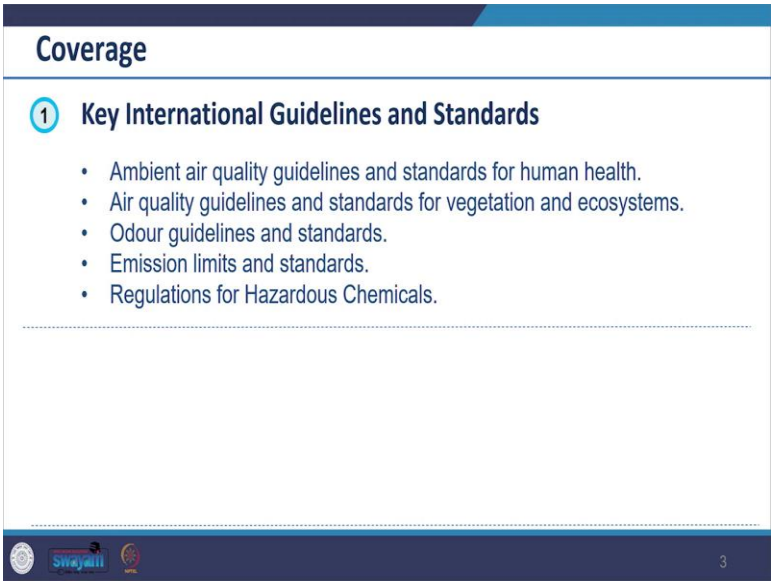
Environmental Impact Assessment
Professor Harshit Sosan Lakra
Department of Architecture and Planning
Indian Institute of Technology, Roorkee
Lecture 15
EIA – Law, Policy and Institutional Arrangements for EIA Systems (Part-III) - Air

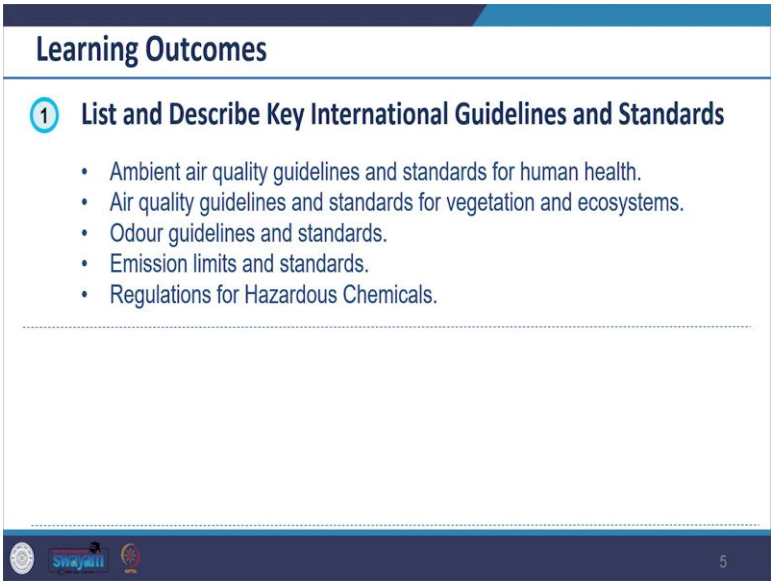
Welcome to the course- Environmental Impact Assessments. In the previous lecture, we developed an understanding of key concepts of policies. Then we looked at different forms of governance approaches and policy instruments. And we looked specifically to the air. We also looked at related global environmental agreements related to climate change, ozone, and PBT.

(Refer Slide Time: 00:54)



So, in this part today, we will look at air policies and while doing that, we will be looking at the ambient air quality guidelines and standards for human health. And then we will be looking at air quality guidelines and standards for vegetation and ecosystems. Then we will look at what are the standards and guidelines for odour. Then emission limits and standards how what are the parameters which guide what kind of standards we have? And then what are the guidelines set up? And then we look at the regulations for hazardous chemicals. So, looking at this will simultaneously cover air guidelines and standards specific to India.

(Refer Slide Time: 01:36)



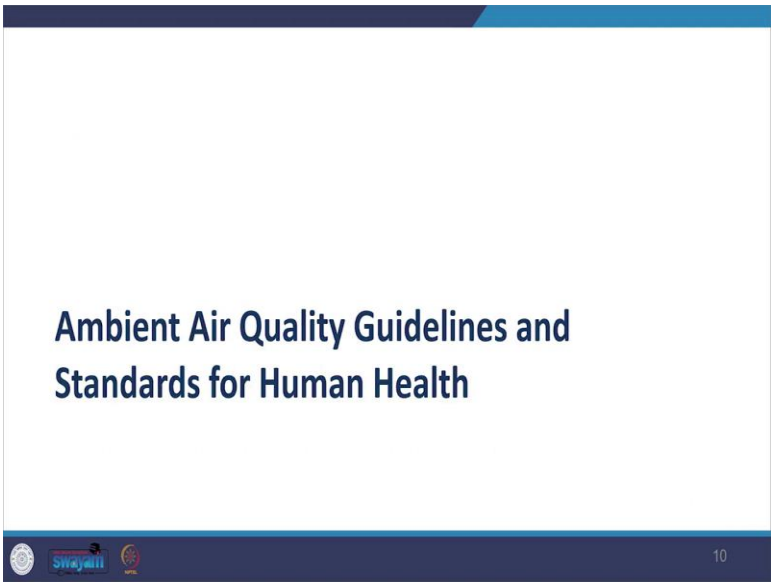
And so the expected learning outcomes from you, after completion of this session, include that, you should be able to list and describe and also synthesize the key international guidelines and standards related to air concerning the ambient air quality. And then it is a bad concern with ambient air qualities, particularly for human health as well as then you should be able to describe air quality guidelines and standards related to vegetation and the ecosystem. You should be able to identify guidelines that are there for odor and also the emission limits and standards and then also list the regulations related to hazardous chemicals.

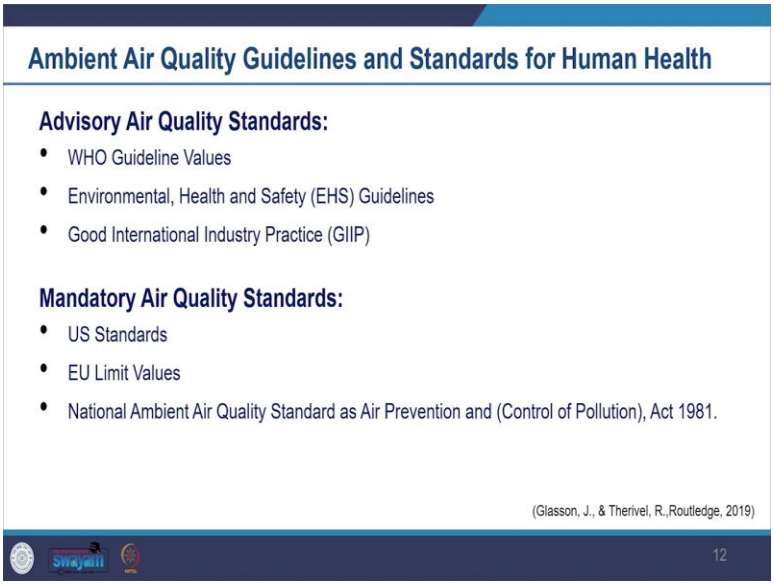
(Refer Slide Time: 02:25)

So, looking at some of the Key International Guidelines and Standards. So, the key international guidelines and standards, we look into five domains when we look at these, so that was about how we determine standards and guidelines. And now we will be looking at the domains of standards and guidelines. So, where we find all these standards and guidelines one is related to ambient air quality guidelines and standards for human health. So, what is good for us, what is the basic level which is there?

So, ambient air quality guidelines and standards are set based on that second, we see air quality guidelines and standards for vegetation and ecosystem, you also have guidelines and standards for odour, and then you also see emission limits and standards then also you see regulation for hazardous chemicals. So, all these five domains, you see, are where the guidelines and standards are usually set.

(Refer Slide Time: 03:28)

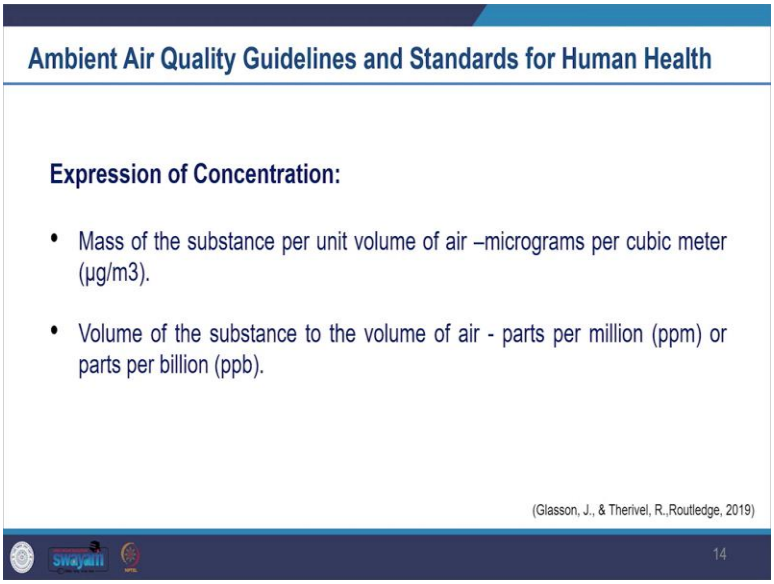




So, looking at Ambient Air Quality Guidelines and Standards for Human Health. So, the ambient air quality, and the levels of pollution set within air quality standards are sometimes advisory. So, you might see that they are not necessarily mandatory, but they can be advisory such as you see the WHO guidelines, they are advisory and then they can vary or many countries cannot acts align with those standards.

You can see others are mandatory and backed up with legislation such as you have US standards and EU limit values. And then we also see in India you see the CPCB standards which are there for ambient national ambient air quality standards, you see those things. So, you have certain which are advisory while there are certain which are mandatory, so it might completely depend on what is your context.

(Refer Slide Time: 04:33)

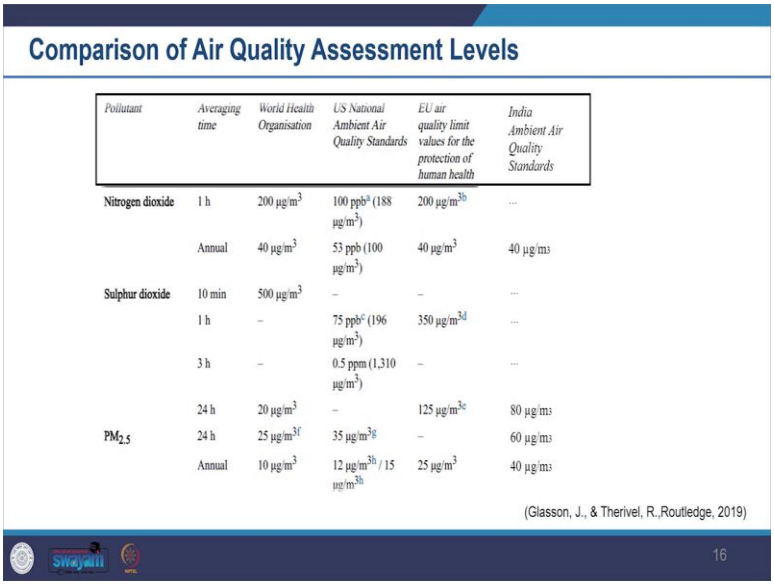


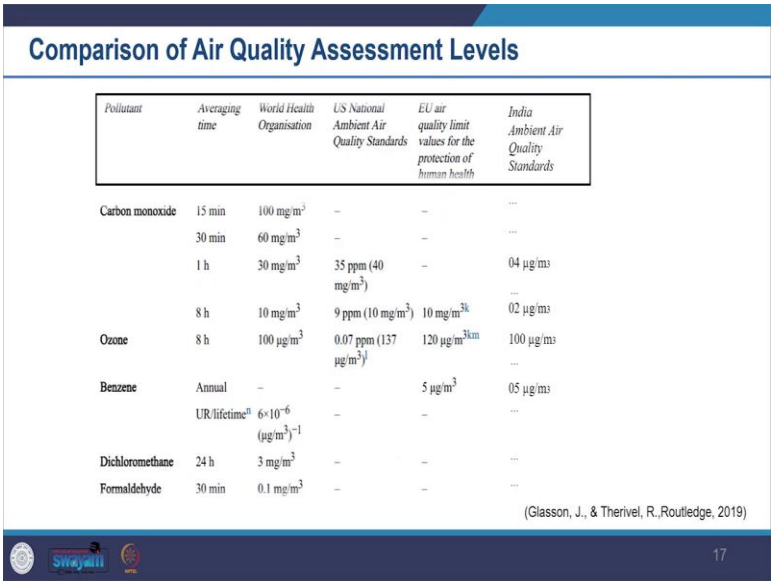
So, usually, if we look at how to read these numbers, the concentrations are expressed either as mass of the substance per unit volume of air, so how many substances they are in the per unit volume of air, whatever volume of air you are taking, for example, micrograms per cubic meter. So, how much pollutant how much microgram pollutant is there and per cubic meter.

So, this is abbreviated as you can see here microgram per cubic meter, and then you see a volume of the substance or you can see the volume of the substance to the volume of the air. So, the pollutant compared to the volume of the air, so, what is the proportion of that for example, parts per million?

So, you can express this in parts per million or parts per billion, and they are abbreviated as ppm and ppb respectively, and these units can be converted from one to another using published conversion factors. So, you can do those conversions. However, there might be slightly some variations in the standardization local context variations might be there.

(Refer Slide Time: 05:47)





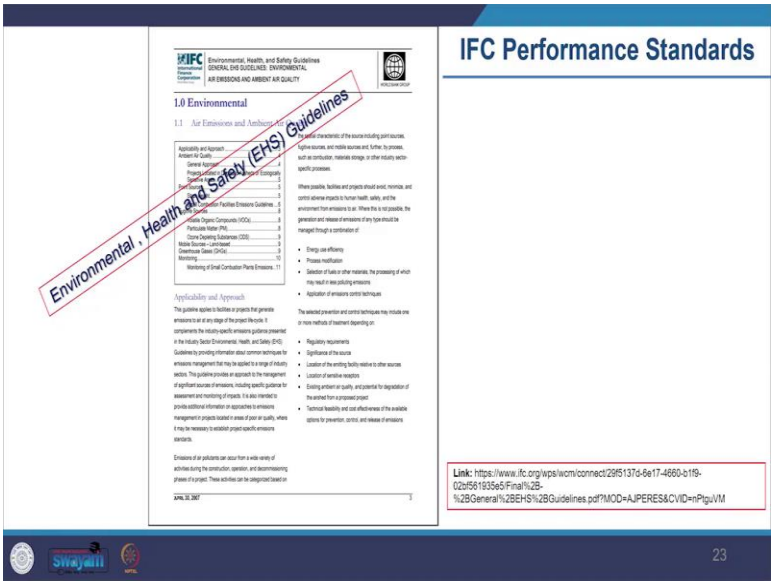
So, in the image here, we can see the comparison chart of like, WHO you can see the US National Ambient Air Quality as well as EU air quality and then how they vary at the same time, we will be also looking at India's national ambient air quality standards. So, you see, how they vary as per the, what we can apply and what we can attain based on that.

Health standards are different in different countries given the technical feasibility and economic feasibility as per the political and social context. So, we see that the WHO provides guidelines based on the observed health effects and has very high standards. And significant we see that there has been note.

It has been noted that their significant success has been achieved through national and international policy and regulatory structure. So, what kind of structure we have, we have been able to be, we have been successful so far. And we have been able to reduce the emissions to a certain extent and that is a positive indicator right now.

So, we also see that some pollutants like carcinogenic pollutants, arsenic, benzene, and chromium, have not been given in the guidelines. So, it depends upon what has to be included in the list. You also see there are certain exposure effects are also provided which help as a guideline to manage risk and then how to manage risk about the major health impacts. They also give guidelines the short-term and long-term exposure, and what happens with the various levels of exposure to the pollutants.

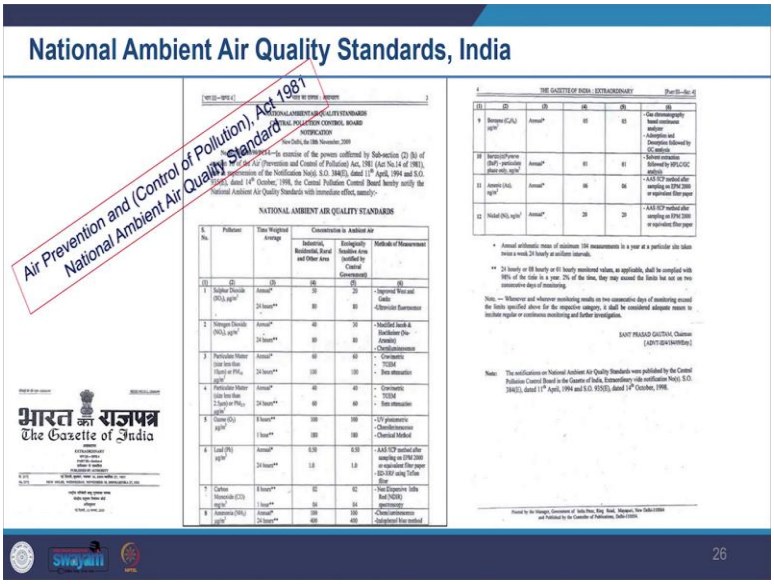
(Refer Slide Time: 07:48)



Among the guidelines, we would also find IFC performance standards and environmental health and safety guidelines, which these guidelines provide technical advice. So, this is again advisory with generally general and industrial-specific examples. So, you can see here to meet the performance standards. So, whenever the projects are undertaken for funding through the World Bank, they have to meet these standards. So, you will find that Infrastructure Planning Commission Performance Standard Three is also there, which provides resource efficiency and pollution prevention.

So, here all the commercial clients, people who are investing are required to integrate pollution prevention and they need to adopt control technology and practices to all these for funding.

(Refer Slide Time: 08:47)



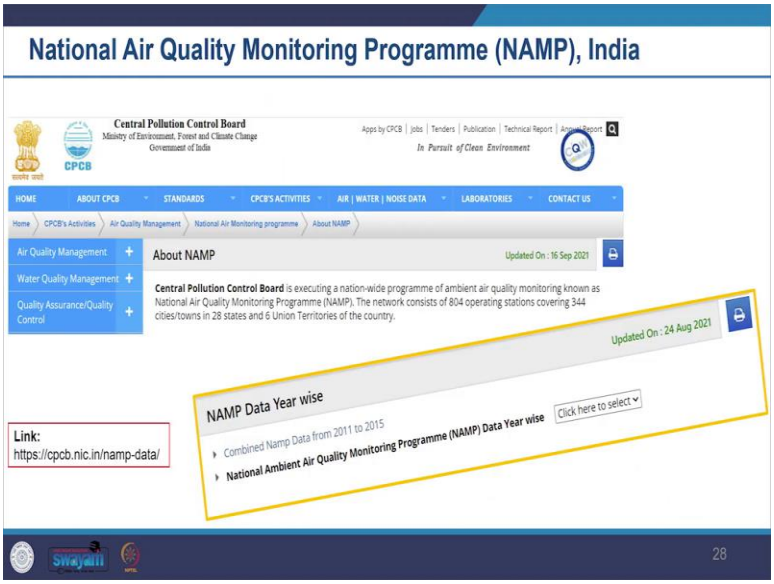
So, the guideline states that the projects with significant error emissions wherever the significant error emission is there so one needs to, they have to be looked into in terms of how those impacts can be minimized and those guidelines and those standards have to be met. So, in India, we see that we have national ambient air quality standards.

So, air pollution, air quality regulation, and action for like reduction of air pollution, this all undertaken under the provision of the Air Prevention and Control of Pollution Act 1981. So, under the Air Prevention Control of Pollution Act 1981, and Environmental Protection Act 1986. This mechanism is prescribed, in the image you can see the National Ambient Air Quality Standard, and then where you evaluate whether the impact is significant or unacceptable.

Based on these values, you see the emission discharge load, what is the load and the characteristics of the load, and whether whatever activities have been undertaken are the result of environmental quality exceeding or violating the standards or not. So, all those kinds of things you make here so, you can see in the National Ambient Air Quality Standard, the first column shows you all different kinds of pollutants here.

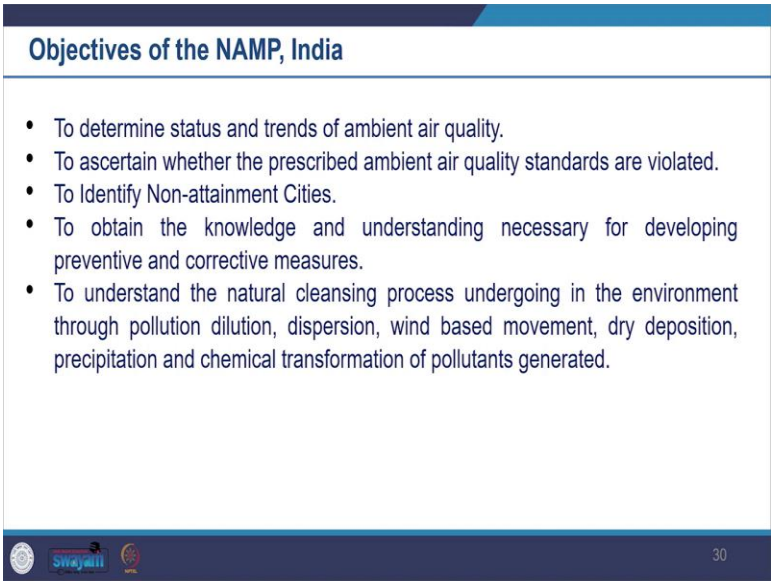
And then you see the time-weighted and then you see industrial, residential, rural and other areas, ecologically sensitive areas also have been identified and how you are going to measure them, you can see in the column number 6, how you are going to measure them, the modes of measurements are also provided. So, when you do the assessments, you refer and you are guided, guided, or bound by these acts, which are in place.

(Refer Slide Time: 10:51)



We also found a national air quality monitoring program, which is there in India CPCB is executing this program nationwide and this is called as National Air Quality Monitoring Program NAMP.

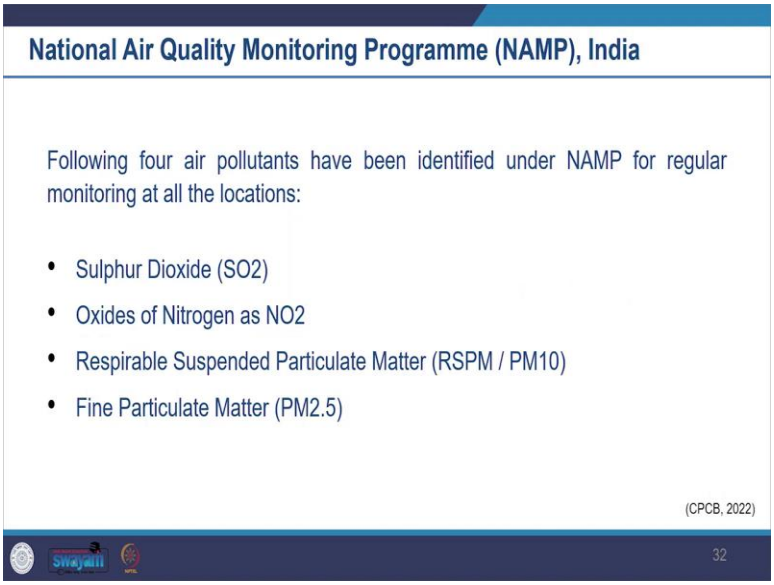
(Refer Slide Time: 11:09)



So, within this, the main purpose of NAMP is to determine or like what is the status and the trend in ambient air quality. So, through this, we keep monitoring and try to confirm whether the prescribed we can meet the ambient air quality as per the standards or not, and how we are doing as for cities and what understanding we are developing about what is working, what prevention is working or corrective measures are working or not.

And then we also try to understand the natural cleansing process. So, as per the environment, a lot of things naturally cleanse, so whether that is taking place or not a natural cleansing through dilution, dispersion wind-based movement, and all these things. So, whether it is a lot of things can be taken care of naturally. So, these are set up to regularly monitor status as well as to see what is working or not working.

(Refer Slide Time: 12:12)

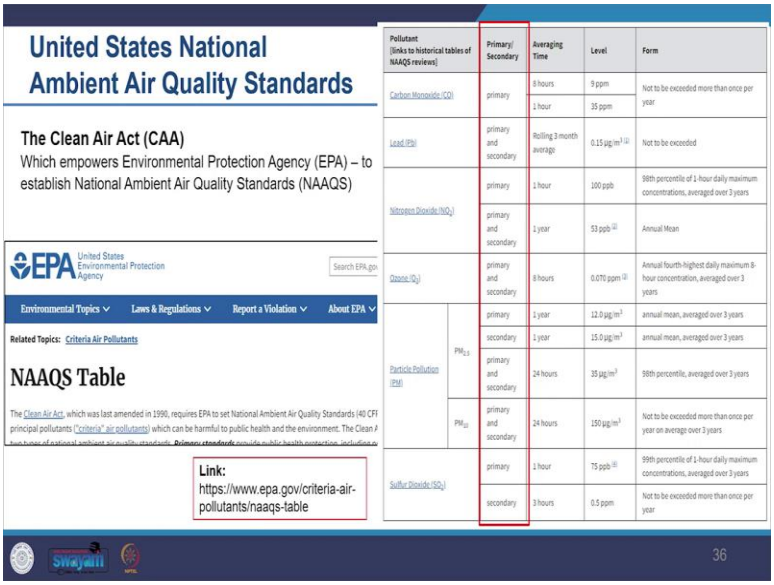


So, there is a range of pollutants that are looked at through this NAMP. So, you have sulfur dioxide, oxides of nitrogen, and then you have suspended particulate matter. So, all these are monitored fine particulate matter PM, so, you will come across a lot and this is all monitored by the NAMP program.

Along with this relative humidity is taken care of temperature is also added with this and then monitoring of pollution is carried out 24 hours and the sampling is done for all these gaseous pollutants 8 hourly sampling for particulate matter. So, we keep on keeping this record all the time 8 8-hour particulate matter.

So, these are recorded and these are available as sources for data for your calculation purpose. So, this monitoring and everything is taken care of with the help of the CPCB central pollution control board, as well as the state pollution control board. And then there is also the National Environmental Engineering Research Institute which is located in Nagpur then you also see that CPCB coordinates with all these agencies to ensure uniformity and consistency of air quality data. So, you see this institutional setup which is there.

(Refer Slide Time: 13:48)

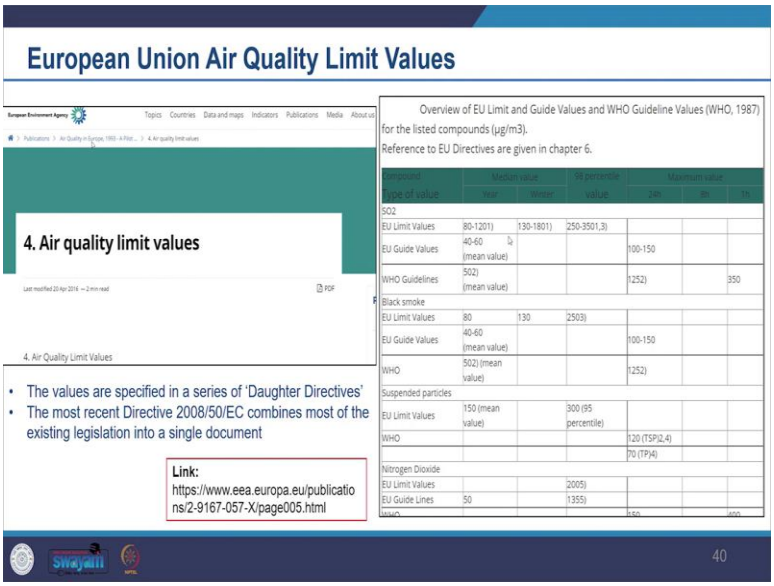


So, now moving on, we see that, similarly United States national ambient air quality standards are also there, you have the Clean Air Act, which provides like the federal law, the central law that regulates air emissions, and it looks at the air emissions from the stationary as well as the mobile sources.

So, if you think some of the air pollution must be coming from stationary sources, we will look into it more in detail when we deal with air in the method section, what sources are there? So, they identify this for stationary and mobile sources. Then also the law empowers the Environmental Protection Agency to establish national ambient air quality.

So, they are going to establish what standards we are going to set up and set up for the, for public health and public welfare and those standards for also for the emission and also for the hazardous air pollutants. So, we see that there are primary standards and there are secondary standards primary standards provide Public Health Protection whereas secondary standards provide also certain other lighter health concerns like visibility, damage to animals, crops, vegetation, and protection. So, you see the primary standards as well as secondary standards. So, that was about the USA.

(Refer Slide Time: 15:25)



Then you also see in the European Union you have air quality limit values. So, they had air quality standards in the form of mandatory health-based limit values and they had more stringent nonmandatory guide values to protect the environment, and guide values are intended to be long-term objectives.

Here what you see here you see the European Communities Framework Directive on Ambient Air Quality Assessment and Management, which is available, and the values are specified in a series of You will see the Daughters Directive with the first one being agreed upon in 1999 which covered a range of like SO2 particulate matter then you have NO2 and lead and you see that later on the Daughters Directors also had ozone and then benzene and carbon monoxide all these we are also included in the list of the directives.

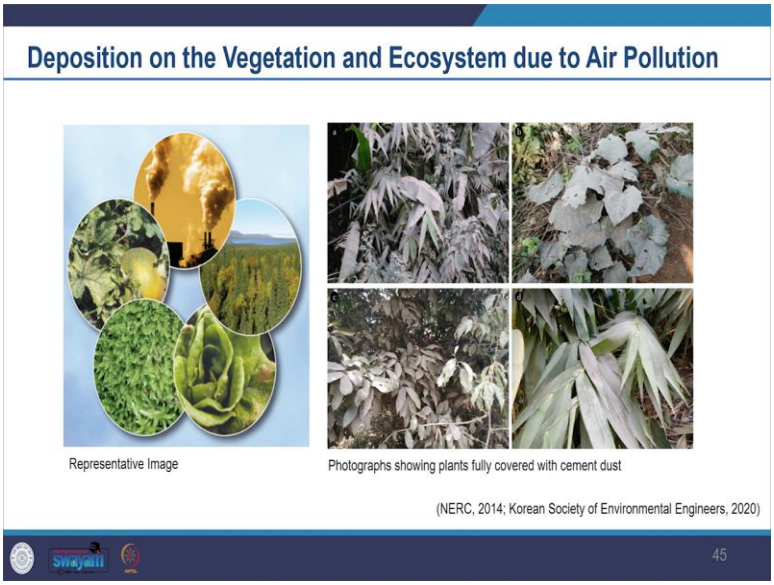
So, a very recent directive as of 2008, which combines most of the existing legislation in the country we are talking about the UK, Europe area, are talking Europe, introduced a new air quality objective for PM 2.5 and this permits certain time extensions for member states to comply with the limit values. So, we cannot attain this limit value immediately. So, there is a certain period in which can attain those targets.

(Refer Slide Time: 17:09)

So, now, moving into another domain, air quality guidelines and standards for vegetation and ecosystems. So, we may think of how complex it would be to determine the effect of air pollution on vegetation and ecosystems because of the complexity and differences, and because of this complexity, you would require different expertise.

Different expert areas need to coordinate together like you would need air quality expert scientists and ecologists also to come together. So, this is a very, difficult complex area, but that is also done and then you may also know that this area is also an evolving area. So, we are developing our understanding, we do not have a complete understanding as of now, and we see constant improvement in this area.

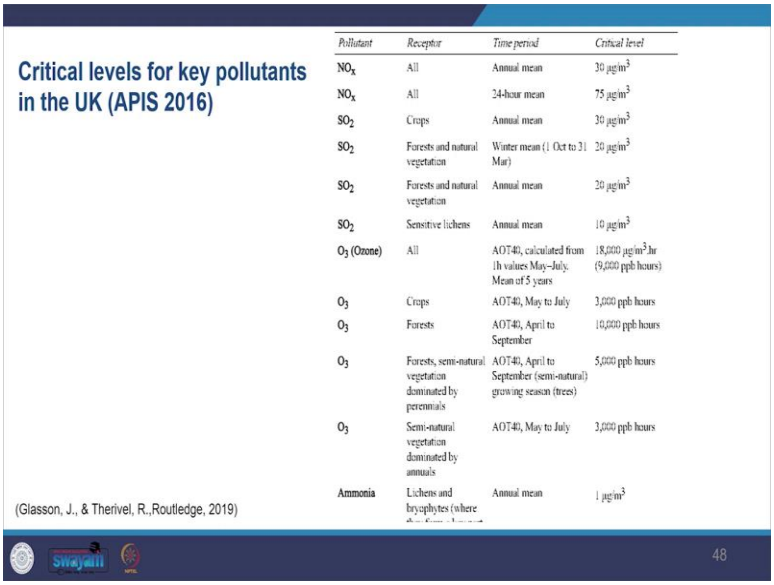
(Refer Slide Time: 18:06)



So, as we can think of in a very simple way of our day-to-day observation of our environment, and our activity, because of air pollution, there is a deposition of vegetation and ecosystem. So, this deposition is of a certain quality. So, whatever layers come, they have certain, they are of a certain quantity, and then they are deposited for a certain duration and then they are also based on the sensitivity of the receiving environment.

So, who is receiving how sensitive they are? So, they are all determined, how much impact and significance it would have. So, that all will be studied in the method section also, but just for the overview at this moment.

(Refer Slide Time: 18:51)

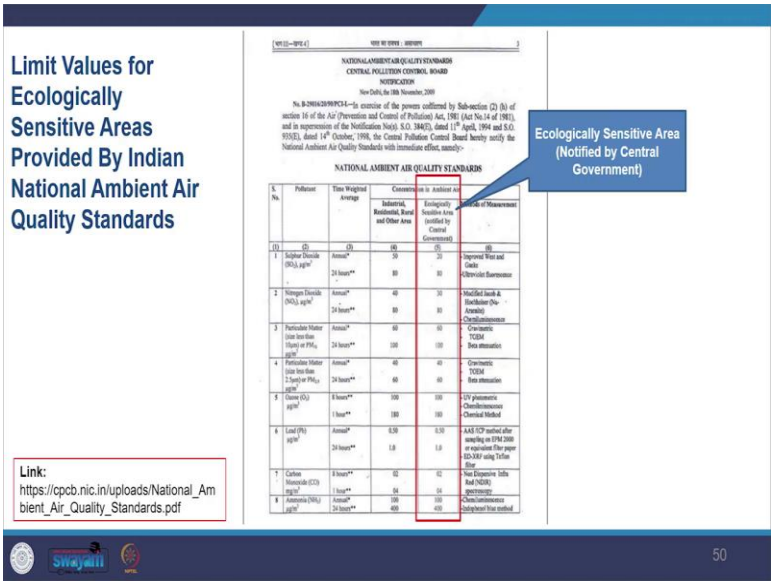


Pollutant	Receptor	Time period	Critical level
NO_x	All	Annual mean	30 $\mu g/m^3$
NO_x	All	24-hour mean	75 $\mu g/m^3$
SO_2	Crops	Annual mean	30 $\mu g/m^3$
SO_2	Forests and natural vegetation	Winter mean (1 Oct to 31 Mar)	20 $\mu g/m^3$
SO_2	Forests and natural vegetation	Annual mean	20 $\mu g/m^3$
SO_2	Sensitive lichens	Annual mean	10 $\mu g/m^3$
O_3 (Ozone)	All	AOT40, calculated from 1h values May–July. Mean of 5 years	18,000 $\mu g/m^3$ hr (9,000 ppb hours)
O_3	Crops	AOT40, May to July	3,000 ppb hours
O_3	Forests	AOT40, April to September	10,000 ppb hours
O_3	Forests, semi-natural vegetation dominated by perennials	AOT40, April to September (semi-natural) growing season (trees)	5,000 ppb hours
O_3	Semi-natural vegetation dominated by annuals	AOT40, May to July	3,000 ppb hours
Ammonia	Lichens and bryophytes (where	Annual mean	1 $\mu g/m^3$

So, for reference for how much load, loads are of concern on an ecosystem, the United Nations Economic Commission for Europe provides critical loads for deposition into the sensitive ecosystem, and in India's case, you saw there was a column that mentioned the sensitive ecosystem. So, we also have those guidelines in place and then how we take care of it.

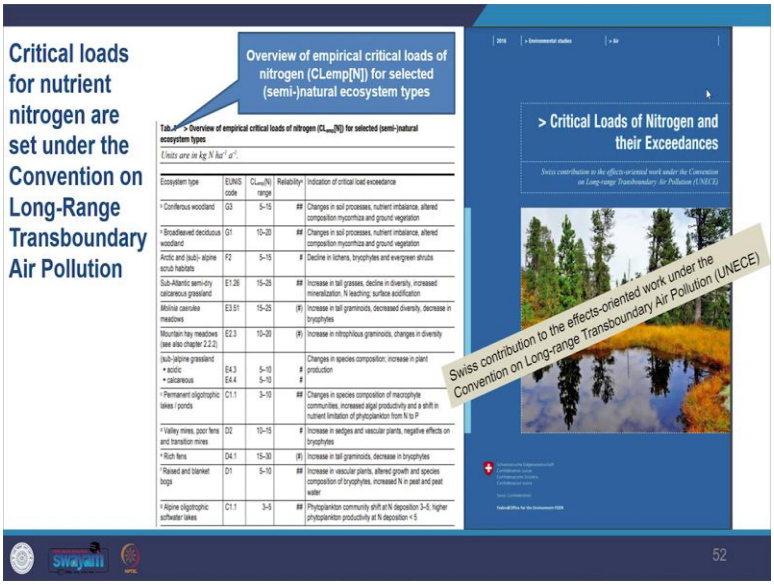
So, anything beyond the prescribed value is considered as a pointer for potential damage. So, you also see the UK Air Pollution Information System, which provides all these critical loads and levels for key pollutants. An example of critical levels and sources of limit value are shown in this table you can see.

(Refer Slide Time: 19:43)



So, Indian national ambient air quality standards also provide a useful guide to critical loads and levels. You can see examples of critical levels when the source limits value, you can see here the ecologically sensitive, you can see the ecologically sensitive area notified by the central government and what is the value given there. So, you will see that the value is much less compared to the industrial residential and rural and the other areas.

(Refer Slide Time: 20:14)

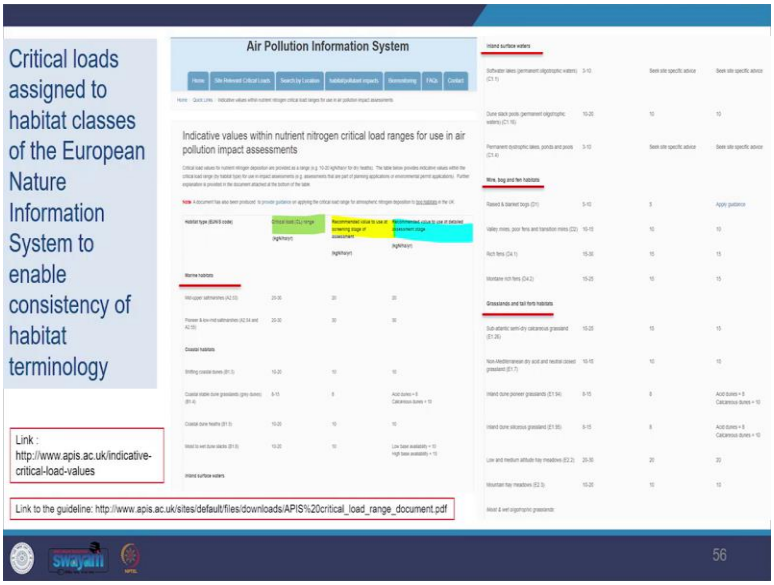


So, we see that substances released into the air do not need to be assessed for deposition to the ground unless they contribute to acidification and eutrophication.

So they are very selective. So, you would see their selective lists. So, only those which are of concern are taken into consideration. Then there are also critical loads for nutrient nitrogen, which is also set under the convention on long-range transboundary air pollution. So, these standards are set based on the experiments and the other studies which have been done.

So, you can see here the loads for nutrients nitrogen, how they are given, and you can see how it is given for different ecosystems, ecosystem type you can see here on the first column, you can see coniferous woodland, and all this is given here. And for that, what is the range and what is the indicator of critical load accidents how do you evaluate it? So, those all are mentioned here so these all documents can be referred to.

(Refer Slide Time: 21:29)



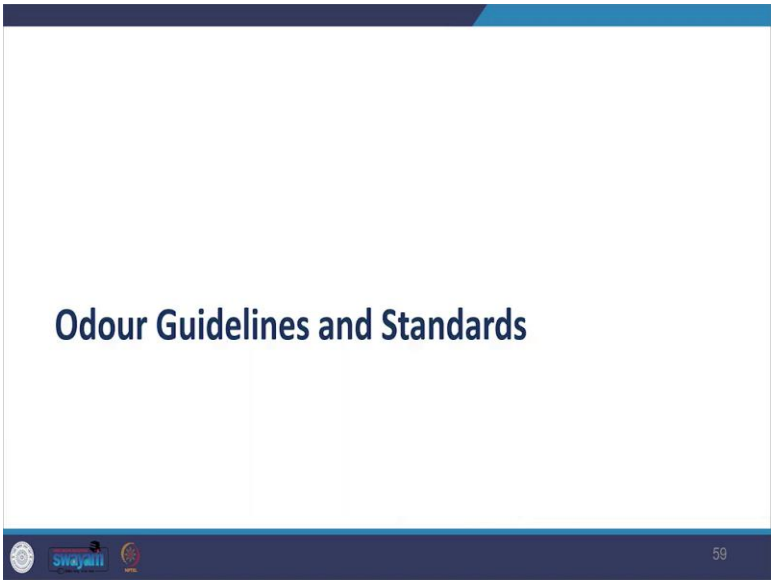
So, any Europe Critical Loads are assigned to habitat classes of the European nature information system. This enables consistency of habitat terminologies. And then the critical value loads are given in the range of like you have kg nutrients per hectare per year to reflect variations in the ecosystem response.

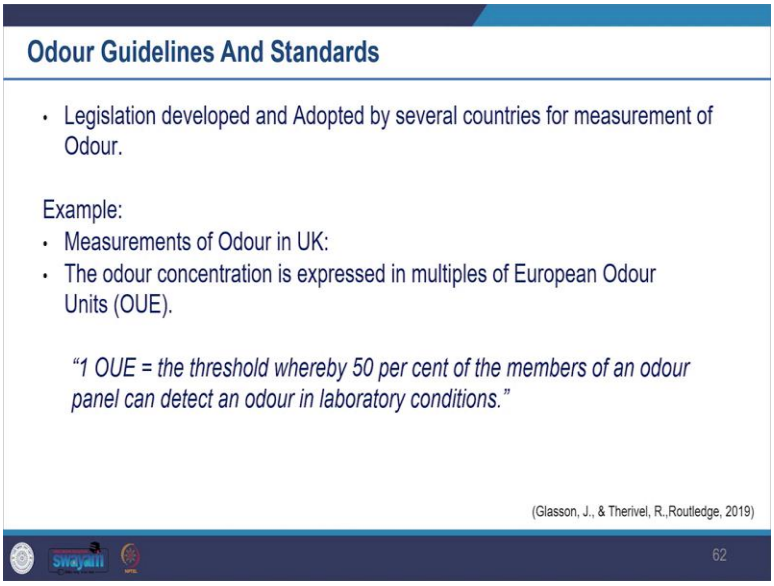
So, in the table taken from the air pollution information system of the UK, you can find nutrient nitrogen critical load range for using air pollution and impact assessments and by habitat type for assessment that is part of like planning applications and also for environmental impact assessment and all the procedure you would be required to do that.

So, in the first column, underlined with red, you can see the different habitats such as Marine Habitat, inland surface water, Mire bog fan habitat, grassland, and tail for habitat so all these habitats have been mentioned. The second column you can see highlighted in green shows the critical load range in kg nutrient nitrogen per hectare for you and the third column highlighted in yellow color shows the value used at the screening stage.

In the fourth column, you can see the value used in the detailed assessment stage. So, how even with the EIA process at the screening stage and the assessment stage, what are the values acceptable, and then the link is also provided for downloading these values? So, I have given you the link here.

(Refer Slide Time: 23:11)





So now, moving on to the other aspects we will look at the Odour Guidelines and Standards. So, there are no internationally recognized standards. So, many of the nations have set up standards for this. And we will also look at it when we deal with methods and air domain. So, the precise definition of odor and how it is assessed in concentration terms vary from country to country. So, tolerable levels would vary from location to location as well.

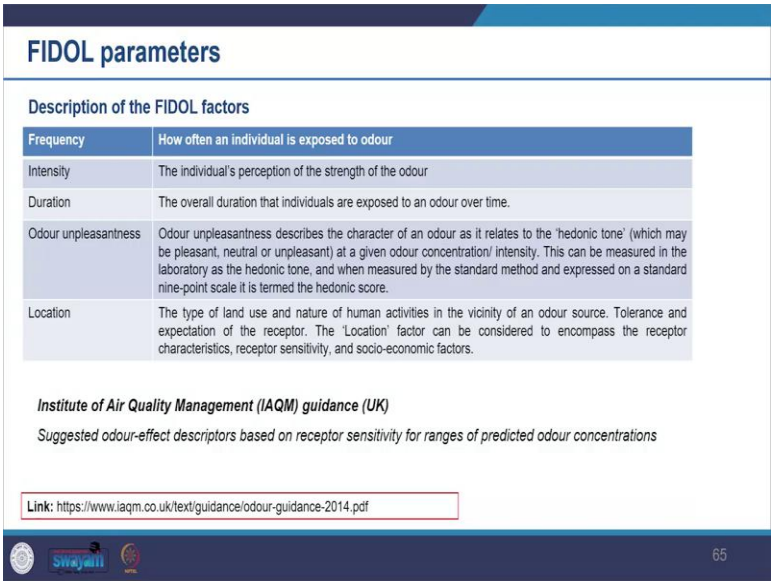
So, country to country also varies, it will vary from location to location, and a higher level of odor may be tolerable. For example, in an industrial area, you might be able to tolerate a higher odor compared to your residential area. And you would be able to tolerate some level of odor in the like restaurants and other places.

So, there is always relativity and then you have the European odor unit the UK provides that, so, European odor unit which is abbreviated as OUE. So, 1 OUE represents the threshold. So, a certain value where 50 percent of the members. So, members who are going to set that of the panel detect the odor in the laboratory conditions.

So, they can 50 percent of the people can detect that. So, that is considered as 1 OUE and this wave fluctuates also. And then so, these are like fluctuating this may vary then you have certain concentration levels also in which this odor is expressed. So, a mass unit of pollution set up for acceptability of a particular odor, depending on a particular land use, you have like in terms of percentile also it is mentioned.

So, in India, schedule 2 and Schedule 6 are general standards for the discharge of effluent under Environmental Protection Rules 1986 prescribe that all efforts shall be made to remove unpleasant odors as far as practicable. So, we have a very broad concentration here and it also depends on the level of complaints and annoyances. So, we also go by that so that also can fluctuate because people may, or may not complain. So, it varies across.

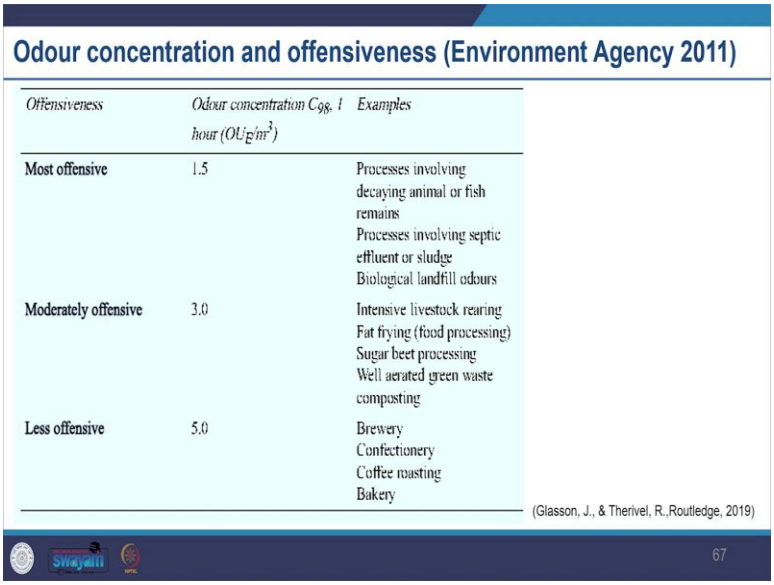
(Refer Slide Time: 25:39)



You also see the FIDOL parameter, FIDOL which is like which is defined in terms of like you can see intensity duration or the unpleasantness and location which you see here. So, based on that, it is FIDOL factors are given. So, you see the intensity. So, how the individuals like you and I would like to perceive the strength of the odor?

What will be our acceptability level, the duration overall duration that individuals can tolerate over time, and how unpleasant is the character and then where it is located? So, based on that this FIDOL factor has been identified. And then you also see Institute of Air Quality Management guidance given by the UK which also suggests odor effect, descriptors based on research sensitivity for a range of predicted odour concentration.

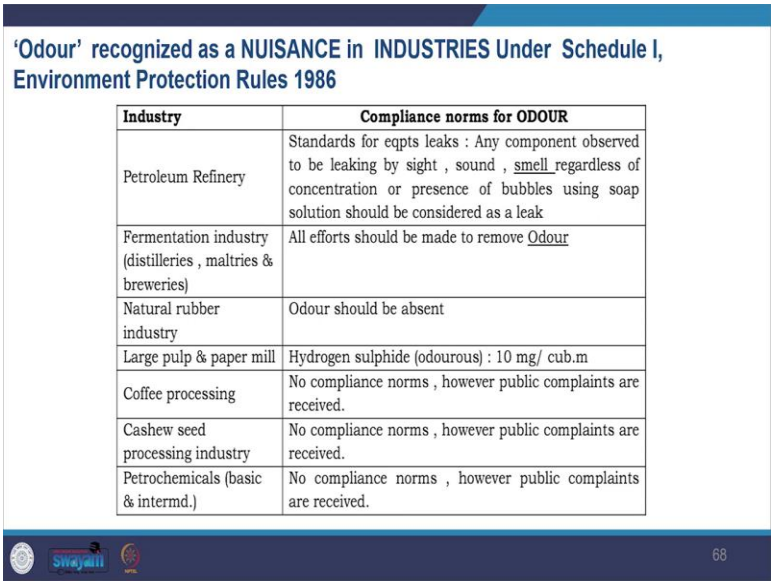
(Refer Slide Time: 26:43)



So, you get up to odor management regulatory guidance, then you can see in the table where the odor is classified into three categories you can see offensive range value, and then various offensive ranges are given. So, you can see how it is given most offensive, moderately offensive less offensive.

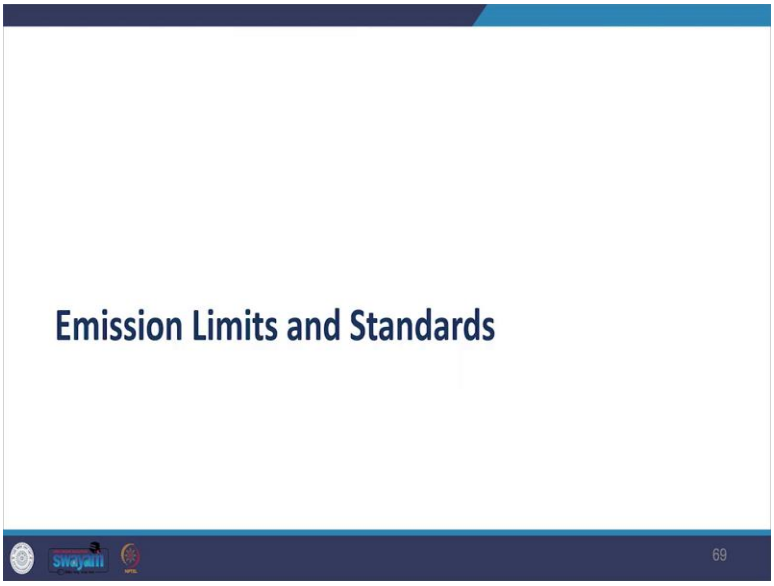
So, the most offensive would be decaying animals, fish remains, and septic things, and then you would see moderately offensive like sugar beet processing and livestock raring less offensive could be like you can have a brewery, bakery, restaurant, and all kinds of things which are less offensive. So, you can see all those categories here.

(Refer Slide Time: 27:30)



So, you also see odor is recognized as a problem nuisance in industrial industries. So, you see those also under the environmental protection rules of 1986 you can see the petroleum refinery fermentation industry, natural rubber industry, large pulp, coffee processing, and then what kind of compliance norms for odor has to be kept. You can see those are mentioned here you can refer.

(Refer Slide Time: 28:01)

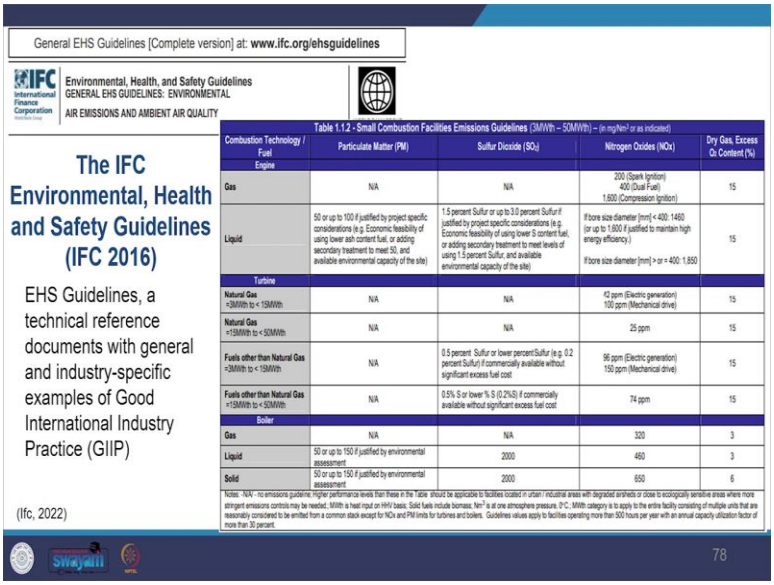


Then there are emissions. There are emission limits and standards. So, air quality standards refer to the levels of air pollution to which people and ecosystems are exposed. Another type of legislated standard is the emission standard. So, these standards are also there. And then emission standards are usually derived from consideration of the cost and effectiveness of available control technology. So, what kind of technology we have, how expensive it is going to be, and how effective it is going to be based on that we will decide upon what will be the limits and standards.

(Refer Slide Time: 28:36)

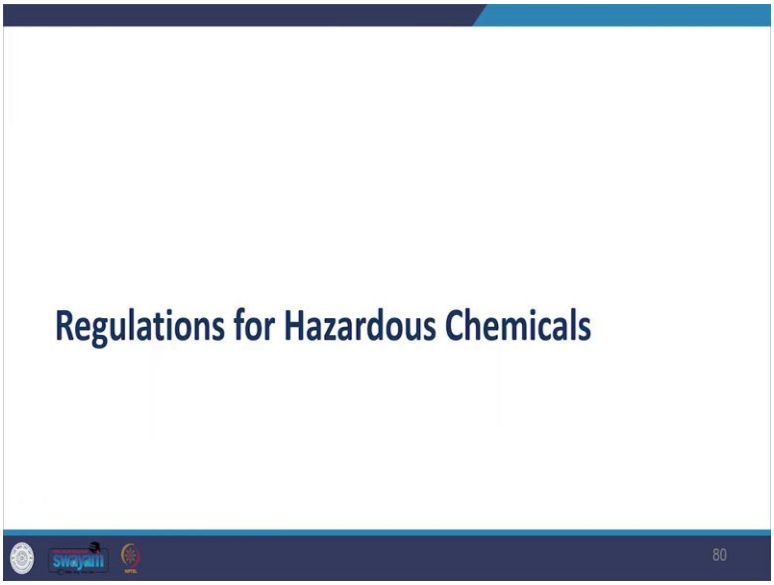
Then we also see, the USA Pollution Prevention Act, then we also see EU industrial emission directives, and then also, IFC environmental health and safety guidelines. You can find all those here for further reading. It is all these provide an emission from a point source and it suggests that it should be avoided it also emphasizes the combined application of process modification emission controls, all these tools should be used together. That is what is suggested.

(Refer Slide Time: 29:08)



So, now there is a lot of pressure on reduction of the emissions, and the emphasis is laid on technology development and the use of clean fuel, you may refer to IFC environmental health and safety guidelines and good international industry practice also. So, you can see that also how we are guiding development.

(Refer Slide Time: 29:27)

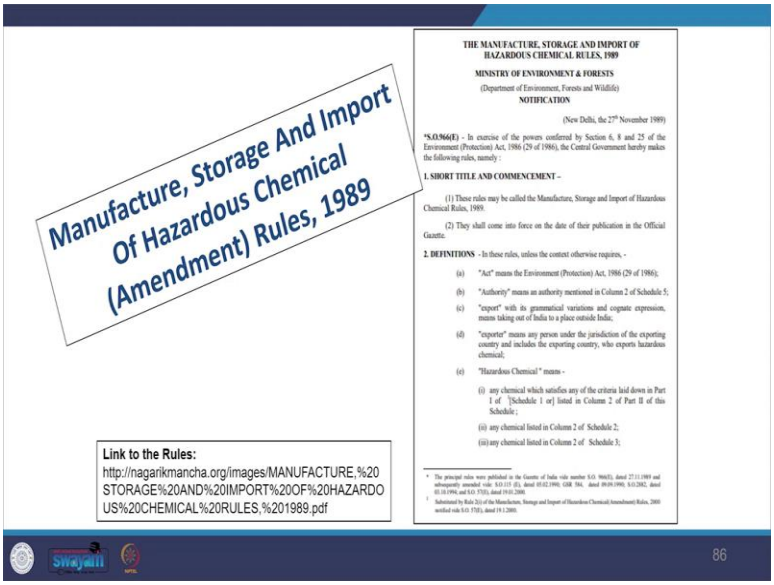


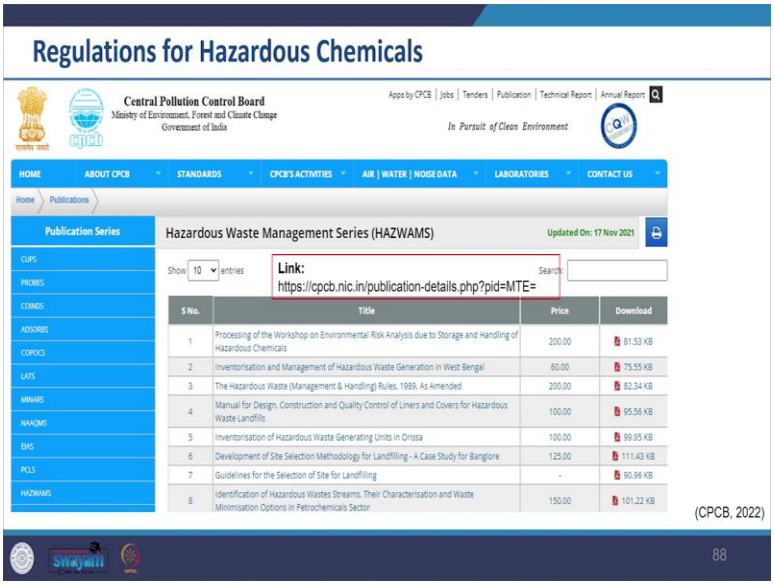
So, there is also now looking at the regulation for hazardous chemicals. So, here you see that we also have regulations for hazardous chemicals. So, in many development cases, like wherever the development will happen, some of the development activity might be dealing with the materials, which are damaging for the people if something goes wrong. So, EIA, environmental impact assessment should indicate what kind of prevention measures are being taken. So, to avoid those kinds of accidents, and then you see that European EIA directives also provide that and these directives control major accident hazards of these dangerous substances.

(Refer Slide Time: 30:12)

You have a Seveso three directive which looks at the prevention of accidents. So, these are available. Then it is toxicology, like different toxicology of particular chemicals that could be released in the event of an accident is also required to be prepared in EIA. So, that is all listing has to be done for EIA purposes.

(Refer Slide Time: 30:37)





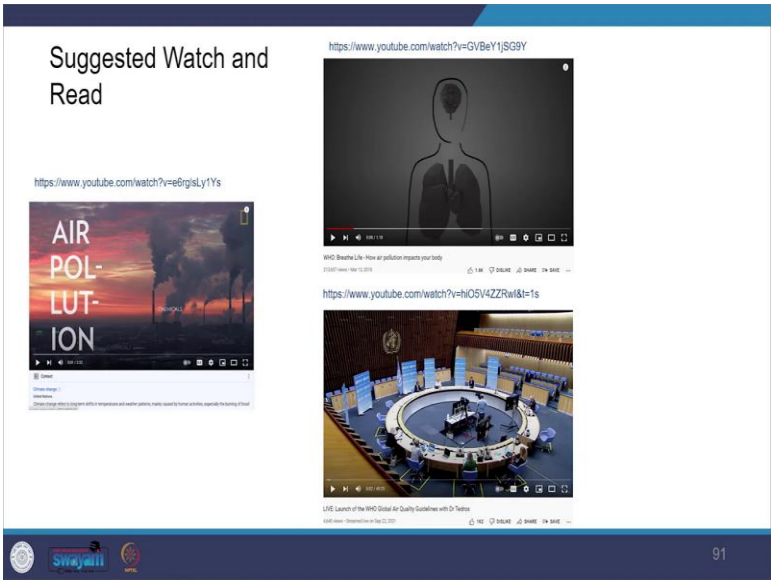
Then we also find that in our country, we also have the hazardous chemical amendment rule 1989, which again, provides the entire listing and it regulates the manufacture storage and how the things have to be imported. So, if you are dealing with hazardous chemicals in India, it will have regulations related to manufacturing, storage, and import of the substance as well as the transport of these chemicals. And that is all guided by the 1989 rules.

So, that is their regulation for hazardous chemicals. You can look here at the CPCB site. So, that was for this session.

(Refer Slide Time: 31:26)

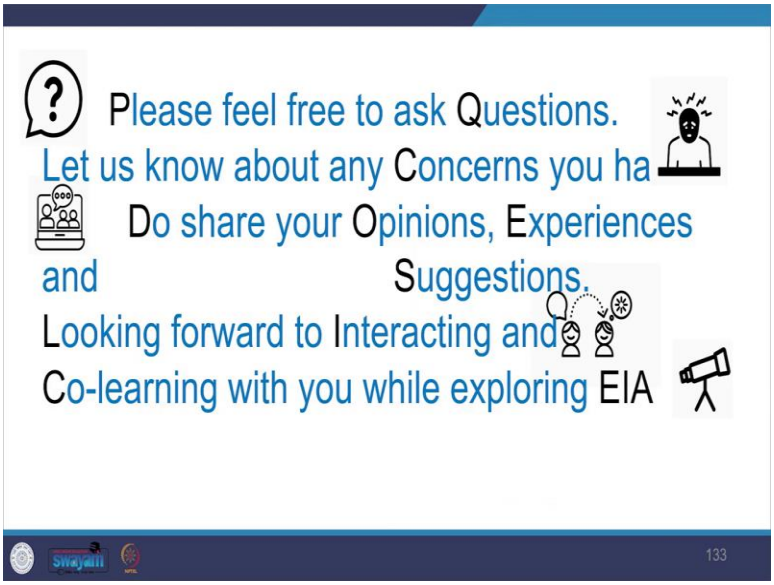
So, summarizing, what we covered today. We looked at the key international guidelines and standards about ambient air quality guidelines related to human health. Then we looked at all these guidelines related to vegetation and the ecosystem. And then we looked at the odour, the guidelines associated with it, the standards associated with it, and then we looked at the emission limits and standards, and then finally, we looked at the regulation for hazardous chemicals.

(Refer Slide Time: 32:00)



So, these were our references for today for this particular session. And these are the suggested watch and read.

(Refer Slide Time: 32:07)



Please feel free to ask questions. Let us know about any concerns you have to share your opinions, experiences, and suggestions looking forward to interacting and co-learning with you while exploring EIA. Thank you.