JAI NARAIN VYAS UNIVERSITY JODHPUR
INSTITUTIONAL BIOSAFETY POLICY

PREAMBLE

The University is following the guidelines and established procedures as specified *in* ***Biosafety Regulatory Framework, "Regulations and Guidelines for Recombinant DNA Research and Biocontainment, 2017", and "Guidelines for establishment of containment facilities: Biosafety Level 2 (BSL-2) and 3 (BSL-3) and Certification of BSL-3 facility, 2020"***, issued by Department of Biotechnology (DBT), Ministry of Science & Technology, Government of India.

In compliance with "Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells 1989 (known as 'Rules, 1989') under the Environment (Protection) Act, 1986 (EPA 1986), an Institutional Biosafety Committee (IBSC) is to be constituted by every organization engaged in research, use & applications activities related to GE organisms (organisms include microorganisms, animals, plants, arthropods, aquatic animals, etc.) and hazardous microorganisms (microorganisms include parasites, protozoa, algae, fungi, bacteria, virus, prions etc.) and products produced through exploration of such organisms. IBSC serves as the nodal point within an organization for implementation of the biosafety regulatory framework.

In the past few years, several reforms in Indian biotechnology regulation have taken place to facilitate use of biotechnology, its promotion, adoption, and popularization without compromising safety and security concerns. The reforms include decentralized regulatory powers to IBSC and implementation of a user- friendly online transactions mechanism of regulatory process through Indian Biosafety Knowledge Portal (IBKP). All these reforms have been presented in the "Handbook for Institutional Biosafety Committee (IBSC), 2020, as notified at https://ibkp.dbtindia.gov.in/. The handbook describes the competent authorities under Rules 1989, constitution, composition, registration and renewal mechanism of IBSCs. It also provides roadmap of functions of IBSCs pertaining to steps of application evaluation, approval procedure, monitoring & compliance, and online transactions through IBKP.

INDIAN BIOSAFETY REGULATORY FRAMEWORK

In India, all activities related to Genetically engineered organisms (GE organisms) or cells and non-GE hazardous microorganisms and products thereof are regulated as per the Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells 1989 (known as 'Rules, 1989') notified by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India, under the Environment (Protection) Act, 1986 (EPA 1986).

The Competent Authorities entrusted with implementation of biosafety regulations under Rules 1989 are: Recombinant DNA Advisory Committee (RDAC), Institutional Biosafety Committee (IBSC), Review Committee on Genetic Manipulation (RCGM), Genetic Engineering Appraisal Committee (GEAC), State Biotechnology Coordination Committee (SBCC), District Level Committee (DLC). While the RDAC is advisory in functions, IBSC, RCGM and GEAC are

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जोधपुर (राजस्थान)

involved in regulatory and approval functions. SBCC and DLC are responsible for monitoring the activities related to GMOs at state and district levels respectively.

INSTITUTIONAL BIOSAFETY COMMITTEE (IBSC)

In compliance with Rules 1989, an Institutional Biosafety Committee (IBSC) is to be constituted by every organisation engaged in research, use & application activities related to GE organisms (organisms include microorganisms, animals, plants, arthropods, aquatic animals, etc.) and hazardous microorganisms ("microorganisms" shall include all the bacteria, viruses, fungi, mycoplasma, cells lines, algae, protodones and nematotes). IBSC is the nodal agency within an organization for implementation of the biosafety regulatory framework. DBT/RCGM has been entrusted with registration and monitoring of IBSCs.

Institutional Biosafety Committee (IBSC) is solely responsible:
i. To implement and respond to institutional biosafety & biosecurity at the institution level and
ii. Evaluation of applications/ reports related to rDNA technology work involving the GE organisms and non-GE hazardous microorganisms in an organisation.

RESPONSIBILITIES AND FUNCTIONS OF IBSCs

a) Assess and monitor the items of general consideration i.e. research facilities, procedures and experts involved in HMOs/GMOs/LMOs and GE research and ensure that the proposed risk assessment, risk management and emergency plans are sufficient.
b) Provide guidance to Principal Investigator on the issues related to biosafety while using HMOs/GMOs/LMOs and GE research including safety of the researcher(s) associated with the work.
c) Inform the Principal Investigator about IBSC review, approval or rejection of applications.
d) Copies of site emergency plan to be submitted to RCGM, GEAC, State Biotechnology Coordination Committee (SBCC) or District Level Committee (DLC) as the case may be, as per Rules, 1989e). The IBSC shall inspect laboratories using checklists. IBSC shall apprise short coming measures (if necessary) under information to Head of Organisation. Inspection reports should be maintained in the IBSC.
(e) Reporting for incidents and release: It is necessary that any incident within an organisation such as non-compliance of the biosafety guidelines, any biosecurity issues or any significant research-related accidents and illnesses be reported to IBSC/ RCGM.

REGISTRATION OF IBSC

Constitution of an IBSC and its registration in DBT through Indian Biosafety Knowledge Portal (IBKP) is mandatory in India for every organization working with GE organisms, cells and hazardous microorganisms under Rules 1989. Without registration/renewal of the IBSC, the institution/organization shall not be eligible to conduct any rDNA activities and research on hazardous microorganisms that fall under the purview of Rules 1989. Any modification/ update of information of a registered IBSC and renewal of IBSC shall also be made through IBKP. Only the utmost authority of the organization or his/her designate (suitably a senior competent officer) who shall serve as the Chairperson, IBSC; shall register the institution/organization online at IBKP.

CONSTITUTION OF IBSC

The IBSC shall comprise of a Chairperson, Member Secretary, Biosafety Officer, a DBT nominee and at least four scientists engaged in rDNA work (at least one each from within and outside the organization) as members.

Composition Criteria

Chairperson: The Head of the organisation or his/her designate (suitable senior officer) shall be the Chairperson (utmost authority) of the IBSC. The Chairperson should preferably have knowledge and experience in scientific research pertaining to GE organisms, latest technological developments in the area & handling of hazardous microorganisms.

Member Secretary: One of the internal members should be designated as Member Secretary.

Biosafety Officer: Each IBSC shall have a member with medical qualifications designated as Biosafety Officer. The Biosafety Officer should be adequately trained with good lab practice in handling RG3 & RG4 pathogenic agents that require special containment conditions (Biosafety Level 3 or 4 facilities) and be able to offer advice on specialized containment requirements.

DBT Nominee: Each IBSC shall have an outside expert nominated by DBT who oversees the activities to ensure that biosafety aspects are being fully adhered by the organisation. While seeking registration of IBSC, the organization shall suggest 3 outside experts working in the areas preferably from nearby institutions. DBT may nominate one among them as DBT nominee or may nominate any other suitable expert as DBT nominee.

Internal and External members: IBSC shall have at least four members with at least one internal and one external member, preferably scientists engaged in rDNA work & non-GE hazardous microorganisms.

ROLES/ RESPONSIBILITIES OF IBSC MEMBERS

Chairperson, IBSC

- Has awareness of all requirements regarding compliance with the Rules, 1989 and other regulations related to HMOs/GMOs/LMOs/ and products derived thereof and ensure that the biosafety guidelines are followed in their organisation.
- Ensures that the available facilities at the organisation are adequate to meet the biocontainment levels stipulated while working with Hazardous microorganisms and GE organisms as per the latest guidelines while approving or forwarding applications.
- Ensures that training of IBSC members and Laboratory Personnel are being conducted on regular basis.
- Ensures that regular meetings of IBSC are held to review research projects in the organisation; open discussion takes place amongst the members in the meetings and the views of external members as well DBT nominee are recorded in the minutes. All decisions and approval need to have concurrence of DBT nominee.
- Ensures on-site biosafety & emergency plan are in place and decontamination & disposal mechanisms for laboratory and biomedical waste are in place as per the latest DBT Guidelines and also in accordance the guidelines issued by Central Pollution Control Board (CPCB) and local authorities.

- Ensures that in case of any accidental release, the concerned Scientist/Principal Investigator must immediately bring it to the notice of the Chairperson, IBSC who would be responsible for ensuring containment of the released organism(s) and informing the regulatory bodies (RCGM/GEAC) in the stipulated timeframe.

Member Secretary, IBSC

- Acts as a focal point for compliance with rDNA safety guidelines, good lab practices, biological containment etc.
- Be responsible for reporting and communication with RCGM with respect to functioning of IBSC in an organization. Ensures to organise regular meetings of IBSC and maintain updated documents such as agenda, minutes of meetings and other related papers for proper record keeping.
- Ensures that IBSC minutes and applications considered in the meeting are submitted through IBKP portal within 7 days of meeting.
- Ensures that annual reports in the prescribed proforma and medical surveillance reports are submitted at IBKP portal on or before 15th February of each year.
- Provides technical advice to Principal Investigator about safety procedure and containment facility as per the guidelines issued by DBT.

Biosafety Officer

- Ensures that biosafety measures are in place to prevent the accidental escape of hazardous microorganisms and GE organisms.
- Wherever there is a BSL3/4 facility, Biosafety officer must be trained to familiarise with BSL-3 and 4 facilities and be responsible for monitoring such facilities and health of workers in the facility.
- Undertake periodic laboratory inspections specially BSL-3 and BSL-4 facility.
- Assist Project Investigators (PI) in developing emergency plans for containment and clean-up of investigates, accidental releases, if any etc. and review emergency plans from time to time to prevent any lab accidents.
- Prepares Medical Surveillance Reports for people working in BSL 3 or 4 facilities in the proforma available on IBKP of all laboratory personnel annually and submit to Member Secretary for uploading online at IBKP before commencement of rDNA work by PIs.
- Review and report to the Head of the organisation and Member Secretary, IBSC, DBT nominee of any non-compliance of guidelines / health issues of staff.

DBT Nominee, IBSC

- Serves as the link between DBT-RCGM and the respective IBSC. Ensures that the IBSC reviews all ongoing activities.
- DBT nominee must ensure compliance of all relevant guidelines.
- Ensures that all the activities carried out in the organization are within the purview of the DBT guidelines and guide the IBSC on all biosafety matters including compliances.
- Includes an assessment report of on-site inspection of the available facilities in the IBSC meetings.

- If any new pathogen/ higher Risk group organism (RG 3&4) is to be used by the organization, the DBT nominee shall assess the capacity and infrastructure to conduct the experiments in the organisation and include that in the IBSC meeting minutes.
- In case of any accidental release, the IBSC Chairperson must inform DBT nominee at the earliest. The DBT nominee must then review the safety measures taken and accordingly, send an independent report on the "accidental release" highlighting any non-compliance of guidelines / health issues of staff to the Member Secretary, RCGM within 48 hrs.

Internal and External Members

- Review all submitted applications as per the guidelines and checklist.
- Participate in the training programs organized by IBSC to train researchers on biosafety and Biosecurity aspects.

CONFIDENTIALITY AGREEMENT

All IBSC members are expected to maintain confidentiality of the proposals and other related information made available to them for review, reference or discussion and not divulge any confidential or Intellectual Property (IP) or commercial business information (CBI) of an applicant/organisation/institute acquired as a result of review of such proposals and subsequent discussions. Each IBSC member including Chairperson, Biosafety Officer, DBT nominee, Member Secretary and internal/external experts shall sign confidentiality agreement in the proforma available on IBKP at the time of constituting IBSC or effecting changes in the composition of IBSC.

TENURE AND RENEWAL OF IBSC

- The tenure of the IBSC is for a period of 3 years from the date of issue of approval letter. The institute has to renew IBSC registration after every three years. IBSC shall process renewal request through portal at least 3 months before the expiry date of the current validity period.
- Registered IBSCs requesting for major changes in the IBSC composition including the change of DBT nominee may request for renewal of IBSC during the validity period.

IBSC MEETINGS AND RECORDS

Regular IBSC Meetings

The IBSC shall review and approve/ recommend the applications. There is no restriction on number of meetings to be held by IBSC. However, a minimum of two meetings must be held in a year within the institutional premises, in compliance of biosafety regulations. In case, organizations are involved in working with Risk Group 3 and above organisms or Category III and above experiments, IBSC must meet every quarter to ensure safety compliance.

Quorum for conducting IBSC meeting

At least 50% of the IBSC members must be present to conduct the meeting. No meeting shall be held in the absence of Chairperson, Member Secretary, Biosafety Officer and DBT nominee. The final approval or disapproval of non-exempt projects of HMOs/GMOs/LMOs/rDNA requires a majority vote by IBSC members and consent of DBT nominee.

Emergency IBSC Meetings

The Chairperson, IBSC may call an emergency meeting, to address any urgent issue such as non-compliance or unexpected events involving GE organisms, hazardous microorganism and rDNA materials in an organization.

Minutes of IBSC meetings

The minutes of the IBSC meetings are to be filled online at the portal. The approved minutes signed by all members present must be uploaded at the portal for approval by RCGM.

IBSC minutes should be self-contained and should cover:

i) Review of organisation, availability of contained facilities and trained manpower as mentioned under General Consideration;

ii) Scientific Considerations based on which IBSC approved the proposal or recommended to RCGM for approval;

iii) HMOs/ GMOs/ traits with quantities approved/ recommended to RCGM;

iv) It is mandatory to provide the duly signed attendance sheet.

In case of applicant initiating work involving RG3 and above organism or Category III experiment, DBT nominee shall visit the site and provide comments on adequacy of facility to conduct such work while recommending the application by IBSC. All decisions and approval during IBSC meetings must have concurrence of DBT nominee. In case of any dissent, the opinion of DBT nominee needs to be recorded in IBSC minutes.

Conflict of Interest

IBSC members who have a conflict of interest in a project should not be present during the deliberations of that project in the meeting and the same must be recorded in the IBSC minutes.

IBSC Records

Each IBSC has to maintain the following records (in hard and soft copies):

- Approved and duly signed minutes of IBSC meetings including attendance sheets.
- Annual report of all ongoing GE organisms/hazardous microorganisms projects.
- Copies of applications considered and approved by IBSC.
- Applications forwarded to RCGM or GEAC.

  Other documents such as statements regarding conflict of interest, confidentiality agreements signed by members.

Training

IBSCs must provide training on the issues related to biosafety to all the researchers while using HMOs/GMOs/LMOs/rDNA materials. At the R&D stage, organisms used in the research laboratory may be pathogenic to humans and/ or harmful to the environment. Experiments could involve organisms and/or inserts, which may be injurious to the health of the workers. It is therefore extremely important that the research and laboratory staff is well trained in biosafety measures.

Training of IBSC Members

It is the responsibility of the Head of the Organisation to arrange training for the members of IBSC including Chairman IBSC on biosafety frameworks, the Rules, 1989, related regulations and guidelines. Biosafety officer shall be adequately trained to monitor BSL-3 or BSL-4 laboratory whenever such facilities are in operation in the organization.

Training of Laboratory Personnel

General biosafety training is mandatory for all individuals conducting research with GMOs/LMOs/GE materials and Hazardous Microorganisms. Such training may be organized by the organization itself or through experts. This includes knowledge in handling of organisms, approved decontamination approaches and management of incidents/accidents in the facility and information on when and how to report laboratory incidents. Individuals proposing to work in BSL-3 or BSL-4 containment facilities must go through BSL-3 or BSL-4 laboratory specific training before using the facility. Records/ information pertaining individuals trained on such facilities in the institute to be maintained by the IBSC.

SUBMISSION OF APPLICATION FORMS AT THE IBKP PORTAL

For conducting research in the organisation, the Principal Investigators (PIs) must apply online by filling appropriate application form before initiating research. The application forms are available at the IBKP portal. The online application forms are to be filled and submitted for consideration by institute's IBSC and then by RCGM. The forms would be accessible to all the registered IBSCs on the portal. IBKP hosts application forms for import, export, transfer and R&D at contained (laboratory) and confined (field trial) activities specific for healthcare, agriculture and environmental use. All forms are interactive in nature where applicant can submit the application required information along with required enclosures in relevant application proforma.

Processing the applications for approval of IBSCs

IBSC shall review and evaluate capabilities of the organization to undertake the proposed rDNA research activities specially those involving high risk group (RG3 and RG4) organisms and Category III and above experiments. The 'Regulations and Guidelines on Biosafety of Recombinant DNA Research & Biocontainment, 2017' have classified GE experiments into three categories (Category I, II & III) with increasing risk concerns and respective competent approval authorities. Depending on the organism involved in GE experiments to be performed, the categories of GE experiments and biosafety level facilities are summarized in appendices 1 & 2 respectively.

- Category I GE experiments, the sub-user should intimate the IBSC about the objective and experimental design of the study along with organisms involved.
- Category II GE experiments require prior authorization from IBSC before the commencement of the experiments through submission of information in the prescribed proforma.
- IBSC may permit the Import/ Export/ Transfer/ Receive of regulated items of specified quantities for Biopharma R&D purpose of Drug Development and R&D purpose under "Revised Simplified Procedure/Guidelines on Import, Export and Exchange of Regulated items, 2020"
- In case of export of biological materials belonging to Special Chemicals, Organism, Materials, Equipment & Technologies (SCOMET) category, the applicant needs to apply to Directorate General of Foreign Trade (DGFT), Ministry of Commerce after approval from IBSC/ RCGM ion from IBSC (www.dgft.gov.in). In case of GM plants and planting materials, the import is routed through the Director, National Bureau of Plant Genetic Resources (NBPGR) of the Indian Council of Agricultural Research, on the basis of the authorization letter issued by the RCGM Secretariat.
- As per the 134th GEAC recommendations, IBSCs are permitted to conduct event selection trials within the organization/company owned premises without the

requirement of NOC from State Governments. In all such cases, IBSC must follow "Guidelines for the conduct of confined field trials of regulated, GE plants (http://www.geacindia.gov.in/resource-documents/biosafetyregulations/ guidelines-and-protocols/Guidelines for Confined Field Trials of Regulated Genetically Engineered GE Plants.pdf) and adhere to Standard Operating Procedures (SOPs) for confined field trials of regulated, GE plants, 2008 (http://www.geacindia.gov.in/resource-documents/biosafetyregulations/ guidelines and-protocols/Standard-Operating-Procedures-for confined- field-trials.pdf)

Other approvals required

Apart from the approval of IBSC and RCGM, the GE activities may require approvals from other regulatory agencies. Approval from GEAC, CDSCO, NBA, DHAD, DGFT, Plant Quarantine Authorities, Animal Ethics Committee, NOC from State Government in case of field trials etc. as required is applicable.

EVALUATION OF APPLICATIONS BY IBSCs

Safety assessment of each application based on scientific knowledge and experience must be done by IBSCs. Some logical steps that need to be followed for review of a project proposal in the context of safety assessment by IBSC are given below. It may be noted that this list is indicative and specific additions/deletions or modifications shall be made to suit the requirements of each project on a case-to-case basis.

Molecular Biology

i. Characteristics of the donor/source organisms

If the insert contains genes which are biologically active, producing toxins or virulence/pathogenic factors, then characteristics of the donor/source organism is extremely important for risk consequence. If the donor organism is merely used as a source of well-characterized gene or DNA sequence coding a specific trait or a promoter or other regulatory sequence, the characteristics of the source organism may or may not be critical consideration for additional safety considerations. Although, the characteristics of the source/donor organism are of less relevance for the risk assessment than those of the host, the hazard group of the resultant GMO would be generally higher of the two within which the host and donor fall.

ii. Characteristics of the host/recipient organisms

The characterization of the host/recipient organism provides the starting point for the risk assessment. A thorough knowledge of the host or recipient organism is extremely important in assessment of the risks of the GMOs particularly keeping in view the concept of substantial equivalence as a starting point. The identity of the host must be established and the taxonomy well understood. The documented evidence on the safe use of the host organism, if available, should be considered. The general assumption is that the level of risk associated with the genetically modified organism is at least as great as that of the host organism (wild type), until proven otherwise.

iii. Characteristics of the modification/ insert/ gene construct

The properties of the insert/gene construct are extremely important in risk assessment of GMOs. Individual components used in the preparation of the construct i.e. regulatory

sequences (promoters, enhancers, etc.), selectable markers and other genes that do not get transformed themselves but aid the process to achieve desired base pair changes and insertion of foreign DNA (eg. CRISPER/Cas9) require careful review and safety assessment.

iv. Characteristics of the vector and method of transformation

The vector has to be characterized both for its own potential for pathogenicity and for its ability to transfer the insert to organisms other than the intended horizontal transfer. The function of the genetic material in the vector should be known as this would ensure that the vector is free from sequences that could be harmful to humans or the environment. The presence of genes coding for antibiotic resistance might be of serious concern, although some of the antibiotic resistance genes used in the vectors are commonly found in the environment. The method of transformation used for introducing the required gene(s) should be considered for the risk assessment of the modified organism as copy number of transgenes and site of integration vary significantly depending on the method followed. For example, in case of plants, the two principal methods of transformation that are widely used are the *Agrobacterium* mediated transformation and particle bombardment. While *Agrobacterium* mediated transformations result in a low transgene copy number, minimal rearrangement and higher transformation efficiency; particle bombardment causes extensive rearrangements to transformed sequences. Similarly, emerging technologies such as genome editing should be considered for the risk assessment of the modified organism from non-targeted modifications in the genome point of view.

v. Characteristics of the modified organism

Molecular characterization provides information about the composition and integrity of inserted DNA, the number of copies of inserted DNA, the number of sites of insertion, evidence confirming desired modification/editing and non-target modifications, if any, and the expression level of introduced novel proteins over time and in different tissues in case of plants and animals which help in the formulation of risk hypothesis and subsequently risk assessment. The inheritance and stability of each introduced modification/trait i.e. functional in the modified organism must be determined. The first presumption for safety assessment of GMO is that the modified organism is as hazardous as the host. For each novel trait the pattern and stability of inheritance must be demonstrated as well as the level of expression of the trait by estimation and analysis of the protein. If the new trait is one that does not result in the expression of new or modified protein then its inheritance will have to be determined by examining the DNA insert directly or by measuring transcript levels.

Human/Animal Health Considerations

The risk assessment initially considers a wide range of potential pathways. Those pathways that describe substantive risks should be considered in more detail and the level of risk evaluated. The result provides a qualitative measure of the risk, and allows a containment level to be assigned for the use of the organism. The risk assessment strategy for genetically engineered (GE) organisms and derived food seeks to deploy appropriate methods and approaches to compare GE organisms and derived food with their appropriate comparators having a history of safe use. The underlying assumption of this comparative approach is that traditionally cultivated crops have a history of safe use for consumers. This approach focuses

on determining whether any new or altered hazards are present, relative to existing conventional foods, with any identified hazards becoming the focus of further assessment. The Comparative Safety Assessment (CSA) of GE food is basically a two-tiered approach.

The molecular characterization together with the comparative analysis of trait related to biochemical composition and phenotypic characteristics of GMO with the closely related conventional counterpart to identify differences that may have safety implications constitutes the first step. The second step comprises of the toxicological, allergenic and nutritional evaluation of the identified differences. Impact on human/ animal health is studied by analyzing the modified organism for the risks of toxigenicity, allergenicity, pathogenicity, teratogenicity etc. as relevant in a particular situation. Assessment procedures and criteria vary in each case of genetic modification carried out in microorganisms, plants, animals etc. and products thereof.

Environmental Considerations

Risks associated with a GE organism is assessed in a structured, reasoned approach for determining the chance of harm from the environmental release of a GE organism, based on scientific evidence and taking into account any information received from subject experts and other stakeholders. The aim is to identify, characterize and evaluate risks to the health and safety of people or to the environment from the use of GE organism, when compared with risks posed by conventional varieties. The risk assessment begins by determining what could go wrong and how harm might occur if a particular GE organism was intentionally released into the environment. Risks are then characterized by considering how serious the harm could be (consequences) and how likely that harm could occur. The level of risk is then evaluated by integrating consequences and likelihood. In addition to the effect of inserted gene(s) or modified gene(s) and their impact on genotype and phenotype of a modified organism, it is important to study the proliferation of the GMO in the environment and the effect impact on its equilibrium. Environmental risk assessment of GMOs must be undertaken on a case-to-case basis and there can be no single method or model to follow. Broader issues include the potential adverse effects, likelihood of these risks becoming a reality, consideration of risk management strategies and assessment of overall potential environmental impact.

Possible adverse effects include outcrossing between a GMO and pathogens, negative adverse effect on population of non-target organisms, including indirect effects on population levels of predators, competitors, herbivores, symbionts, parasites and pathogens. Identification of any potential adverse effect is followed by a stage in which an estimation is made of the likelihood that the identified potential adverse effect will actually occur. It is important to estimate the chances of each of potential effect for assessment purposes. The likelihood of certain potential adverse effects occurring can be influenced by characteristics of the size and scale of application in addition to those of inserted transgene and the recipient organism. In brief, IBSC shall undertake the risk and safety assessment of a GMO with reference to Molecular Biology, Human & Animal Health and Environmental Considerations.

RISK GROUPS AND CONTAINMENT FACILITIES

In general, biosafety begins with ensuring that the workplace (whether it is a laboratory, fermentation plant or open field) is safe for the working staff, the general public and the environment by proper containment/ confinement. Containment includes combination of facilities, practices and procedures for managing risk-inherent microorganisms, GE organisms or cells where they are being handled or maintained for reducing the exposure, preventing

their escape within establishment and/ or in natural environment. The selection of containment facilities depends upon the risk category of microorganisms. The Risk Groups with details of microorganisms falling into each category and required containment facilities for each group are given in "The Regulations and Guidelines for Recombinant DNA Research & Biocontainment, 2017". The list provided is indicative but not exhaustive and will be updated periodically. However, for working with organisms not listed in these guidelines, it is the responsibility of the investigator to determine appropriate risk groups and containment level in consultation with IBSC/RCGM.

Risk Groups of microorganisms

In case of microorganisms, the pathogenicity of the organism is extremely important for the risk assessment and its subsequent categorization. Infection by a microorganism followed by disease depends on its ability to multiply in the host and on the host's ability to resist or control the infection. Classification of microorganism into risk groups is based on:

a. Pathogenicity of the organism towards humans/animals/plants.
b. Modes of transmission and host range of the organism.
c. Availability of effective preventive treatments or curative medicines.
d. Capability to cause epidemics.

Risk Group (RG) classification

RG 1 (no or low individual and community risk):
Microorganism that are unlikely to cause human/ animal/plant disease

RG 2 (moderate individual risk, low community risk):
Microorganism that can cause disease in human /animal/ plant. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited

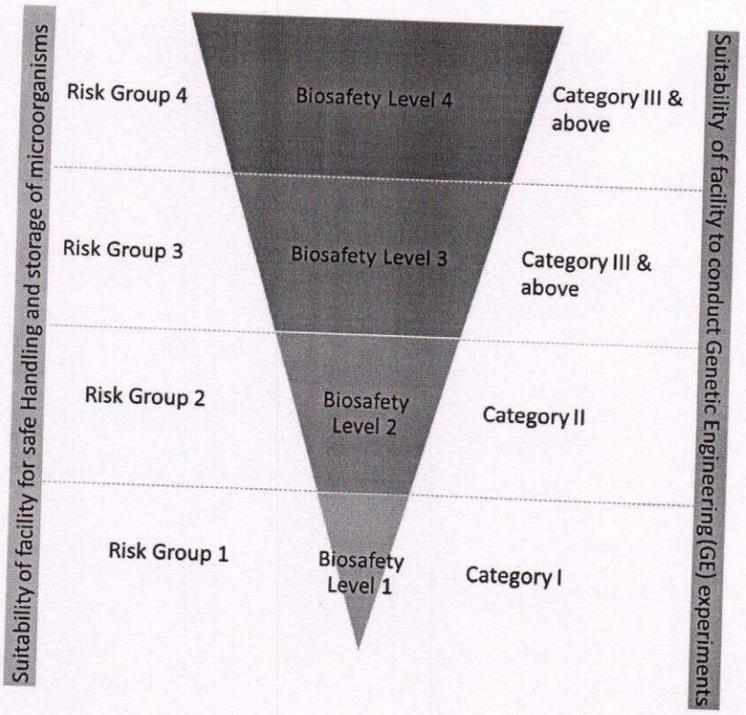
RG 3 (high individual risk, low community risk):
Microorganism that usually causes serious or lethal human/ animal/ plant disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available.

RG 4 (high individual and community risk):
Microorganism that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available.

Categories of Genetically Engineered (GE) Experiments and Biosafety Level Facility Requirements

Considering fact that genetic engineering can alter/change the overall risk of an organism, a risk re-evaluation approach has been mentioned in these guidelines for the selection of appropriate containment facility. Operational details that are not specified in these guidelines shall be as per International best practices wherein the proposals shall be taken up in the IBSC meeting(s) for proper deliberations and approval before commencement of the work. Further, request for any change of an operational parameter(s) of a containment facility shall be evaluated by IBSC in the same manner before approval to ensure that the change does not affect the biosafety and biosecurity concerns that may arise while working in the facility. Higher the risk group that the organism belongs to, higher is the risk involved: A guide for

selection of appropriate containment facility for handling and storage microorganisms and conducting GE experiments is shown in Figure below:



Guide for selection of appropriate biosafety level laboratory for handling microorganisms and conducting GE experiment

OTHER GUIDELINES

IBSC shall also refer following guidelines:

- "Guidelines and Standard Operating Procedures (SOPs) for Confined Field Trials of Regulated, Genetically Engineered (GE) Plants 2008". This guideline not only assists in proper conduct of confined fields trials but also in transport and storage of regulated GE plant material, management, harvest or termination and post-harvest management, storage inspection, planting, spatial isolation, and monitoring of confined field trials of GE crop in the country.
- "Guidelines for the Environmental Risk Assessment of Genetically Engineered Plants, 2016" for generating data in a systematic and structured approach to their risk analysis.
- "Guidelines on Similar Biologics, 2016"
- "Guidelines for Generating Pre-Clinical and Clinical Data For r-DNA Based Vaccines, Diagnostics And Other Biologicals, 1999" for generating data for preclinical safety evaluation in a systematic and structured approach to cover safety, purity, potency and effectiveness of the product.

- "Guidelines for the Safety Assessment of Foods Derived from Genetically Engineered Plants, 2008" and/ "Protocols for Food and Feed Safety Assessment of GE crops, 2008".
- Approval procedures for import and export of GE plants and planting materials as described in the 'Procedure of Import and Export of GM Plants & Planting Material' published by GEAC, MoEF & CC.

COMPLIANCE ADHERENCE

IBSC shall ensure storage and handling of HMOs, GE Organisms and related materials in accordance with the conditions specified in "Regulations and Guidelines for Recombinant DNA Research and Biocontainment, 2017". Further, on-site emergency plan shall be prepared with adequate familiarity with the organisms being handled and detailed precautions while working with them. Necessary provisions against unauthorized entry and staff movement in restricted areas of the organisation should also be in built to ensure the compliance of the assigned risk category.

PERSONS RESPONSIBLE FOR COMPLIANCE ADHERANCE

a. Head of the Organisation

The head of the organisation shall be responsible:

- For compliance with Rules, 1989 and other related regulations regarding GE research.
- To bear ultimate responsibility for the safe conduct of activities involving HMOs/GMOs/LMOs/GE research.
- To ensure authorized access and proper storage of biological materials.
- To keep informed SBCC and DLC at all stages of rDNA work in the organization.

b. Principal Investigator (PI)

The responsibilities of PI are summarized below:

- Based on the RG of the GE organisms/LMOs and GE materials, the PI determines the proper containment level for the project and in accordance with the guidelines, develops the necessary experimental protocols.
- Depending upon the risk category experiments, the PI has to inform the IBSC for category-I experiments, seek permission of IBSC before starting the experiments for category-II or seek permission of the RCGM through its IBSC for category-III & above experiments.
- To make an initial determination of the required levels of physical and biological containment in the research activity to be under taken in accordance with the stipulated guidelines.
- To submit the initial research protocol and any subsequent changes (such as changes in the source of DNA or host vector system) to the IBSC for review and approval.
- To ensure that no work is initiated until the research project has been approved by the IBSC or by RCGM/GEAC also as the case may be and has met all requirements of DBT guidelines.
- To instruct laboratory staff about the practices and techniques required to ensure safety, and the procedures for dealing with accidents including the reasons and

provisions for any precautionary medical practices advised or requested (e.g. vaccinations or serum collection).

- To supervise the performance of the laboratory staff to ensure that they follow all safety guidelines and establish good laboratory practices. They must work within the assigned biological safety containment level and use personal protective equipment as recommended by the PI.
- To properly treat the resulting Biowastes and also ascertain that organisms are either destroyed or rendered harmless before disposal into the environment.
- To undertake corrective measures promptly for any work errors/ accidental laboratory spillage and conditions that may result in the release of hazardous microorganisms, GE organisms and cells and products thereof.
- Submit annual progress report, Final report of the project to IBSC.
- Inform IBSC of premature termination of study/ experiment.
- Immediately notify the PI or BSO of any health condition that may be due to their work in the laboratory or any health condition that may be compromised prior to the initiation of a research project (i.e. pregnancy, immunosuppression).

COMPONENTS OF ON-SITE BIOSAFETY & EMERGENCY PLAN

IBSC to approve up-to-date on-site biosafety & emergency plan for each project according to the manuals/guidelines of the RCGM before any rDNA work is undertaken. IBSC shall make available copies of up-to-date on-site biosafety & emergency plan to the District Level Committee (DLC)/State Biotechnology Co-ordination Committee (SBCC) and the Genetic Engineering Appraisal Committee (GEAC). The various components of on-site biosafety and emergency plan are:

a. Containment/Storage of Hazardous microorganisms/GE Organisms including storage facility and Related materials

- IBSC shall ensure storage of HMOs, GE Organisms and related materials in accordance with the conditions specified in "Regulations and Guidelines for Recombinant DNA Research and Biocontainment, 2017".
- IBSC must evaluate the availability of proper containment facilities before the commencement of experiments. Containment facilities cover laboratory where genetic modifications are made and greenhouse or growth room and Net houses where they are grown for trials to assess trait efficacy and human and environment safety. Here safety of the workers and the environment is important. There is also a risk of accidental release where the waste from laboratories/fields is not carefully monitored and treated as per the prevailing laws, acts, rules and guidelines. Therefore, the containment requirements would take into account both impact on human health and environment. The containment could be physical, where there are real barriers to prevent escape or biological in nature where the organism is designed not to be able to survive in the environment other than the laboratory with specific conditions.

b. Health and Medical Surveillance

- IBSC shall ensure that the health and medical surveillance of laboratory personnel is carried out by employing authority and/or project in-charge. The objectives of the health and medical surveillance of laboratory personnel are to prevent individuals

from acquiring infection during the work, early detection of laboratory-acquired infection, assessing the efficacy of protective equipment and procedures, prophylactic vaccinations where needed and monitor booster regimens and assessment of sero conversion, in applicable cases.

c. Decontamination and Disposal

- IBSC shall ensure selection of appropriate decontamination and disinfection strategies for laboratory and biomedical waste treatment and disposal waste should be as per the Biocontainment Guidelines and also in accordance the "Revised Guidelines for Common Bio-medical Waste Treatment and Disposal Facilities, 2016" issued by Central Pollution Control Board (CPCB) and local authorities. IBSC may review the disposal methods. The potentially hazardous biological materials and HMOs/GMOs/LMOs/GE materials are to be considered as "regulated waste" and should be disposed of in a manner consistent with "Regulations and Guidelines for Recombinant DNA research and Biocontainment, 2017" and other stipulated guidelines issued from time to time by other agencies.

d. Emergency Procedures

- IBSC should ensure that emergency contingency plans in consideration of every possible breach in biocontainment should be prepared for each individual laboratory as well as for the institution. These are best prepared by the individual laboratory supervisor in conjunction with his staff and the biosafety officer. This procedure offers the best prospect of success as it is the immediate staff that is most familiar with the hazards associated with a particular laboratory.
- The PI must be conscientious of biosafety at all stages of handling of HMOs and rDNA work in the project including safeguard of GMO materials and should be held accountable for them. The PI, depending on the risk group organisms, HMOs/GMOs/LMOs and GE materials, should develop an on site biosafety & emergency plan to protect the manpower & security of the material in question. The plan might include measures such as additional locks for laboratories, chain-ofcustody forms within laboratories to track materials, inventories of biological materials, logs of access etc. The SOPs for use of biological materials should be in place including access to HMOs/GMOs/LMOs and GE materials for routine cleaning, maintenance, and repairs, restricting unauthorized persons, addressing loss of keys, passwords and any other secured information, GE material etc.

REPORTING OF INCIDENTS AND ACCIDENTAL RELEASE

It is necessary that any incident within an organization such as non-compliance of the biosafety guidelines, any biosecurity issues or any significant research-related accidents and illnesses (e.g., exposure to any uncontained hazardous microorganisms, GE organisms and cells and products thereof, or contamination from equipment failure or a potential or over exposure in the BSL-3 or BSL-4) be reported by the PI to the IBSC Chairperson within 24 hours. Member secretary–IBSC/ Chairperson IBSC is responsible for reporting such incident to the DBT Nominee and RCGM within 48 hours from the incident. The DBT nominee shall assess the incident and send an independent report.

ADDRESSING NON-COMPLIANCE

Non-compliance can result in the IBSC taking one or more of the following actions:

i. Suspension of the use of HMOs/GMOs/LMOs/GE materials.

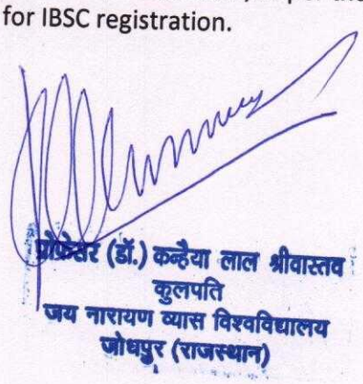
ii. Cessation of the approval for use of the HMOs/GMOs/LMOs/GE materials.

iii. Confiscation and/or destruction of the HMOs/GMOs/LMOs/GE materials.

iv. Any other action deemed necessary to protect the public and environment, including suspension of all relevant research activity.

v. Reporting to the RCGM.

Our University has constituted Institutional Biosafety Committee, as per the above guidelines (Appendix-3), and has applied to DBT, GOI for IBSC registration.



APPENDIX 1. Categorization of GE Experiments and Approval requirements

S. No	GE experiments on					Approvals
	Microorganism	Animals	Plants	Insects	Aquatic animals	
Category I	Insertions of gene into RG 1 microorganism having no adverse health, phenotypic or genotypic consequence. Experiments involving approved host/vector systems provided that the donor DNA is originated from RG 1 microorganism. Self-cloning, fusion of protoplasts between nonpathogenic RG 1 organism, etc.	Breeding, housing and experiments of gene 'knockout'. Breeding of GE animals transformed with sequences of viral vector belonging to RG 1. Research involving the introduction of nucleic acids into animals provided that the nucleic acid does not give rise to any infectious agent.	Research & development, and maintenance of GE plants harboring DNA from Risk Group 1 microorganism. Working with plants for the development/i improvement of transformation protocols. Genome editing leading to SDN1-type mutations.	GE arthropods with genes from RG 1 microorganisms and other nonpathogenic organisms provided the genetic engineering process has no, or only negative effects on viability, survivorship, host range, or vector capacity. Challenged or infected with GE microorganisms that fall under RG 1.	GE aquatic animals containing genes from RG 1 microorganisms. Challenged or infected with GE microorganisms that fall under RG 1.	An investigator should intimate the IBSC of the study objectives and experimental design along with organisms involved. IBSC should review the same as and when convened for record purpose, monitoring or action to be taken, if any.

Category II	Work with non-Experiments approved with host/vector systems where the host or vector does not cause disease in plants, humans or animals. Experiments with approved host/vector systems, in which the gene inserted is a pathogenic determinant. Experiments on RG 2 microorganism in the presence of helper virus Experiments in which DNA from RG 2 or 3 organisms is transferred into non-pathogenic prokaryotes or lower eukaryotes host vector system.	Experiments with GE animal and associated materials, harboring DNA from a RG 2 microorganism. Experiments with animals infected with GE microorganism (s) that fall under Risk Group 2	Research & development, and maintenance of GE plants harboring DNA from Risk Group 2 microorganism. Experiments on GE plants conferring herbicide tolerance or pathogen resistance. Genome editing leading to SDN 2 and 3 - type modifications.	GE arthropods with genes from RG 2 microorganism s and other nonpathogenic organisms provided the genetic engineering process has no, or only negative effects on viability, survivorship, host range, or vector capacity. Challenged or infected with GE microorganism s that fall under RG 2.	GE aquatic animals containing genes from RG 2 microorganisms and other nonpathogenic organisms provided the genetic engineering process does not increase virulence and environmental fitness of the organism. Challenged or infected with GE microorganisms that fall under RG 2	An investigator requires prior authorization from IBSC before the commencement of the experiments
Category III and above	Experiments on RG 2 and RG 3 microorganisms where insertion of gene directly involved in production of toxin or allergen or antimicrobial compounds.	Experiments with animals infected with GE microorganisms that fall under RG 3. Experiments on animals using DNA which encodes a vertebrate toxin.	Growing genetically modified plants containing genes from microorganisms that fall under RG 3. Experiments involving GE plants containing genes directly involved in the production of toxins/allergens	GE arthropods with genes from RG 3 microorganism s and other pathogenic organisms. Challenged or infected with GE microorganism s that fall under RG 3.	GE aquatic animals containing genes from RG 2 microorganisms where the genetic engineering positively affects environmental fitness and virulence Challenged, infected with RG 3 microorganisms.	An investigator requires prior authorization from IBSC and subsequent approval from RCGM before the commencement of experiments.

APPENDIX 2. Category of experiments, GE organism involved and Bio safety Level Facility Requirements

Category	GE Microorganisms	GE Animals	GE plants	GE Insects	GE Aquatic organisms
Category I	BSL-1	ABSL-1	PBSL-1	IBSL-1	AqBSL-1
Category II	BSL-2	ABSL-2	PBSL-2	IBSL-2	AqBSL-2
Category III and above	BSL-3/ BSL-4	ABSL-3	PBSL-3	IBSL-3	AqBSL-3

JAI NARAIN VYAS UNIVERSITY, JODHPUR
(RESEARCH & DEVELOPMENT CELL)

No.: JNVU/R&D/2023/3445 Date: 06.02.2023

OFFICE – ORDER

The Hon'ble Vice-Chancellor has been constituted Institutional Biosafety Committee (IBSC) for Jai Narain Vyas University, Jodhpur to facilitate high standard research on transgenic plants animals and microbes. The committee was constituted as per the guidelines of Deaprtment of Biotechnology (DBT), GOI, and consists of following members :-

1. Chairperson - Prof. K.L. Shrivastava
   Vice-Chancellor
2. Member Secretary - Prof. C.R. Choudhary
   Dean, Faculty of Science
3. Biosafety Officer - Dr. B. Derashri
   University Medical Officer
4. Proposed DBT Nominee (3) :
   (i) Dr. Jaykaran Charan
   Associate Professor & Sub-Dean (Research)
   Department of Pharmacology, AIIMS, Jodhpur
   (ii) Dr. Sushmita Jha
   Associate Professor
   Department of Bioscience & Bioengineering, I.I.T., Jodhpur
   (iii) Dr. S.K. Singh
   Head, Division of Plant Improvement & Pest Management
   ICAR, CAZRI, Jodhpur
5. Outside Subject Expert - Dr. Tarun Kant
   Scienetist – F & Head
   Genetics & Tree Improvement
   Division, AFRI, Jodhpur
6. Internal Member :
   (i) Prof. G.S. Shekhawat, Deptt. of Botany, J.N. Vyas Univeristy, Jodhpur
   (ii) Dr. Shweta Jha, Deptt. of Botany, J.N. Vyas University Jodhpur
   (iii) Prof. Praveen Gehlot, Deptt. of Botany, J.N. Vyas University Jodhpur
   (iii) Dr. Heera Ram, Deptt. of Zoology, J. N. Vyas University, Jodhpur

This is in supersession of this office order No. 2271 dated 08.2.2022.

REGISTRAR

Copy to the following for information and necessary action:-

1. All the Members of Committee, IBSC, J.N. Vyas University Jodhpur.
2. The P.S. to Vice-Chancellor/P.A. to Registrar, J.N. Vyas University Jodhpur.

ASSISTANT REGISTRAR