consumables on both sides (Chemical resistant tabletops& shelves as per laboratory standard with Chemical resistant wash basin). • Storage cabinets to be provided above and below the working platform. Selective cabinets to have locking mechanism. • All materials used in labs should not react with chemicals. • Three stainless steel stools in work area

3. Equipments-

Digital balance	Aczet Make (300g/0.01g) Readability : 0.01g Repeatability : ± 0.03g Power Supply : AC Adapter 9V / 500 mA
Digital Multi-Parameter Hand Held Meter (pH, Conductivity, TDS and Temperature)	E.I make, Model- 7200 Range: pH: -2 to 16.00, TDS: 0 to 1300 ppm, 1.30 to 13.00 ppt, Conductivity: 0 to 2000 µS, 2.00 - 20.00 mS mV: -1000 to 1000 mV Salt: 0 to 1000 ppm, 1.00 to 12.00ppt Temperature: 0 to 90 °C, 32 to 194 °F Power : DC 1.5 V x 4 battery (UM-4/AAA), Auto power off after 10 minutes
Digital refractometer-Portable	Hanna Make, Model HI 96801 Sugar Content / Temperature Range : 0 to 85% Brix / 0 to 80°C (32 to 176°F) Sugar Content / Temperature Resolution : 0.1% Brix / 0.1°C (0.1°F) Sugar Content / Temperature Accuracy (@25ºC/77ºF) : ±0.2% Brix / ±0.3 °C (±0.5 °F) Measurement Time : approximately 1.5 seconds Minimum Sample Volume : 100 µL (to cover prism

	totally) Light Source : yellow LED Sample Cell : stainless steel ring and flint glass prism Battery Type / Life : 9V / approximately 5000 readings
Hot plate	ASIND, Model- ASI-HP/RC1012/ER
Hot air oven	ASIND, Model- ASI-HO1212S/D
Rapid Milk Screening Apparatus	FOSS, Model- Milkoscreen Sample Type : Raw Cow milk, Raw Buffalo Milk and Raw Mixed Milk Sample Volume : <5 ml Measuring speed : minimum 80 samples per hour Parameters : Fat, SNF, Protein Calibrated adulterants : Screening upto 5 specific adulterants Warm up Time : Maximum 30 min Sample Condition : 5 to 40 °C Display : LCD, Graphical Electrical interface : 12V DC Power consumption : <20W
Mixer grinder (small)	Compact, around 200 ml grinding jar To operate at 3 different speeds Power Supply 50Hz : 220-240V Jar Material : Stainless steel Warranty : 1 year

III- General Procedures

1. Operating Schedule

The unit shall give a schedule of movement with specific locations for the next 30 days and possible route map for the oncoming 90 days. Such schedule shall be available on the website of the state department as well as the operating agency. The schedule shall contain timing at every location. The schedule shall be drawn based on food business operating units in that particular area.

2. Unit Halting Points

The unit shall stop in a clean location away from industrial or other pollutions. It shall stand on a firm ground where water is not stagnant and it is well protected from arboreal animals. The required permission for such halting shall be the responsibility of nodal officer.

3. Timing

The unit shall operate from 9:30 am to 05:30 pm on at least 22 or more working days in a month. The timing in special cases shall be indicated along with the schedule.

4. Display

The lab shall have a display board or a screen of a printed communication to communicate on the details of testing done with rates and expected report distribution time. Such displays shall also indicate mode of payment, consumer contact number/e-address.

5. Testing

Testing shall be done as per established procedures read with FSSAI protocol wherever applicable. The detailed methodology for every scope on all forms of testing including chemical shall be available in a manual duly pre-authorised by competent authority. The SOP shall be stored in a restricted system within the unit accessible only to the analyst for reference. No violation of protocol shall be done. Any deviation if done to meet consumer requirements may have proof of validation or reference of science literature justifying such a decision.

6. Reporting

The reporting format shall be in alignment with established IS 17025 procedures including indication of test protocols adopted for every test. The signing authority is deemed to be the

approving authority of the report. The depository of reports must be protected both in hard copy forms and with protected soft back up.

7. Analyst

Analyst must be trained properly and should have qualified through a system established by FSSA for handling the entire necessary test in the unit. Such person is responsible-

a) for ensuring availability of reagent, chemicals, media, glasswares, equipment, handling tools and other consumables for day to day testing.
b) For doing trial runs to verify functioning of the equipments before daily work.
c) Shall calibrate all measurement devices as per pre-defined schedule based on assessment.
d) Shall ensure required controls are in place for test wherever applicable.
e) Shall ensure lab waste is disposed properly without causing environmental pollution.
f) Shall ensure that periodic checking happens on fire safety and other such emergency preparedness arrangements.
g) Shall ensure that highest integrity and reliability are preserved.
h) Shall ensure reporting is true and shall preserve all actual recordings for inspection or audits by competing auditing committee.
i) Shall ensure that reports are given in prescribed format with proper seal or authority as maybe defined by the authority.
j) Shall call for re-sampling if it is believed that the testing may not reflect the true opinion of the sample.
k) Shall ensure maintenance of all standards within the laboratory like internal environment hygiene, pre-sanitation of certain surfaces, backwash of filters and basic washing and cleaning.

8. Unit Design And Facilities

The interior of the unit must be cleanable and made of non absorbent material. The fixtures as far as possible must be modular and removable for specific repair or maintenance issues.

a) Water: Distilled water should be used for all testing purposes.
b) Drainage: The unit shall have a proper flooring gradient to ensure non stagnation of water after cleaning. The wash basin shall be connected with a collecting tank which will be disposed in an appropriate manner.

c) Waste disposal: There shall be 3 small bins within the unit namely, dry garbage, chemical and other consumable waste.

d) Lighting: Lighting shall be adequate and shatterproof.

e) Ventilation: The heat handling area must have proper exhaust during operation of such hot vessels and shall be closed during stationary period.

f) Power: Adequate power must be available for basic set up. There shall be provision through an extended wiring system to take power from a nearest resource for specific operations like autoclaving. According to designed need, a proper power back up maybe arranged.

9. Material Management

a) Materials like chemicals, reagents, glasswares, equipments etc. shall be purchased from approved vendors only.

b) In case of equipments, safety certificate, manufacturer work instructions and calibration certificate must be provided along with the equipment.

c) Purchases shall be done through proper purchase orders only.

d) On receipt of any material, proper visual inspection is to be done.

e) Any other purchase made out of specification must be validated to justify such procurement.

f) Stock of all materials must be checked on a weekly basis. There shall always be a basic stock quantity maintained which is to be replenished as and when needed. Minimum order quantity and lead time may be worked out for all supplies to ensure smooth operations of the unit.

10. Recommended Solutions to Challenges in a Mobile Lab

a) The operator shall have a base lab to prepare basic mixtures of chemicals and certain other things.

b) As per plan, coordinate with local authorities to find suitable place for overnight parking of unit in a safe and secured place.

c) Make clear arrangements for stay of analyst and other staff of unit throughout the route.

d) Choose a particular time period to remove all modular items out of the unit enabling vehicle service to be done.

e) Check every evening before closing that there is no spill of any chemical or any such leakage which may result in explosion and accidents.
f) As much as possible don't do any chemical titration, transfer or handling during movement of vehicle.
g) Schedule sample testing work during stationary phase of the unit.
h) Ensure battery and UPS are recharged when unit is stationed or parked overnight.
i) Don't keep glasswares or chemicals above hip level or in tilt condition due to jerk in a moving vehicle.
j) Calibrate measurement devices more frequently than stationary lab.
k) Address rust formation in the mobile unit or cracks in glasses immediately as electrical short circuits can be dangerous.
l) Ensure communication address and contact details are well displayed in English and local language.
m) Constantly update the knowledge of the analyst through a vibrant training mechanism.
n) All staff in unit must be well trained in first aid and fire safety.

IV-Safety Procedures

These guidelines are to maintain and ensure a safe laboratory environment for food analysis. Awareness of the safety and health hazards associated with potential hazardous materials and equipment in the laboratory is the responsibility of the person entering the laboratory.

Potential hazards within an analytical laboratory include

- Splashes and spills from liquid chemicals particularly acids or caustic liquids
- Fires and burns caused by Bunsen burners, chemical reactions, inflammables, electrical heating units.
- Chemical gases or vapors of organic solvents
- Harmful dusts/fines of grinding
- Irritants and lachrymators
- Wounds and punctures particularly from broken glass
- Burns from cryogens such as liquid Nitrogen/solid CO_2
- UV radiation
- Heat and Cold (-80C freezer) burns
- Noise from grinder/sonicator

1. General safety and operational guidelines

It is the individual's (food analysts, junior analysts, technicians and lab assistants) responsibility to practice the following general safety guidelines at all times:

a. Every analyst working in the laboratory has a duty of care to other colleagues, and is expected to behave in a manner that does not compromise their safety.
b. Always wear appropriate protective clothing i.e. a suitable lab coat with long sleeves and buttoned up.
c. Always wear proper eye protection (safety glasses/goggles/face shield) during chemical/biological testing, handling and in storage areas at all times.
d. Contact lenses should normally not be worn. Fitted goggles are essential if, for therapeutic reason, contact lenses/prescription glasses must be worn.
e. Confine long hair (under a cap or tied and tucked into coat) and loose clothing.
f. Do not wear high-heeled shoes, open-toed shoes, chappals, sandals or shoes made of woven material in the lab. Use a pair of closed shoes exclusively for the lab
g. Always know the hazards associated with the materials that are being utilized in the lab.

h. Read the MSDS of the chemical used, carefully.
i. Be aware of all the safety equipment, their location and proper use:
    i. Emergency response guide
    ii. Emergency evacuation route and meeting area
    iii. Fire extinguishers and closest pull station
    iv. Safety showers
    v. Eyewash stations
    vi. First aid kit
    vii. Spill kits if applicable
j. Always wash hands and arms with soap and water before leaving the work area. This applies even if you have been wearing gloves.
k. Never eat/drink/smoke at any time anywhere in the laboratory work area.
l. Never store any food/drink in the lab or working laboratory refrigerator
m. Never perform any hazardous work when alone in the laboratory. At least two people must be present.
n. Never perform unauthorized work, solution preparations or tests.
o. Never engage in horseplay, pranks or other acts of mischief in chemical or biological testing areas.
p. Never remove chemicals, biological agents, or radioactive materials without proper authorization from the head of the laboratory.
q. Know the appropriate emergency response procedures.
r. Use equipment and hazardous materials only for their intended purposes.
s. Never mouth-pipette any chemical solution including water when transferring and testing. Always use a pipetting device like bulb or pump to transfer solutions.
t. Avoid placing any object in your mouth - (pencils, pens, fingers etc).
u. Do not pour chemicals and bio hazardous fluids down the sink.
v. Return all chemicals, reagents, cultures, and glassware to their appropriate places.
w. Always lubricate glass thermometers or thistle tubes before inserting them into a stopper. Always wrap towelling around them while inserting into the stopper.
x. Use a fume hood when using flammable solvents, poisonous or irritating fumes being emitted.
y. Never leave an experiment unattended while it is being heated or is in progress.
z. Keep beakers/ test tube stands/flasks and other equipment at the back away from the edge of the work bench to prevent spillage.

aa. Support all beakers and flasks with clamps. Do not use cracked or chipped glassware.

bb. Never store chemicals, especially liquids on the floor, except in closed door cabinets suitable for the material to be stored. Do not store large bottles (2.5 l or larger) above the bench top.

cc. Stored items or equipment should not block access to the fire extinguisher(s) and other safety equipment.

dd. Stairways, hallways, passageways and exits must not be obstructed in any fashion, including storage, equipment, phone or other wiring.

ee. No combustible material such as paper, wooden boxes, empty cartons, etc., should be stored under staircases or in hallways.

ff. Be familiar with the first aid and emergency procedures so that mishaps can be speedily contained.

gg. Locate and use of hazardous waste accumulation areas

hh. Report all chemical spills, fire, physical injury and any accidents minor or major and any potentially hazardous operations to the Laboratory Head/Chief Public analyst immediately.

2. Eating, drinking, smoking

a. Eating, drinking, smoking, chewing gum/pan/betel nut etc, applying cosmetics, and taking medicine in the working areas of the laboratories are strictly prohibited.

b. Food, beverages, drinking and eating utensils must never be stored in areas where any chemicals/reference cultures are handled or stored.

c. Glassware such as beakers/conical flasks and microwave ovens/heating ovens etc. used for laboratory operations should not be used to prepare or consume food or beverages.

d. Laboratory refrigerators, ice chests, cold rooms, ovens, and so forth should not be used to store or prepare food. Separate refrigerators/microwave ovens outside the laboratory are to be used

e. Laboratory water sources, distilled water and deionized water should not be used for drinking water. Separate facilities for drinking water to be provided outside the working area

f. Laboratory materials should never be consumed or tasted.

3. Hygiene Practices

a. Understand the health hazards associated with exposure to hazardous material(s), both biological and chemical, used in the laboratory
b. Wash hands thoroughly before leaving the laboratory, even if gloves were worn while performing tests.
c. Wash lab coats/aprons, separately from personal laundry.
d. Never wear or bring lab coats into areas that are meant for the consumption of food, remove and hang in the laboratory.
e. Never mouth pipette even water. Always use a pipetting device e.g. bulb/pump or dispenser
f. Always use the recommended personal protective equipment (see Annexure I) to avoid direct contact with any hazardous chemical.
g. Understand the hazards associated with exposure to hazardous material(s) used n the laboratory
h. Replace personal protective equipment as needed to maintain its integrity.

4. Personal Protective Equipment (PPE)

a. Laboratory Responsibilities for PPE

PPE must be made available to all laboratory workers to reduce exposures to chemical hazards in the laboratory. PPE includes items such as gloves, eye protection, long sleeved and buttoned up lab coat, fully enclosed shoes, face shields, hearing protection, etc. depending on the laboratory task (Table 1). PPE must be made readily available to visitors. Careful consideration should be given to the comfort and fit of PPE to ensure that it will be used by laboratory personnel.

b. Clothing

Protective garments provide additional body protection from physical and chemical hazards. These include long sleeved and buttoned up lab coat, fully enclosed shoes, shoe covers, coveralls, etc. used over street clothing protect from biological or chemical contamination and splashes etc.

i. Aprons, lab coats, and other protective clothing, preferably made of chemically inert material, should be worn by all lab personnel before entering and all times in the testing area of the laboratory. This is particularly important if personal clothing leaves skin exposed.

ii. The material of a laboratory coat is preferred to be made of cotton rather than synthetic fibre. Cotton is also the preferred personal clothing fabric when working in the chemical testing laboratory.

iii. The laboratory coat must be of appropriate fit for the analyst wearing it

iv. Coats should preferably have snap fasteners rather than buttons so that they can be readily removed in case of an emergency.

v. Hair should also be restrained (wearing a cap or tied or pinned or plaits inserted into the lab coat) because loose hair can catch fire or dip into chemical solutions.

vi. Wearing a lab coat is required of everyone (including visitors) who enters the chemical/biological testing area.

vii. Lab coats should be removed on leaving the laboratory and preferably hung on a hook.

viii. Lab coats should be washed regularly segregated from normal everyday street clothes

ix. A lab coat which is grossly contaminated with hazardous material must be disposed of as hazardous waste.

x. Shoes should be worn at all times in the laboratories. Sandals, slippers, flip-flops, open-toed shoes, and shoes with woven uppers, should not be worn because of the danger of spillage of corrosive or irritating chemicals.

c. Eye protection

Eye protection is one among the most important and easiest forms of PPE. Laboratory personnel should use eye protection for many of the chemical and physical hazards found in laboratories including flying particles, broken glass, molten metal, acids or caustic liquids, chemical liquids, chemical gases or vapors, or potentially injurious UV- radiation.

- The use of eye protection is a mandatory requirement for all laboratory personnel, including visitors, working in or entering laboratories.
- All laboratory employees should wear protective eyewear while in laboratories at all times, even when not working directly with chemicals.
- Employees who wear prescription lenses (spectacles) and contact lenses, must wear eye protection that can be worn over the prescription lenses (goggles, face shields, etc.).

- If safety glasses become scratched, throw them out and replace. Glasses should be washed periodically with soap and water.

i. Safety Glasses

Safety glasses provide eye protection from moderate impact and particles associated with grinding, scaling, broken glass, and minor chemical splashes, etc. Side protectors are required when there is a hazard from flying objects. Safety glasses cannot be worn on top of regular prescription glasses. In this case only safety goggles can be worn on top of prescription glasses.

ii. Splash Goggles

Splash goggles provide adequate eye protection from chemical splashes, use of concentrated corrosive material, and bulk chemical transfer. Goggles are available with clear or tinted lenses, fog proofing, and vented or non-vented frames.

Safety glasses

Splash Goggles

iii. Face shields/Dust masks

Face shields are necessary when working with severely corrosive liquids, with glassware under reduced or elevated pressure, with glass apparatus used in combustion or other high-temperature operations. Face shields provide additional protection to the eyes and face when used in combination with safety glasses or splash goggles. Face shields must not be used alone and are not a substitute for appropriate eyewear. Face shields should always be worn in conjunct ion with a primary form of eye protect ion such as safety glasses or goggles.

Dust masks can be used for respiratory protection against non-toxic particulate matter such as fine dust while weighing powders or while grinding is required for laboratory workers. They should be worn when preparing a chromatography column. Most masks are disposable or have disposable filters, so should not be reused.

Table 1: Laboratory tasks, hazards and recommended PPE

Lab task	Hazard	Mandatory PPE
Handling small volumes of corrosive liquids (< 1 litre).	Skin or eye damage	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Chemically resistant gloves closed shoes, pants*
Handling large volumes of corrosive liquids (> 1 litre), acutely toxic corrosives, or work which creates a splash hazard	Large surface area skin or eye damage, poisoning, or great potential for eye and skin damage	Fully buttoned long sleeved Lab coat, Safety goggles and face shield Chemically resistant gloves, closed shoes, pants*
Handling small volumes of organic solvents (< 1 litre).	Skin or eye damage. Cumulative and Slight poisoning potential through skin contact	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Chemically resistant gloves closed shoes, pants*
Handling large volumes of organic solvents (> 1 litre), very dangerous solvents, or work which creates a splash hazard	Major skin or eye damage, or potential poisoning through skin contact	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Chemically resistant gloves closed shoes, pants Work in the fume hood*
Working with toxic or hazardous chemicals (solid or liquid).	Potential skin or eye damage, potential poisoning through skin contact	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Chemically resistant gloves closed shoes, pants*
Working with chemical dusts/fines from grinding.	Skin or eye damage, respiratory damage	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Chemically resistant gloves closed shoes, pants* Use Fume hood and face mask
Chemical spill cleanup.	Skin or eye damage, respiratory damage.	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Chemically resistant gloves closed shoes, pants* Use appropriate respiratory protection (face mask/shield.
Working with ultraviolet	Conjunctivitis, corneal	UV resistant safety glasses/goggles

radiation.	damage, erythema.	Fully buttoned long sleeved Lab coat, chemically resistant gloves closed shoes, pants*
Working with liquid nitrogen /dry ice /removing chemicals etc. from -80 °C deep freezer.	Major skin, tissue, or eye damage. Frostbite (cold burn), hypothermia	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Heavy insulated gloves closed shoes, pants*
Working with hot liquids, equipment, open flames (autoclave, Bunsen burner, water bath, oil bath)	Burns resulting in skin or eye damage.	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Heavy insulated gloves closed shoes, pants*
Glassware washing.	Lacerations, eye damage	Fully buttoned long sleeved Lab coat, Safety glasses or goggles Heavy rubber gloves, closed shoes, pants.
*Exposing any part of the leg during any laboratory task/hazard is mandated. This is achieved by appropriate covering of the leg from top to bottom. Pants or any similar attire that provide complete protection may be used.		

d. Hand Protection

The proper use of hand protection (gloves) can help protect the hands against physical, chemical and biological hazards such as lacerations, abrasions, cuts, punctures, snags, chemical burns, thermal burns, and harmful temperature extremes. Gloves must be worn when using chemicals that are easily absorbed through the skin and/or particularly hazardous substances (such as "select carcinogens", reproductive toxins, and substances with a high degree of acute toxicity and pathogens).

i. Glove selection

When using corrosive compounds (concentrated acids, organic solvents), extremely low and high temperature materials, and sharp materials such as broken glass, one must wear the appropriate type of gloves to protect the hands. There are various types of gloves each with a unique function. Proper glove selection is essential to ensure glove performance as a barrier to the hazards.

Table 2: Properties of Gloves used in an analytical laboratory

Glove material	Resistant to
Natural Rubber Latex	Most biological materials, Nonhazardous chemicals, Clean room requirements, Medical or veterinary applicate ions. Very dilute, aqueous solutions containing <1% for most hazardous chemicals
Neoprene	Mineral acids, organic acids, caustics, alcohols, and petroleum solvents
Nitrile	Alcohols, caustics, organic acids, and some ketones and Chlorinated solvents such as dichloromethane, chloroform.
Norfoil	For chemicals considered highly toxic and chemicals that are easily absorbed through the skin. Not recommended for use with Chloroform
Polyvinyl chloride (PVC)	Mineral acids, caustics, organic acids, and alcohols
Polyvinyl alcohol (PVA)	Chlorinated solvents, petroleum solvent s, and aromatics
Heavy gloves	To handle very cold containers and equipment and very hot containers.

ii. Common rules for glove use

- Gloves, which are resistant to the chemicals being used must be worn.
- The relevant Material Safety Data Sheet (MSDS) of chemical in use must be read
- Heat resistant gloves must be worn when in contact with and/or handling hot materials and materials at extremely low temperatures (-20 C and below), liquid nitrogen and dry ice
- Gloves must be of correct size and fit; too small gloves are uncomfortable and may tear; overlarge gloves may interfere with dexterity.
- Gloves (even new ones) must be checked for physical damage such as discoloration, tears or pin holes and for previous chemical damage: this is especially important when dealing with hazardous materials. Check the expiration date and never use gloves beyond expiry date.
- Light weight disposable gloves, may be flammable: take caution near naked flames or other high temperature heat sources.

- While removing gloves, avoid the contaminated exterior of the glove coming in contact with the skin.
- Always wash hands with soap and water when work is complete.
- Dispose of contaminated gloves properly.
- Never re-use disposable gloves.
- Remove contaminated gloves when leaving the laboratory, while handling the telephones, computer keyboards, and door knobs, light switches etc.

5. Laboratory Upkeep, Environment and Maintenance

A safe environment in the laboratory is created by, by organizing and keeping things clean.

a. The work area should be kept clean, well organised and uncluttered.
b. All hazardous materials and equipment should be properly stored. Electrical cords must be secured off the floor to prevent tripping hazards.
c. Boxes, containers, and other storage items should not block the aisles of the working area.
d. The way to the emergency fire exit, safety equipment, such as the safety shower, eyewash and fire extinguishers should be completely free and never be blocked.
e. All hazardous waste must be identified by labels. Use the appropriate procedure for disposal of chemical/biological wastes and solvents. Supplies and laboratory equipment on shelves should have sufficient clearance so that,
f. Any maintenance service such as equipment repair, plumbing, electrical etc. the laboratory staff must prepare and secure area prior to initiation of maintenance and maintenance personnel is informed about the hazards.

a. Electrical Safety

In the laboratory, a wide variety of electrically-powered equipment including stirrers, shakers, pumps, hot plates, heaters, power supplies, ovens, and others are used. These and all electrical devices present a potential danger of injury due to electric shock, fires due to poorly installed or maintained systems and due to sparks serving as an ignition source for flammable or combustible materials. The hazards of electricity can be prevented by following some basic guidelines and safety practices:

a. All electrical equipment should be properly grounded. Electrical outlets should have a grounding connection and accept three-prong plugs. Multiple plug outlet adapters should not be used.
b. Keep flammable materials away from electrical equipment. The equipment may serve as a source of ignition for flammable or explosive vapors
c. Be aware that if drying ovens are used to dry organic materials, vapors may accumulate inside the oven and/or escape into the lab atmosphere. Take care to prevent developing explosive mixtures in air by not drying organic materials that can create these conditions.
d. Maintain an unobstructed access to all electrical panels.
e. Fuses and circuit breakers are safety devices that protect equipment from high currents or voltages and prevent overheating of electrical wires. They are rated for a certain voltage and maximum current and come in two types: fast and slow blowing. When choosing fuses and circuit breakers, use appropriate amp rating (e.g., 10 amps, 15 amps) and type.
f. All the circuit breakers and the fuses shall be labelled to indicate whether they are in the "on" or "off" position
g. Fuses must be properly rated. Never replace blown fuses with fuses of higher ratings. Always disconnect the circuit or unplug equipment before inserting an in-line fuse. Never insert in-line fuses into a live circuit. If the new fuse blows again, determine the reason, or have the equipment checked by an electrician or the manufacturer.
h. Inspect power cords to be sure they are not frayed or have exposed wiring. Use electrical cords only if they are in good condition. Cords must not be cracked, frayed, or have corroded prongs
i. Equipment, appliance junction boxes must be in good condition and clean
j. Avoid using extension cords whenever possible. If you must use one, obtain a heavy-duty one that is electrically grounded, with its own fuse, and install it safely.
k. Extension cords should not go under doors, across aisles, be hung from the ceiling, or plugged into other extension cords or suspended unsupported across working area or passageways.
l. Extension cords should NOT run through holes in walls, ceilings, floors, doors, or through windows and should be inspected before each use.
m. Do not route cables over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc. Do not place under carpet, rugs, or heavy objects

n. Do not use multi-outlet plugs unless they have a built-in circuit breaker.
o. Always make sure all capacitors are discharged (using a grounded cable with an insulating handle) before touching high voltage leads or the "inside" of any equipment even after it has been turned off. Capacitors can hold charge for many hours after the equipment has been turned off.
p. If you are adjusting any high voltage equipment USE ONLY ONE HAND. Your other hand is best placed in a pocket or behind your back. This procedure eliminates the possibility of an accident where high voltage current flows up one arm, through your chest, and down the other arm.

b. Safety Equipment

The availability and use of a number of types of safety equipment is essential and must be present in well-marked, highly visible, and easily accessible locations in or near all laboratories in the facility and must be maintained in working conditions. **The lab personnel must be aware of the location of emergency equipment and trained in its proper use. All laboratories should be provided with the following Safety and Emergency Equipment**

- Hand wash facility
- Hand-free eye-wash stations (not eye-wash bottles)
- Fire extinguishers (dry chemical and carbon dioxide extinguishers)
- Fire blankets
- Chemical storage cabinets
- Emergency lights
- Emergency signs and placards
- First-aid kits
- Spill control kit (absorbent and neutralizing agents)
- Large plastic buckets for carrying chemical bottles
- Separate Containers for broken glass and sharps
- Material Safety Data Sheets (MSDSs) of all hazardous chemicals
- Emergency Action Plan for the laboratory

Hand wash facility

There should be a area in the laboratory for a hand wash to be utilized by individuals who come in contact with chemical, biological, or radioactive agents in the laboratory. These

should be equipped with soap and paper towels. These sinks must never be used to dispose of hazardous waste material (e.g. solvents etc.) down the drains

Working with hazardous agents on a routine basis requires washing of hands before and after using the agents.

The responsibility of ensuring that the hand wash stations are accessible and properly equipped at all times lies with the Laboratory Head.

Hand-free eye-wash stations (ANSI standard Z358.1)

The eye wash station is designed to deliver water to rinse contaminants from a user's eyes and not a substitute for primary protective devices (including eye and face protection and protective clothing) or for safe procedures for handling hazardous materials. Hand free eyewash stations must provide a gentle and continuous, low-pressure flow of potable tepid (16-37 °C) water at 1.5 L per minute for a period of at least 15 minutes.

The stations must be strategically placed and easily accessible (within 10 seconds walking time from the location of a hazard) from any part in the laboratory. Their location should be clearly identifiable with a highly visible label.

All laboratory personnel must be trained on activating and use of the eyewash stations.

The ANSI standard Z358.1 requires that eyewashes be activated weekly. All eyewash units to be checked on a weekly basis and annual maintenance carried out.

Fire Extinguishers

Fire extinguishers are very important components of a safe laboratory operation. Each laboratory should be equipped with a fire extinguisher and be capable of immediate utilization.

Fire extinguishers are classified by the types of fires they put out.

a) Class A is for combustibles such as wood, paper, some plastics and textiles.
b) Class B is for flammable liquids.
c) Class C is for electrically conductive fires.

d) Class D fire extinguishers are for flammable solids such as magnesium, sodium or titanium.
e) Class K fire extinguishers are specific to commercial kitchen applications.

Currently Multipurpose 'ABC fire extinguishers' that put out all three classes of combustibles, flammable liquids and electrically conductive are used for the majority of laboratories

A bucket of dry sand (marked "Class D Fire Extinguisher") or commercial Class D fire extinguisher must be present in laboratories where water reactive (Na, Mg metals etc) and combustible metals and metal alloys are used or stored.

Fire extinguishers must be

a) located in the designated place that is easily accessible, mounted properly on a wall
b) not obstructed in access or visibility
c) have visible operating instructions and nameplate
d) have unbroken seals
e) indicate pressure is in the operable range
f) have no physical damage, corrosion, or leakage
g) An inspection tag (monthly), which is dated and initialled for every inspection.

All laboratory personnel should know the locations of all fire extinguishers in the laboratory, the type of fires for which they are appropriate, and be trained on how to operate them correctly.

The **PASS** Method for using a fire extinguisher:

PULL THE PIN: Allows discharging of the extinguisher.

AIM AT THE BASE OF THE FIRE: Not at the flames the extinguishing agent will fly right through and do no good.

SQUEEZE THE TOP HANDLE OR LEVER: This depresses a button that releases the pressurized extinguishing agent in the extinguisher.

SWEEP FROM SIDE TO SIDE: Start using the extinguisher from a safe distance away, then move forward. Once the fire is out, keep an eye on the area in case it re-ignites.

Fire Blankets

Fire blankets are recommended in all laboratories that use flammable liquids and should be located throughout the laboratory, easily accessible and unobstructed.

In the event that a person's body or clothing catches fire, the person should immediately drop to the floor and roll to help extinguish the fire (STOP-DROP-and-ROLL method). Do not wrap the blanket tightly around the body. Fire blankets should never be used on a person when he/she is standing. A fire blanket should be used only as a last resort to help smother a body or clothing fire. Fire blankets can be dangerous if used incorrectly. Fire blankets can also be used to keep shock victims warm.

6. Safe Storage and Handling Requirements in the Laboratory

Materials should always be segregated and stored according to their chemical family or hazard classification. Do not store chemicals alphabetically unless they are compatible. Acids, bases, and organic solvents are commonly used in analytical laboratories. These are "hands on" hazards that can cause severe burns, tissue damage, organ damage, asphyxiation, and genetic damage if used improperly.

a. Handling of Laboratory Chemicals and Storage

Proper storage of chemicals is necessary to maximize employee safety with regard to chemical compatibility, spill control, fire/explosion control, to provide security, identification, and provide a "user friendly" system with respect to point-of-use. All containers used for storage (even short term) shall be labelled legibly.

b. Material Safety Data Sheet (MSDS)

The first step in evaluating hazards associated with any given chemical is to refer the Material Safety Data Sheet (MSDS). MSDSs are technical documents, several pages long, typically beginning with a compilation of data on the physical, chemical, and toxicological properties of the substance and providing concise suggestions for safe handling, storage, and disposal. Finally, physical and chemical hazards, emergency and first-aid procedures are usually outlined. It is a statutory requirement that this information is provided by the supplier.

It is available, both electronically and physically upon delivery. Ensure MSDS are available for all materials (either electronically or as a hard copy) and archived in a specified folder. All laboratory personnel should always *read* and *heed* the label and the MSDS before using a chemical for the first time. A comprehensive file of MSDSs must be kept in the laboratory or be readily accessible online to all personnel working in the laboratory.

Undertake a review of the MSDS and quantity of chemical being ordered and ensure that suitable controls are in place for safe delivery, handling and storage. Date all chemical bottles when received and when opened. Note storage conditions and adhere to them.

Laboratory chemicals are generally transferred from larger containers to smaller ones and often carried from one place to another. Most spills and accidents occur either while transferring liquids or while transporting chemical bottles.

It is prudent practice to use a secondary containment device (i.e., bucket) when transporting chemicals from the storeroom to the laboratory or even short distances within the laboratory. A single bottle should be carried using both hands; one at the neck and the other below the base. Never attempt pick up the bottle by the cap or carry it by the neck allowing the base to dangle, especially acids, solvents, or other liquids.

When transporting several bottles (more than one) use carts with attached side rails. When transporting or a cart. Bottles of liquids should be separated to avoid breakage and spills. Ensure the hallways and path is clear of any clutter to prevent accidents.

c. Storage

Choose the appropriate storage location in accordance with the MSDS. Use containers that are appropriate and do not overfill them. .The Globally Harmonised System of Classification and Labelling of Chemicals (GHS) is an internationally recognized system for hazard classification and communication. GHS classifies substances by the physical, health, and environmental hazards that they pose.GHS recognizes 16 types of physical hazards, 10 types of health hazard, and an environmental hazard (Table 3). The system provides signal words (e.g., Danger), hazard statements (e.g., may cause fire or explosion), and standard pictogram-based labels to indicate the hazards, hazard classes with which they are associated and their severity (Table 4). The pictograms appear in the shape of a diamond with a distinctive red border and white background. Ensure appropriate spill kits and procedures are for all hazard classes. Table 5 given below is a general guide for storage of chemicals by hazard class. This table is not exhaustive but includes most chemicals used in a food analysis laboratory MSDS sheets must be referred to for detailed storage guidelines and chemical incompatibilities.

The storage area/room should be adequately ventilated to remove or dilute noxious, toxic or flammable fumes and vapors and prevent their build-up. Rooms that are used specifically for chemical storage should have controlled-access areas that are identified with appropriate signage. Chemical storage rooms should be designed to provide proper ventilation, two means of access/egress, vents and intakes at both ceiling and floor levels, a diked floor, and a free suppression system.

If flammable chemicals are stored in the room, the area must be a spark-free. Special grounding and bonding must be installed to prevent static charge while dispensing solvents

Most labs have limited space. The following rules may help in deciding how to store the chemicals in a small lab:

1. Do not store chemicals alphabetically unless they are compatible.
2. Store flammable liquids in approved safety containers in flammable storage cabinets.
3. Do not store anything but flammable or combustible liquids in these cabinets.
4. Segregate acids from bases.
5. Segregate most organic acids from oxidizing mineral acids.
6. Keep oxidizers away from other chemicals, especially flammables, combustibles, and toxic materials.
7. Keep corrosives away from substances that they may react with and release corrosive, toxic, or flammable vapors.
8. Dispose unneeded or outdated chemicals
9. Update regularly the hazard warning signage on the laboratory door
10. Replace torn or missing labels and broken caps on bottles
11. Maintain an up-to-date chemical inventory.
12. Chemicals should be stored as close as feasible to the point of use in order to maximize efficiency and minimize transport distance.

Table 3: Hazard recognized by Globally Harmonized System (GHS)

Physical Hazard	Health Hazard	Environmental Hazard
Explosives Flammable Gases Flammable Aerosols Oxidizing Gases Gases Under Pressure Flammable Liquids Flammable Solids Self Reactive Substances Pyrophoric Liquid Pyrophoric Solids Self Heating Substances Substances which in contact with water, emit Flammable Gases Oxidizing Solids Oxidizing Liquids Organic Peroxides Corrosive To Metals	Acute Toxicity Skin Corrosion or Irritation, Serious Eye Damage or Eye Irritation, Respiratory Of Skin Sensitization, Germ Cell Mutagenicity, Carcinogenicity, Reproductive Toxicology, Target Organ Systemic Toxicity – Single Exposure, Target Organ Systemic Toxicity – Repeated Exposure, Aspiration Hazard	Hazardous to Aquatic environment: Acute aquatic toxicity or Chronic aquatic toxicity with • Bioaccumulation potential • Rapid degradability

Table 4: GHS of pictograms/ signage for Hazardous chemicals

Table 4: Globally Harmonized System (GHS) ofpictograms/signage for hazardous chemicals		
		
Oxidisers	Flammables Self reactives Pyrophorics Self-heating Emits flammable gases Organic peroxides	Explosives Organic peroxides Self reactives
		
Acute toxicity	Corrosives	Gases under pressure
		
Carcinogen Respiratory sensitizer Reproductive toxicity Target organ toxicity Mutagenicity Aspiration toxicity	Irritant Dermal sensitizer Acute toxicity (harmful) Narcotic effects Respiratory tract irritation	Environmental toxicity
Adapted from Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, / Committee on Prudent Practices in the Laboratory, Board on Chemical Sciences and Technology, Division on Earth and Life Studies. — Updated ed. 2011		

Table 5: General Guide for Chemical Storage in a Food Laboratory			
Chemical Hazard	**Storage method**	**Chemicals Examples (Compatible)**	**Incompatibles**
Compressed Gases– Flammable	Store in a cool, dry area away from oxidizing gases; securely strap individual cylinders to a permanent structure like wall or bench top.	Methane, Acetylene, Hydrogen	Oxidizing and toxic gases, oxidizing solids
Compressed Gases– Oxidizing	Store in a cool, dry area away from above flammable gases; securely strap individual cylinders to a permanent structure like the wall or bench top.	Oxygen	Flammable and toxic gases;
Corrosives – Non oxidizing Inorganic Acids	Store in a lined acid storage cabinet or in deep corrosion resistant trays. Do not store acids directly on metal shelves.	Hydrochloric Acid, Hydrofluoric Acid, Phosphoric Acid	Keep oxidizing acids separate from non oxidizing acids
Corrosives – Oxidizing Inorganic Acids	Store in a lined acid storage cabinet or in deep corrosion resistant trays. Do not store acids directly on metal shelves	Chromic Acid, Per chloric Acid, Nitric Acid, Sulfuric Acid	Keep oxidizing acids separate from no-oxidizing acids
Corrosives – Organic Acids	Store in a lined acid storage cabinet or in deep corrosion resistant trays. Do not store acids directly on metal shelves	Acetic Acid, Trichloroacetic Acid, Lactic Acid, Formic Acid, Benzoic acid	Flammable liquids, oxidizers, poisons, bases, and inorganic acids. Keep away from cyanides and sulfides, and active metals such as

			sodium and potassium metal
Corrosives – Bases	Store in a lined bases storage cabinet or in deep corrosion resistant trays.	Ammonium hydroxide, Sodium hydroxide, Potassium hydroxide	Flammable liquids, oxidizers, poisons, and acids
Organic bases	Store in a separate cabinet	Triethylamine Diethylamine Triethanolamine	Mineral acids, organic acids, oxidisers, poisons, oxidising acids and alkalis
Explosives	Store in a secure location away from all other chemicals and sources or ignition; store in an area where they would not be subject to shocks or falls.	Ammonium nitrate, sodium amide, Trinitrobenzene, Trinitrotoluene, Picric Acid, Sodium azide	Away from all other chemicals
Flammable Liquids	Store in a flammable storage cabinet	Acetone, Benzene, diethyl Ether, Methanol, Hexanes, Toluene, Acetonitrile, Isopropanol, Formalin	Acids, bases, oxidizers, and poisons
Flammable Solids	Store in a dry cool area away from oxidizers and corrosives. Keep water and air from entering container	Calcium hydride, Phosphorus, Sodium borohydride	Acids, bases, oxidizers, and poisons
Halogenated solvents	Store in separate cabinets	Dichloromethane, Chloroform	Inorganic acids, alkalis, oxidizer's
Oxidizers	Store in a spill containment tray separate from flammable materials and reducing agents	Peroxides, Perchlorates, Chlorates, Nitrates, Bromates,	Reducing agents, flammables/ combustibles, organic material, and corrosives

Peroxide Forming Chemicals	Store in air tight container in a cool dark area with flammable liquids. Label with a date of receipt and date of opening.	Diethyl ether, THF, 1,4-Dioxane, 2-Propanol	Acids, bases, oxidizers, and poisons
Poisons/Toxic chemicals	Store in cool, dry, ventilated area away from other hazard classes. Liquids should be in chemically resistant secondary containment	Cyanides, Cadmium, Mercury, Sodium azide, Phenol	Most other hazard classes, particularly acids, bases, and oxidizers
Water-Reactive Chemicals	Store in a cool, dry area away from sources of water and protected from asprinkler system if possible. Place a "Water Reactive Chemical" sticker on container.	Sodium metal, Potassium metal, Lithium metal, Sodium hydride, Thionyl chloride	Separate from all aqueoussolutions and oxidizers
General Chemicals – non-reactive	Store on general lab shelves	sodium chloride, sodium bicarbonate, citric acid, sodium tartrate, copper sulfate etc	Consult MSDS

d. Storage of Corrosives

Corrosives such as strong acids and alkalis should be stored in a cabinet labelled with the corrosive pictogram (Table 4). Specially designed (coated with epoxy enamel) corrosive proof storage cabinets properly labelled. Polyethylene trays are used to collect small spills and to provide additional protection from corrosion of the shelves

7. Handling Chemical Spills

Laboratory personnel should be familiar with the chemical, physical, and toxicological properties of each hazardous substance in the laboratory. Read and consult the MSDS prior to the initial use of each hazardous substance. Always use the minimal amount of the chemical and use caution when transporting the chemical.

In the event of an accidental chemical release or spill, personnel should refer to the following general guidelines:

1. The nature of the spill is determined by the risk from the hazardous substance and the level of containment of the spill.
2. The laboratory should have appropriate supply of hazardous chemicals spill cleanup kits, their location prominently displayed.
3. The spill kit must be capable of containing or cleaning up small, known chemical releases.
4. Laboratory personnel should not attempt to clean up a spill of hazardous chemicals if appropriate spill kit and protective equipment is not available, or if the chemical or level of exposure hazard is unknown.
5. The following properties of chemicals are of most concern when preparing for handling spills: flammability, reactivity to air or water, corrosiveness and toxicity.
6. The laboratory should have written spill response procedures for such chemicals. This should include details on the initial steps to be taken when a spill occurs and analyst responsibilities, instructions on using spill control kits, and spill cleanup and residue disposal. A copy of the ACS Guide for Chemical Spill Response Planning in Laboratories would be useful for clean-up procedures.
7. If a volatile, flammable material is spilt, immediately inform everyone, control the source of ignition and ventilate the area by opening closed fume hood sashes to full open position. Exterior doors may be opened to ventilate non-toxic vapors. Do not operate electrical switches unless to turn off motorized equipment. TURN OFF ELECTRIC AT THE MAINS, NOT AT SWITCHES INSIDE THE LABORATORY
8. If the material is flammable, then a fire extinguisher of an appropriate size and extinguishing medium should be used
9. Use appropriate PPE, warnings, barricade tapes, and protection against slips or falls on the wet floor during and after clean up.

Liquid spills in the laboratory are handled by 1)Absorption of the bulk of the liquid and 2) Neutralizing and/ or removal of the remaining residue. Neutralization is commonly used for acid and bases, where the goal is to produce a harmless chemical product.

Specific absorption agents:

- For organic solvents - Inert absorbents like vermiculate, clay, sand, cotton waste or commercial products. such FlorDri, and Oil-Dri

- For oil - sawdust is acceptable, only if there is no risk of fire.
- Mercury spills, which are small, should be removed with mercury, vacuumed up with a suction flask or dusted with sulphur powder. Clean up the mercury thoroughly. Once the Mercury is contained it should be clearly labelled and submitted for waste disposal. Note: mercury vapours are highly toxic.

Specific neutralization agents:

- *CAUTION* - do not use rags or sawdust to clean up spills of acids. The spill must be neutralized first. Neutralizing agents should be added carefully and slowly as the reaction generates heat.
- For acids - use soda ash (Na_2CO_3) or sodium bicarbonate ($NaHCO_3$). Sprinkle liberally over the spill. Avoid breathing soda ash dust.
- Hydrofluoric acid (HF) requires a special treatment: Antidote Gel - Calcium Gluconate.
- For alkalis - use citric acid or boric acid to neutralize.
- Mercury spills, from broken thermometers which are small, should be removed with a mercury sponge, vacuumed up with a suction flask or dusted with sulphur powder. Clean up the mercury thoroughly. Once the Mercury is contained it should be clearly labeled and submitted for waste disposal.

Clean-Up Material:

- Plastic Dust Pan and Scoop
- Plastic Bags
- Plastic buckets with lids for spill and absorbent residues

8. Handling Broken Glassware

Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.

- Discard all broken, chipped, starred or badly scratched glassware.
- Hand protection should be used when picking up broken glass and inserting glass tubing into rubber stoppers.
- When using glass tubing all ends should be fire polished. Lubricate tubing with glycerin or water before inserting into rubber stoppers or rubber tubing.
- Do not store glassware near the edge of shelves. Store large or heavier glassware should be stored in the lower shelves.

- Conventional laboratory glassware must never be pressurized.
- Use a dustpan and brush, not your hands, to pick up broken glass.
- All broken glass should be collected in rigid, puncture proof containers such as a plastic bucket or metal can with a sealing lid. All broken glass disposal containers shall be clearly marked "DANGER - BROKEN GLASS"

9. Handling Compressed Gas Cylinders

Many laboratory operations require the use of compressed gases for analytical or instrument operations. Compressed gases present a unique hazard. Depending on the particular gas, there is a potential for simultaneous exposure to both mechanical and chemical hazards. Gases may be combustible, explosive, corrosive, poisonous, inert, or a combination of hazards. The gases are contained in heavy, highly pressurized metal containers and therefore careful procedures are necessary for handling the cylinders containing the compressed gases, regulators or valves used to control gas glow, and the piping used to confine gases during flow.

1. The contents of any compressed gas cylinder shall be clearly identified by a stencilled or stamped on the cylinder or a label, provided that it cannot be removed from the cylinder.
2. All gas lines leading from a compressed gas supply should be clearly labelled to identify the gas, the laboratory served
3. All gas cylinders should be secured at all times to prevent tipping. Cylinders may be attached to a bench top, individually to the wall with a chain or placed in a holding cage.
4. New cylinders should be inspected that the proper cap is secured in place and the cylinder is not leaking. Cylinders shall have clear labels indicating the type of gas contained.
5. Cylinders containing flammable gases such as hydrogen or acetylene should not be stored in close proximity to open flames, electrical sparks etc.
6. Oxygen cylinders, full or empty, should not be stored in close proximity to flammable gases.
7. Cylinders should be positioned with easy and direct access to the valve at all times. The main cylinder valve should be closed as soon as it is no longer necessary that it be open.

8. Stand to the side of the regulator when opening the cylinder valve.
9. Regulators are gas specific and not necessarily interchangeable. Always make sure that the regulator and valve fittings are compatible with the gas.
10. Never use oil or grease on the regulator of a cylinder valve.
11. Compatible piping material should be used when gas is supplied by piping. Distribution lines and their outlets should be clearly labelled as to the type of gas contained. Piping systems should be inspected for leaks on a regular basis.
12. Before replacing an empty cylinder close all valves, bleed the system, remove the regulator replace the valve cap and returned to the designated storage area
13. Empty and full cylinders should be stored in separate areas.

10. Waste Chemical Disposal

1. Clean up procedures for chemicals should be known before a spill occurs.
2. Do not allow waste to build up, dispose of your waste on a regular basis and do not wait until the end of your research. To reduce waste always order in minimum amounts of chemicals.
3. Clearly label waste containers with the contents, the date of filling, the lab number and your name, using a permanent label and ink.
4. Waste disposal containers must be suitable for the waste liquid being stored in it.
5. Use the same waste container for the same types of waste, e.g. keep all mercury contaminated waste separate to other waste, always separate chlorinated solvents from non-chlorinated solvents where possible, water-based from non-water-based, polar solvents from non polar-solvents, methanol from ethanol, hexane, methylene chloride.
6. Waste solvents are still flammable, store under the same regulations for its pure form.
7. Staff members who use this facility must read the procedural risk assessment and complete a procedural checklist before disposing of waste.

11. Safety Training

- There are mandatory rules in some labs. Work in these labs cannot commence until the appropriate training has been successfully undertaken.
- The Institute can provide or facilitate training in the following areas:

1. Manual Handling
2. Fire Fighting

3. First Aid
4. Chemical Handling/Disposal Procedures

- Be aware that risk assessments for projects may identify that training be sought in other procedures. Risk assessments thus become part of the planning process for how we intend to work.

V- Sampling Procedures

Monitoring activity is an ongoing process and samples picked for this activity are large in size. The sample number should be preferably in the range of 5 to 8 samples per location/product. The reports of these monitoring samples help the system to review quality, safety, freshness and preferences in market place. It also helps in ascertaining consumption pattern and exposures to food additives and unintended contaminants and residues.

Routine sampling will take place to monitor the quality and safety of foods manufactured, distributed and retailed. All routine samples will be purchased and procured anonymously by an authorised officer and should be analysed or examined in an informal manner by the appointed Analyst.

The label should also specify the nature of analysis to be conducted (Qualitative/ Quantitative/Microbiological / Chemical).

1. Objectives of sampling

a. Sampling involves the selection of a certain portion, number of container and product units from a particular lot of the same food. It must be as representative

b. Samples are usually collected from a lot of food for random surveillance, collection of data for a specific purpose, or monitoring/and to determine the conformity to product standards specified in the regulation.

c. The authorised person may collect samples from any place where any article of food is manufactured, or stored for sale, or stored for the manufacture of any other article of food by Authorized officer for sale, or exposed or exhibited for sale or where any adulterant is manufactured or kept.

d. The authorised person while taking samples of food or imported article of food for analysis shall, follow the specified procedure for taking samples and sending them for analysis.

2. Importance of Sample Collection

a. Sample collection is very important to ensure that analytical data is reliable and to draw a representative sample.

b. 3 activities in analysis

- Collection of representative sample
- Sample preparation
- Analysis using proper methods & instruments

c. Potential sources of variation for above activities to be identified and minimized or avoided.

d. Proper sample size, suitable containers for sampling or use of appropriate preservatives to prevent spoilage /damage before analysis.

3. Precautions during sampling

a. The condition of the sample received for examination is of primary importance.

b. A representative sample is essential when pathogens or toxins are sparsely distributed within the food.

c. The number of units that comprise a representative sample from a designated lot of a food product must be statistically significant.

d. The proper statistical sampling procedure, according to whether the food is solid, semisolid, viscous, or liquid, must be determined by the authorised person at the time of sampling.

e. Clean, dry, leak-proof, wide-mouthed and sterile containers of a size suitable for sample of the product must be used.

f. Sample must be submitted in original and in sealed condition.

g. Dry or canned foods that are not perishable and are collected at ambient temperatures need not be refrigerated.

h. Collect frozen samples in pre-chilled containers.

i. Follow the storage norms. The storage condition will be determined by the temperature control required for individual products.

i. Perishable. Sample storage under chilled or frozen condition as the product demands. Ice packs can be used during transportation and temperature is to be maintained between 4-6 deg C.

ii. Non-perishable: Storage of non-perishables should maintain the originality of the sample as is during the sampling conditions. Transportation should be done at temperatures not more than 40 degree C. Care should be taken to provide maximum protection from pilferage

4. Sampling tools and containers

Samples collected from bulk packages or unpackaged foods sold at retail must be placed in suitable containers for storage and handling to be presented for laboratory analysis.

a. Sampling tools

The tools available to Authorized Officer range from common tools for general purposes to special tools to be used in specific situations and for specific examinations of particular food products.

A sampling kit should be designed based on the nature of sample and the purpose of sampling. Below enlisted are the basic requirements that are to be fulfilled by a sampling kit:

- Carrying case
- Notebook
- White coats
- White hats
- Chill packs
- Lockable or secure freezer (-18 0C)
- Insulated boxes
- Adequate supply of hard frozen ice blocks
- Food grade sampling bags
- Sample Labels
- Seals
- Hair nets
- Disposable paper towels
- Measuring jug(s)
- Funnel(s)
- Scissors
- Knives
- Spoons
- Can Opener
- Sample containers (various sizes)
- Glass bottles
- Thermometer (Calibrated)
- Disinfectant wipes
- Sterile sample jars (various sizes)

- Sterile knives and spoons as necessary
- Swabbing equipment
- Water sampling bottles
- Latex gloves
- Isopropanol (70%)

b. Sample containers

The laboratory sample must be placed in a clean, inert container which provides secure protection from contamination, damage and leakage. The container should be sealed, the sampling record must be attached and the sample delivered to the laboratory as soon as practicable.

i. Solids: For packaged consumer packs, the samples should be collected as is without opening the packs. This is true for solids and liquid packaged products. For open and loose food products, the containers should be of appropriate size, clean, sterile in case of microbiological testing and should have tamper evident closures and seals. Sterile and clean sampling gadgets, seals, and containers should be used. Aseptic sampling procedure should be followed.

ii. Liquids: Containers liquid/semi-solid products should preferably be of inert materials, glass or plastic. The containers should preferably be of appropriate size, capable of air-tight closure and preferably dark-coloured so as to prevent light-based degradation

Type of containers

Food Safety officer or Sampling personnel's should have regard to any advice provided by the analyst on the need to observe aseptic sampling techniques. The owner of the food should be given the opportunity if present to observe the sampling procedure. The container should be:

- Material of the container should be inert.
- Containers used for sampling should be air tight for chemical analysis and sterile for microbiological analysis.
- Preferable type of container used for chemical and microbiological analysis should be the same for ease.
- Samples of food which are not pre-packed or opened cans or packets of foods should first be placed in clean, dry leak-proof containers such as wide-mouth glass or food quality plastic jars, stainless metal cans or disposable food quality plastic bags.

- Jars, bottles or cans should be suitably closed. Disposable food quality plastic bags should be sealed securely after filling so that they cannot leak or become contaminated during normal handling.
- Samples of alcoholic drinks should be placed in glass bottles.
- Samples for microbiological examination should be taken and handled in a manner that eliminates the risk of contamination during the sampling process.

5. Sample Collection Techniques

Before collecting any sample, the FSO/ Authorized Officer must observe the lot from which the sample is to be collected, and record relevant observations. Information obtained should include the following as appropriate;

i. Name of the food;
ii. Lot size;
iii. Type of packing;
iv. Container size or sizes;
v. Product code or control numbers;
vi. Number of consignments;
vii. Labelling information;
viii. Condition of the lot, i.e., broken packages, evidence of rodent or insect infestation, debris, etc.
ix. General condition of the area or building in which the lot is stored.

If the subsamples for packaged food are drawn from boxes or crates, the sample units should be marked with numbers. Corresponding numbers should be written inconspicuously on the boxes or crates, together with the FSO/ Authorized Officer‘s initials and the date. The boxes or crates are thus identified, as is the entire lot, so that they can be recognized later if they are re-sampled.

a. Sampled Unit (Lot)

Every effort should be made to restore the lot from which the sample is collected to its original condition. Boxes or crates should be refilled, re-glued and re-stacked. Sacks or bags which have been opened should be refilled and closed. These operations require some physical effort, but it is essential to leave the stock in good saleable condition. Refilled units must not be contaminated. It may not be possible to restore some lots completely to their original condition, as the sampling operation may do some damage that the FSO/ Authorized

Officer cannot avoid or correct. This problem should be discussed with the owner of the goods before sampling begins, so that a satisfactory arrangement can be reached. Whenever possible, samples should be collected from previously unopened boxes or crates, unopened retail packages, and unopened bulk containers such as sealed barrels, etc. The FSO/ Authorized Officer may, however, often find that the bulk containers from which he wished to collect the sample have already been opened by the dealer. Often samples may have to be collected from bulk containers which have been inadequately covered. When this happens, the existing condition should be described in detail, keeping in mind the effect that opening could have had on the composition of the product.

b. Sample integrity

Because of the large variety of food products which may be sampled, it is impossible to provide specific guidelines for each product. However, the FSO/ Authorized Officer must always be aware of the perishability of the sample and that, for analytical significance, the sample must reach the laboratory in a condition similar to that at the time of sampling. In taking official samples, many food control authorities prescribe the use of special tamper-proof containers or sealing with wax and a seal with the FSO/ Authorized Officer‘s designated identification number. It is usually a good precaution to have the owner of the good sign for the owner‘s portion of the sample.

6. Quantity of Food Samples to be collected for Analysis

Quantity of sample to be drawn should be sufficient for the required analysis. This should be as per the FSSA for most samples. Odd expensive items can be given due consideration. Quantity will vary according to product and type of analysis. It will also depend on the purpose for which the analysis is undertaken. Twice the amount of samples required for analysis should be taken. In case of large consignment of imported food, modified protocol would be necessary. Minimum 100g of sample must be sent for analysis Samples for examination are not required to be divided into three parts since the non homogeneous distribution of bacterial contaminants means that no two samples will be the same. It is not appropriate to retain a part for examination later in the event of a dispute, as bacteria may not survive prolonged storage or conversely, may greatly multiply.

- Under the provision of Rule No. 13 (FSSA), the quantity of sample of food to be collected shall be as specified in the table below:

While defining these please bear in mind microbiological and chemical tests. Should you feel that fixed sample weights can be applied for dry, non-perishable and perishable foods, please categorize in general and not for individual categories

S. No.	Article of food	Approximate quantity recommended in FSSA
1.	Milk	500 ml
2.	Sterilized Milk/UHT Milk	250 ml
3.	Malai / Dahi	200 g
4.	Yoghurt/Sweetened Dahi	300g
5.	Chhana / Paneer / Khoya / Shrikhand	240g
6.	Cheese/Cheese spread	200g
7.	Evaporated Milk/Condensed Milk	200g
8.	Ice-cream /Softy/Kulfi/Ice Candy/Ice lolly	300g
9.	Milk Powder /Skimmed Milk Powder	250g
10.	Infant Food /Weaning Food	500g
11.	Malt Food/ Malted Milk Food	300g
12.	Butter/Butter Oil/Ghee/Margarine/Cream/ Bakery Shortening	200g
13.	Vanaspati, Edible Oils/Fats	250g
14.	Carbonated Water	600g
15.	Baking Powder	100g
16.	Arrow root/Sago	250g
17.	Corn flakes /Macaroni Products/ Corn Flour/Custard Powder	200g
18.	Spices, Condiments and Mixed Masala(Whole)	200g
19.	Spices, Condiments and Mixed Masala (Powder)	250g
20.	Nutmeg/Mace	150g
21.	Asafoetida	100g
22.	Compounded Asafoetida	150g
23.	Saffron	2.0 g
24.	Gur/jaggery, Icing Sugar, Honey, Synthetic Syrup, Bura	250g
25.	Cane sugar/Cube sugar /Refined sugar /Dextrose/ misri/dried glucose syrup	200g
26.	Artificial Sweetener	100g
27.	Fruit Juice/Fruit Drink/Fruit Squash	400 g

28.	Tomato Sauce /Ketch up /Tomato Paste, Jam/ Jelly/Marmalade/Tomato Puree/Vegetable Sauce	300g
29.	Non Fruit Jellies	200g
30.	Pickles and Chutneys	250g
31.	Oilseeds/Nuts/ Dry Fruits	250g
32.	Tea/Roasted Coffee/RoastedChicory	200g
33.	Instant Tea /Instant Coffee /Instant Coffee Chicory Mixture.	100g
34.	Sugar Confectionery /Chewing Gum/Bubble Gum	200g
35.	Chocolates	200g
36.	Edible Salt.	200g
37.	Iodised Salt/ Iron Fortified Salt	200g
38.	Food Grains and Pulses (Whole and Split)	500g
39.	Atta/Maida/Suji/Besan/Other Milled Product /Paushtik and Fortified Atta/Maida	500g
40.	Biscuits and Rusks	200g
41.	Bread/Cakes/Pastries	250g
42.	Gelatin	150g
43.	Catechu	150g
44.	Vinegar/ Synthetic Vinegar	300 ml
45.	Food colour	25 g
46.	Food colour preparation (Solid/Liquid)	25 g Solid/100 ml liquid
47.	Natural Mineral water / Packaged Drinking water	1000 ml
48.	Silver Leafs	1 g
49.	Prepared Food	500 g
50.	Proprietary Food, (Non-Standardised Foods)	300 g
51.	Canned Foods	2 sealed cans
52.	Food not specified	300 g

FOOD SAFETY AND STANDARDS
AUTHORITY OF INDIA

Inspiring Trust, Assuring Safe & Nutritious Food

FDA Bhavan, Kotla Road, New Delhi - 110 002 | Tele.: +91 011 2322 0995
Telefax: +91 11 2322 0996 | ceo@fssai.gov.in | fssai.gov.in

Connect with FSSAI

FSSAI
Toll-Free No.
18 0011 2100

WhatsApp
98 6868 6868
FSSAI

www.fssai.gov.in
@fssaiindia