INDIAN INSTITUTE OF TECHNOLOGY MADRAS.

Indian Institute of Technology Madras
NPTEL
National Programme on Technology Enhanced Learning

NUCLEAR REACTOR AND SAFETY
AN INTRODUCTORY COURSE

Module 14 Lecture 03
Safety Practices in Indian NPPs cont…

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Good morning everybody in the last two lectures we had covered some of the safety practices which are being followed in the nuclear power plants and in the last lecture I was talking to you something about the on-site emergency response.

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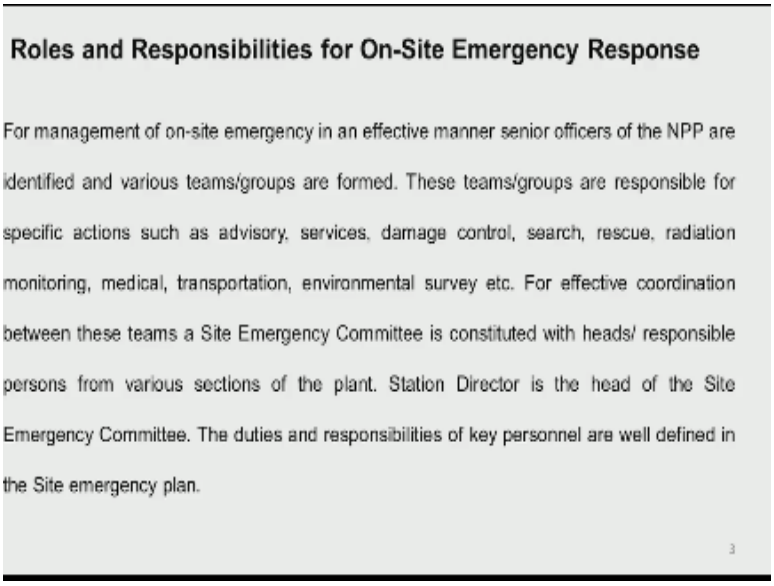

Integral good morning everybody in the last two lectures I had apprised you about the safety practices which are being followed in the Indian nuclear power plants the principles of course have been enunciated earlier.

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But what we really do is very important and these safety practices have evolved over practically two to three decades of operation of nuclear power plants we have nearly 25 nuclear power plants in operation and then towards the end of my last lecture I covered something on, on-site emergency response.

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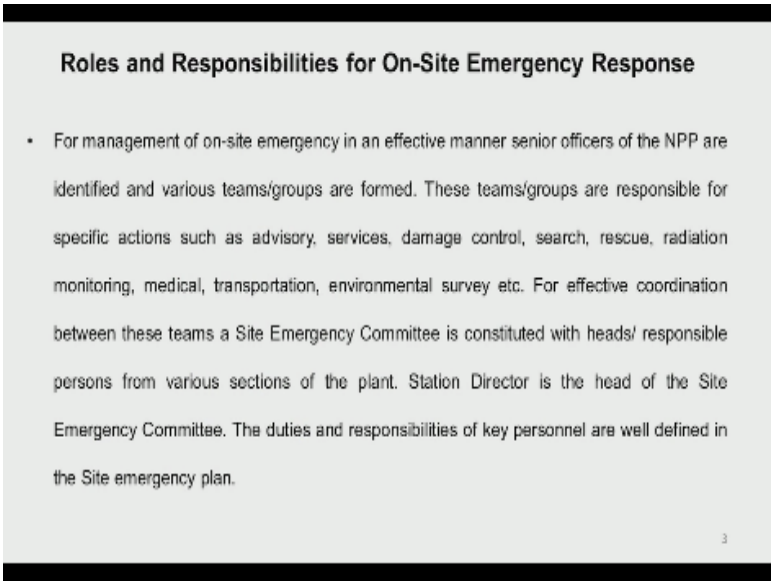

As I mentioned to you we talked about emergency response when there has been an accident and when the accident effect is restricted only to the site we call it on-site emergency and the response for that that means the off-site that the people in the public domain are not affected that was the case with the Three Mile Island reactor where it was only an on-site emergency there is

no radioactivity release from the containment there is no containment failure as in Chernobyl reactor so we have the organization.

I explained to the organization so just to summarize that so here what are the roles and responsibilities for this on-site emergency response effective manner all the senior officers or the plant are put in two different teams and each team is given a specific role one could be an advisory role one could be a damage control other could be a search and rescue then radiation monitoring the medical if any person has to be attended to then the environmental survey transportation transporting the people from the site to outside so and to have a good coordination between the site.

Between the different agencies which we have identified within teams in the site we have the site Emergency Committee so the site Emergency Committee will involve all the responsible persons and the headed this emergency committee would be headed by the station director so that is what was the important thing this such an organization for on-site emergency response now we come to the off-site emergency plan.

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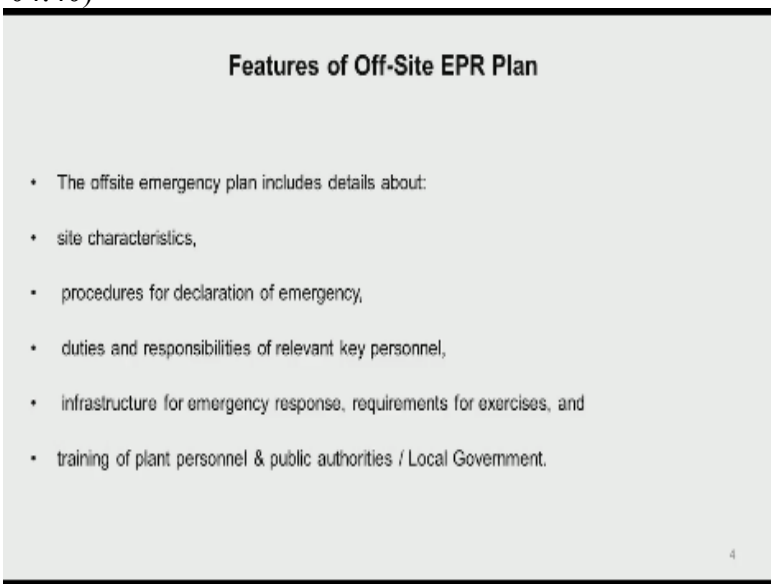

Of course offside emergency means on-site emergency is also there but when we make the procedures we do not write in the procedures okay off-site emergency plan follow the procedures in on-site plus something we make it very clear what is to be done so there are no doubts about following how to follow so the offside emergency plan what it needs it needs a site

characteristics and again here who has to declare the emergency because the pin the public domain people are getting affected then again the role comes of the duties and responsibilities is a personal here not only the personal from inside the site from outside.

The site also will be involved we will see who are all involved then again the infrastructure which is needed to see that the emergency response has been done properly and what sort of requirements are need what sort of excises need to be done this exercise means even though you do not have an emergency as such we try to do a mock excise so that is why they take this called exercise then last. But not the least we need to train people who are not in the nuclear domain basically the people in the public domain the officials of the state government officials of the district officials of the panchayat and other public authorities.

We have to teach them so that are in train them so that they can help us in such a case of an emergency.

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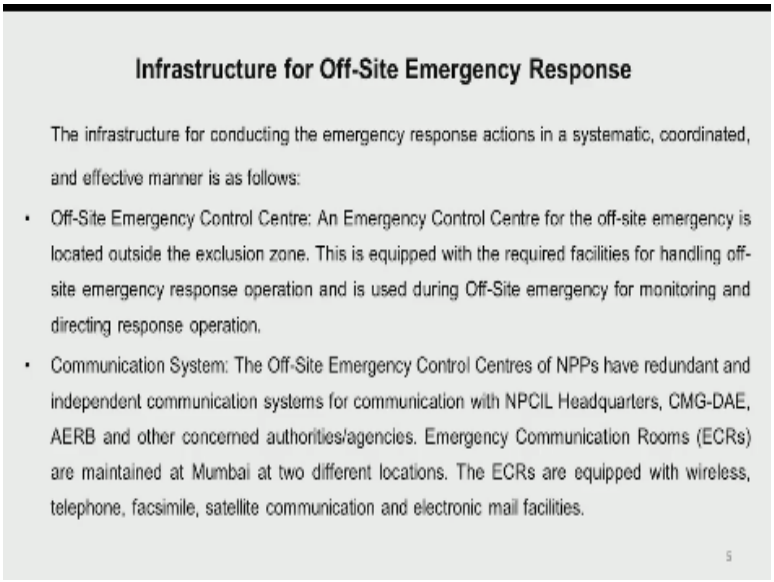

So what would be the infrastructure when we talked about a non-site emergency we had an emergency center in the site but not but not in the facility outside the facilities but here in the case of an offsite emergency we need to have this emergency much beyond the exclusion zone because activity is going to be there in the exclusion zone so the location of an offsite emergency control center will be outside it would not be the same control center as for on-site emergency

response so this Center would be needed to be equipped with handling the emergencies so not only the handling emergencies monitoring and also detecting the response.

So next is the communication system here the communication system will not within sight outside side to other authorities so here all the nuclear power plants which have this off-site emergency control centers they have again redundant and independent communication systems for communicating with the Nuclear Power Corporation headwaters they also need to communicate with the crisis management group in DAE the AERB atomic and regulatory board and different authorities agencies local agencies state governments etcetera so they all these emergency control centers are equipped with wireless telephone, mobiles all facts also that the communication is not going to be affected.

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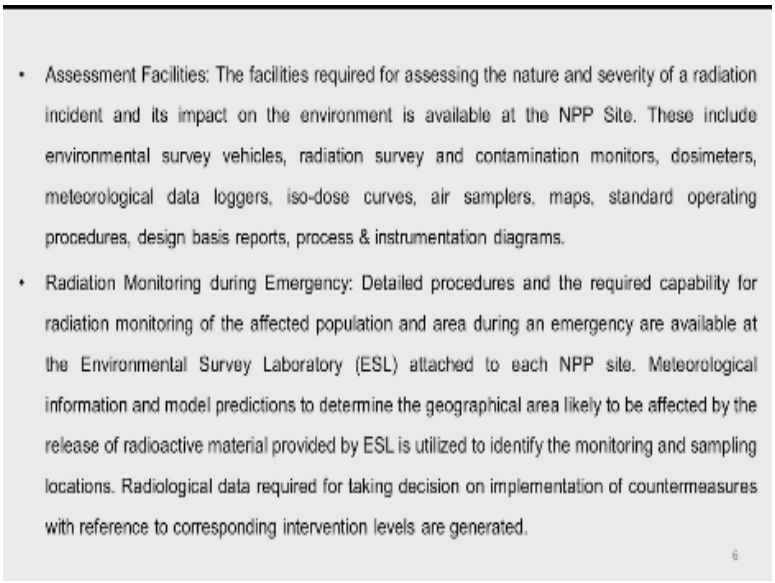

Then assessment as in the case of on-site emergency here also we need an assessment of the whole thing so you require a lot of vehicles which can with which people can go and do the environmental survey radiation survey then we need to have these people need to have contamination monitors then dose meters then meteorological data loggers where they can get the wind speed and things like that air samplers then map of the place then standard operating procedures and whatnot ,so these assessment facilities are essential for any on-site or off-site emergency.

Then radiation monitoring during emergency here the detailed procedures are very important and in case of a such an emergency we immediately take advantage of the environmental survey laboratory which is there in the public domain located in the public domain and again the meteorological data all are available at the internal survey lab so we need to identify the monitoring and sampling locations the CSL will do based on the meteorological data which direction things are moving and carryout the countermeasures with reference.

To the intervening levels that is if the activity is not necessary for intervention you need not intervene but if it is to be intervening you intervene so this is where the radiation monitoring helps you went to intervene that is most important.

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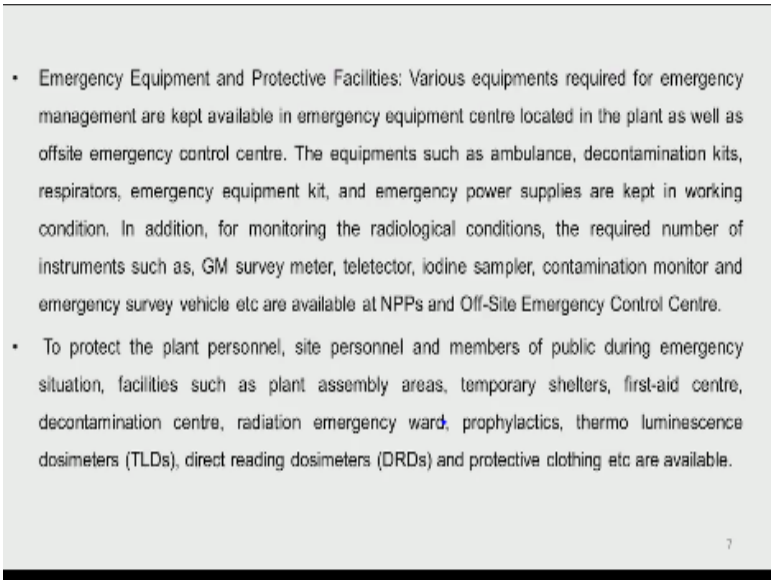

Then you do surely require the emergency equipment protective equipment for example protective clothing for the people who will be in the radiation contamination areas they may require some breathing equipment then you require decontamination suppose it has come to the public domain also still it you have to have some places where decontamination should be there you have need to have an ambulance for taking people who were getting affected by that then of course surely the survey meters iodine samplers all these things are needed at the off-site emergency control center.

So that they can take the and again remember emergency power supply because if suppose the power plant is not working and you are cut off so all these emergency control room should be

provided with the unlimited power supply system so this is a very important thing to note now as in the case of on-site emergency or offset emergency we need the people to assemble in certain areas so that they can be transported to safer area safer areas means we are radioactivity is not there so also herein the case of off-site emergency we will ask them to you know assemble in a spot where the transportation can pick them up.

So they are all identified in the different places and then a first state center which is attached to the hospital very close to the site but not within the exclusion zone so there and there in the first aid center they also have a decontamination center where any person who comes with radiation contamination can be decontaminated then we also have prophylactics I mentioned to you about iodine 131 being given the idea of that is the radioactive ideal which is getting released normally would go and try to go to the thyroid so what we do we give normal thyroid so that normal I did in which is taken by the people and that goes to into the thyroid.

So there is no chance for it to take the radioactive iodine so we have this prophylactics and tides thermal limits and rejected so that the persons who are working there they should not get they should know how much those is they are getting then of course your protective clothing for the doctors and you know nursing personnel all these things are kept in the emergency medical center.

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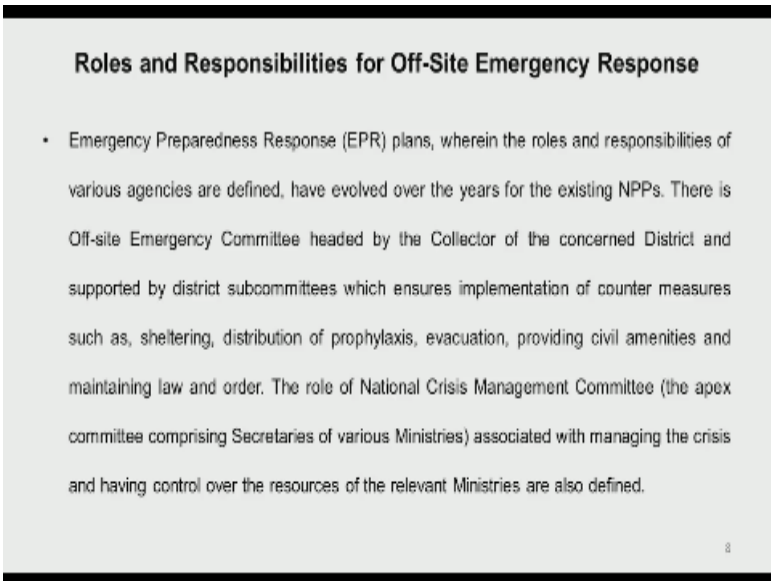

Nowhere the roles and responsibilities of sight emergency this off-site emergency is the head of the off state emergency is the collector. Where has an on-site emergency it was a station director because he only had to take the people in the station consider those only so about whom he has the data but as far as the state is concerned or the district is concerned the collector of the district is the person so all the responsibility right from declaration of the emergency to the removal of the emergency is all the whole thing is vested with the collector of the district for kalpakkam it comes under contributing district so the Kanchipuram district collector is the chairman of the off-site Emergency Committee.

Then he supported by different committees subcommittees in which the plant personnel are also not the plan for the play or the emergency in Randall survey a person all are involved and they will support the evacuation the distribution of prophylactics provision of civil amenities and then you require the police to maintain law and order so that people do not move you know in helter-skelter manner then we have the national crisis management committee which consists of the secretaries of different ministries who need to take an overall picture in the national level and like this these are there now we will go more detail into the different agencies and their responsibilities.

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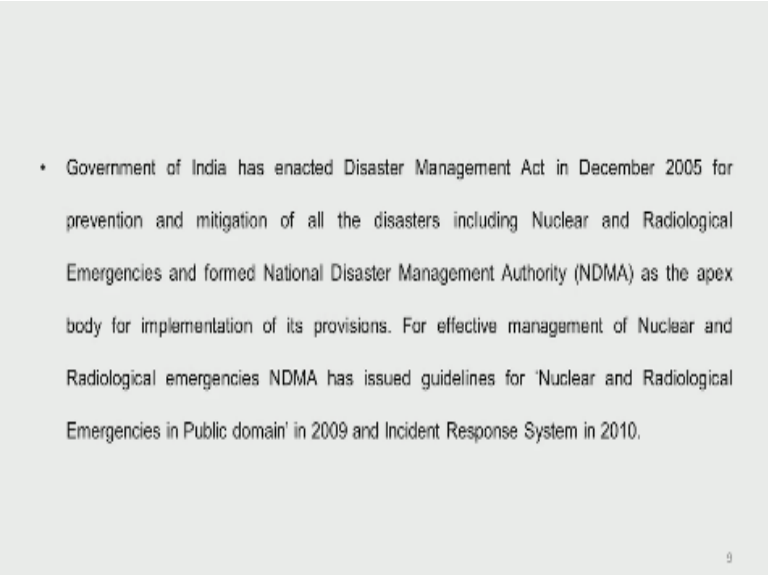

Now after realizing the need that there should be in case of any disaster whether it is a radio activity or whether it is a what I call cyclone disaster or any other type the government of India in enacted catcalled as a disaster management act in 2005 for the prevention and mitigation of all

disasters including nuclear and radiological emergencies so an organization called as national disaster management authority NDMA was formed for this now for each type of disaster NDMA issues some guidelines.

So NDMA also has issued guidelines for nuclear and radiological emergencies in the public domain in 2009 and 2010 they are available.

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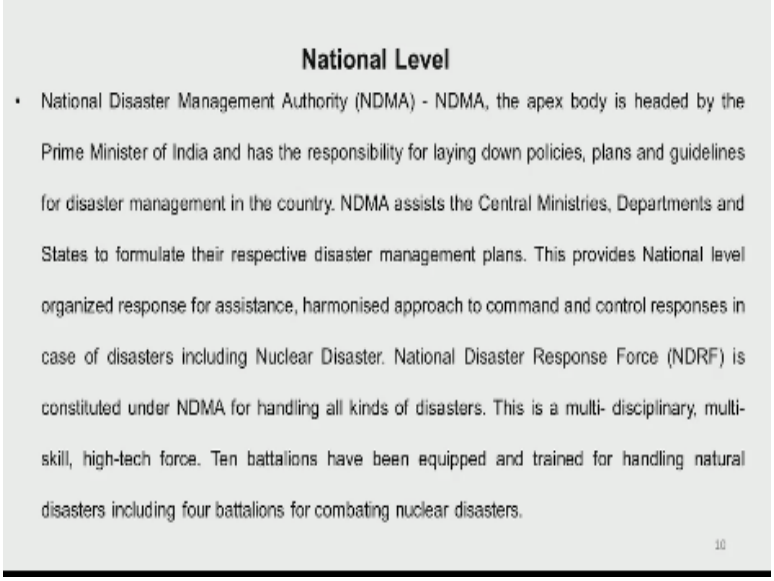

Now let us look at the NDMA is a natural national level and NDMA is as such headed by the prime minister of India because he has a responsibility for laying down policies plans and guidelines for the disaster management in the country now this NDMA again is assisted by the different ministries departments because different departments are involved in the disaster management, so all the departments need to be brought in the right in the beginning level let us say what is a mining disaster the coal ministry would come back.

If it is a you know some disaster or the cyclone then you might need to have the ocean ministry which is concerned with shorelines and all those things would be required the Navy would be required so all those things are brought in and this way you have a very harmonized approach to not only do a command of the holes response not and control the response in case of a nuclear disaster and this NDMA as a National Disaster Response Force which has got different battalions and it is a multidisciplinary force high-technology force and they can handle their plane to handle different natural disasters recently.

You might see the disaster cost by the cyclone in Vishakhapatnam and you find that the deaths were minimal because they could plant the evacuation well in advance they could really take people to safer areas and even though the damage was done by the cyclone which is a natural one we didn't have much of debts.

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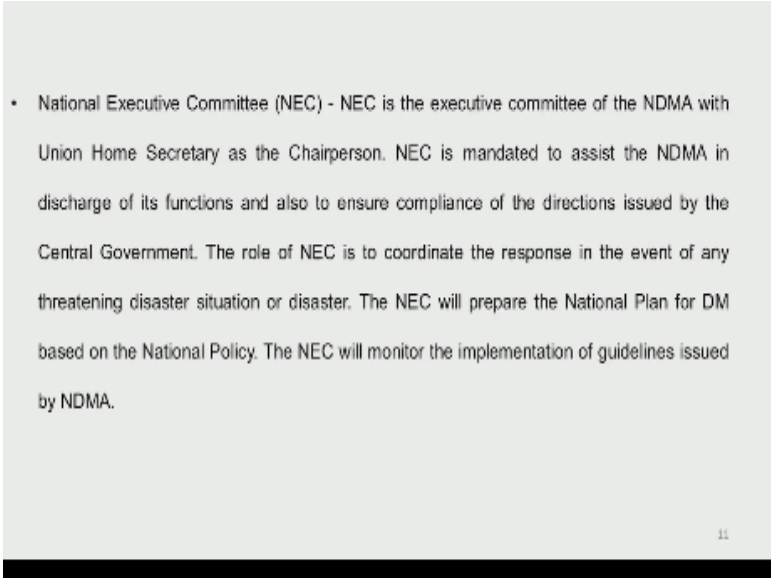

Then we have for the NDMA we have a national executive committee this is headed by the Union Home Secretary as a chat person and he will assist NDMA in the discharge of the function because Home Ministry controls the police and the different local authorities they are in touch so the Home Ministry is also brought in there and the role of this national executive committee is basically to coordinate.

The response in the event of any disaster it is a coordination is a very important one and they also prepare they also advise the NDMA in preparing the different policies not only that the implementation of these policies are also overlooked by the or not there would say monitored by the NEC.

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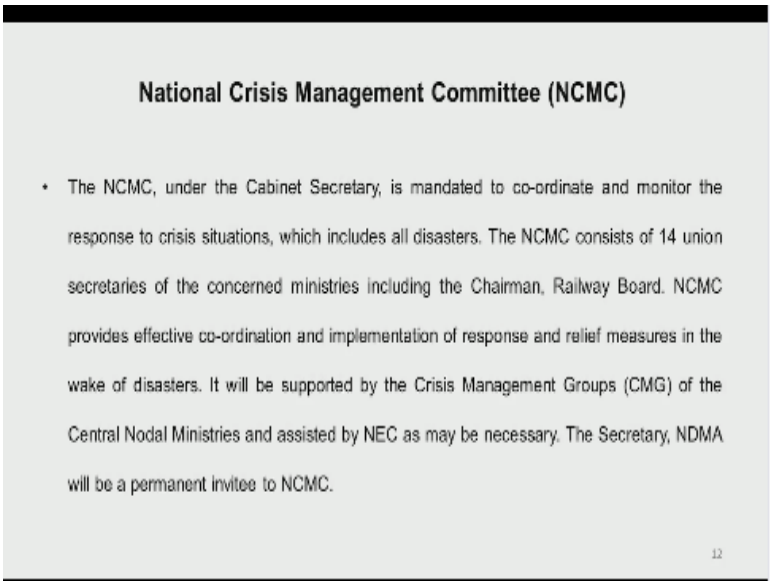

Then in case of a large emergency not only that you have a national crisis management committee this national crisis management committee is headed by the cabinet secretary again it is meant to coordinate the things but at a higher-level it has members of all the union secretaries of the different ministries are there it has a chairman of the railway board and this NC MC is also supported by the crisis management group of the DA or the different ministries and assisted by the National Emergency Committee and the Secretary NDMA is a permanent annuity to the NC NC so this organization different level committees are in place now the crisis management group of DA is a nodal agency.

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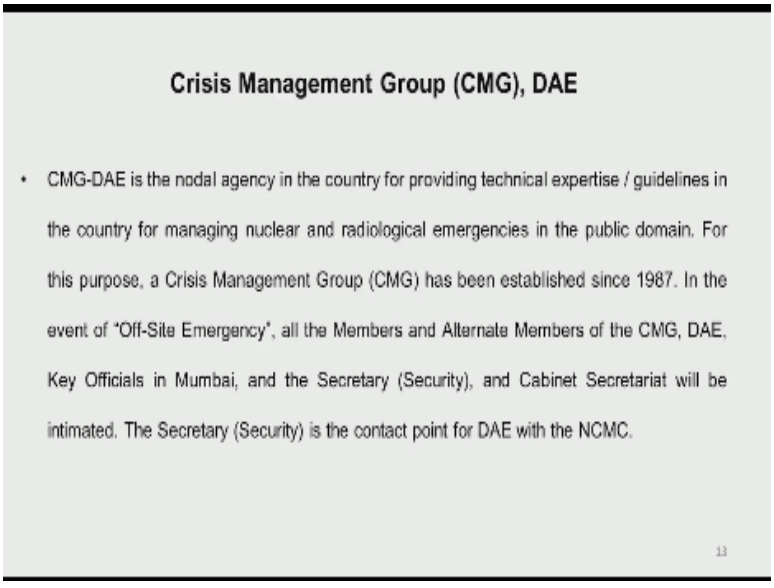

As far as providing technical expertise and guidelines to manage any nuclear or emergency response in the public domain a very stressed public domain so for this purpose this was established in the year 1987 and then all the members of this CMG or drawn from the different units of the DAE and some of the key officials are the security secretary security at the DAE is the person will be the contact point for DA in the NC MC.

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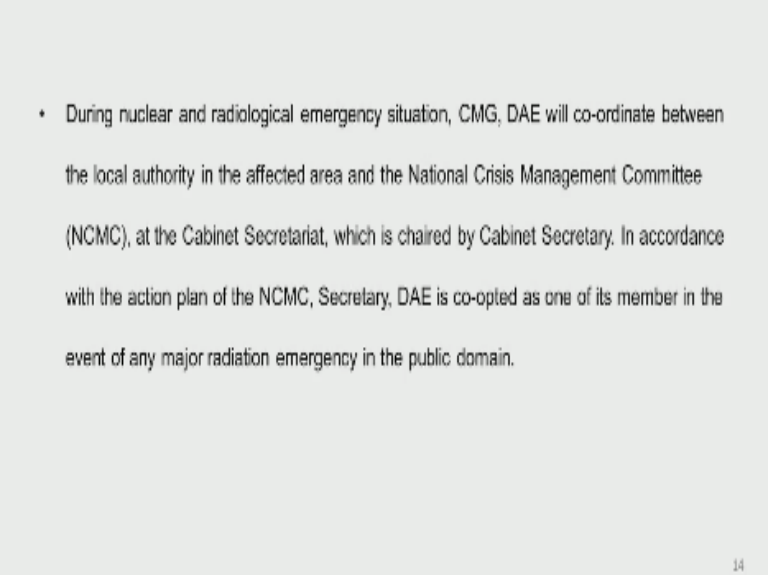

So this crisis management group of DAE will coordinate between the local authorities. In the means the affected area and the national crisis management committee at the cabinet Secretariat so this actually is in between the national body and the local power plant or site which is having the accident.

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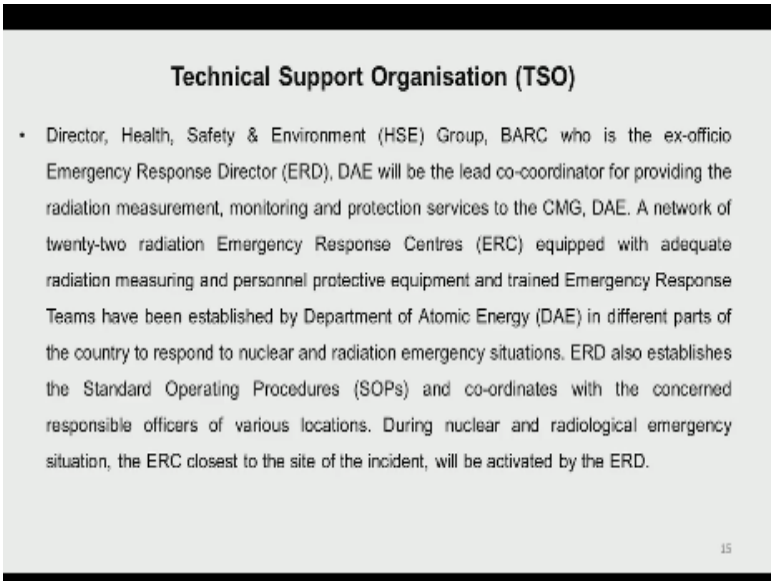

Then technical support organization having said that the technical support needs to be given by the crisis management of DAE the real group which will give is the Directorate of health safety and environment group of BRC which has who is also the emergency response director basically he will coordinate the radiation measurement and monitoring and protection services at the accident site.

Now for the purpose of this Directorate has established emergency response centers at more than twenty two places means where the all the nuclear power plants are located and they have provided enough radiation measurement equipment and also the protective equipments and not only that these centers have trained people to respond in case of an emergency and this direct rate of Health and Safety also draws up the procedure standard operating procedures in case of an emergency.

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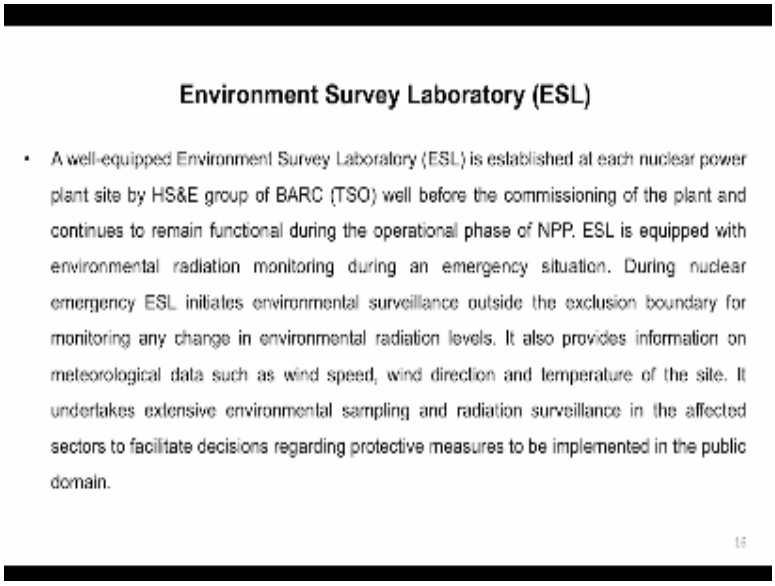

As I said the environmental survey lab has got a big role to play and this environmental survey lab anyway reports to the health safety and environment group of BRC. Before, the plants stop ting after the plant starting during the plant operation. Everywhere, so ES cells are very well equipped to deal with an emergency situation.

And they as I said it gets the information on the metallurgical data wind speed temperature etcetera in the environment and it facilitates decisions because these people have moved about in the local area so they are able to tell what sort of things what sort of road so everything they are better equipped to advise the emergency measures then the Atomic Energy Regulatory board.

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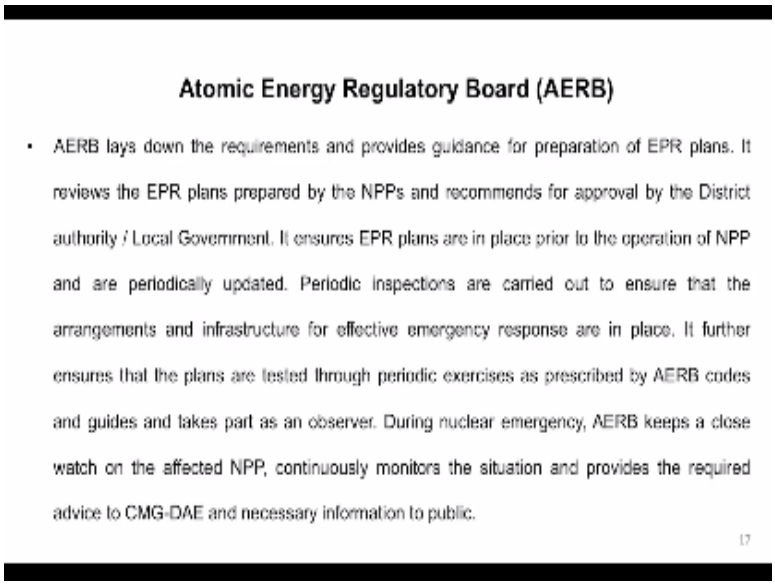

The role is basically the guidance for the emergency plan response plants and from time to time they review these plants and these recommends any changes and these plants as I mentioned for the offsite emergency.

It is the collector of the district so, they pass on these plants to the district authority and the local government for approval because you must have a plan if it cannot be administered and executed properly there is no good and here offside emergency you require the state government and the local authorities so these procedures are approved by the district or local government authorities and we also carry out a year be what it does having said this a RB does period inspections to see whether the infrastructures are having the right things whether the right people train people are available all those things this what it does in the inspection as a part of their inspection regulatory inspection. AER bid also does the inspection of these environmental survey laps and sees whether emergency response room is in place.

Whether, all the things are in place so how much of equipment protective equipment is there are they in operation whether they have radiation detectors are they in operation so everything and during an emergency again it monitors the response and again add voice is the crisis management group in case of any requirement it does advices gives advice to the crisis managers group of add so coming to the state level.

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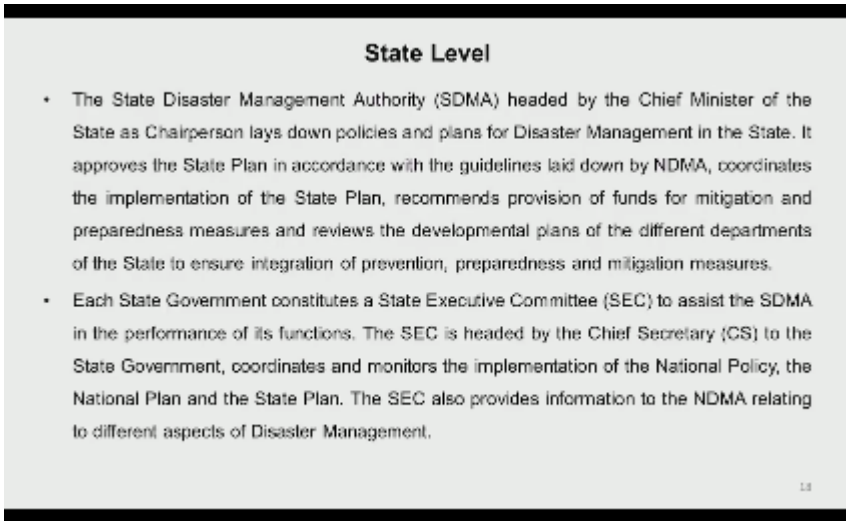

The state district management disaster management authority is headed by the chief minister of that place. Who is responsible for the happenings in the state? So, he is the chairman so it approves the plan emergency response plan along in accordance with the guidelines of the NDMA and coordinate State level people in executing the emergency response plans and basically, it is a coordination and integration of the different people at the state level.

Then there is a state executive committee which assists the state disaster management authority in performance and that is headed by the Chief Secretary. Just, as web there we had the cabinet secretary for the national level the state level is headed by the Chief Secretary and it also coordinates monitors and implements the National policies at the district level.

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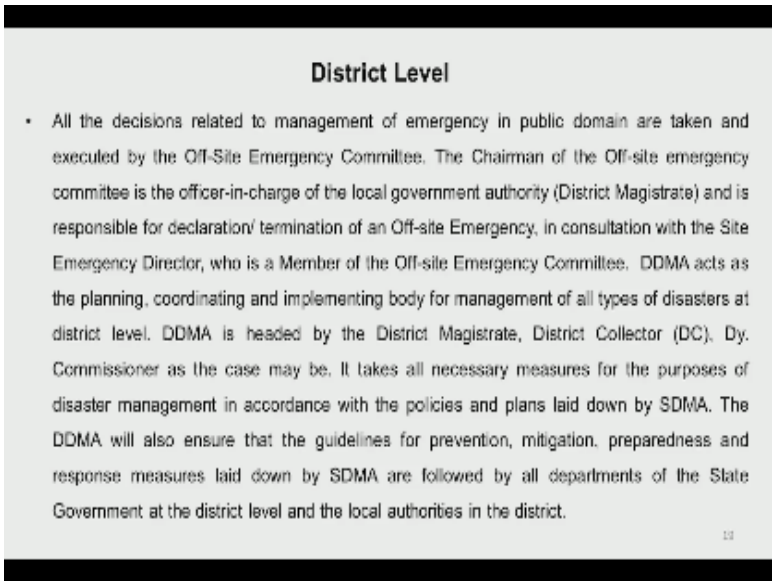

As, I mentioned the we can have either the collector or the district magistrate who will be the head of the offside emergency committee and he consults the emergency director and the district disaster management company does the planning coordinating and implementing so at the district level soothe district level committee as the either as I mentioned the district magistrate or the district collector ortho Deputy Commissioner depending on ores one of the three is takes the responsibility and carried out the response.

As per the policies laid down by the soma or the state disaster management authority so here again if you see there are three levels of organizations the state district level again in coordination with the other there also you had the national level and the crisis management group of deform radiation accidents if it is a cyclone again and some other department would come into picture then what would-be the role of the individuals.

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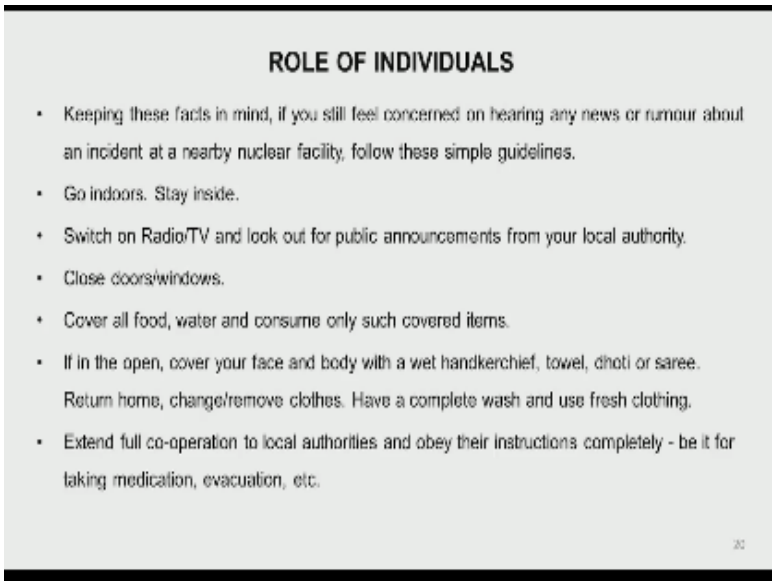

Let us say as a as a public person what would-be my role that is very neat to be defined should I run away suppose there is a siren saying that there is an radioactivity release there an accident what should i do so in case you hear a noose notice it through the TV or through the radio or here in room hear arum or that there is an accident in a facility nearby you first go indoors go inside the house stay inside. The activity will be outside if you are inside you will not get much of the activity then look out for announcements.

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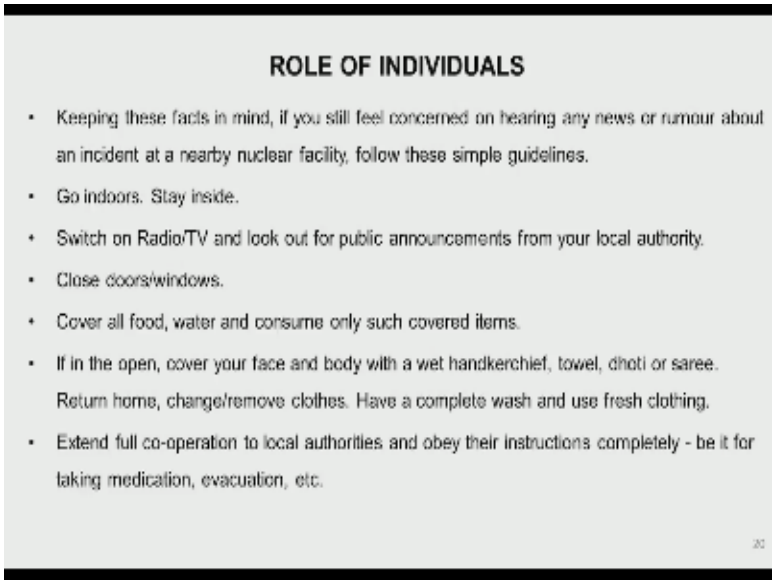

Through, the TV and radio because these systems will be utilized by the disaster management people to convey to the people so that there is no undo what you call restlessness on the people they will make announcements so that you can do things as per their because there is only way to reach the whole public so keep your TV sets on radio on and look for any announcements.

Close the windows so that any contamination does not any activity is there it does not come because lady activity can come to air path or the water path so at least you can close it then whatever, food you have you coverall the food items water in case your store you store cover it then if you are in the open cover your face maybe and take a wet hair cut chip put it onto your nose and maybe you can cover your body with a loose cloth or sorry come home change the clothes.

whatever clothes you are wearing outside change it give you then have your wash so that you are decontaminated and where flash clothes then having done this your duty is to again look for announcements look for what instructions are being given by the local authorities suppose you are asked to take medication like prophylactics like I didn't take evacuation follow the process there is no need to run as I mentioned we are living with radiation and the radiation.
Activity which is going to be added by these accidents is not very high only thing is we do not want to unnecessarily load ourselves with more of activity so we would like to keep safe that is why as I have been repeatedly talking as low as reason able achieve able has been our approach this approach has really.

Some people may say why because there is nothing anything which is nothing is too good nothing should be too bad so we want to keep as low as possible then comes the training and excise.

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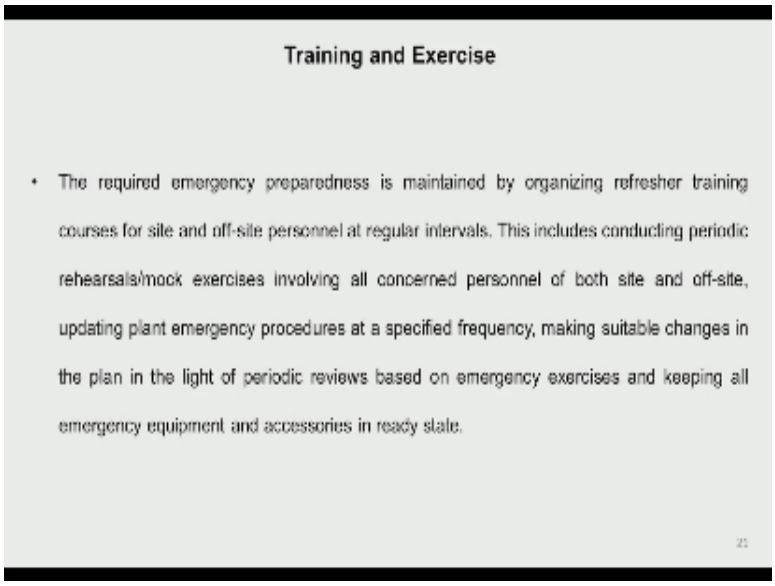

This training for emergency preparedness is done as per the procedures at regular intervals what we do we have more Coptic sizes for both on-site and off-site emergencies and normally the OPP side emergencies we are supposed to do once in a year the purpose of this exercise is to see whether all the infrastructures everything is in place and whether there is need to augment it or whether there is need to what you call improve our procedures whether somewhere the communications are not proper all this that is to improve the you know procedures operating procedures in case of an emergency.

So during mark excises you really get a chance okay, some coordination problem is there how to see that the coordination problem does not happen the next time so and then once this excise is done you have a meeting of all the people you have a review of that and you see how to improve it to the next now this training and exercise are very important component now first and foremost is to train the employees of the nuclear power plant.

So here many of the people who are not working on the radioactive facilities the administrative staff the account staff and all they may not be very well aware of radioactivity and other things so we give them talks on what is the radioactive sister dub how safety things we have provided in the plant and we also tell them should there be a very rip in the remote chance of happening then how they should act so we have standard training procedures and training courses for that plus in the public domain.

We go and give lectures among the different societies professional societies different colleges different schools and different villages and so that we familiarize them with the actions needed during an emergency so this is all these programs are organized under the National Disaster Response Force they do that and all these are in place and these programs are arranged of course with the support of the nuclear you know establishment like BRC IG car Nuclear Power Corporation and the AERB.

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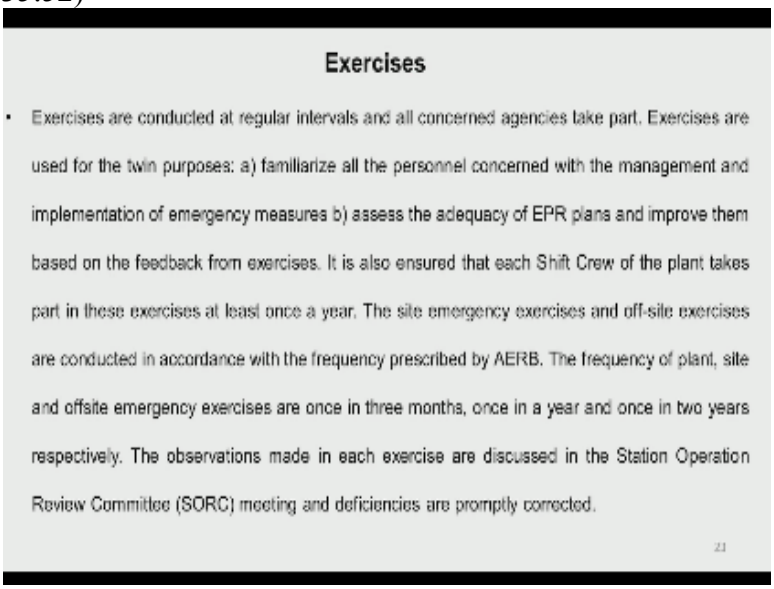

Exercises as he said the mock-up excises are conducted and all the concerned agencies take part and as I mentioned the exercises having a two-pronged attack one familiarize the personal with the implementation of management of implementation of the emergency plans and also assess the adequacy whether it is okay, and whether there is any need for improvement so in all these activities from the plant side the shift crew also takes place and this sort of exercises as I said at least once a year we carryout.

Then the offside emergency on-site emergency frequency could be more sometimes once in three months offside emergency could be once in two years again depending on the frequency which is given by the national district management authority now the within the site emergency whatever observations are done then they are all discussed in the station operation review committee and the emergency procedure for on-site emergency is you know improve.

So basically what we do we have a side on which gives the which is symbolic of an on-site emergency or an off-site emergency and then in the if it is an on-site emergency all the people in the different groups they go to the different assembling areas it is all marked assembly areas and in the assembly areas what they do they take the number of people who are present there and then pass it on to the Emergency Committee their local emergency committee how many people are there so that they can decide how many buses are need to transport them.

So like that and all these assembly areas are connected by proper communication systems so then in the offsite domain you have the distribution of prophylactics and all needs to be done.

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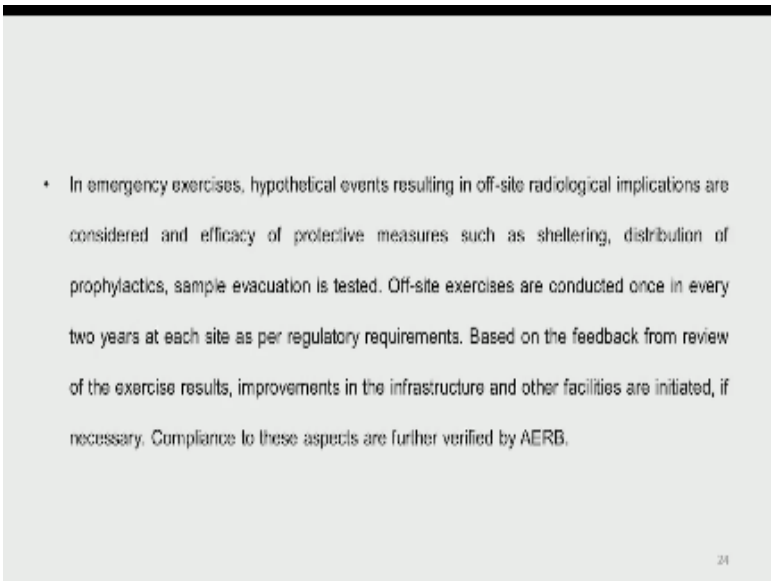

But we do not really do it in a actual in the mock exercises but we do persons go wrong and so that we know that this storage of this prophylactics are there in good quantity at the site so all these whether we are complying with this as I mentioned earlier is done during the AERB regulatory inspection.

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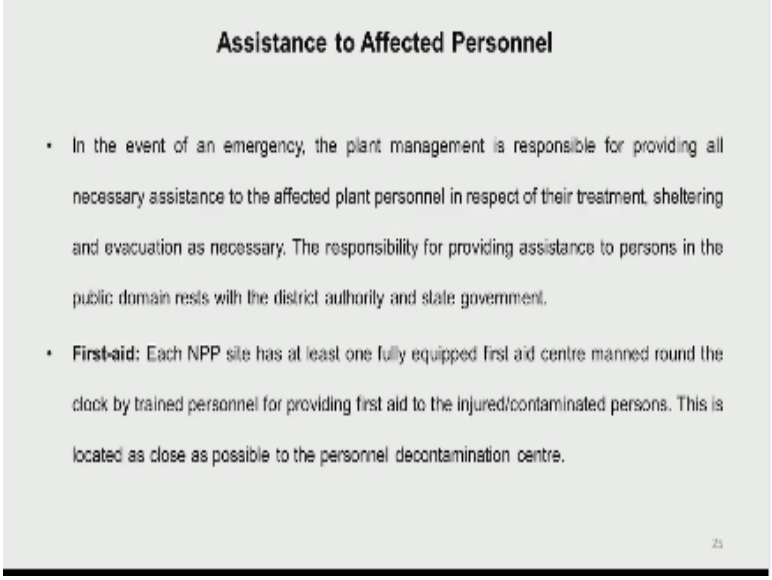

Now the plant management no doubt is responsible for providing the necessary assistance to the affected personal for treatment sheltering of course and evacuation so first is the first aid so this first aid center every nuclear power plant has it fully equipped basically decontamination is one and any medical treatment immediate first aid that is where what is done at the first aid shelter as I said.

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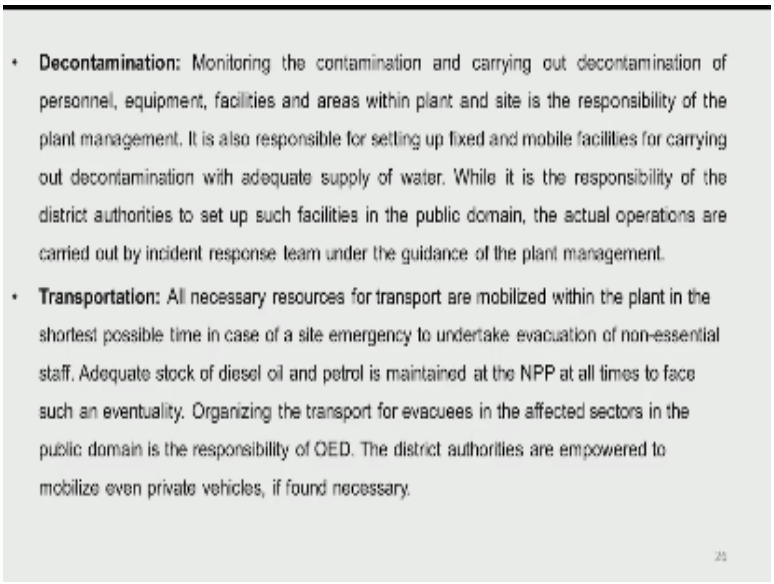

The decontamination equipment need to be there with adequate supply of water and that is this is for on-site. Similarly in the offsite emergency if the public is contaminated then you have a in the emergency center where we have decontamination rooms that we have to take care where do I

have all these facilities and of course again these things will be carried out under the guidance of the plant management then transportation.

In case of an on-site emergency of course evacuation is done by the plant authorities from the plant to outside so here you might wonder whys many buses are available at most of the nuclear facilities is because they are required to transport people in case of an emergency but if you do not use these buses in a normal time they will rust so they are used for transporting employees even in the normal thing as a welfare measure so this question of why for atomic energy there are lot of buses is basically to do.

In case of an emergency but then they are used in the normal so whereas the district authorities use the public transport which is already available to them.

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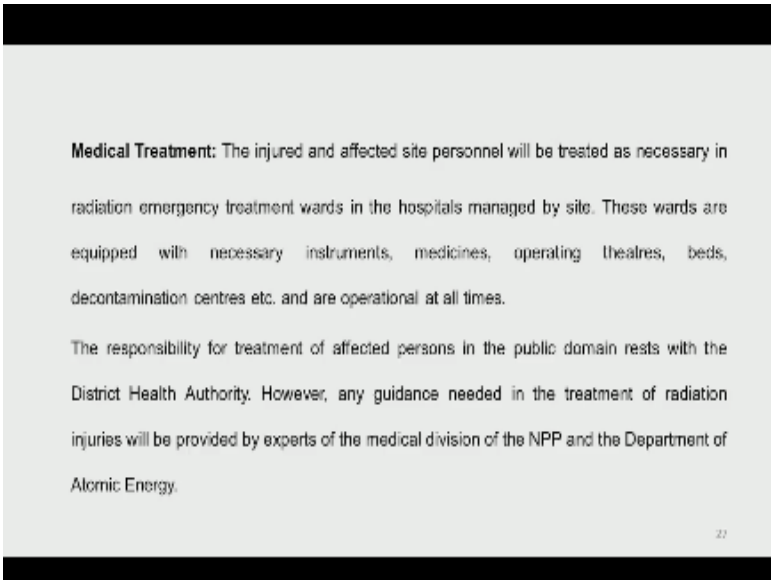

Then medical treatment these hospitals and everywhere as i mentioned in Kalpakkam or hospital has special wards for treating radiation he personnel and you have got all the instruments bed separately for this radiation affected people so the treatment of them and in our doctors are trained what to do in case of a radiation emergency not our doctors our medical nurses staff all are trained how to deal in case of an emergency.

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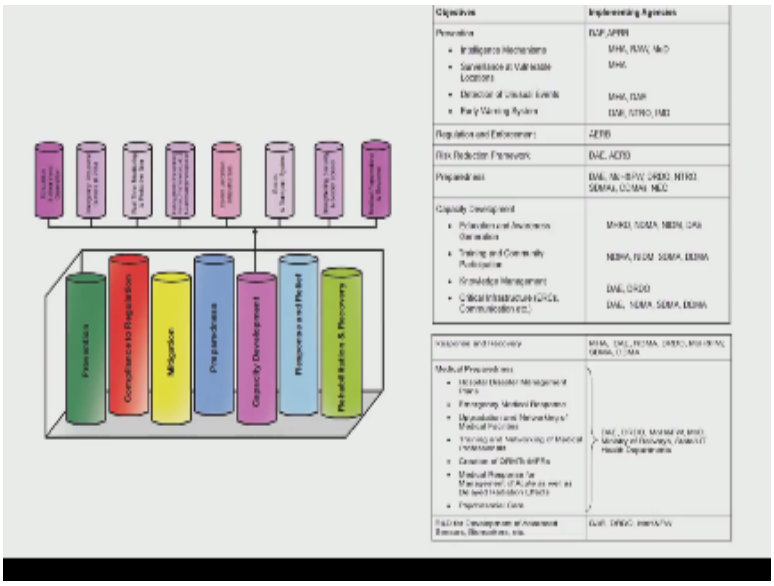

If you just lookup whatever I have mentioned in the in this lecture different agencies are involved and that i have just pictorially put in a different manner colorful manner how many agencies are involved how much of activities and responsibilities are their prevention compliance to regulation mitigation preparedness capacity development response and relief rehabilitation and require so all these things are to be done by the different agencies.

And here are the agencies when say Ministry of Home Affairs research analysis wing of the cabinet Ministry of Defense DAE herblike that lot of organizations are involved so the roles are very clear for prevention what agencies for regulation and enforcement agencies for preparedness what agencies for response and recovery what agencies and medical preparedness what agencies so any RND needed who should do all these things are clearly brought out clearly plan.

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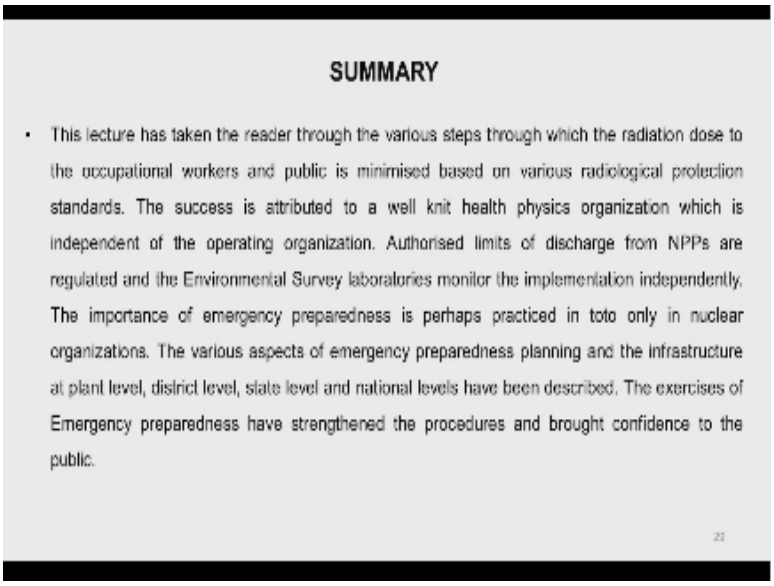

Now in summary I can tell that these three lectures have taken you through the various steps through which radiation doses to occupational workers as well as the public is minimized and based on the various radiological protection standards and you may recall that at Kudankulam when there was a opposition started it started at a time when we are planning an emergency response maybe the training or the people or the awareness of the people was not that much that when they said the mark exercise.

They thought it is an emergency an accident and something has happened even before the reactor started so here is where public education and public awareness take a very important thing with reference to the emergency preparedness. I am was very well associated with the emergency preparedness plan at kalpakkam so in fact initially we had an open house for few years to bring in the people to site.

And show them what is happening in case you know normally and then they have a feeling that o they are also a part of it then we also gave them lectures from different villages we brought them of course we gave them food and so that we took care of the hospitality we took care then subsequently we what we did we also our own colleagues in the department in the establishment like administrative and accounts.

We gave them lectures then we also told them about our emergency exercises and then we did the emergency excise and it was very successful so the basic thing is we have to take the local people into confidence before we do such exercise in the of sight emergency divine.

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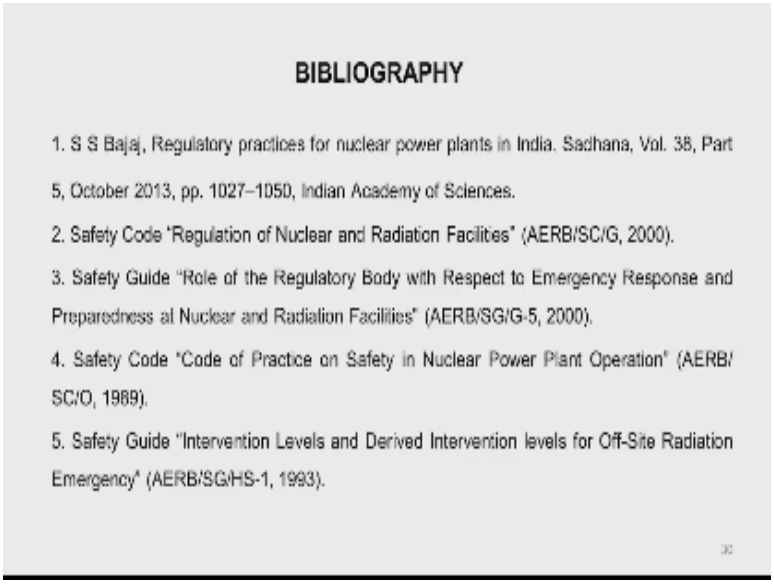

This amount of all these things are well documented if you are interested to see what sort of regulatory practices you can very well see the paper by Chairman ARB SS Bajaj published in 2013 then the revelation of the nuclear body with respect to emergency response and preparedness at nuclear and radiation facilities this safety guide of AERB brings out very clearly all these have got enough clarity.

Because they have been gone through many times and improved upon based on the responses then intervention levels when we should intervene when we should you know say that it is the offside emergency when we should say it is an onsite with all those things are brought out surely then.

(Refer Slide Time: 46:24)

6. Safety Guide "Preparedness of the Operating Organization for Handling Emergencies at NPPs" (AERB/SG/O-6, 2000.

7. Safety Guidelines "Preparation of Site Emergency Plans for Nuclear Installation"(AERB/SG/EP-1, 1999).

8. Safety Guidelines "Preparation of Off-Site Emergency Plans for Nuclear Installation"(AERB/SG/EP-2, 1999.

9. Safety Manual "Radiation Protection for Nuclear Facilities" (AERB/NF/SM/O-2, Rev.4, 2005).

10. National Disaster Management Guidelines—Management of Nuclear and Radiological Emergencies (2009)

The preparedness excise then off-site on-site radiation protection all these are all there and the national disaster management guidelines the NDMA website contains lot of information.

(Refer Slide Time: 46:34)

11. AERB/SC/D-13 Liquid and Solid Radwaste Management.

12. Government of India, National report to the convention on nuclear safety. A.E.R.B. website. Available from: http://www.aerb.org.

13. R. Deolalikar, Safety in nuclear power plants in India, Indian J Occup Environ Med. 2008 December; 12(3): 122–127.

14. K.Raj,K.K.Prasad,N.K.Bansal, Radioactive waste Management Practices in India, Nuc.Engg. Des. 236 (2006), 914-930

Now some people have done how the environment has been seen there is a very nice paper by safety nuclear power plants in India published in 2008and also another by on radioactive waste management practices all these are meant to give you a complete information about the plant as in my all other modules at the end of this module also, I would like you to go through the module and then answer these questions.

Which would be very helpful to you in telling okay, what has happened and whether we have really understood and not only that it will really put you in a better position to appreciate that how we well we are prepared even for any eventualities thank you.

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