Air Pollution and Control
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Lecture - 13
Status of Air Quality Monitoring in India

Hello friends, today we will discuss about status of air quality monitoring in India. Basically, we will look into how air quality monitoring is carried out? What is its importance? What is its significance? What are the thumb rules or the processes which determines the locations, number of air quality monitoring stations, frequency all those kinds of things we will discuss.

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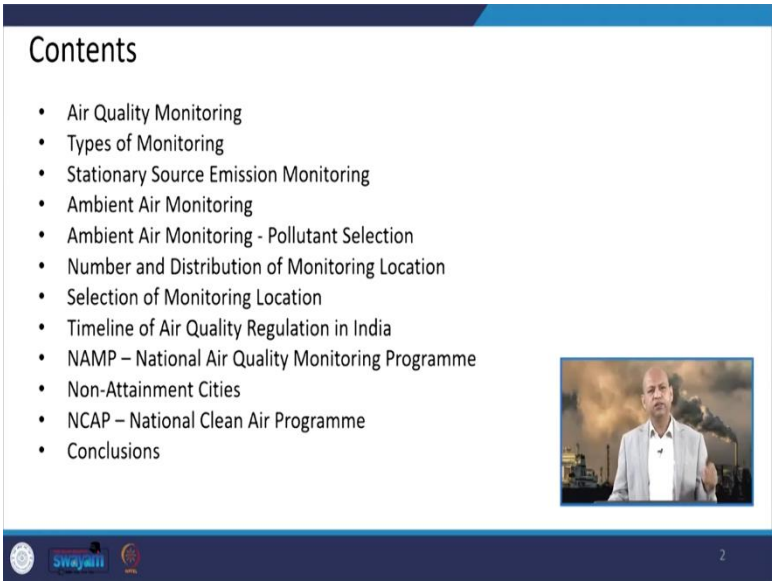

So, before going in detail, I can give you this contents list for this lecture, like we will look into very basic, very brief information of air quality monitoring. Then different kinds of types of monitoring, what are those types of monitoring or the way we carry out the monitoring, air quality monitoring in different ways. So, we will discuss about them. Then stationary source emission monitoring, we will look into because air quality monitoring and emission monitoring two different things are there, but they are both important.

Then we will look into ambient air monitoring, like different kinds of pollutants which we focus on when we go for air quality monitoring, ambient air quality monitoring. Then the number and distribution of monitoring locations, selection of monitoring locations, those kind of principles, basic rules and the timeline of air quality related regulations which have been implemented over the period of time in India so, that we will look into.

Then national air quality monitoring program. We will discuss briefly and the non-attainment cities that is exceeding air quality standard. So, about those cities we will discuss. Then we will focus on National Clean Air Program which is very important program which has been sponsored by central government of India. National Clean Air Program or NCAP and after that we will conclude.

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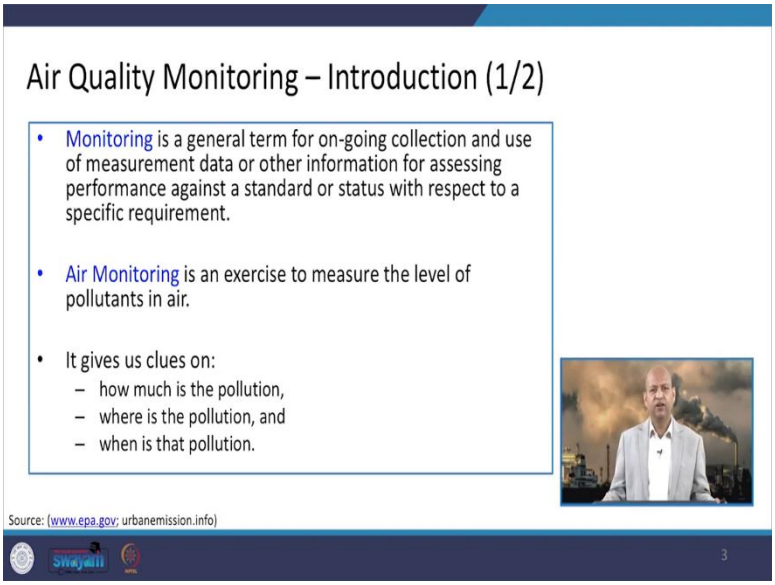

So, when we talk about basics or brief information on air quality monitoring, so you can see that monitoring is nothing but a general term which relates to collection of data or measurement of the data and the information assessing, processing after the collection of those air quality related data. And the monitoring is an exercise of measurements of different levels of air pollutants, basically.

And it gives us some information which is related to, like how much is the level of the air pollution of a particular pollutant at a given location, where this pollution is there and what is the time series or when this pollution has occurred. Those kinds of things are determined with the help of air quality monitoring.

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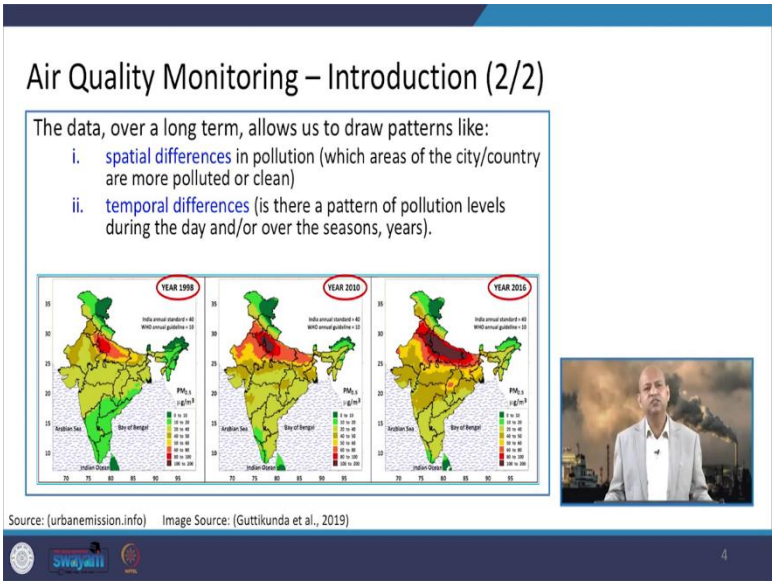

When we look into like special differences or temporal differences or trends. So, with respect to the space or place, you can see the variation may be there from state to state within the state, city to city within the city from location to location there may be differences in the levels of air pollutants. Similarly, over the period of time if we monitor from one year to another, there is variation in different months.

So, average concentration, air quality concentration in different months may be different because of several factors like emissions may be different, plus metrological factors which also kind of govern the pollution levels because sometimes wind is more than it can take away the pollutants and then when precipitation is there, then again cleansing of air becomes very easy. So, those kinds of metrological parameters also influence the air quality.

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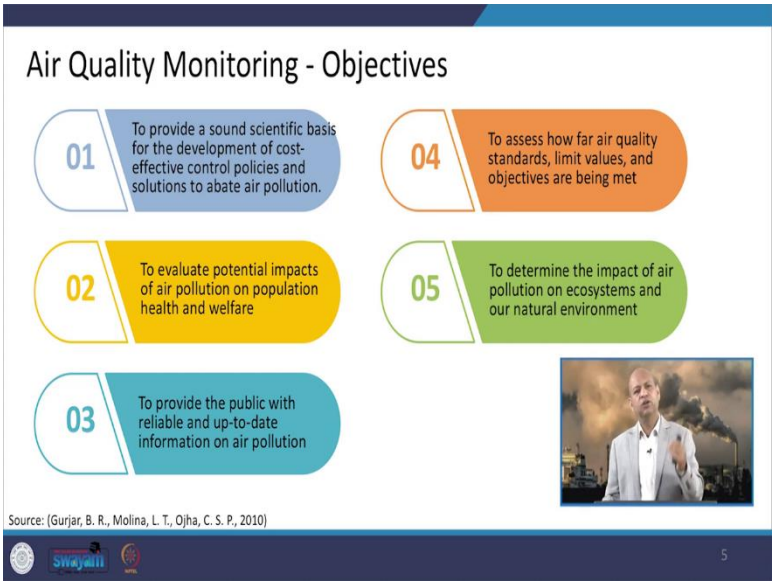

So, the temporal variation is there, special variation is there. When we look into the objectives or aims. So, most of the air pollution monitoring or air quality monitoring, then what is the purpose itself basically? There are numerous purposes basically, like it can provide a very sound and scientific basis for development of cost-effective control policies and programs or technological interventions which are needed to control the pollution discharges or emissions and to improve the air quality, you can say.

And it also helps in evaluation of potential impacts of air pollution on population, health and environmental health or welfare of the public because the air quality determines the public health related issues also. Then it also provides information about reliable information and up to date information on air pollution levels related to particular location or related to particular source.

So, that way we can control that particular source which is emitting more of the air pollutants. Then it also helps in assessing the air quality standards, whether those air quality standards are being met or not. If it is exceeding at a particular place, then what are the responsible factors for that. Is it because of some topographical factors or because of some source emission?

Then it also helps us in determining the impact of air pollution on the ecosystem and our natural environment and also assessing different policy measures which we have taken to improve the air quality. So, how much impact is there of that policy or technological intervention. So, that way air quality monitoring gives us a lot of information from that perspective.

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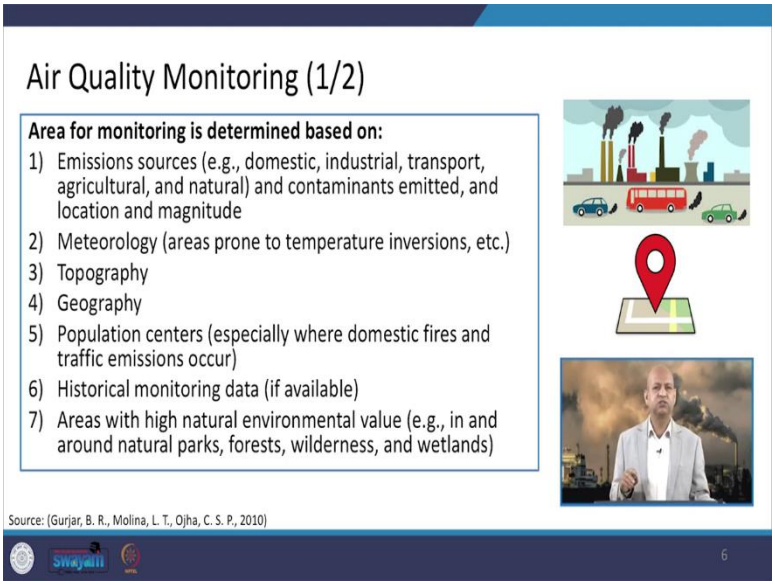

Well, area for monitoring determined on the basis of emission sources, whether it is domestic or industrial transportation or agriculture related, natural and then those pollutants which are being emitted, what are the nature of those pollutants? Then the location and magnitude of the pollution intensity, all those things govern where we need to monitor.

Then metrological factors are also important because some areas are prone to temperature inversion, which can enhance the pollution levels. So, those kinds of things, then, topographical issues and undulation is there or flat terrain is there, geographical issues, population centres where a lot of population is there. So, receptor maybe more. So, it may be needed to monitor the quality because they will be impacted, their health will be impacted if a large number of populations is there.

Then historical monuments are also important because they can be affected by the air quality. So, we need to monitor the air quality in and around those places. Then also some very sensitive zones like natural parks for us, and wetland. So, pollutants can really change their particular ecosystem. So, we need to know how much pollution is there in and around those particular areas. Next is like, if some areas are vulnerable to pollution plumes, then again it is needed to monitor so that we can learn which particular pollutant is problematic.

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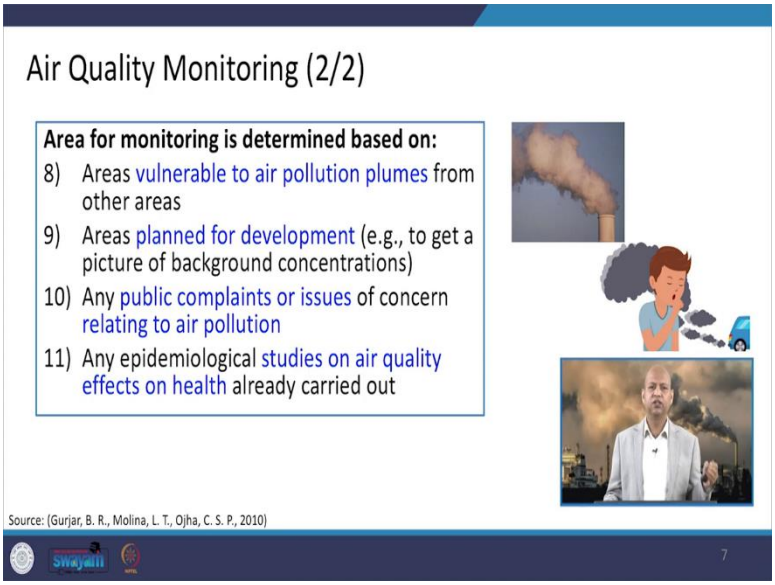

Then the plan for the development, like if we are planning some particular industrial cluster or some new city something like that, then also we need to know the background concentration so that we can foresee that after implementation of our execution of this plan, what will be the air quality at that location.

Then, if there is complaint from the public or some person that at a particular place some pollutant concentration is increasing because of some source or because of some industry and the industry is not taking care of that, then again air quality monitoring is required to see whether it is true or not.

And then, any epidemiological studies on air quality affect the health already carried out. So, relationship between the epidemiological studies or the public health or the health on particular group of the public like children or old people and its relationship with the pollutants. So, those kinds of relationships can also be established by virtue of this data which is obtained from air quality monitoring.

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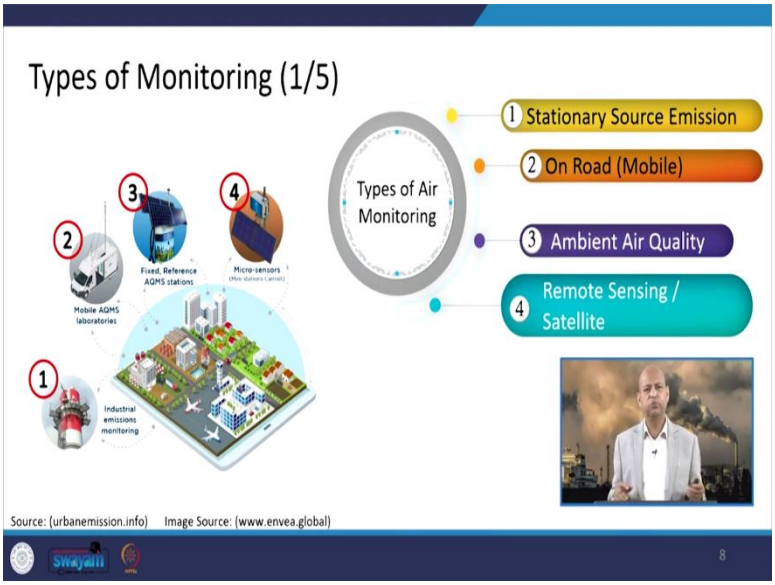

When we talk about what kind of monitoring techniques are there, then you can see, a stationary source emission monitoring can be there when some stack is there and you can monitor the emissions which is coming out of that stack. On road mobile when related monitoring instruments can be in that mobile and you can travel and you can also monitor the air. So, you can have a kind of trajectory of the air quality from one place to another. So, that kind of profile you can generate, a special profile, temporal profile.

Then ambient air quality can also be monitored by virtue of manual instruments or automatic instruments. Then remote sensing related instruments are also available nowadays or satellite observations can also be done. So, you can have this column of the air, you can see how much pollution is there of a particular pollutant, whether particulate matter or ozone or those kinds of pollutants you can easily monitor from the satellite also. There are certain sensors and they can give the reading of those concentration in that column.

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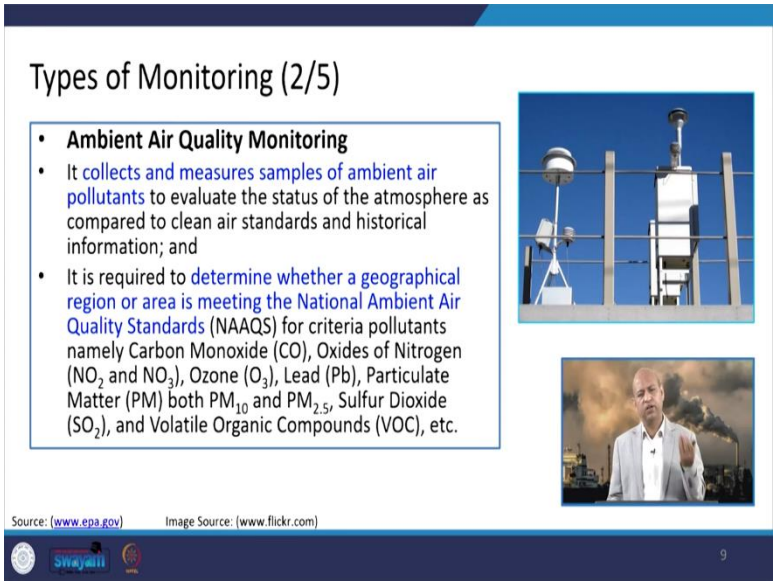

Then when we talk about ambient air quality monitoring, so, we have to see what is the purpose of that because in ambient air different pollutants are there. So, we have to monitor different pollutants. So, accordingly we need to install the instruments and we can assess the concentration of criteria pollutants for example CO or nitrogen dioxide or oxides of nitrogen like and NO, NO_2, NO_3, those kinds of things. Then ozone or heavy metals, etc, VOCs all kinds of these pollutants can be monitored by some technique, some instruments or especially instruments.

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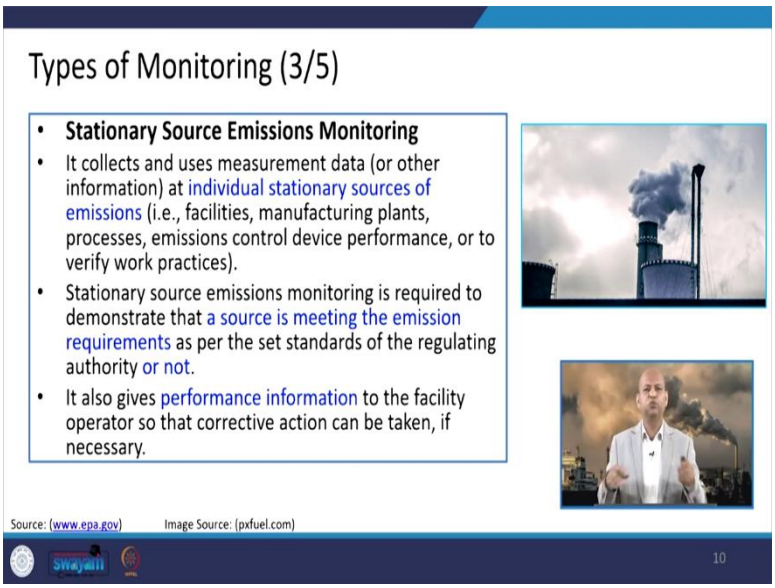

Then the stationary source emission monitoring is done when the stack emissions are there. We want to know how much emission is going out of that stack and what is the concentration

in the exhaust gases which will be diluted afterwards in the air. So, those kinds of things because we need to know the performance of this air pollution control equipment.

For example, you want to see some ESPs there Electrostatic Precipitator at coal based thermal power plant etc. So, you need to know how much performance intensities they are or what is the efficiency of that instrument. So, unless you know how much is the input and how much is the output. So, those kind of stationary in the stack emissions you can see and know about those emissions.

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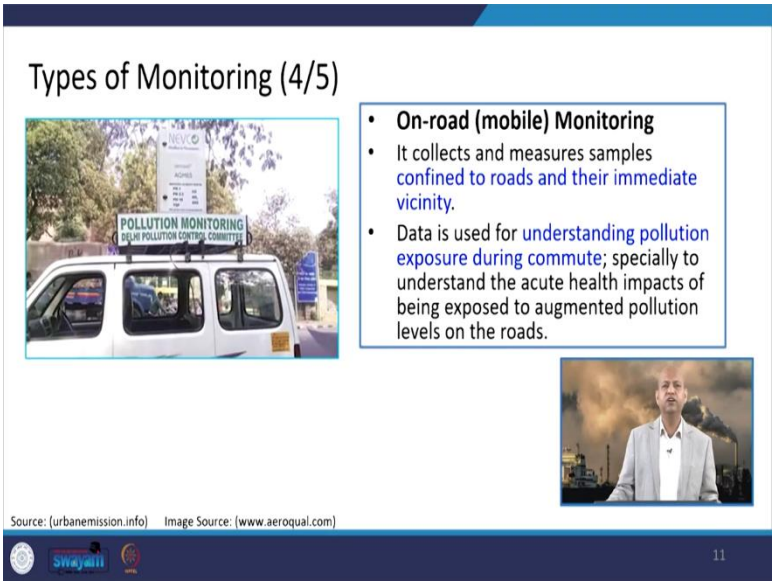

Then you can see On-road mobile monitoring which can be done as I said, you can have different kinds of instruments in the mobile van and then you can suck the air through those inlet pipes. And there are censor-based instruments also, they can give the readings of those pollutants and you can see the profile of the pollutants with respect to the time and the space.

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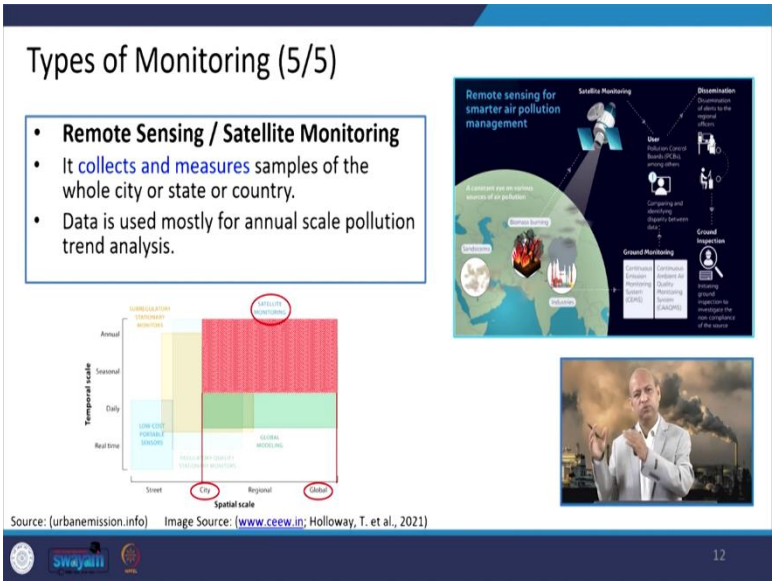

Well, when we talk about remote sensing, satellite-based monitoring, then also depending upon the pollutants and depending upon the location, weather city, you want to focus, you want to focus the whole State. So, accordingly you can have this air quality monitoring and readings can be taken.

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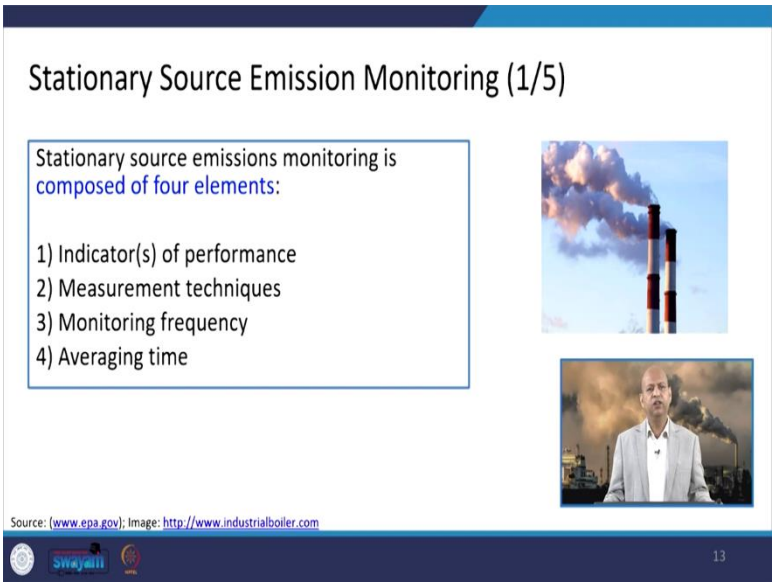

Well, when we talk about a stationary source emission monitoring, so, as I said, there are different components of that particular process like indicators of the performance, then measurement techniques, different measurement techniques, monitoring frequency, averaging time, all these things are important when we carry out the emission monitoring of the stationary sources.

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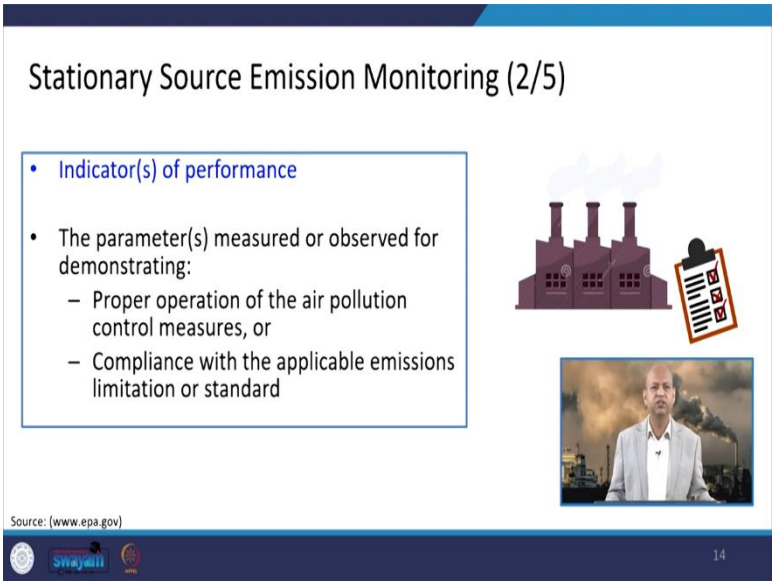

So, when we talk about indicators performance, like proper operation, this is done for demonstrating the proper operation of the air pollution control measures which has been implemented. Then compliance of the applicable emission limitations or standards. Because when we will have some reading, only then we will be able to compare what are the norms and how much emissions are coming out. So, that indicator performance is done by this stationary source emission monitoring.

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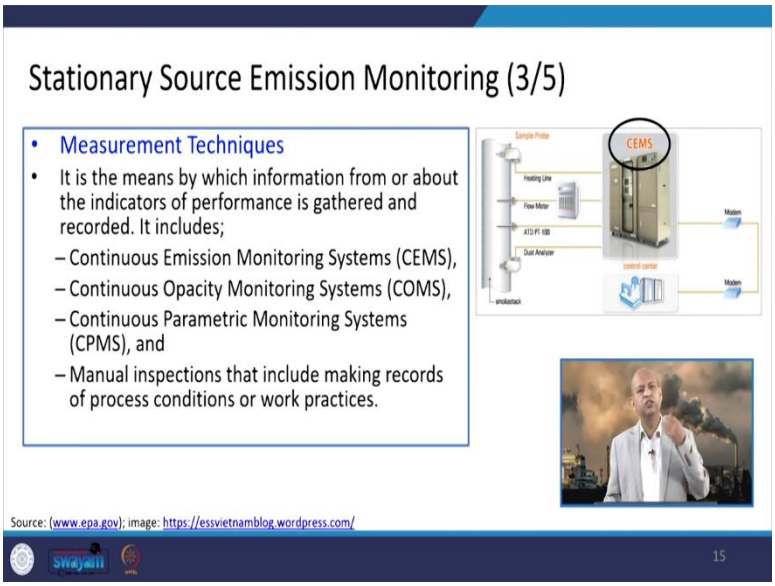

Then there are different techniques like Continuous Emission Monitoring System can be there CEMS, Continuous Opacity Monitoring System can be there. Continuous Parametric Monitoring System can be there or Manual inspections that include like records and

processes, different kinds of different conditions, work practices, all those things can be combined and then you can evaluate those things to see what is the emission. Basically, what is the intensity of the emission and what is the air quality impact of that emission in that surrounding.

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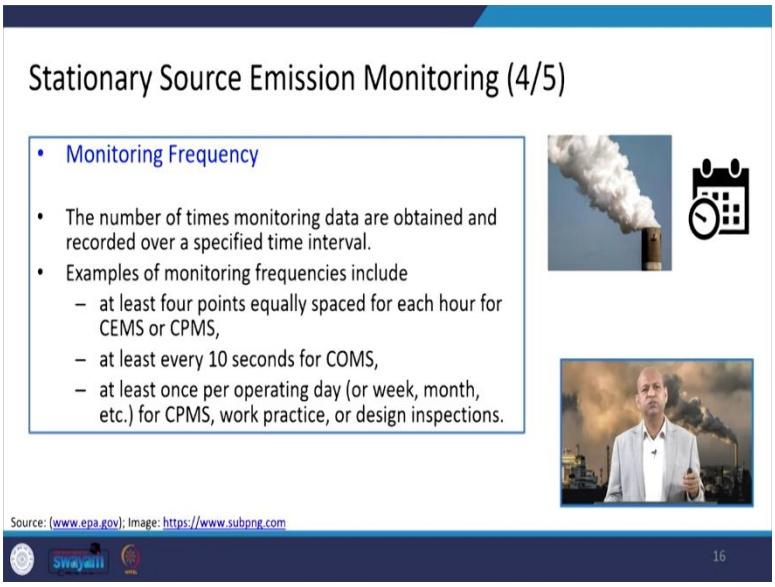

Then the frequency means like hourly or weekly, depending upon the purpose you can decide the frequency basically and then even if you are having hourly, then you can convert it into weekly or monthly depending upon what kind of purpose is there for this monitoring?

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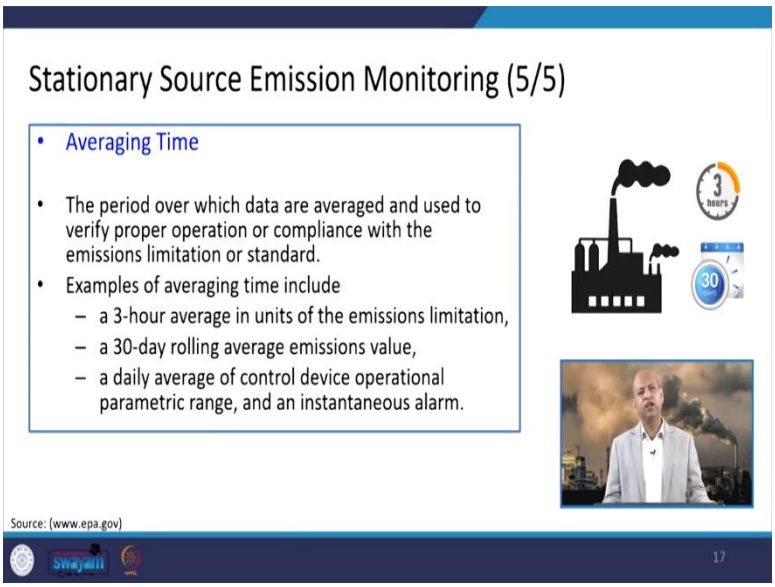

Well, averaging time again you can do because instruments are there which can give you per minute data, per second, data per hour. So, then you can process, what is the average in time

depending upon, you want to compare with 24 hourly emissions or hourly emissions. Accordingly, you have to do the averaging time. So, that comparison can be of the same unit.

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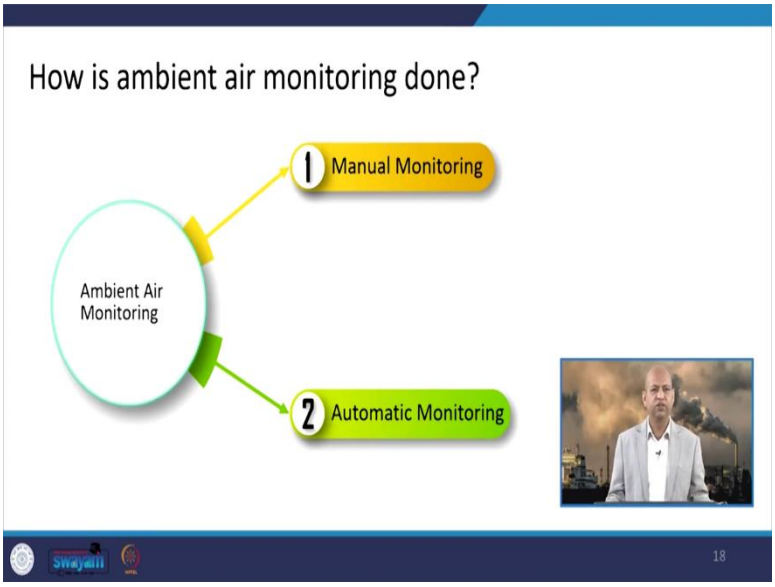

When we talk about ambient air monitoring. Then again, it can be done like through manual monitoring, by hand instruments and then automatic monitoring.

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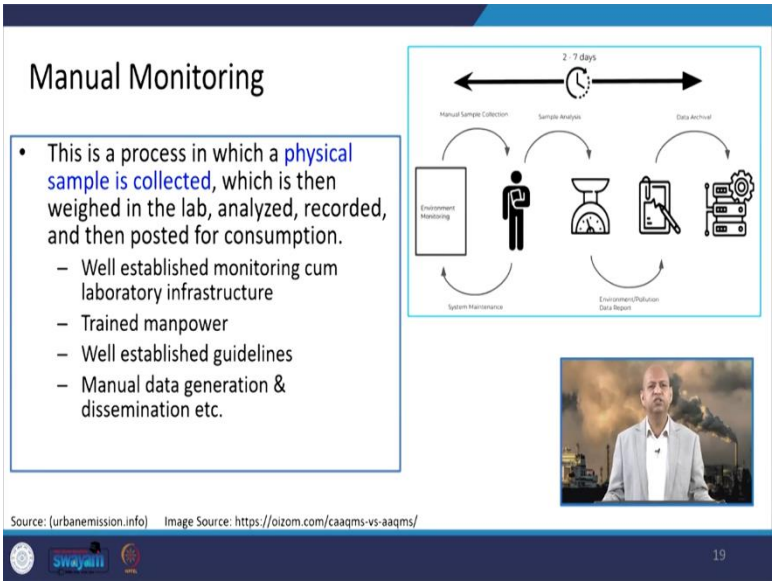

So, manual monitoring is basically like some instruments are there and you do like physical activity when for example, you are monitoring particulate matters so, you have to weigh the filter paper, you have to install it and then you have to run, you have to check the reading. So, that means a lot of involvement is there of the expert or the skilled person who knows how to carry out the air quality monitoring using that particular instrument.

So, there are well established guidelines which needed to be followed and the manpower must be skilled and the manual data generation and dissemination is possible by this particular methodology.

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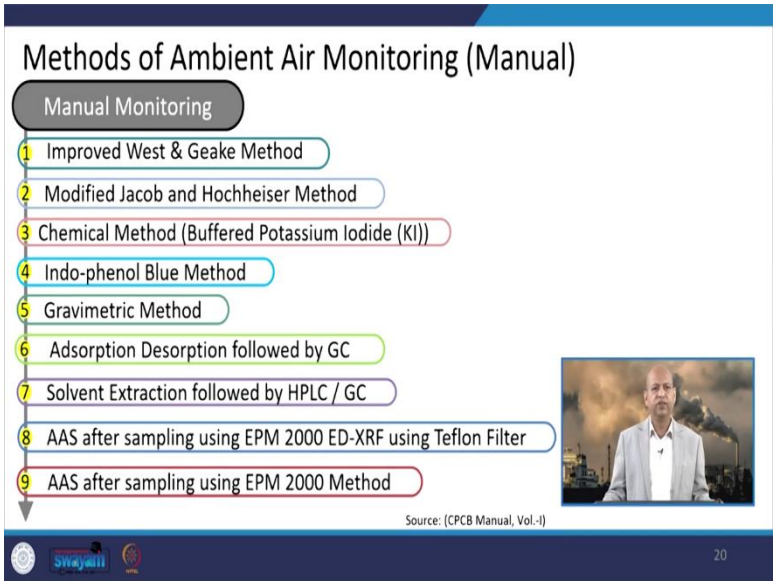

So, there are several instruments which are used for manual monitoring like Improved West and Gaeke Method, Modified Jacob and Hochheiser Method, then Chemical Method can be there, Garvimetric Method can be there for particulate matter. So, these are the listed different kinds of instruments which can be used.

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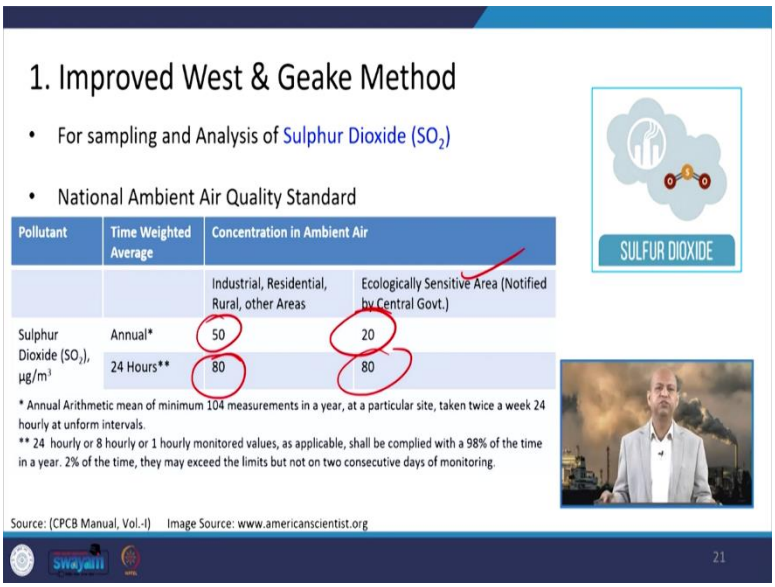

So, if we go one by one then this particular method which is known as Improved West and Gaeke Method, this is used for monitoring the sulphur dioxide and there are these annual

standards 50 and 20 for industrial, residential and ecologically sensitive areas. Then 24 hours these guidelines or concentrations are also there, which are 80 micrograms per cubic meter. So, accordingly monitor data can be compared with these guideline concentrations.

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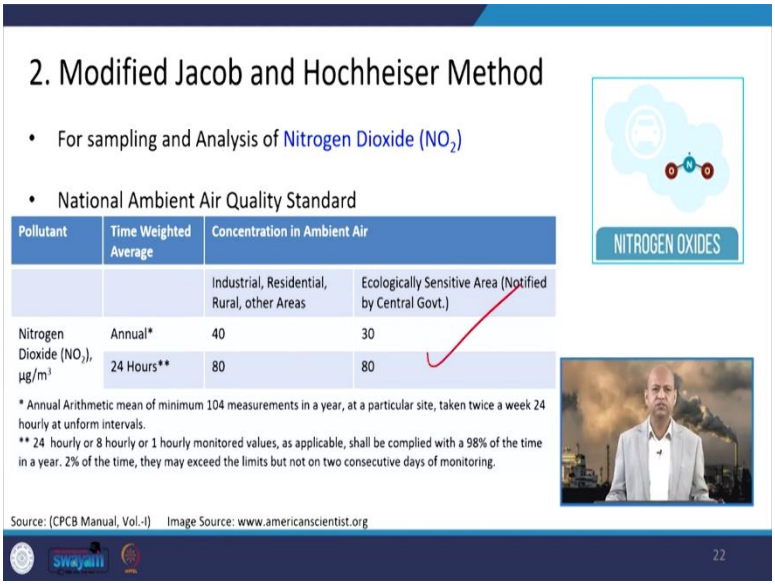

Similarly, if we talk about modified Jacob and Hochheiser Method, then this is done for measurements of NO_2, nitrogen dioxide. And we can compare with again this table gives the air quality standard, National Ambient Air Quality Standards for 24 hours and for annual standards. So, whatever data you are processing you can compare accordingly.

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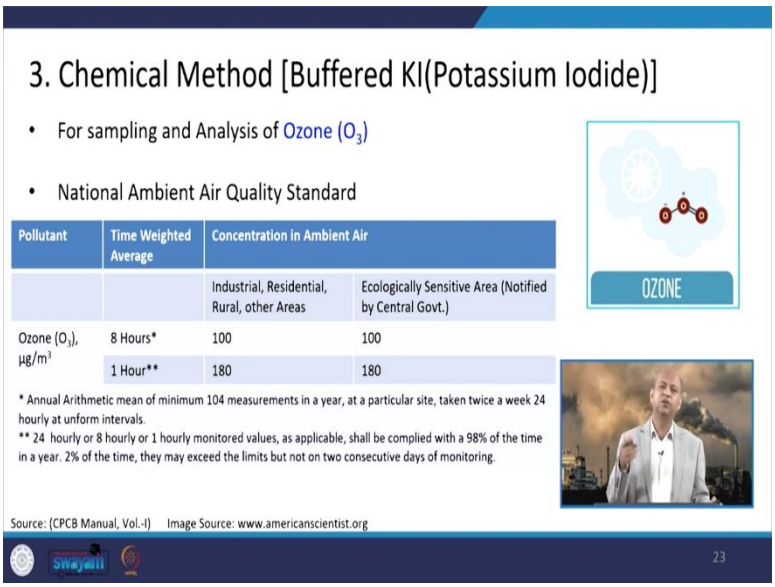

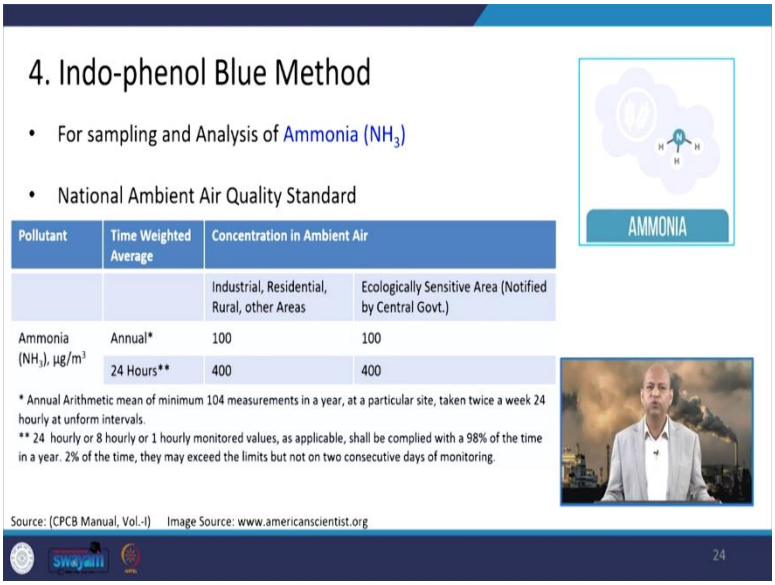

When we talk about ozone monitoring or sampling, then this chemical method which is also known as buffered potassium iodide method, this is used. We will look into these methods in detail later on. I am just giving you a brief introduction about different instruments or methods which are used for air quality monitoring. For ammonia, we need to use this Indo-phenol Blue method.

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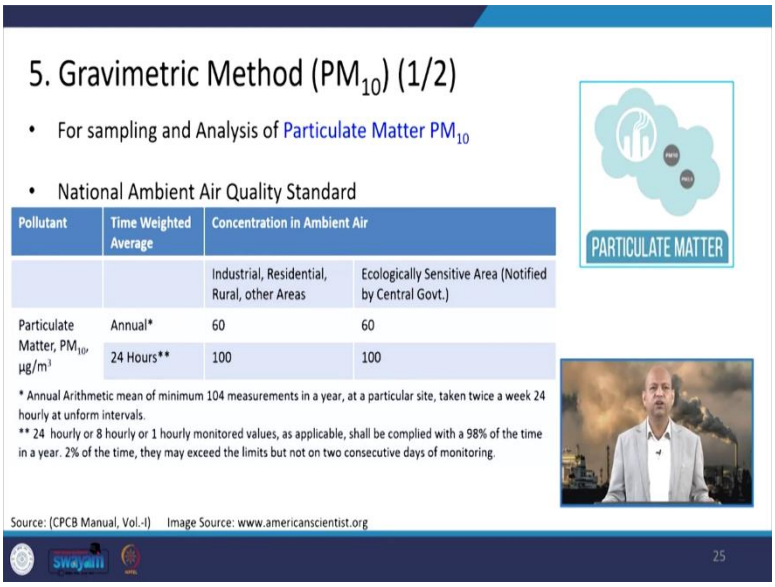

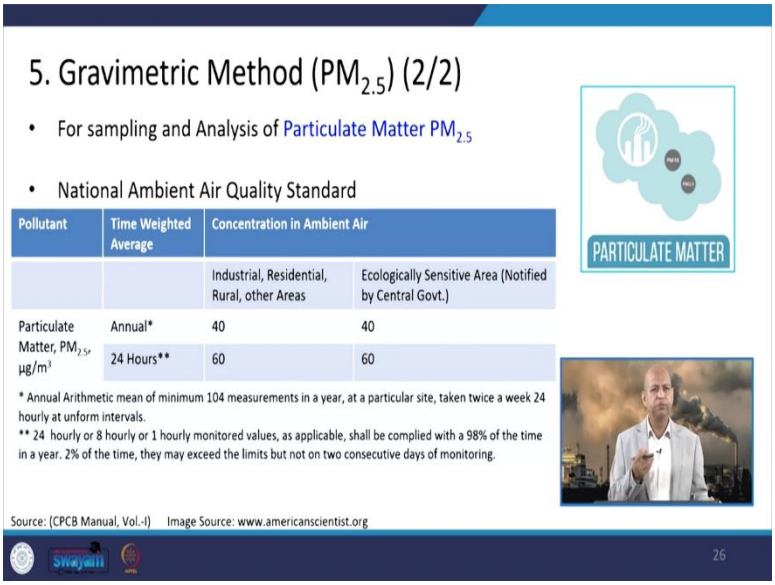

For Gravimetric Method like for PM_{10}, particulate matter of 10 micrometre size or less than that RSPM, it is also known as like respiratory, the suspended part plate matter. So, the same Gravimetric method can be used for $PM_{2.5}$ also and you can see these ambient air quality standards which need to be met.

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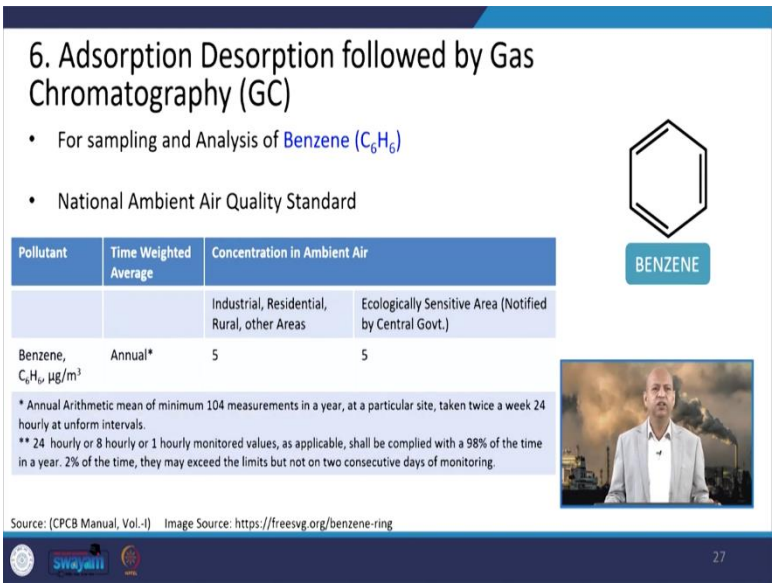

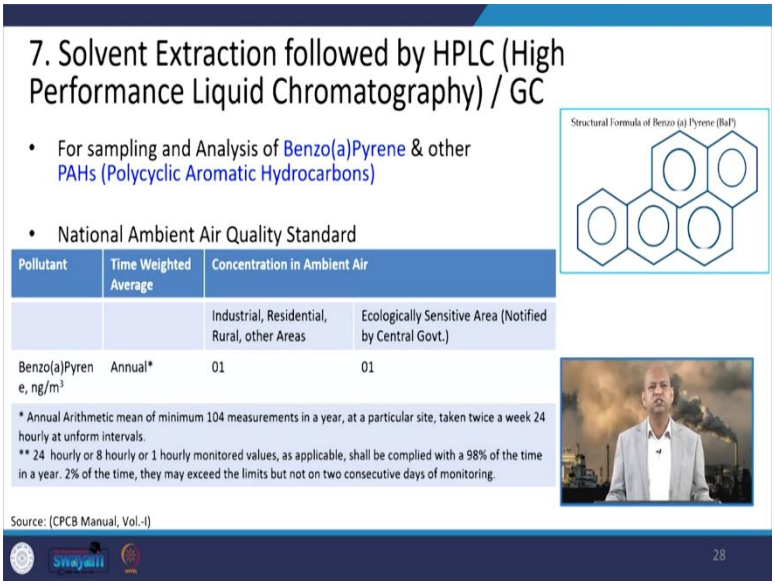

Well, like gas chromatography method is there, adsorption desorption followed by gas chromatography which can be used for benzene measurements or sampling. And, if you want to monitor this Benzo Pyrene then solvent extraction followed by HPLC. HPLC is High Performance Liquid Chromatography and gas chromatography can also be used. So, these methods are necessary for measurement of Benzo Pyrene.

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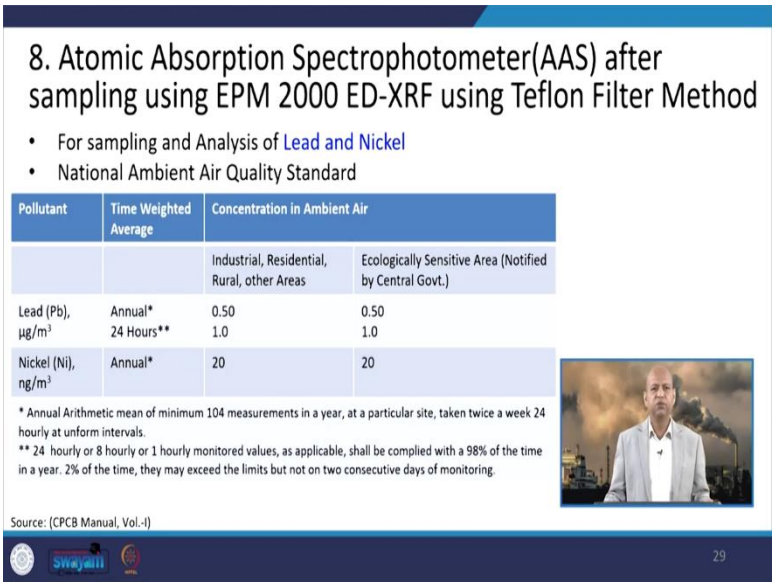

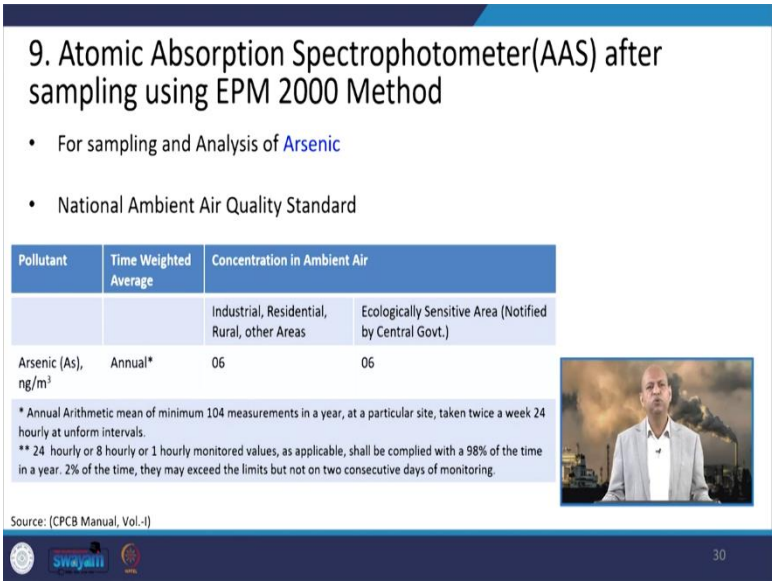

Similarly, if you go for heavy metals like lead or nickel then, you need to go for Atomic Absorption Spectrophotometer (AAS), there are different mix, different companies make it but this is the methodology which is used for this particular, these particular pollutants. If you go for Arsenic sampling and monitoring, then Atomic Absorption Spectrophotometer AAS, is there and using EPM 2000 method can be used for these Arsenic monitoring.

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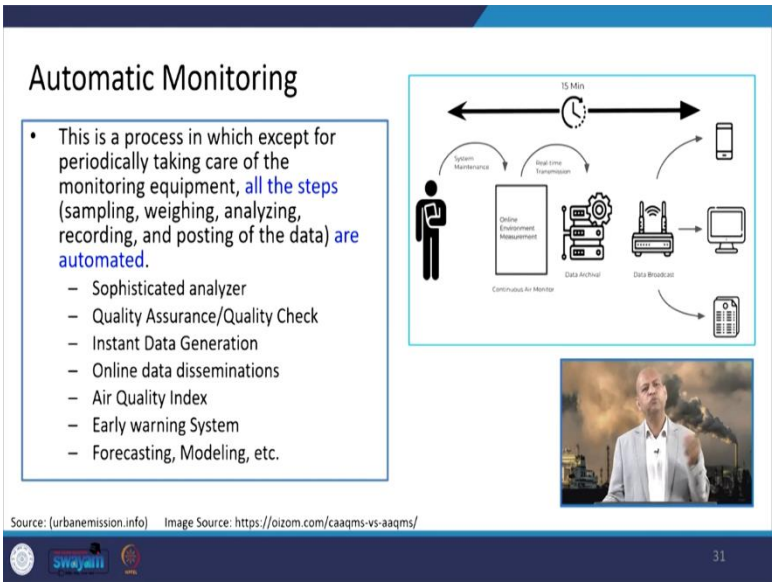

When we go for automatic monitoring, then there are sophisticated analyzers which are sensor based and different techniques are there and the quality assurance, quality check is to be done. Air Quality Index Development all these things can be done by automatic monitor because in this case, intervention of human needs very less. Automatically measurements happen sensor-based calculations happen.

So, computer-based calculations are also there, it can help us in calculating Air Quality Index or early warning systems forecasting modelling, all those things are basically done by these Automatic Monitoring Systems because they give the real time observations, real time measurements.

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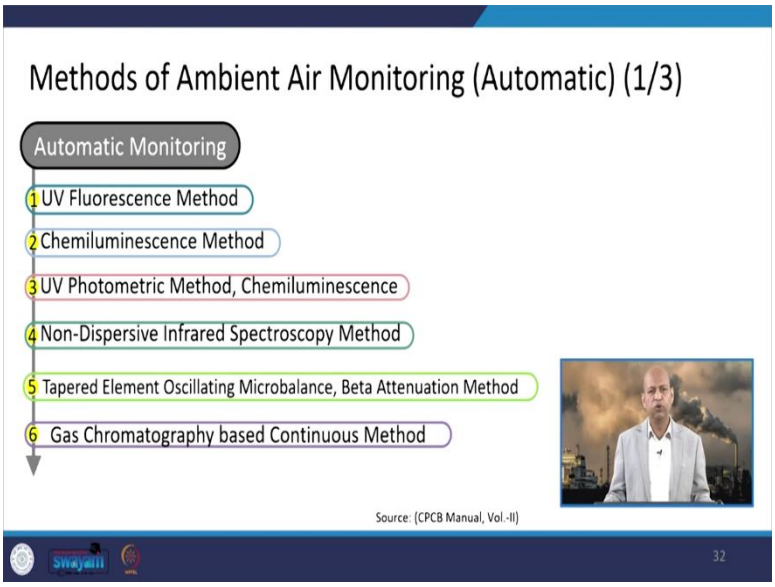

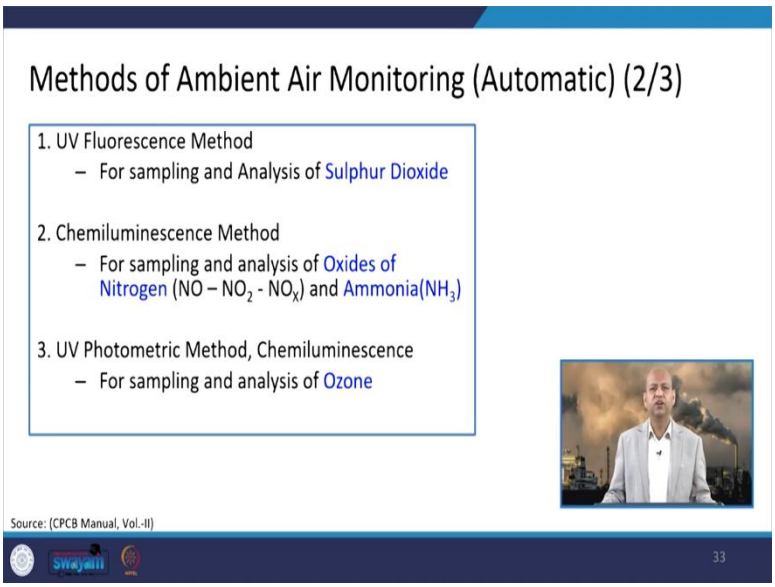

And different methods of the ambient air monitoring of the automatic nature, we go for ultraviolet, this fluorescence method or this photometric method is also there. So, these are listed you can see like ultraviolet fluorescence method is for sulphur dioxide, then for oxides of nitrogen or ammonia, you can use this Chemiluminescence Method and Ultraviolet Photometric Method can be used for ozone.

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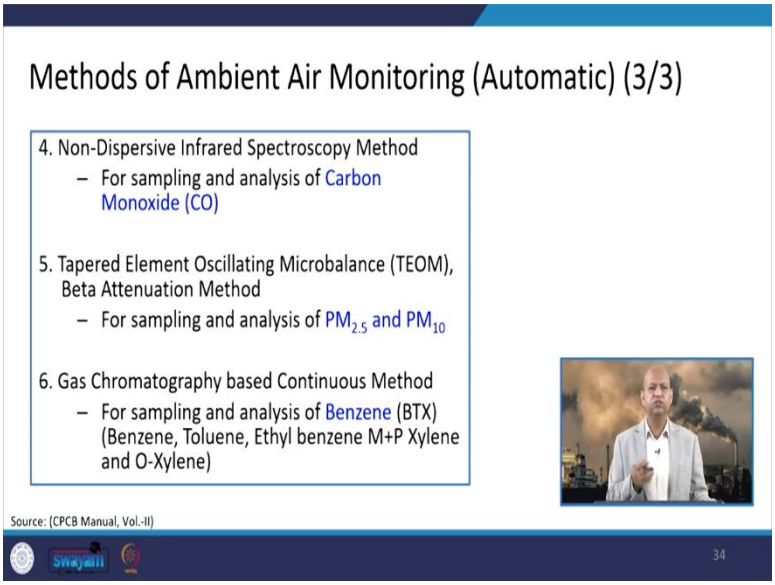

Similarly, other methods are also there for carbon mono-oxide and $PM_{2.5}$, PM_{10}. All those different pollutants can be measured by these automatic sensor-based equipment. And Gas Chromatography is quite expensive, but this can help in measurements of benzene and there are some sensors also which are used for measurements in automatic fashion.

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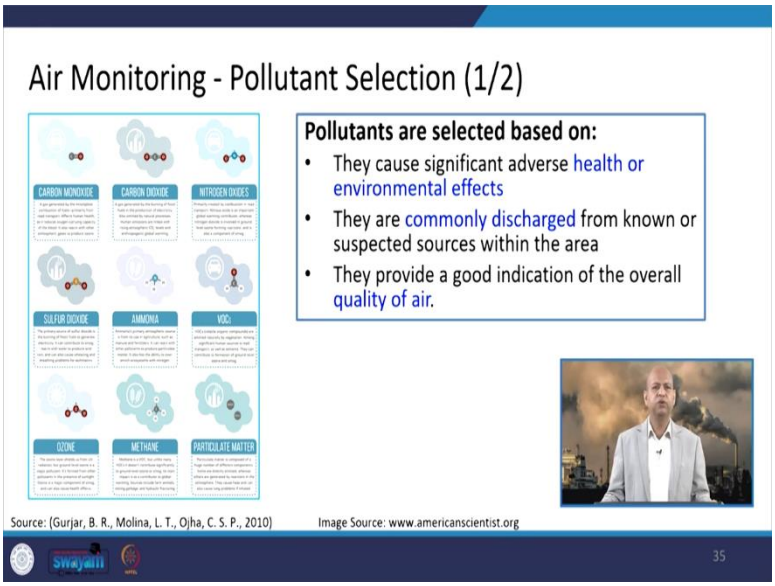

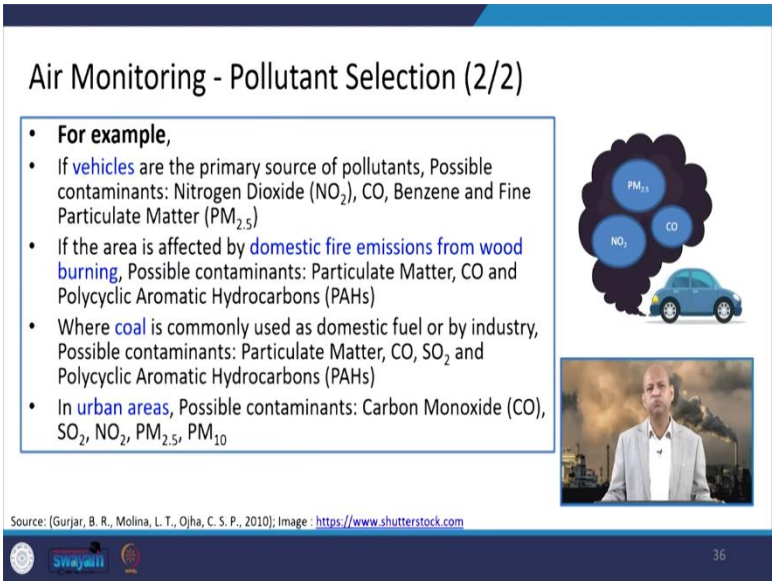

Well, so, when we go for selection of pollutants, which pollutants are important. So, this depends upon what kind of health impacts we are going to assess or evaluate. So, accordingly we need to go for that particular pollutant. Also, it depends on what kind of major pollutant sources can be there.

So, accordingly you can choose the pollutants, like if you want to major near highways or vehicular air pollutions, then basically carbon monoxide or nitrogen dioxide, benzene, fine particulate matters like $PM_{2.5}$ They are the important because they are emitted in large quantity from these particular sources.

When you go for like coal-based power plant then SO_2 particulate matter are more important. Urban areas, you can go carbon monoxide SO_2, NO_2, $PM_{2.5}$, PM_{10}. So, depending upon nature of the pollution sources and other issues you can choose which particular pollutant we need to monitor.

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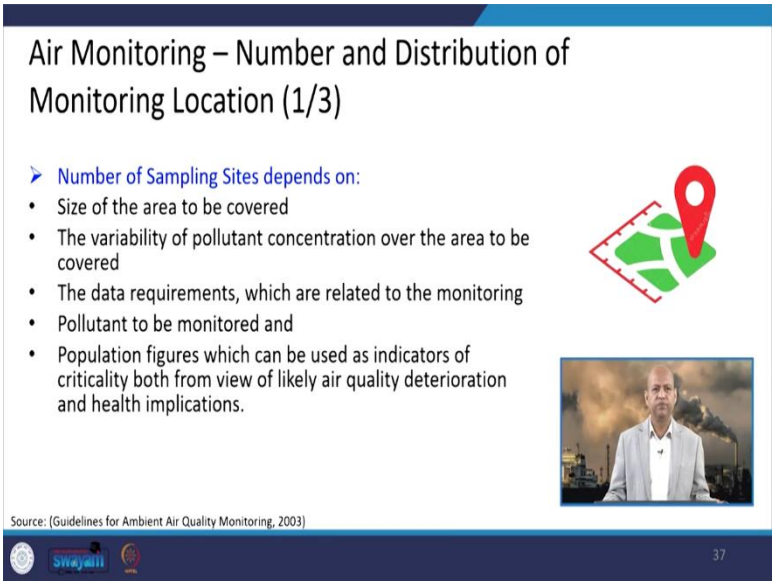

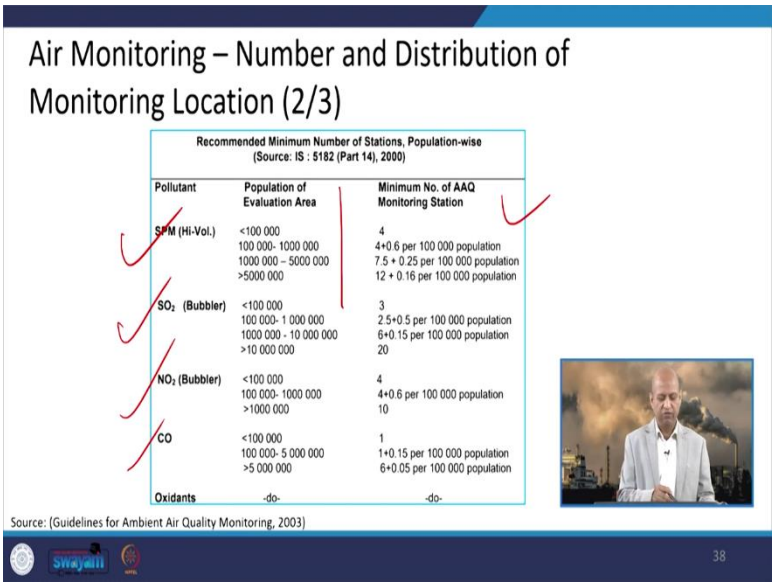

Then we come to how many numbers and distribution of monitoring locations can be there. How many samples, sampling stations we should install? So, that depends on various factors like size of the area, how many people are living in that particular area, frequency of the data which we need. So, all those factors influence the number of these locations or sampling stations.

For example, if you go for like SPM monitoring and this is the population data, so it gives the number of, these monitoring stations which are required. So up to one lakh population 100,000 population, minimum 4 stations are recommended. Then population increases, so, there is some relationship empirical relationship which can be used to decide the, to determine the number of stations.

So, similarly, for all different pollutants, we can get the number of these stations, air quality monitoring stations like carbon monoxide, you can have only 1 station is enough 400,000 people whereas for SPM you need 4, for NO_2 you need 4, for SO_2 you need 3. So, depending upon pollutants, number of stations also vary.

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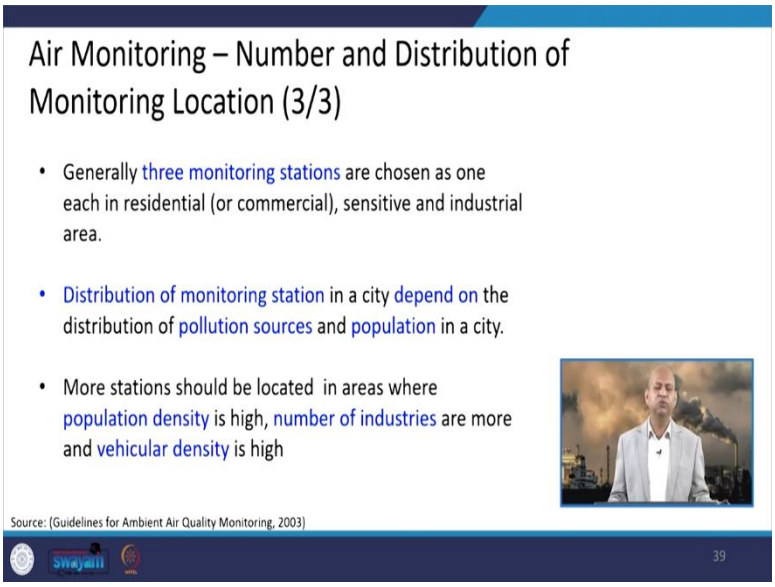

Then there are, on the basis of the experience and expert opinion and a statistical parameter, three monitoring stations are chosen as one in each residential or commercial sensitive and industrial areas. So, that can give fair level of air pollution in different nature of the areas. And the distribution of monitoring stations can also depend upon pollution sources and population. So, in a particular location more population is there, then you can add additional these instruments. Depending upon the sources also.

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Air Monitoring – Selection of Monitoring Location (1/4)

Requirements to be fulfilled:

1. Representative Site

- The site should be selected such that it is expected to remain a representative site over a long time and no land use changes, rebuilding's etc. are foreseen in near future.
- The site should be away from major pollution sources depending upon its height and its emissions. The station should be at least 25 m away from domestic chimneys, with larger sources the distance should be greater (WHO,1977).
- The site should be away from absorbing surfaces (absorbing building material). The clearance normally be at least 1 m. (WHO, 1977).

Source: (Guidelines for Ambient Air Quality Monitoring, 2003)

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Air Monitoring – Selection of Monitoring Location (2/4)

2. Comparability (IS 5182 (Part 14) 2000)

- All four sides should be open, the intake should not be within a confined space, in a corner, under or above a balcony.
- For traffic pollution monitoring the sampling intake should be 3 m above the street level.
- Sampling in the vicinity of unpaved roads and streets results in entrainment of dust into the samplers from the movement of vehicles. Samplers are therefore to be kept at 200 m from unpaved roads and streets.

Source: (Guidelines for Ambient Air Quality Monitoring, 2003)

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Air Monitoring – Selection of Monitoring Location (3/4)

3. Physical requirement of the monitoring sites:

- The site should be available for a long period of time.
- Easy access to the site should be there anytime throughout the year.
- Site sheltering and facilities such as electricity of sufficient rating, water, telephone connection etc. should be available.
- It should be vandal proof and protected from extreme weather.

Source: (Guidelines for Ambient Air Quality Monitoring, 2003)

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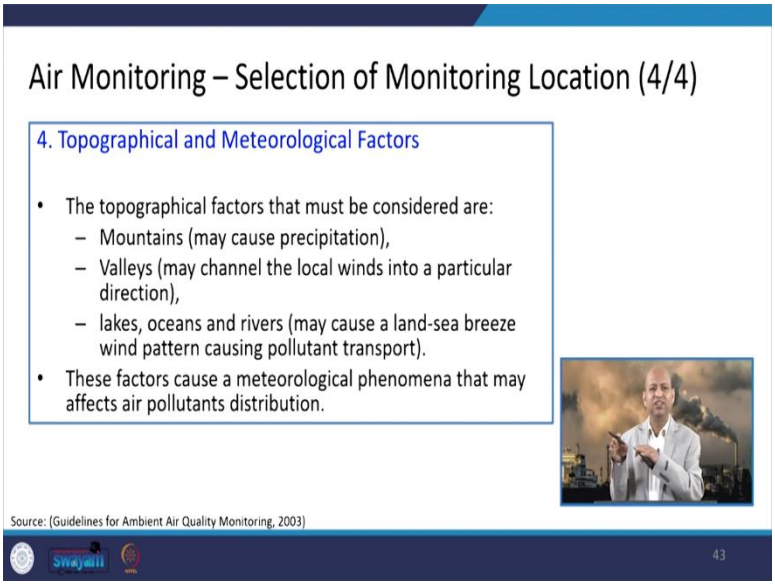

Then, if we go for selection of monitoring location. So, that location how to decide? Basically, that location should be representative means if you are having so many sources in industrial location, you choose that location which can be representative of that industrial area. And if you want to have the background concentration, then you should be locating that sampling station quite far away from those major sources.

So, that way the representative site this concept must be kept in mind when we are choosing the monitoring station. Then there are other rules and regulations also like it should be at least 25 meters away from the domestic chimney's, those kind of thing, guidelines are there. It should be one meter clearance from those absorbing surfaces like buildings, walls etc. So, all these things need to be kept in practice.

Then those locations must also follow the law of comparability. So, all four sides should be quite open. Otherwise, not only it will not be representative, it will not be comparable with that particular site or location. Then it should be away from the balcony and this traffic pollution, if you want to have then also it should be away by 3 meter above the street level and it should be 200 metres from the unpaved roads because then resuspension of dust etc, can influence the readings. It will give quite biased reading. So, we have to avoid those biased reading, disproportionate reading.

Then, for longer period or easy access all those power supply, all those things are the factors which can influence the location. If there is no power then it is very difficult, if you are having a diesel generator, then it can also add to the pollution. So, those kinds of things we need to keep in mind that this location should not be destroyed by some external sources. Topography and metrological factors also influence. If it is a mountainous region or valley,

then how to keep this? Land sea breeze, all those things should not again influence this monitoring exercise.

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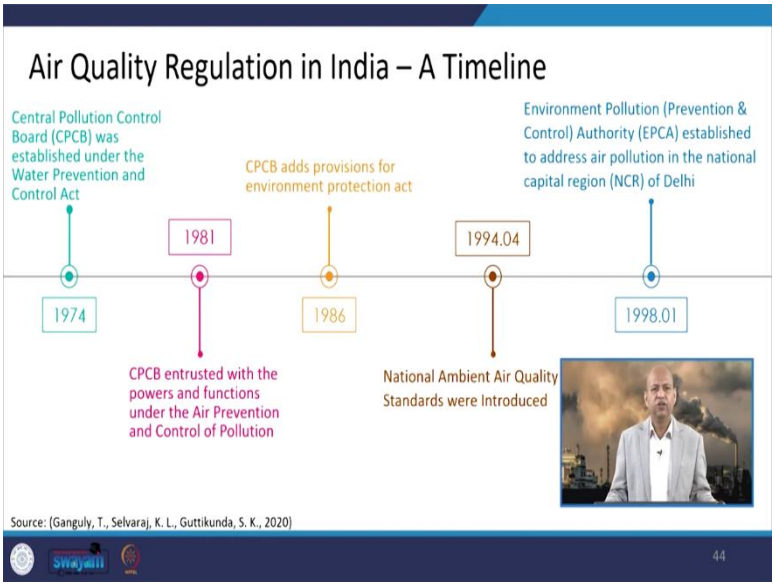

Well, when we look into different regulations which emerged or which were framed by the different government agencies especially like CPCB, MoEFCC (Ministry of Environment and Forests and Climate Change). So, you can see in 1974 from Indian context we are talking about. Air quality regulations which emerged in India, so, timeline can be seen like in 1974 the central pollution control board was established. In 1981, then it was entrusted the CPCB was entrusted with the powers and functions under the Air Prevention and Control of the Pollution Act. In 1986 this added like provisions of Environment Protection Act.

So, evolution has happened over the years. In April 1994 National Ambient Air Quality Standards were introduced NAAQS and then in 1998, January this Environment Pollution Authority PCA, Prevention and Control, this was established to address air pollution related issues in NCR (National Capital Region of Delhi). So, especially because this was affected by several regional sources etc.

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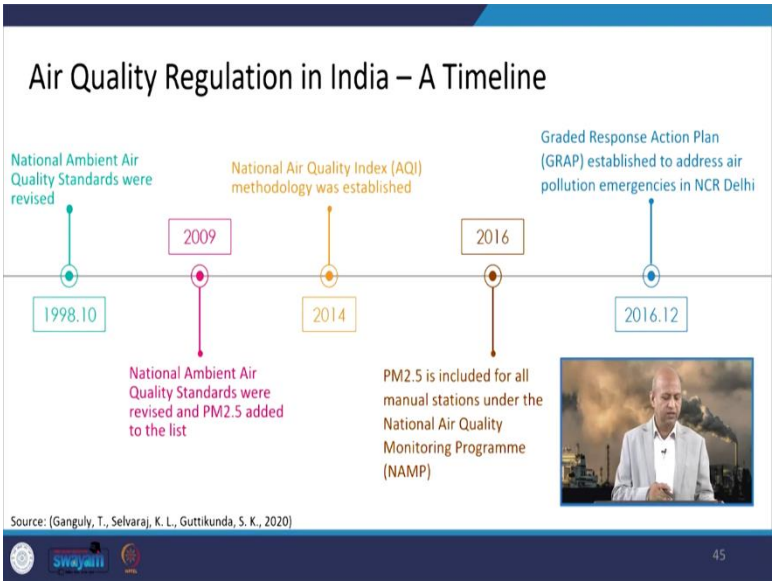

Then again in 1998, National Ambient Air Quality Standards were revised. In 2009, the $PM_{2.5}$ were added, these air quality standards. In 2014, again this National Air Quality Index Methodology was established. So, how to calculate the AQI? In 2016 $PM_{2.5}$ included for all the manual stations under this National Air Quality Monitoring Program otherwise, in 2009, it was added in the air quality standards.

But the monitoring was not happening across the country. But later on it was added in air quality monitoring stations also. Then in 2016, December this Graded Response Action Plan GRAP established to address air pollution emergencies in NCR Delhi.

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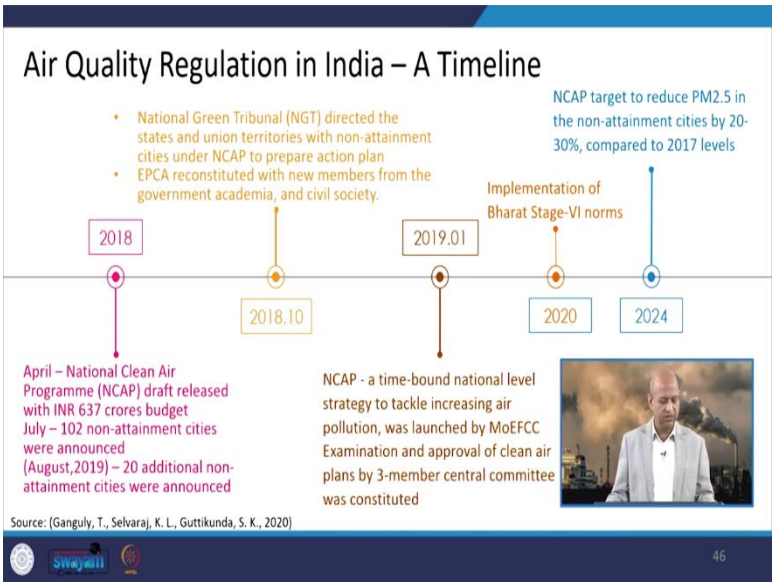

And then in 2018, this National Clean Air Program NCAP, this draft of this particular program, which is very ambitious program was released with 637 crores of the budget and the 102 non-attainment cities were identified later on, 20 more additional cities were added into it. In 2018 October, this NGT (National Green Tribunal) directed the states and union territories with non-attainment cities under NCAP to prepare action plan. How to improve their quality? How to reduce their pollution in those particular cities which are non-attainment in that particular criteria or framework.

So, then in 2019 this NCAP, time bound national level strategy to tackle the increasing air pollution in those cities with the help of this MoEFCC (Ministry of Environment and Forests and Climate Change). So, that really launched this ambitious program and there was this central committee to monitor was also constituted. In 2020, the implementation of Bharat Stage, 6 norms were done because we were having this Bharat Stage 4 like Euro 4. Similar to Euro 4 so, rather than Euro 5 we went directly to Euro 6. So, that is known as Bharat Stage 6.

Then in 2024, we will see because this NCAP is having the target to reduce the $PM_{2.5}$ concentrations in the ambient air in non-attainment cities by 20 percent to 30 percent with respect to 2017 levels, 2017 levels. So, that is the target in 2024 we will see. So, those kinds of activities are going on in that way.

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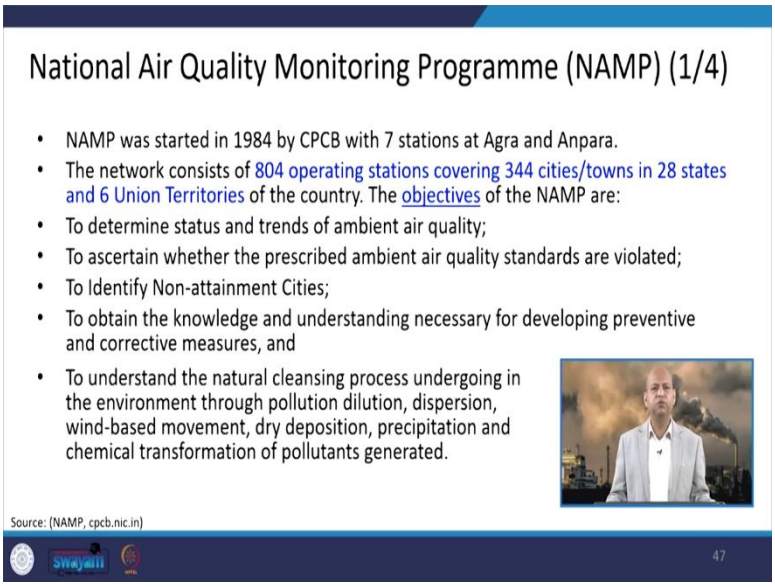

National Air Quality Monitoring Programme (NAMP) (2/4)

- Parameters Monitored are:

- Under N.A.M.P., four air pollutants , Sulphur Dioxide (SO_2), Oxides of Nitrogen as (NO_2), Respirable Suspended Particulate Matter (RSPM / PM_{10}) and Fine Particulate Matter ($PM_{2.5}$) have been identified for regular monitoring at all the locations.
- The monitoring of meteorological parameters such as wind speed and wind direction, relative humidity (RH) and temperature were also integrated with the monitoring of air quality.

Source: (NAMP, cpcb.nic.in)

National Air Quality Monitoring Programme (NAMP) (3/4)

- Frequency of Monitoring:

- The monitoring of pollutants is carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) with a frequency of twice a week, to have 104 observations in a year.

Source: (NAMP, cpcb.nic.in)

National Air Quality Monitoring Programme (NAMP) (4/4)

- Monitoring Agencies:

The monitoring is being carried out with the help of

- Central Pollution Control Board;
- State Pollution Control Boards;
- Pollution Control Committees;
- National Environmental Engineering Research Institute (NEERI), Nagpur.

CPCB co-ordinates with these agencies to ensure the uniformity, consistency of air quality data and provides technical and financial support to them for operating the monitoring stations.

Source: (NAMP, cpcb.nic.in)

Well, National Ambient Air Quality Monitoring Program is a Pan-India program, and it was launched in stages manner like large cities, then in rural areas also. Now, 344 cities are having, 804 operating stations for this particular program. This is very large program and it gives Air Quality Profile for all the cities and countryside for different pollutants, criteria pollutants particularly.

So, these are the parameters which are monitored under this program. And the frequency is like four hourly sampling for gaseous pollutants and eight hourly sampling for particulate matter with a frequency of twice a week and 104 observations in a year, that is minimum as per these standards, NAAQS.

And monitoring agencies are Central Pollution Control Board, then there are State Pollution Control boards. Then pollution control committees in different cities, local bodies, National Environmental Engineering Research Institute nearly all these are in integrated manner monitoring happens and all the data is collected and analysed.

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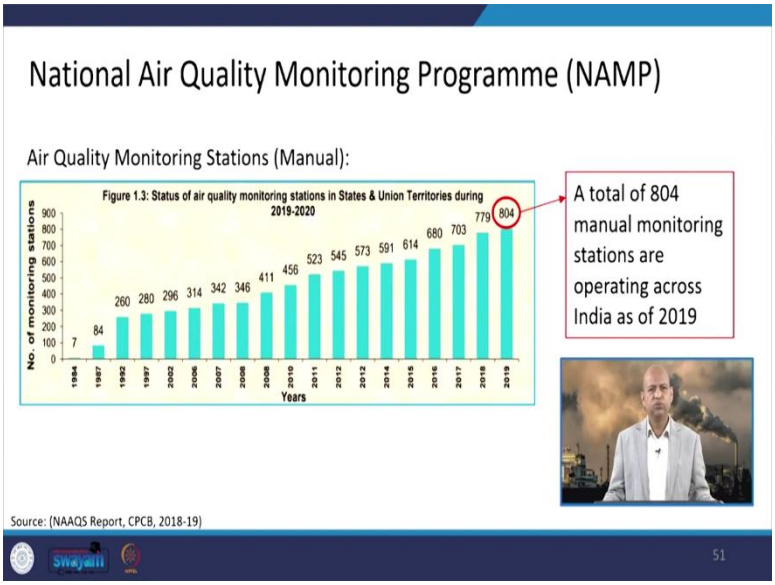

So, you can see, the development and increasing in the number of monitoring stations from 1984 where only 7 stations were there and now it is 804 stations. So, that way, we are expanding in number of stations. So, that gives better profile, special distribution of the air pollution and all those things are better now a days. And it is still increase basically. Different agencies are coming for installing their stations also in addition of these government agencies.

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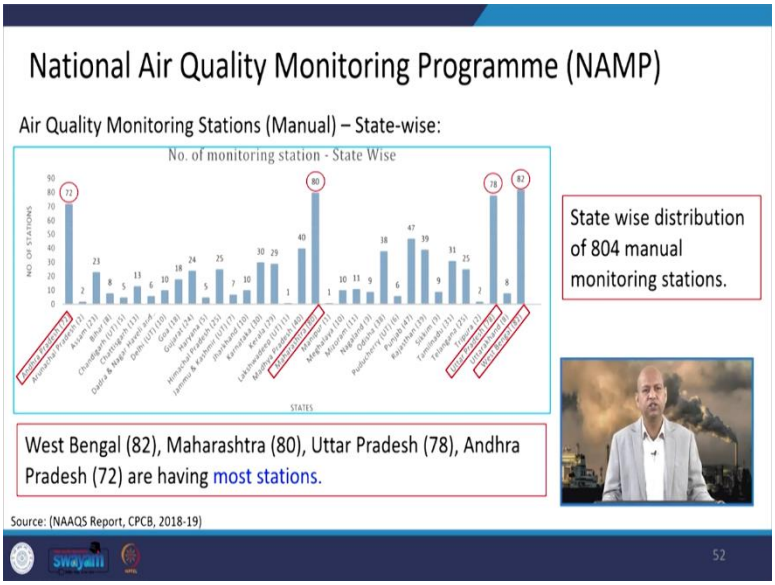

Well, different states have different air quality monitoring stations. So, the highest number are in like West Bengal, Maharashtra, Uttar Pradesh and Andhra Pradesh. They are having large number of Air Quality Monitoring Stations. So, they can have better profile of air quality across the air, regions or different cities.

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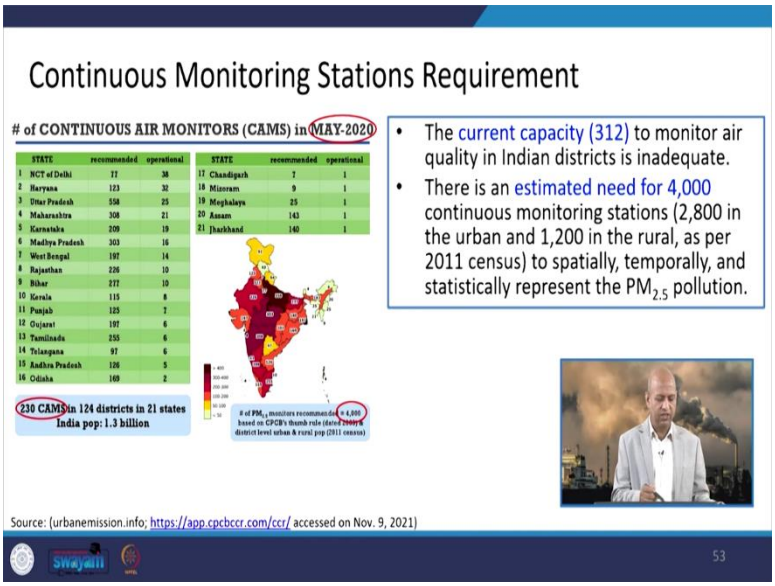

So, this is again given in May 2020, this was only 230 continues monitoring stations, now it is 312. So, continuous monitoring stations are also increasing in number so that really helps in forecasting of the air quality, for near future forecasting or comparison of air quality indices, all those things are possible because of these continuous monitoring stations.

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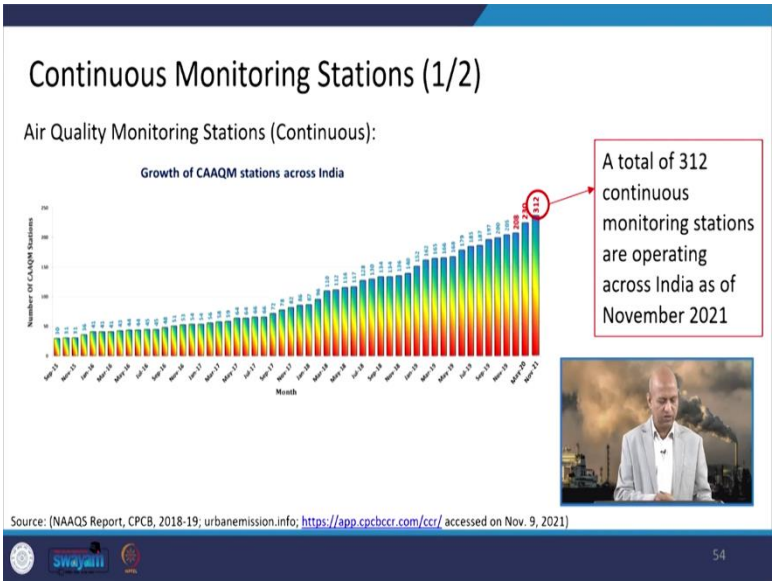

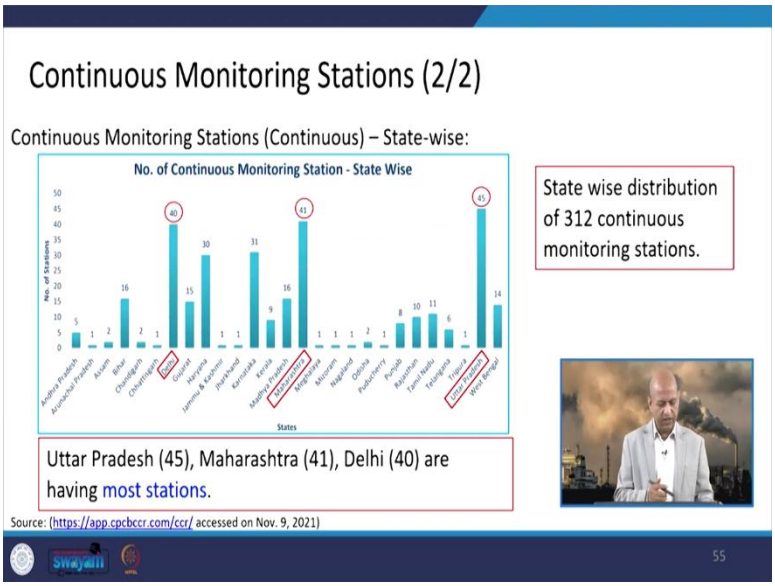

Well, again, you can see these number is continuous. From September 2015, when it was 30, now in November 2021 it is 312 and continuously they are growing in number. So, again, there number is also varying according to States so the pioneer states are Delhi, Maharashtra, Uttar Pradesh are having large number of continuous monitoring stations.

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Non-Attainment Cities (1/3)

- Cities that have crossed the National Ambient Air Quality Standards (NAAQS) for over 5 years are called Non-attainment cities.
- CPCB has identified list of polluted cities in which the prescribed NAAQS are violated.
- 122 cities have been identified based on the ambient air quality data obtained (2014–2018) under NAMP which now stands at 132 including million plus cities.
- Action plans are being formulated and implemented to control air pollution in non-attainment cities.

Source: (NAAQS Report (2018-19); https://cpcb.nic.in/list-of-non-attainment-cities/ accessed on Nov. 9, 2021)

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Non-Attainment Cities (2/3)

Total of 132 Non-Attainment Cities including million plus cities (8) in different States

Out of all the cities in India, cities having population of one million and above are called million plus cities.

Source: (https://cpcb.nic.in/list-of-non-attainment-cities/ accessed on Nov. 9, 2021)

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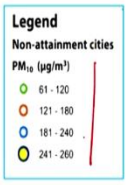
Non-Attainment Cities (3/3)

Non-Attainment cities with PM_{10} concentration exceeding Annual NAAQS Standards of 60 µg/m^3



Source: (MoEF Report, 2018-19)

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Non-attainment cities, those cities which are exceeding the air quality standards, so those are the non-attainment cities, as I said, it was 102 initially and then more added and now it is 122 and some millions of cities were also added and it is now 132 basically. So, you can see the non-attainment cities in different states.

So, highest number are in Andhra Pradesh, Maharashtra and Uttar Pradesh, basically. So, they are the focused area and you can see the distribution of these cities across the country. And they are having different levels of air pollutants and they are also shown in this.

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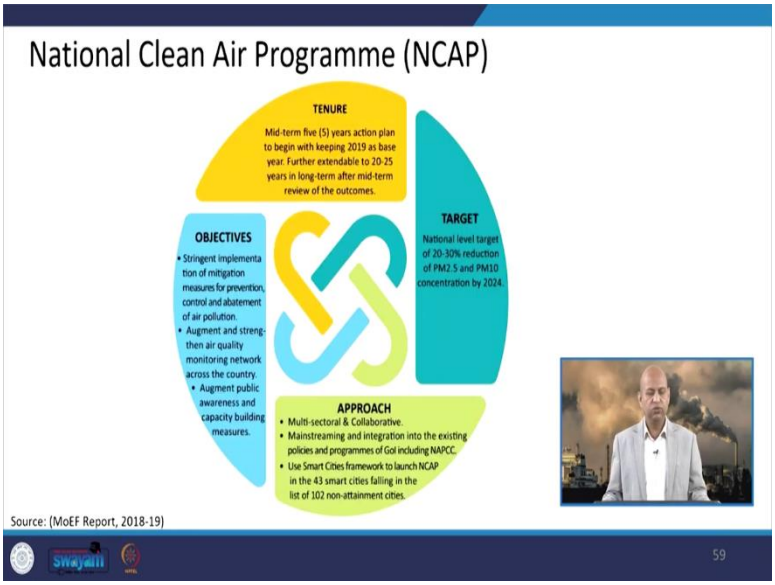

So, the NCAP program (National Clean Air Program) this is very ambitious program and this will really a game changer kind of thing. This will improve air quality in a big way because very focused and targeted efforts are being made in an integrated manner, where central government, state government, local bodies, all are involved.

Educational institutes are also involved so experts and everyone, those stake holders, their participation and all these approaches are well documented. So, uniformity is there, it is not like adhocism. Very systematic way this program is implemented, so I am sure that this will help in improving the air quality of different cities. Right now, non-attainment cities but they will be cleaner in near future.

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And you can see the key components for this particular program are health, economic impact studies and source apportionment studies, all those kinds of studies are incorporated.

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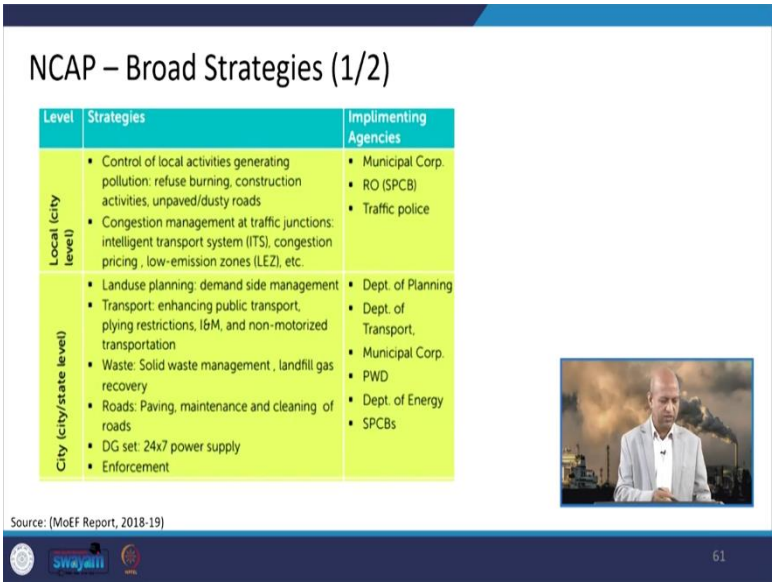

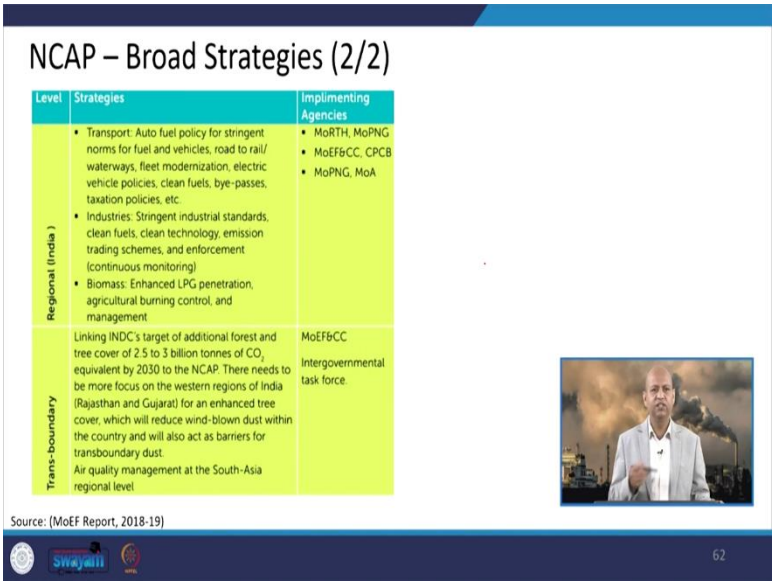

And the broad strategies you can see, the local government as I said, city level, different departments are involved so their integrated approach or integrated efforts will bring light to the problem.

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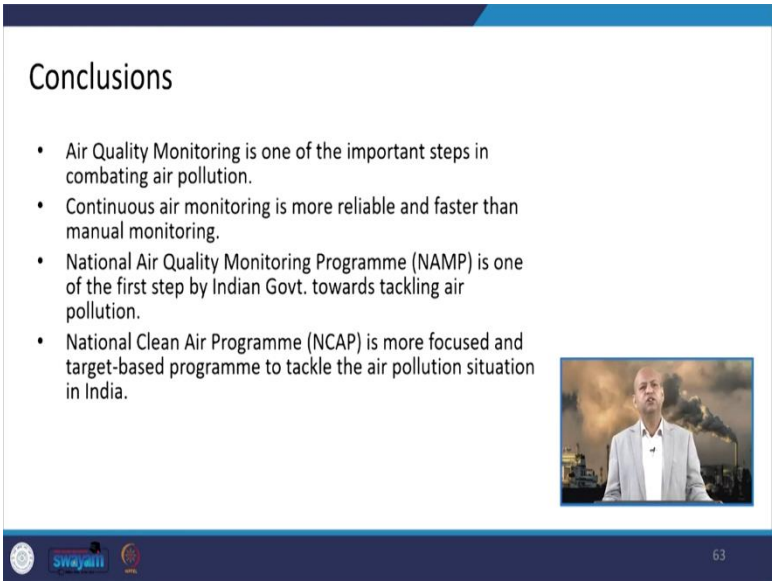

Well, in conclusion we can say, that the air quality monitoring is one of the important steps in combating air pollution and continuous air pollution monitoring is more reliable and faster than the manual monitoring. If provided, calibration is proper because if you are just using the instruments without calibration, then reliable information may not be there.

And National Air Quality Monitoring Program is one of the first step by Indian Government which was taken up and towards tackling the air pollution problem. And NCAP program as I

said, is more focused and target-based program which will tackle this air pollution situation in India and air quality will be improved in a significant way.

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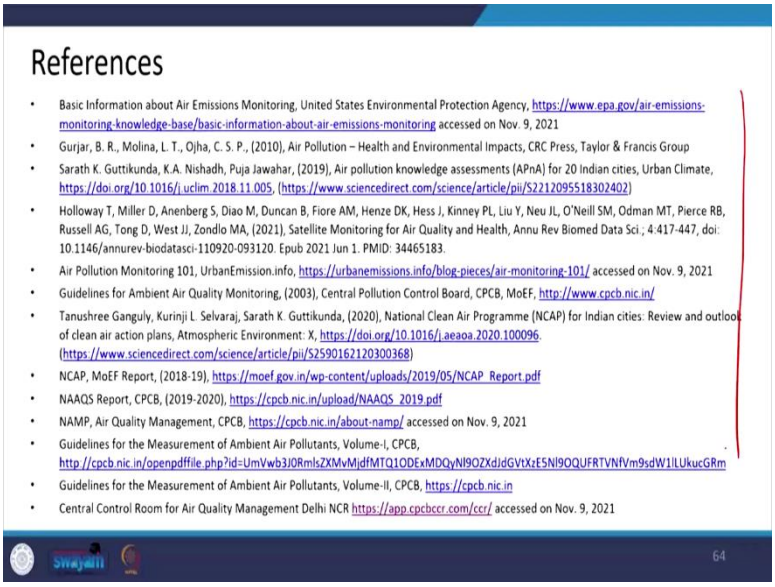

So, this is all for today, you can go through these references for additional information. Thank you for your kind attention, see you in the next lecture. Thanks again.