Legal and Regulatory Issues in Biotechnology
Prof. Niharika Sahoo Bhattacharya
Rajiv Gandhi School of Intellectual Property Law
Indian Institute of Technology, Kharagpur

Module - 03
Biotech Product commercialization: Regulatory Approval Process
Lecture - 11
Regulatory Framework for Genetically Engineered Plant

Hello all. Welcome back to the course again. And today we are in the 3rd module of the course. And in this module, we would be dealing with the regulatory approval process for the different types of biotechnologically derived product. So, in this module, let us start with the genetically engineered plants. So, today we we will discuss about the regulatory framework for the genetically engineered plants.

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And in this discussion, we will focus the need for the biosafety regulation for the genetically engineered plants; and who are the regulatory authorities; who are involved in the process of the regulation or approval procedure for the genetically modified plants.

And what are the different regulatory guidelines or different provisions in terms of legal Acts, rules and regulations; are there any provisions which are controlling the whole process of approval of genetical engineered plants; and what are the international

obligations for the genetically engineered plants. So, these are the points which we will be discussing in this module.

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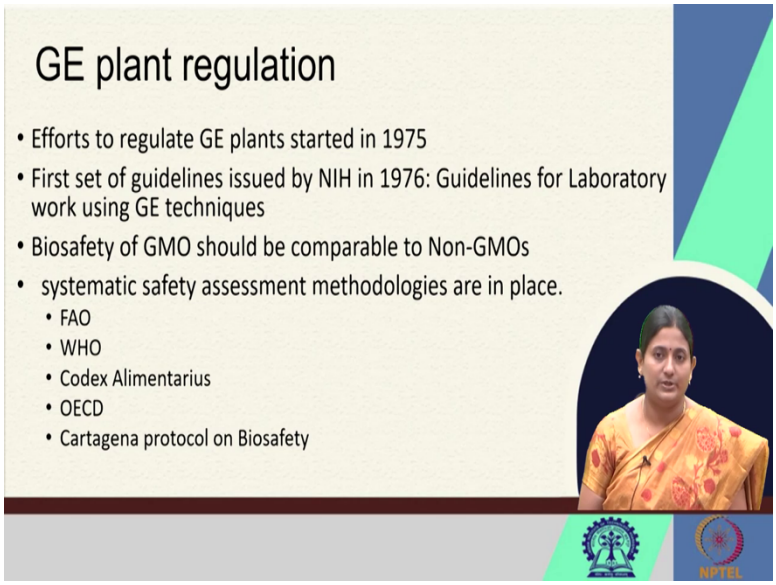

So, we have already discussed about the legal and ethical issues with respect to the development of a genetically modified plants. So, we have seen there are not only scientific concerns when a genetically modified plant is being developed there are other concerns in terms of the environmental, ethical, whether it is safe for the humans for conception, whether it is safe for the animals when it is going to use as a feed or any other purpose.

Or what will be the effect of the what will be the effect on the environment when a genetically modified plant is allowed to proliferate in the natural environment. So, these are the concerns which generally come up whenever there is a development of genetically modified plant.

And we have also seen that there are instances where the newly developed plants, where the new trait or new gene has been inserted, it may lead to undesirable characters in terms of adrenergic response or other effects may be there. So, it needs to be properly assessed before it is released to the environment.

And for that only we have a proper regulatory framework in place which not only sees or oversees the in-house development of a genetically modified plants starting from a lab

scale research, it also regulates the little bit pilot skill studies or we when we are going to experiment in the fields so field trials, and final approval which leads to the product commercialization in the normal market.

So, if we will go to little history of the development of the regulation, we will find that the regulation of the GE plants have started as early as 1975. So, as you know the recombinant DNA technology, it is during 1973 around the technology was in place, and it has after that being used for the development of the various genetically modified plants and other organisms.

So, when this technique came into focus, number of scientists have started working on this. And we really do not have did not have any particular protocol or safety guidelines as such for the recombinant DNA technology. And then with the increased use of this technology, it was felt that there should be certain guidelines which would control the development of the genetically modified organisms or use of this rDNA technology in number of experiments.

To this end, the National Institute of Health in 1976 for the first time developed a sort of guideline which is known as the Guideline for Laboratory Work using the Genetical Engineer Technology. So, this was a very basic guideline which guided the scientist to how to go about the different experimentation while using the recombinant DNA technology in the lab.

And after that, many of the organization they started developing their own set of regulation. And the most notable being the development of guideline by the OECD which is generally referred to as the Blue Book also in case of this, a development of the recombinant DNA techniques. So, the OECD developed a set of guideline which is generally followed by the other member countries.

So, if we see now there are lot of guidelines and not only developed by individual countries, but also there are guidelines of international statutes developed by various international organization like these FAO or World Health Organization or Codex Alimentarius or the OECD which I mentioned. And there are also guidelines under this conventional biodiversity and Cartagena Protocol on Biosafety. So, these are the notable guidelines which briefly regulates the development of the genetically modified plants.

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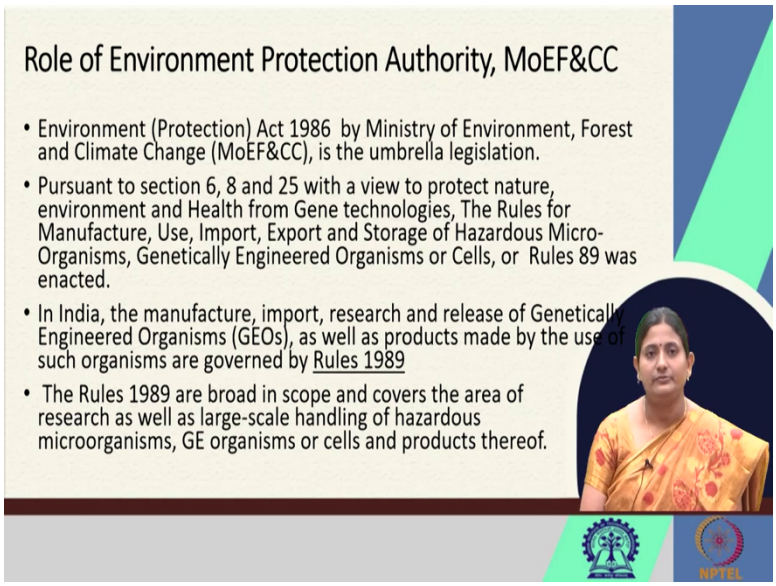

And coming to India, if you will see the ambit or the scope of regulation for the Genetically Modified Organisms - GMO, not only plants, but also animals lies in the domain of the Ministry of the Environment, particularly our environment protection authority under the Ministry of Environment, Forest and Climate Change is the umbrella organizations which regulates all the aspects related to the use of this recombinant DNA technology to the development of the genetically modified organisms and their dispersal or their release into the environment.

So, the environmental protection Act of 1986 by the Ministry of Environment, Forest and Climate Change, is the umbrella legislation which basically governs the regulation which governs the whole aspect of the recombinant plant or animal development. So, if you will see, in pursuant to the section 6, 8 and 25 which basically aims at protecting nature or environment or health from the purview of the gene technologies.

The Ministry of Environment, Forest and Climate Change has enacted a set of rules which is most popularly known as the Rule 89, because it was enacted in 1989. And basically this rule is known as the rule for manufacture use, import, export, and storage of hazardous microorganism or genetically engineered organisms or cell or else in short known as the ‘Rule 89’.

So, this Rule 89 is an exhaustive set of rules which basically deals with all the aspects starting from the manufacture to use of the organism, to import to export to storage of

this organism. And so it is very broad in scope. And it not only deals with the genetically modified plant it also involves genetically modified animals, and handling of all the hazardous microorganisms as well.

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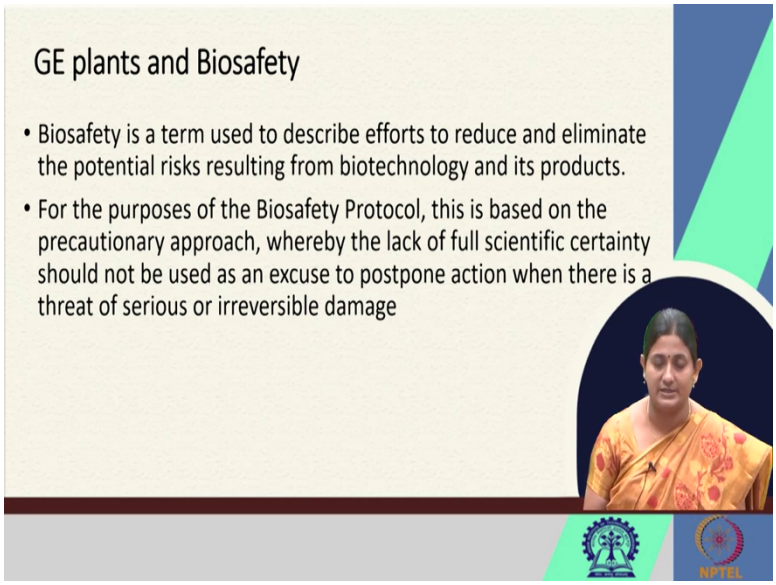

So, why we need this? So, as I said so it is basically to assess the safety of the newly developed product which is genetically modified. So, in scientific terminologies, we call it the biosafety assessment. So, this biosafety is a term which is used to describe the effort to reduce or eliminate the potential risk resulting from the biotechnology and its product.

As I mentioned there are different apprehensions regarding the newly developed product because it has a foreign gene or it has a newly modified gene inside it. So, those apprehensions whether or not the newly developed product is as safe as an existing food item or existing product, so that it has to be assessed in a comparative study.

Means, if I am releasing a genetically modified plant is it safe to consume as if it is in natural form or what would be the effect? So, those things are assessed in the biosafety protocol. So, this is one way of comprehending that provision, but not only it starts at the comparison level, but starting from the lab scale development.

So, all the experiment should be carried out in a contained environment, there would be no contamination or in the sense no release of the pathogenic organisms to the external

environment. All these things has to be taken care of starting from the development initial R&D phase to the final product development.

So, basically for the purposes of this bio safety protocol, it is based on the precautionary approach, where the lack of full scientific certainty should not be used as an excuse to postpone the action when there is a threat of serious or irreversible damage.

So, as far as possible all the aspects in the development and all the parameters which may be tested has to be generally carried out, so that the consumer or people should perceive this product as a safe product whenever it comes to the market or whenever it is released into the environment.

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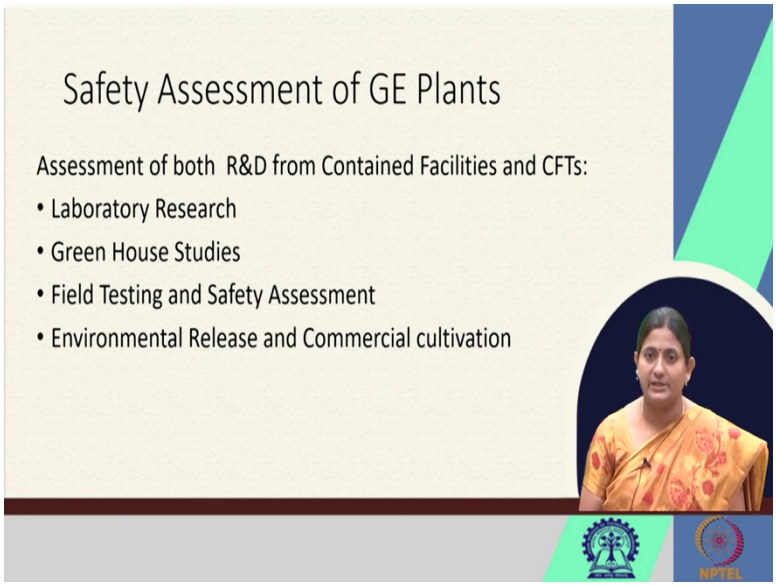

So, if you see the assessment of both the research and development and assessment in the contained facility, or assessment in the confined field trials has to be taken place or has to be done in order to assess whether the product is safe or not. So, there are different stages in which the biosafety protocol acts during the laboratory research period, during the greenhouse studies, during the field testing or the safety assessment, and final in the environment release or commercial cultivation.

So, whenever a first organism is developed it is tested in the lab, then the small scale experiments are performed in a greenhouse condition, as it is a contained condition

where it is kept isolated from the external environment. So, that there will be no cross-contamination from outside environment or from inside to outside.

And then once it is ascertained that it is well expressed as desired, then it may be tested in the field in a limited area of the land maybe 1 acre or something like that.

And then the safety assessment is performed in an open space, so that there is interaction with the other environmental parameters. And then finally, it is released into the environment for the commercial cultivation. So, in each of these steps the assessment has to be carried out.

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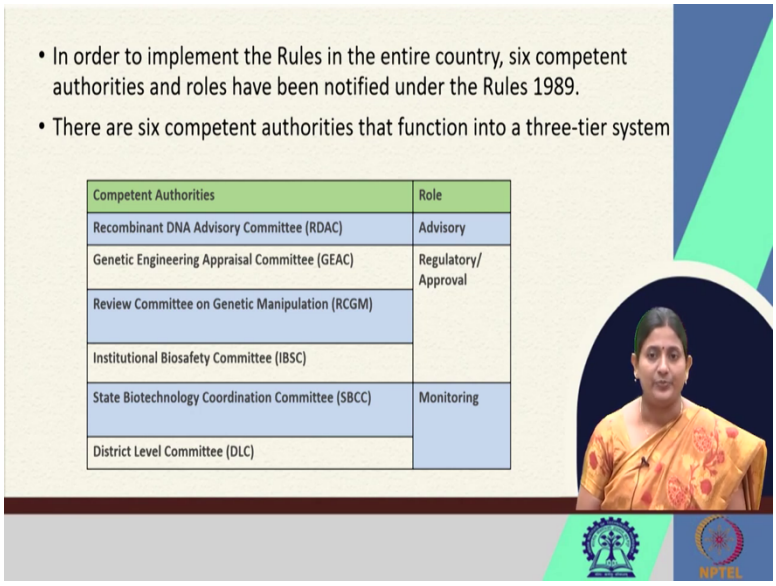

So, we said that ok, there has to be protocol where the assessment should be carried out in terms of the health risk, or in terms of the risk, when it is used as the food substance or that total risk, when it is released to the environment, then we have to understand it under the Environmental Protection Act -who are the bodies; who will be basically regulating all the structures.

So, we discussed about the IPR there are different authorities which deals with the IPR issues, but when it comes to regulation then there needs to be certain scientific group or social scientist or there is a amalgamation of different people from different field of science and social science, and then they basically review the decisions of or review the different study which is given as a test result so that the product can be approved.

So, if you see under this Rule 89 which is the implemented in 1989, it has designated six competent authorities that will be taking care of all the regulatory aspect with respect to the GM plants. And if we see broadly these six competent authorities were divided into a three-tier system means some authorities are solely advisory in nature, some of them are involved in the regulatory or the approval process, and some of the authorities are monitoring in nature.

So, the six competent authorities under this Rule 1989 are the Recombinant DNA Advisory Committee which is solely advisory in nature is basically advises how to develop the scientific endeavors or how to plan for differ the scientific growth of this country. So, this is mainly advisory in function.

Then for the regulatory approval starting from the institutional level to at the final level, we have three different types of bodies which is known as the Genetic Engineering Appraisal Committee or the GEAC. There is Review Committee on Genetic Manipulation. And there is Institutional Biosafety Committee at the institute level.

And to monitor whether or not the all these experiments are going on properly, we have two bodies in place which are the State Biotechnology Coordination Committee, and the District Level Committee. So, these are the six bodies which function together to assess whether a genetically modified plant developed at the lab scale and then progressed into the commercial scale would be safe to release into the environment or not.

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So, let us go into little bit detail of each of this functioning of each of these bodies. So, first is the Recombinant DNA Advisory Committee or RDAC. So, basically this committee is set up under the Department of Biotechnology. And its function as I mentioned earlier it is more advisory in nature.

So, this RDAC basically reviews the development in the area of the biotechnology at the national and the international level. So, basically they oversee what are the developments at the international level and how at the national level we are coping with them, and what would be the national policy to further, so that we are at par with the other international developments.

And this RDAC recommends suitable and appropriate safety regulations in India in the area of recombinant research, and the use and the application time to time. As you know, the technology is evolving and different parameters are coming up, so the use or the application or to go about the safety assessment that is also changing.

So, to keep up with the pace of scientific development, they suggest suitable and appropriate safety regulations. And one of the important functioning the RDAC is to evolve some long term policy for the research and development in the area of the recombinant DNA, means how we can progress in the area of the recombinant DNA research.

So, this is the basic function of this RDAC which is a body set under the Department of Biotechnology. So, in this way if you see the whole regulation for the genetically modified plant, it is not only under the Ministry of Environment and Forest and Climate Change, but also linked with the Department of the Biotechnology.

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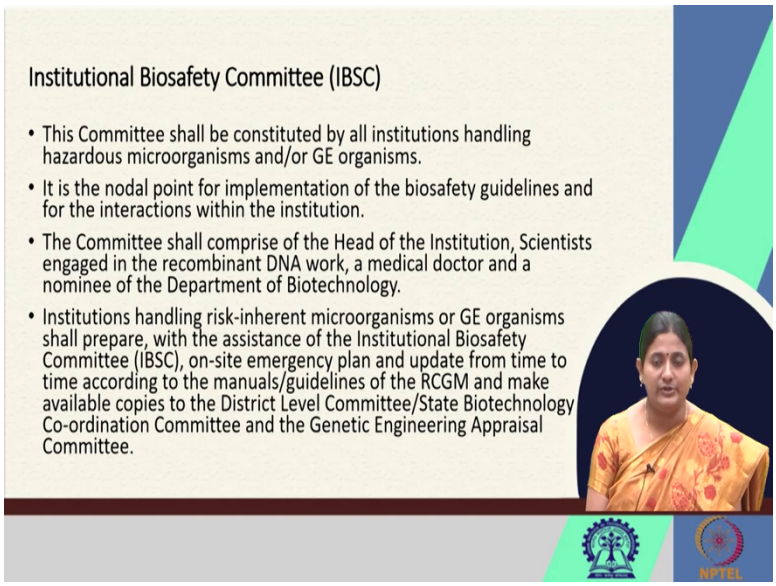

Then coming to the regulatory or approval functioning of the whole bodies which are involved in the approval. The first body or first organization which comes into play is the Institutional Biosafety Committee or IBSC. So, basically this IBSC or Institutional Biosafety Committee should be constituted by all the institutions who are handling high hazardous microorganisms or any genetically engineered organisms.

So, any of the institute that is working in the area of the genetically modified plants or genetically modified animals should have an Institutional Biosafety Committee. So, this will be a nodal point where the implementation of the biosafety guidelines and different interactions within the institution or the other bodies should be taking place. So, this would be the main nodal point or the contact point.

And in general this committee should comprise the head of the institution, other scientists involved in the recombinant DNA work, and a medical practitioner or medical doctor, and a nominee from the department of the biotechnology. So, basically they try to have the representation from the different fields with different stakeholders, so that a proper safety protocol can be practiced.

So basically the institutions handling the risk-inherent microorganism or the genetically engineered organism should prepare, with the assistance of this IBSC, the different on-site emergency plan or the update on how to implement the various manuals or the guidelines or safety protocol.

And basically in the time of need they cooperate with the District Level Committee or the State Level Biosafety Committee, so that the assessment or the risk assessment or safety assessment can be properly examined. This is the basic body which should be there at the institutional level,whoever is involved in the recombinant DNA research.

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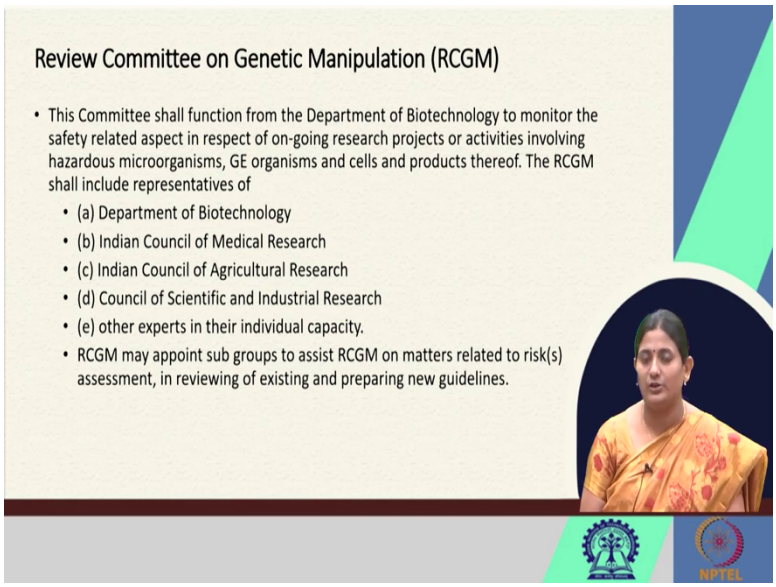

Then the next important committee which is related to the approval of the genetically modified plant is The Review Committee on the Genetic Manipulation or RCGM. So, this committee functions under the Department of the Biotechnology, and it basically monitors the safety related aspects of the ongoing project, and whichever project is involving the hazardous microorganism or genetically modified organisms.

And it is also a kind of a committee where different members from different fields are there. So, they may have representatives from the Department of Biotechnology or they may have representative from the Indian Council of Medical Research (ICMR), persons from Indian council of Agricultural Research, from the CSIR - Council of Scientific and Industrial Research, and different experts in the individual capacity are also members of this committee.

And depending on different cases they may appoint sub groups to assist the RCGM to matter related to assessment of the risk and in case of preparation of the new guidelines or reviewing of the existing guideline. So, this is an important body under the DBT.

And this is also one of the crucial body which checks or assesses the data during the confined field trials or during the short compiler skill studies when the total area of research or total area of the field trials is confined to less than 1 hectare. Basically RCGM is the one which gives approval for those kinds of research.

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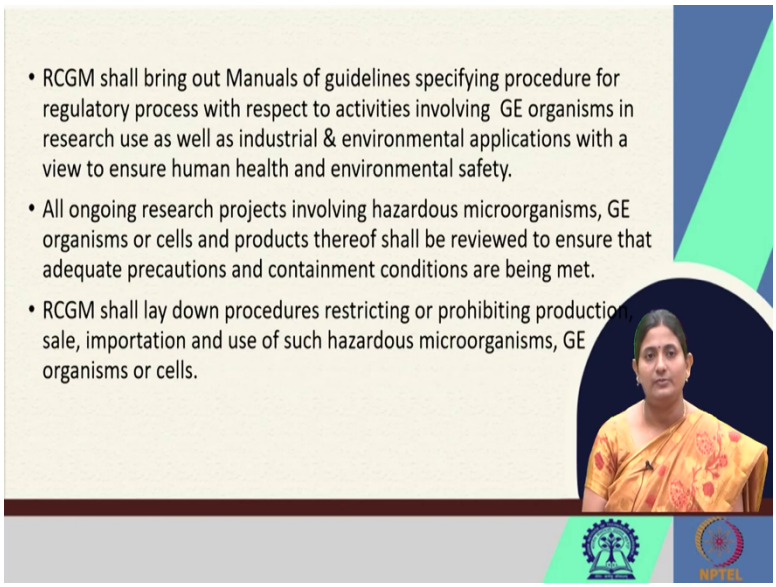

So, this RCGM generally brings out the manuals or the guidelines and specify the procedure for regulatory process with the different activities related to the genetically modify organisms as well as the industrial and environmental applications so that even though the GM plants are used it ensures a safe environment as well as safety from the health safety angle. They provide the guidelines.

And they basically review all the process or procedures which the institutional biosafety committee prepares during their own experimentation. And once their approval is given, then only the like larger or field scale trials can be taken place. And it also lays down procedure for restricting, or prohibiting the production of the sale, or importation of other microorganisms or any other modified cells.

So, RCGM, is at the central level because it is it has also representation from the different stakeholders. So, after the IBSC or institutional level, it this is the first committee which basically controls or regulates the matter related to the development of the GM plants.

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Then the third most important committee for the or the apex body for the regulation of the genetically modified organism is the Genetic Engineering Appraisal Committee or the GEAC. So, the Genetic Engineering Appraisal Committee which is formerly known as the Genetic Engineering Approval Committee or GEAC, earlier it was regarded as the approval committee.

So, the name has changed since 2010. So, the major function of this GEAC is to appraise the activities involving large scale use of the hazardous microorganism or genetically modified organisms which are used in the industrial production from the environmental angle, means when it is a confined field trial, the RCGM is the apex or RCGM is the main body which regulates the activities.

But when it comes to the environment, when it is released to the environment for the large scale field trials, then GEAC is the body which deals with the safety assessment from the environmental angle. And other function involves to appraise the proposals relating to the release of the genetically engineered organisms and product to the environment from including the experimental field trials.

And the committee or any person authorized by this committee also has the power to take punitive action under the Environmental Protection Act. If some organization or some institution, do not comply with the regulation or the guidelines and that may have resulted in the certain laws to the environments.

So, the GEAC has the power to take punitive action against those bodies or those institutions. So, GEAC is the apex body for the final approval into the large-scale field trial have the release of the modified plant into the environment.

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Other two committees which we have to discuss is having the monitoring function- it is the State Biotechnology Coordination Committee or the SBCC. So, the State Biotechnology Coordination Committee is a monetary committee at the state level. And it has the power to inspect investigate and take punitive action in the case of violation of the statutory provisions through the State Pollution Control Board or the Directorate of the Health.

And it basically reviews the safety control mechanisms or the measures periodically at various institutions who are involving the genetically engineered organisms. And it also acts as a nodal agency at the state level to assess the damage because of the release of the GE organism, or to lapse of any of the on-site control mechanism.

So, these bodies are again like monitoring in nature and may not always function, depending on the cases the State Biosafety Coordination Committee function and assess the various experimentation in on-site experimentation.

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And after that we have the District Level Committee, District Level Biotechnology Committee is formed in the districts wherever it is necessary. And it is under the control of the District Collectors. And they basically monitor these safety regulations which are installed,during the installation or engagement of the genetically modified organisms or hazardous organisms and their application in the environment.

And what they do is that any person authorized by the District Level Committee or the District Level Committee itself, they basically visit the site where the experimentation is taking place, where there are genetically engineered plants or hazardous microorganism. And they try to find out if there are any hazards or any risk associated with the particular installation of this kind of the plants.

And they basically coordinate with the State Biosafety Coordination Committee to meet any emergency situation. And they also prepare the off-site management or off-site emergency plan. And the District Level Committee generally submits its report to the State Bio Technology Coordination Committee or GEAC for the proper assessment of the risk arising out of the genetically modified plant.

So, briefly these are the things which I mentioned, are the rules of the various committee which are functioning under the rule in 1989 and functions under the Environmental Protection Act.

And some are created by the Department of the Biotechnology, and some are directly functioning under this Environment Protection Act, Ministry of the Environment. So, both of this bodies, together they function for regulation of this genetically modified plants.

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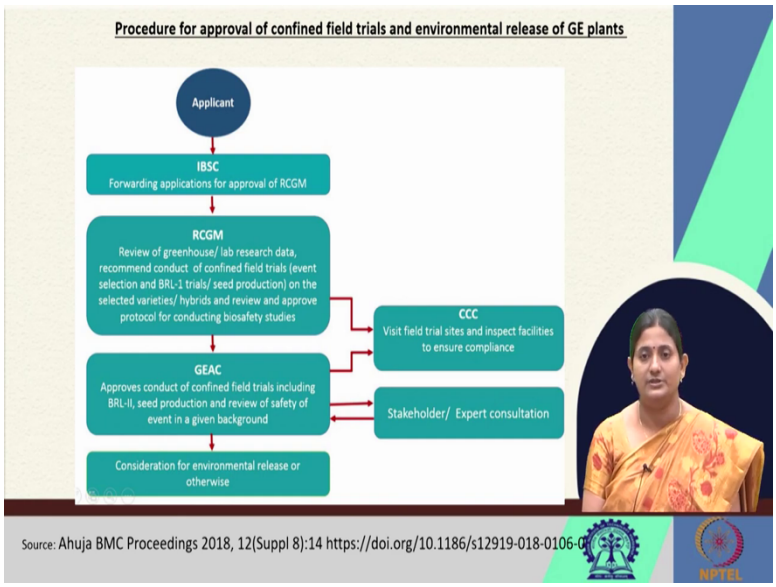

Now, if you see the brief process through which a genetically modified plant is released, is that if there is any organization who are or there is a lab or small university or any college which involved in some sort of genetically modified plant research, they may apply for the larger scale trials or release of this plant to the environment through these bodies.

So, first generally the application is submitted to the IBSC or Institutional Biosafety Committee which basically is a forwarding authority, and it goes through the application and where proper plans has been set up how to conduct those experiments. And the application is forwarded to the RCGM or Review Committee for the Genetic Manipulation.

And the RCGM, next on the receipt of this application, they review the greenhouse or the lab research data and they further approve or recommend the conduct of the confined field trials, which is known as the biosafety research level 1 trials for the seed production. And depending on the data submitted or protocol submitted, they may allow

certain varieties or hybrids or they may review or approve the different protocols for conducting the biosafety studies.

So, first, again I am mentioning that the first level or BRL-1 trials are generally approved by the RCGM. And once the BRL-1 level, the experiments are carried out successfully and you have the sufficient data. Then if you need to conduct the BRL Level 2 or the Biosafety Research, Level 2 a scale of experiments for the seed production or the for the review of the safety, then the application is forwarded to the Genetic Engineering Appraisal Committee.

And this GEAC approves the conduct of the confined field trials including this BRL-2 trials and with the help of the given data or the background which has been submitted to the GEAC. And once it is successful then finally, GEAC is the body which gives the consideration for the environmental release or whether it will allow the plant or not.

And in between we have seen that the Coordination Committees, they visit the field trials, inspect the facilities, and ensure the compliances. And at the final level, there are stakeholders or the expert consultation, that in total decide whether a genetically engineered plants can be released in the environment or not.

So, this is the main procedure through IBSC to RCGM to GEAC and the State Level Committee and the District Level Committee being the monitoring committee. So, briefly this is the approval process through which genetically modified plants are generally approved in India.

So, if you see so far in India, we have only one genetically commercially available crop that is the BT Cotton. And in 2016, India was one of the major producers of the BT Cotton, though many applications have been filed with the IBSC and RCGM at different levels, but none of the cases has become successful.

There are many concerns. So, BT Brinjal was once at the verge of getting commercialization approval, but again due to some ethical issues and other issues, it was not approved. So, this is a long process. And sometimes on the case by case basis different committees are also set up so that they can properly assess the data and then allow the approval of the genetically modified plants.

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So, as I mentioned, Rule 89 is a major one which again specifies who will be the bodies how it should be done. But apart from that we have many other guidelines or the regulations which directly or indirectly regulates the whole process of the genetically modified organism.

For example, the Recombinant DNA Safety Guideline of 1990, so this is a set of guideline which basically tells you how to go about the laboratory scale experiment using the recombinant DNA technology. Then depending upon the nature of experiment whether it is being carried out in the plants or whether it is carried out in the animals, we have other guidelines as well.

Like we have the Revised Guidelines for the Research in the Transgenic Plant which is given in 1998. Then in case of the product developed by the biotechnologically the high process, we have Guidelines for Generating Preclinical and Clinical Data for the rDNA based Vaccines, Diagnostic and the Biologicals Guideline for the Safety Assessment of the Food Derived from the Genetically Engineered Plants.

Guidelines for the Confined Field Trials of the Regulated Genetically Engineered Plants, then Guidelines for Monitoring the Confined Field Trials, then Standard Operating Procedures for the Confined Field Trials for Genetically Engineering Plants. Protocol for the Food and Feed Safety Assessment which is enacted in 2008, then a number of

guidelines for the pharmaceutical sector, then environmental risk assessment, and total risk analysis framework.

So, you can access this whole set of guidelines in the Department of Biotechnology website, or you may also visit dbtbiosafety.nic.in. So, exhaustive list of guidelines are given there. So, if you have interest in knowing further into what are the guidelines and what aspect it covers, then please visit the DBT biosafety site, so that would give you a comprehensive understanding of this guidelines.

So, the purpose of showing you all these guidelines is that, the whole process of development is not streamlined and narrowly defined one, but on the other hand it is a very broad concept where number of guidelines or regulations are playing a part.

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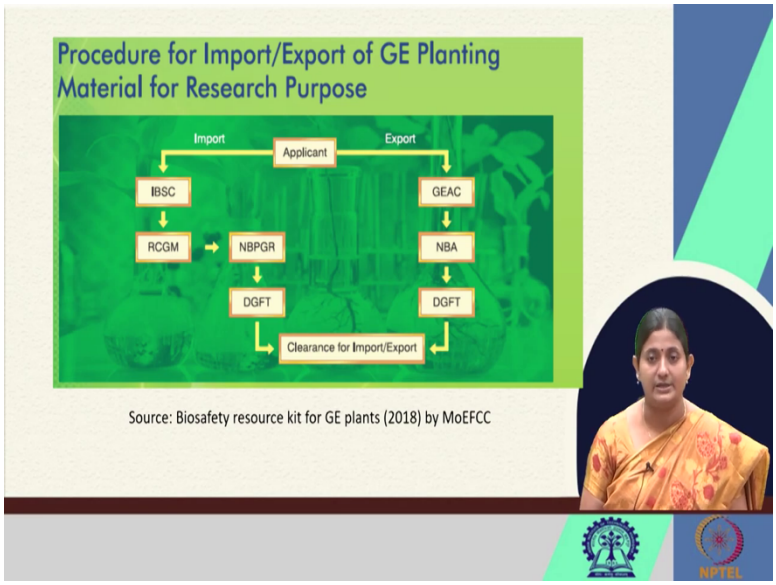

And now as you know the research is not only limited in a single country, many a times what happens you need the assistance of other countries or you need certain resources from other countries, or you need to send those things to other countries. And because this is genetically modified organism, and there are certain inherent risk associated with these organisms.

So, the import or export of this GE plant for research purposes is also not easy. It is further regulated by different agencies or different bodies. For example, in India the if you want to import certain materials from what you call from any other country for your

own research purpose, you have to get permission not only from the Institutional Biosafety Committee which again takes permission from the RCGM.

But we have a particular 'one point contact' or the focal nodal point for all this plant genetic resource at a National Bureau for Plant Genetic Research - NBPGR. So, NBPGR is the nodal body which basically controls or oversees all the aspect related to import and export of the genetic resources and further we need the clearance from the Director General of the Foreign Trade - DGFT, so for this clearance of export or the import.

Similarly, if you want to export certain genetic resources to outside India, then also you need to have permission from the GEAC which again have to take consent from the National Biodiversity Authority and which again have to like the it has to be it has to be in consent with the DGFT or Director General of Foreign Trade for the final clearance in the export or import.

So, because you know there are risk, so you can have a proper risk assessment or risk management plan at place. So, all these bodies function in a hierarchical manner, so that the import or export of the genetic resources can be carried out in a safe manner.

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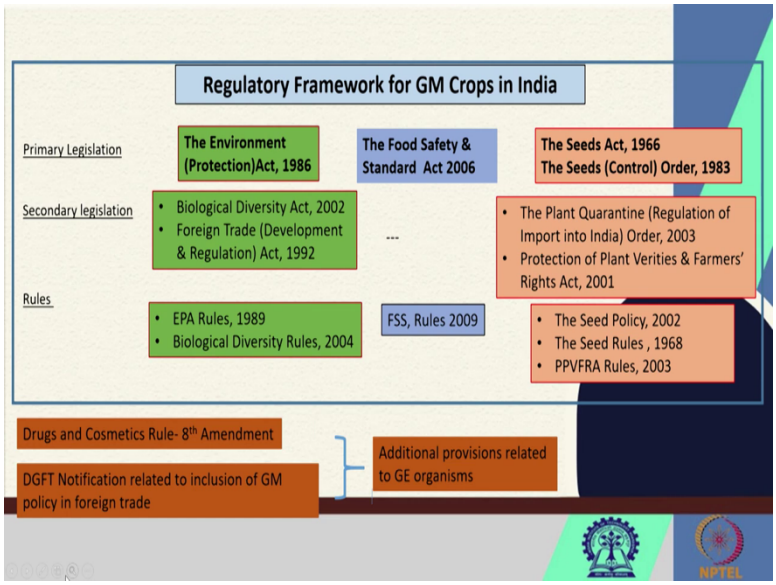

So, this is a chart which I wanted to show you to just an have an idea like the ambit of different types of legislation which is somehow related to the GM crops in India. For example, if you see the major regulations or major act which governs the development

and commercialization of the genetically modified plant is the Environment Protection Act of 1986.

Then when it is being used for the food purpose means when there are certain food items which is derived from the genetically modified plant, it has to be regulated through the Food Safety and Standard Acts of 2006, and also we have provisions under the seeds act of 1966, and the seeds control order of 1983 which have also different provisions which are related to the development of the GM plants.

Now, for example, the if certain genetically modified plant has the potential to be cultivated, then how long should be the field trial. So, it says that ok, there might be 2 years of consecutive research or understanding that ok this plant can be cultivated in a commercial scale.

So, different provisions are also given under the Seeds Act and we can see the rules for them. So, we have different EPA Environment Protection Act and its rules of 1989; the Food Safety Standard Act, we have the Food Safety Standard Rules of 2009 how should be the labeling, packaging, requirement, everything has been given there.

And the secondary legislation if we talk about so we have this Biodiversity Act of 2002 which is again based on the convention of the biological diversity where we talk about the sustainable development, access benefit sharing, and protection of the genetic resources. And under that we have the Biological Diversity Rules of 2004 which is also taken into consideration while development of this GM plants.

And then as I mentioned so Foreign Trade Development Regulation Act of 1992 and this Director General of Foreign Trade is also involved in many of the activity for the GM crops. And under the Seeds Act, we have the seed Rules 1968, then we have the seed policy of 2002 which also talks about the GM plants.

And we have already gone through the Plant Variety Protection Act of India the Seed Generates Legislation where the new varieties of the plant can be protected which is which are developed through the biotechnological process. So, we have this Plant Variety Protection and Farmer Rights Act Rules of 2003, farmer authority 2003 which talks about the different aspects of GM plants as well.

Then plant quarantine order like if something is being imported to India, again for the safety in the biosafety assessment it has to be quarantined. So, this plant quarantine regulation order of 2003 is also applicable for the development of the GM crops in India. So, this so different legislations are there which are together taken into account in the development of the GM crops.

Again this is when we are talking about the GM organisms or any genetically modified thing which is coming out of this GM organisms, then other provisions may come into picture like the Drugs and Cosmetic Rules 8 Amendment, then this DGFT notification related to the inclusion of the GM Policy in the Foreign Trade. So, those may be considered.

We will discuss them maybe in the next chapter when we discuss about the regulatory approval of the drugs, but in case of the plants these three regulations are very important, and they are directly related with the development of the GM plants.

So, this was a snapshot of all the regulations on Acts which are there which overall governs the regulatory framework for GM crops in India. So, in the next session, we will deal with the international obligation for adopting the biosafety procedure and other things.

Thank you.