Basic Environmental Engineering and Pollution Abtement
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Lecture 56
Air Pollution Management, Air Quality Survey, NAAQI – 1

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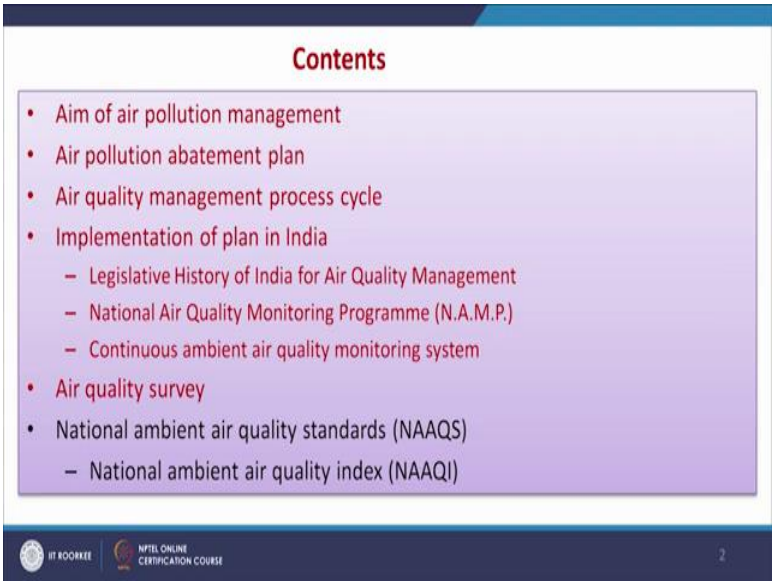

Hello everyone. Now, we will discuss on the topic Air pollution management, air quality survey, national ambient air quality index, part 1 and the contents are aim of air pollution management, air pollution abatement plan, air quality management process cycle.

Implementation of plan in india, that is legislative history of india for air quality management, national air quality monitoring program, continuous ambient air quality monitoring system, air quality survey and national ambient air quality standards and national ambient air quality index. So, these will be the contents of discussion in two classes and in the first class we will cover up to air quality survey and the second class we will discuss these two items.

Now, we will see what is the aim of air pollution management. So, certainly there are some objective, this management plan or Air Quality Management is necessary to ensure the quality of ambient air. So, that it will not create health impacts on the residents or it will not given impact on the plants or on the cultural aspect of the society etc.

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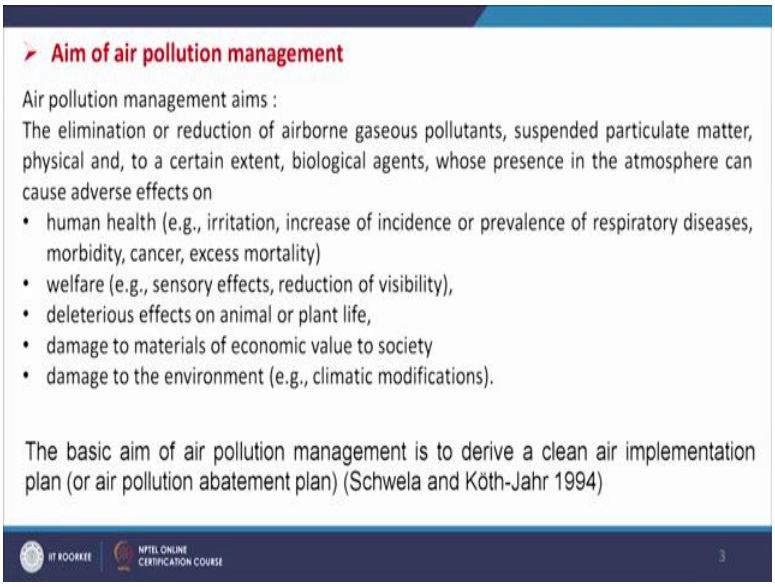

So, we will see the air pollution management aims, the elimination or reduction of airborne gaseous pollutants, suspended particulate matter, physical and to a certain extent, biological agents, whose presence in the atmosphere can cause adverse effects on human health that is irritation, increase of incidence or prevalence of respiratory disease, morbidity, cancer, excess mortality. On welfare like sensory effects, reduction of visibility on deleterious effects on animal or plant life, on damage to materials of economic value to society and damage to the environment that is climatic modifications.

So, these are the main objective of the Air pollution management. And the basic aim of air pollution management is to derive a clean Air implementation plan or we can say air pollution abatement plan.

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So, what is air pollution abatement plan, it consists of many elements such as description of area with respect to topography, meteorology, and socio economy, we are targeting a particular area where we are developing this air pollution abatement plan, then we need to develop the emission inventory.

So, emissions inventory is important, then comparison with emission standards. So, what are the emissions inventory? What are the emission level and how it is with respect to standards, we have to know it first, and then air pollution concentrations inventory and simulated air pollutant concentrations. So, from source to ambient air, how the distribution is taking place, we can model it and we can compare the value with the existing ones with the standards as well.

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So, comparision with air quality standards. So, inventory of effects on public health and environment. So, we need to do the background work to identify the effects of environmental parameters on public health. Casual analysis, how many casualties are taking place, because of this and control measures and cost of control measures? What can be the control measures and what will be the cost associated with each that has to be known first so that the management plan can work or abatement plan can work.

And cost benefit analysis, cost of control versus cost of efforts that is also necessary transportations and land use planning. Enforcement plan resource commitment. So, what are the other plans for enforcement and resource commitments and then we should know and projections for the future on population traffic, industries and fuel consumption.

So, that is very essential to make a long term plan and strategies for follow up, that is also an essential part, whether the plan is working or not. So, that has to be, if we do not take follow up, it may not work perfectly.

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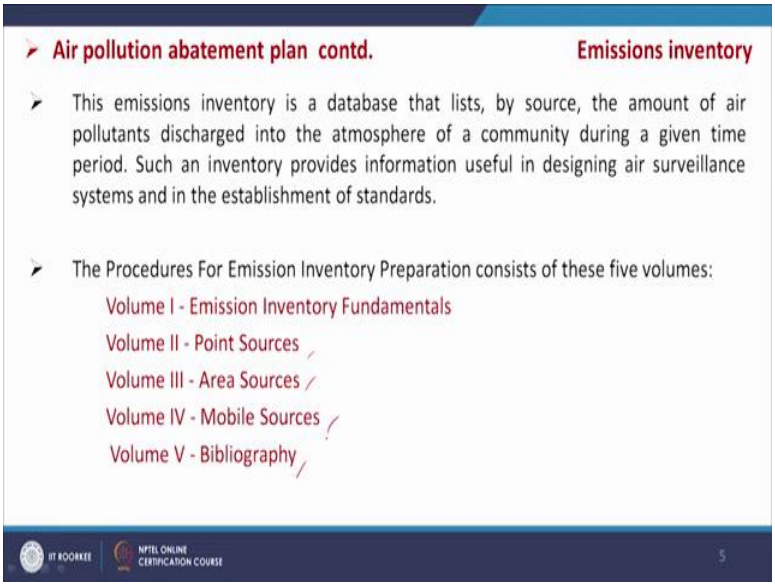

Now we will see. We will discuss in detail some of these factors like say emission inventory. So, this emission inventory is a database that list by source, the amount of air pollutants discharged into the atmosphere of a community during a given time period. Such an inventory provides information useful in designing air surveillance systems and in the establishment of standards.

And the procedures for emission inventory preparation consists of 5 volumes, Volume 1 Emission Inventory fundamentals, Volume 2 point sources, Volume 3 areas sources, Volume 4 mobile sources, volume 5, bibliography.

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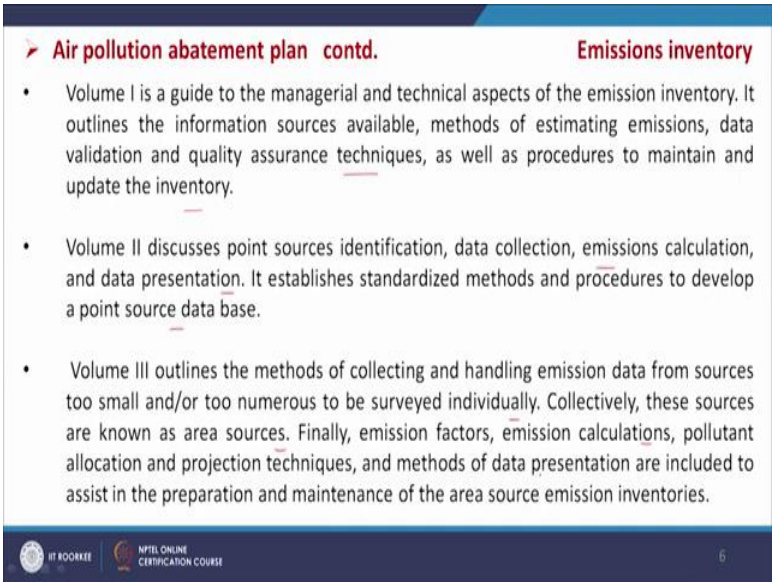

So, Volume 1, suddenly it will contain the procedural part the fundamental aspects like say Volume 1 is a guide to the managerial and technical aspects of the emission inventory. It outlines the information sources available, methods of estimating emissions, data validation and quality assurance techniques as well as procedures to maintain and update the inventory. And Volume 2 discusses point sources identification, then data collection, emissions calculation, and data presentation. It establishes standardized methods and procedures to develop a point source database.

Similarly, volume 3 outlines the methods of collecting and handling emissions data from sources too small and or too numerous to be surveyed individually. Collectively, these sources are known as area sources.

Finally, emission factors, emission calculations, pollutant allocation, and projection techniques and methods of data presentation are included to assist in the preparation and maintenance of the area source emissions inventories. So, that is related to volume 3.

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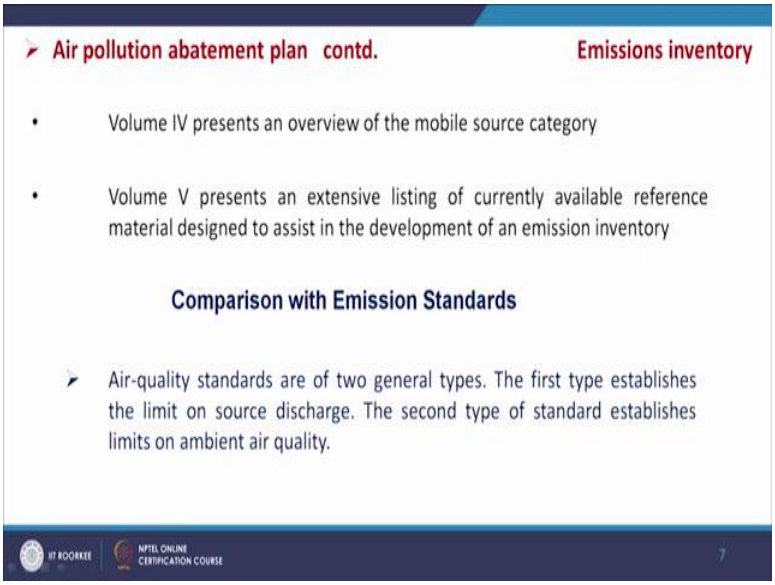

And volume 4 presents an overview of the mobile source category. And volume 5 presents an extensive listing of currently available differences or reference material designed to assist in the development of an emission inventory. So, that is the sources from which the inventory analysis is taking place.

So, another point was competition with emission standards. So, air quality standards are of two general types, the first type establishes the limit on source discharge, the second type standard establishes limits on ambient air quality.

So, what is the source from industrial sources or vehicle assist sources, what emission is coming out that standard and in ambient air, what is the concentration of different pollutants that can be permissible. So, those are another type of standards, we have already discussed on it in our previous classes.

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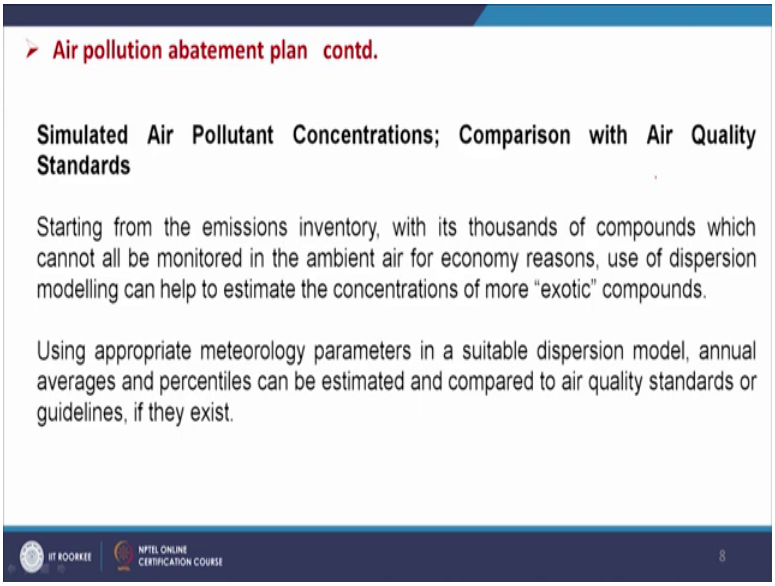

Now, simulated air pollutant concentrations, comparison with air quality standards. So, number of pollutants may be emitted from different sources and those will be distributed into the ambient air.

So, it is needed to develop some dispersion models and predict what is the concentration of the pollutants present in the ambient air and we can get some real life data and compare with that. So, simulated air pollutant concentration comparision with air quality standards is also one important method for the development of this plan. It helps us to take corrective actions.

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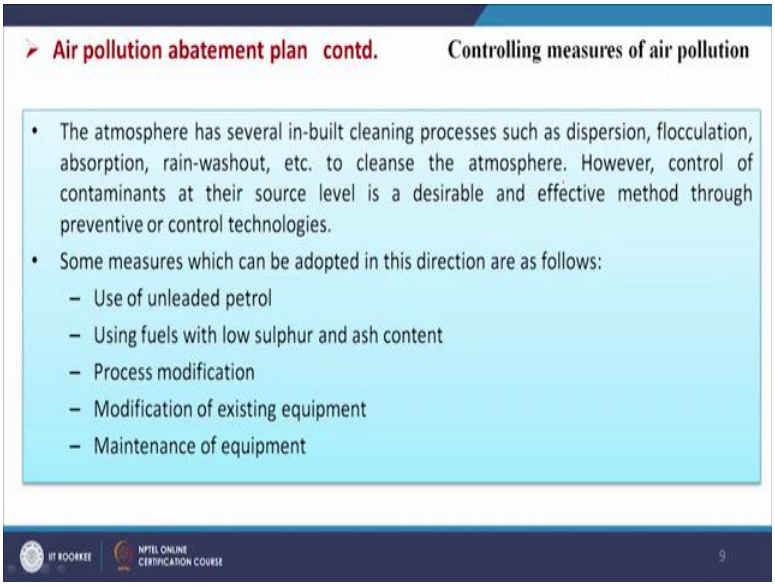

And controlling measures of air pollution. So, the atmosphere has several in-built cleaning process, such as dispersion, floculations, absorptions, rain-washout etc., to cleanse the atmosphere. As we have discussed in our previous classes in the introductory classes that there are some cyclic processes in nature that makes the environment clean and revitalize the environment and can take some pollution load upto certain level.

So, also in air also for the removal of the pollutants some natural methods are there. However, control of contaminants at their source level is a desirable and effective method through preventive or control technologies. So, when the pollutants are being generated, our first principle will be to reduce those generations or emission.

So, some measures which can be adopted in these directions are as follows that is use of unleaded petrol in the vehicle, using fuels with low sulphur and ash content in industries process, modifications of existing equipment and maintenance of equipment. So, that is applicable for car and all vehicles also.

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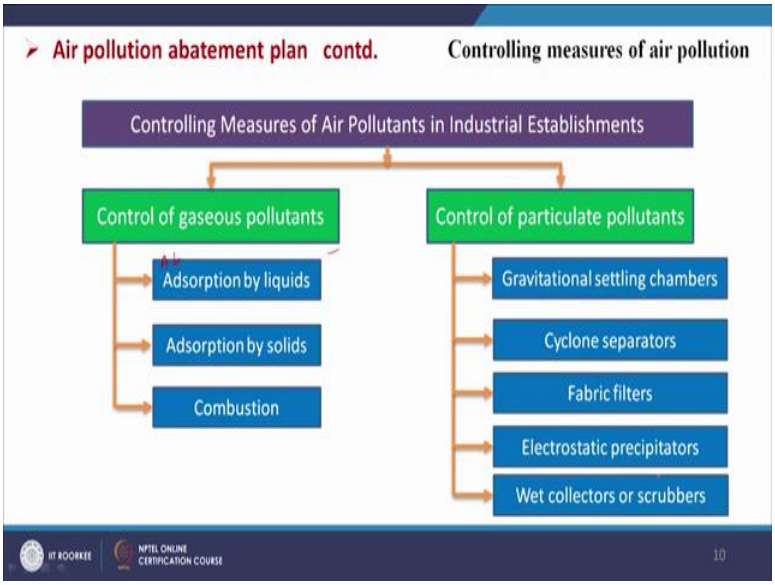

And controlling measures of air pollution in industrial establishments. We can get it done through control of gaseous pollutants and control of particulate pollutants. Already we have made detailed discussions on all these methods like say adsorptions by liquid, adsorptions by solids and combustion.

So, this is adsoptions by liquids, adsorption by solid, combustion and these are gravitational settling chambers, Cyclone separators, fabric filters, electrostatic precipitators and Wet collectors or scrubbers. We have made detailed discussions on this topic.

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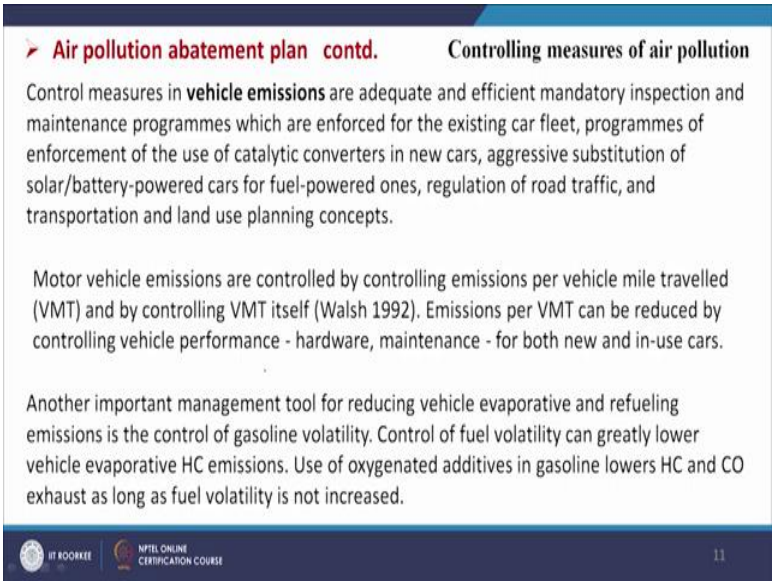

Now, in vehicles, the vehicle emissions can also be controlled, we should take control measures for it. And control measures in vehicle emissions are adequate and efficient mandatory inspection and maintenance programs which are enforced for the existing car fleet. Programs of enforcement of the use of catalytic converters in new cars, aggressive substitutions of solar or battery powered cars for fuel powered ones, regulation of road traffic, and transportation and land use planning concepts. These are some aspects of the, controlling of vehicular emissions.

Apart from that, motor vehicle emissions are controlled by controlling emissions per vehicle mile travelled that VMT that is vehicle mile travel. Emissions for VMT can be reduced by controlling vehicular performance hardware maintenance for both new and in-used cars. Already we have made detailed discussions on this line in our previous classes and we discussed on the standard of vehicular emission.

And another important management tool for reducing vehicle evaporative and refilling emissions is the control of gasoline volatility. So, control of fuel volatility can greatly lower vehicle evaporative hydrocarbon emissions, use of oxygenated additives in gasoline lowers hydrocarbon and CO emissions. As long as fuel volatility is not increased.

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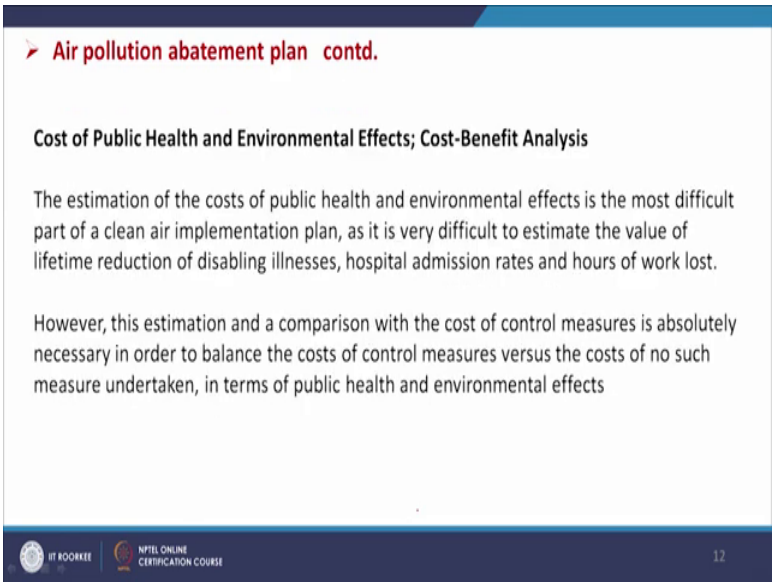

Cost of public health and environmental effects, cost benefit analysis. So, these are very typical cases and not so simple. The estimation of the cost of public health and environmental effects is the most difficult part of a clean air implementation plan. And it is very difficult to

estimate the value of the lifetime reduction of disabling illnesses, hospital admission dates and hours of work lost.

However, this estimation and a comparisons with the cost of control measures is absolutely necessary in order to balance the cost of control measures versus the cost of no such measure undertaken, in terms of public health and environmental effects. So, for this, the involvement of all stakeholders are necessary, the survey is also necessary.

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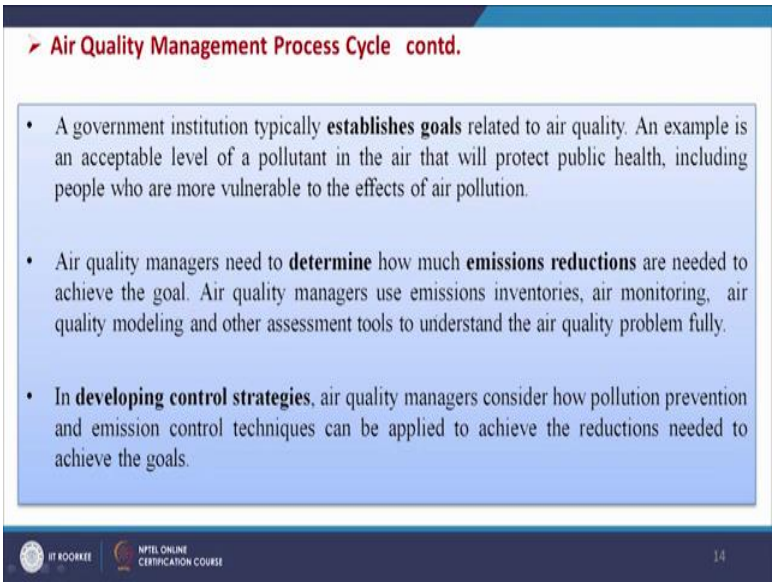

Now we will see Air Quality Management Process cycle. Air Quality Management refers to all the activities a regulatory authority undertakes to help protect human health and the environment from the harmful effects of air pollution. From this figure, we see there are

different steps that is establishment of goals, then determination of emission reductions, and then development of control strategies, implementation programs, and undertaking ongoing evolution. So, these are the different steps for air quality management cycle.

We will see, a government institution typically establishes goals related to air quality. An example is an acceptable level of pollutants in the air that will protect public health, including people who are more vulnerable to the effects of air pollution. So, this is our selection of the goal.

Then, air quality managers need to determine how much emissions reductions are needed to achieve the goal. Air quality managers use emissions inventories, air monitoring, air quality modeling and other assessment tools to understand the air quality problem fully.

In developing control strategies. Air quality managers consider how pollution prevention and emission control techniques can be applied to achieve the reductions needed to achieve the goals.

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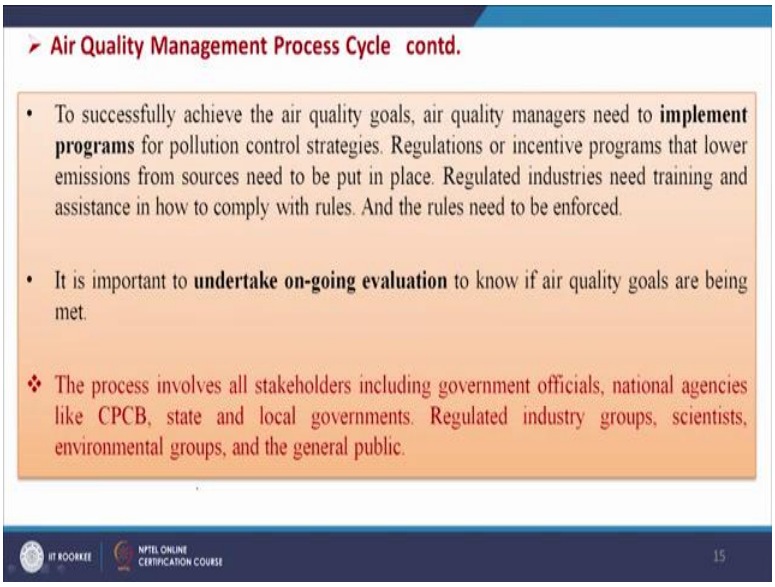

To successfully achieve the air quality goals, air quality managers need to implement programs for pollution control strategies. Regulations or incentive programs that lower emissions from sources need to be put in place. Regulated industries need training and assistance in how to comply with rules and the rules need to be enforced. And it is important to undertake ongoing evolution to know if air quality goals are being met.

The process involves all stakeholders, including government officials, national agencies like CPCB, state and local governments. Regulated industry groups, scientist, environmental groups, and the general public.

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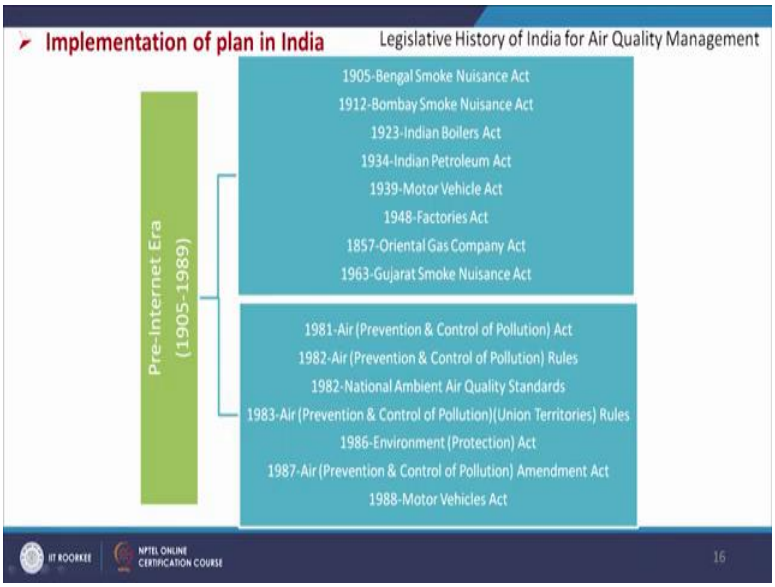

Now, we will see implementation plan in India. So, we see the legislative history of India for air quality management. So, pre Internet era 1905 to 1989, so 1905 Bengal smoke nuisance Act, then 1912 Bombay smoke nuisance act, 1923 Indian boiler acts, 1934 Indian petroleum act, 1939 Motor Vehicle act, 1948 factories act, 1857 that is very old, dated oriental Gas Company Act.

And 1963 Gujarat smoke nuisance act, 1981 Air prevention and control of pollution Act, 1982 Air prevention and control of pollution rules, 1982 National ambient air quality standards, 1983 Air prevention and control of pollution, Union territories rules, 1986 Environmental Protection Act, 1987 Air prevention and controller pollution, Amendment Act, 1988 Motor Vehicles act, 1994 Environmental impact assessment notification.

So, this is transition era 1990 to 1999. 1994 Environmental impact assessment notification, 1994 Revised air quality, 1995 National environmental tribunal Act, and 1997 National environmental appellate authority Act, 1998 Environmental pollution control authority, establishment of this.

And then Internet era 2000 to 2020, 2006 Environmental impact assessment notification, 2009 National ambient air quality standards, 2010 National Green Tribunal Act, 2017 graded response action plan, 2019 Motor Vehicle Acts, 2019 National Clean Air program and 2020 Commission for air quality management. So, significant efforts have been put to control the air quality in the country or manage the air quality in the country.

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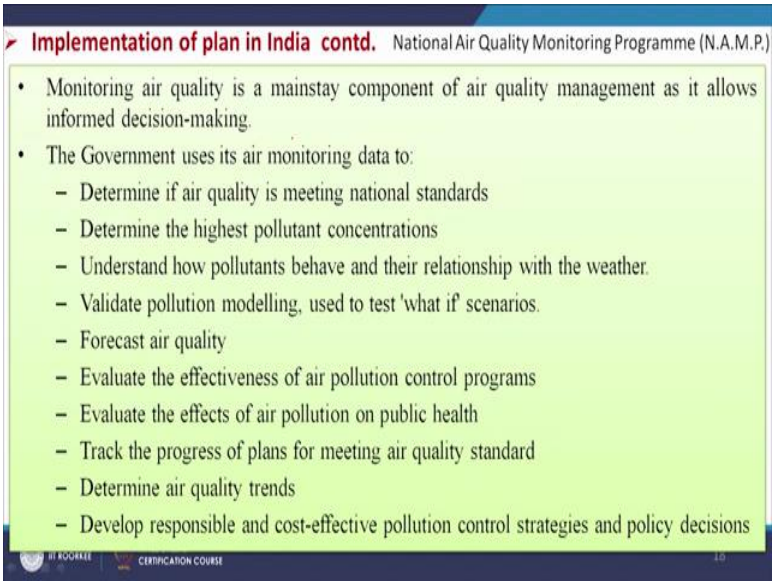

And now we will see the national air quality monitoring program. This is one important program which government of India has implemented. And monitoring air quality is a main stay component of Air Quality Management as it allows informed decision making.

So, this national air quality monitoring program helps to take decision, the government use its air monitoring data to determine if air quality is meeting national standards. Determine the

highest pollutant concentrations understand how pollutants behave and their relationship with the weather.

Validate pollution modeling used to test, if any scenarios and forecast air quality, evaluate the effectiveness of air pollution control programs, evaluate the effects of air pollution on public health, track the progress of plants for meeting air quality standard and determine air quality trends and develop responsible and cost effective pollution control strategies and policy decisions.

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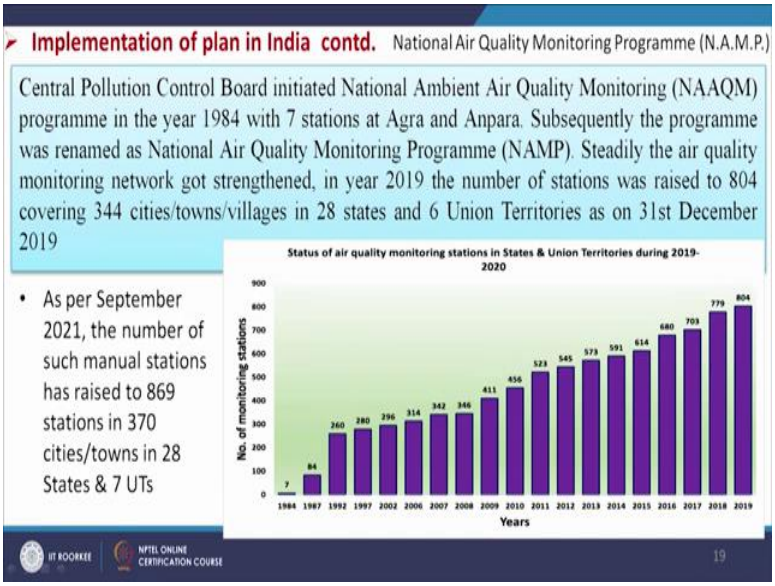

Now, central pollution control board initiated national ambient air quality monitoring in NAAQM program in the year 1984 With 7 stations at Agra and Anpara. Subsequently, the program was renamed as National air quality monitoring program. Steadily the air quality monitoring network got strengthened, in year 2019.

The number of stations was raised to 804 covering 344 cities or towns or villages in 28 states and 6 union territories as on 31st December 2019. As per September 2021, the latest data, the number of such manual stations has raised to 869 stations in 370 cities towns villages in 28 states and 7 union territories.

So, these figure shows status of air quality monitoring stations in states and union territories during 2019 and 2020. So, you see the number of monitoring stations are increasing gradually and all these stations are manually operated and some continuous stations are also there, we will discuss in next slides.

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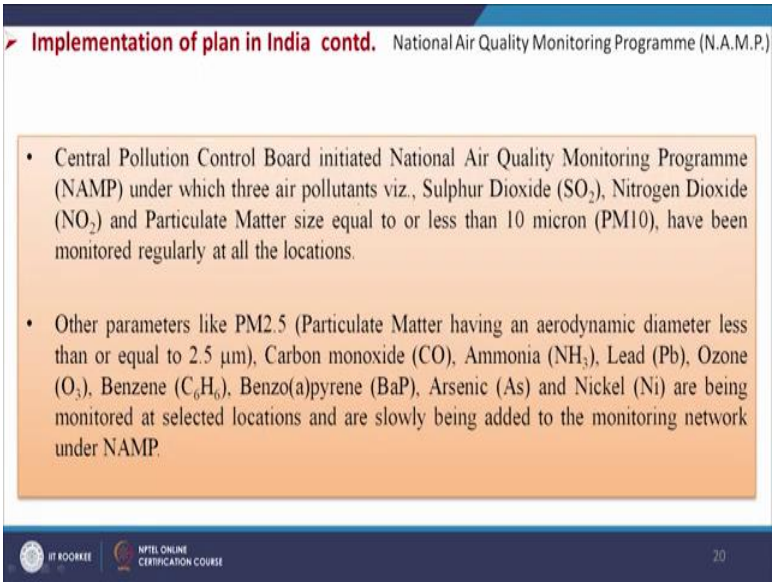

So, central pollution control board initiated national air quality monitoring program as mentioned earlier, under which three air pollutants that is Sulphur dioxide, Nitrogen dioxide and particulate matter size equal to or less than 10 micron have been monitored regularly at all the locations.

So, this is the initial stage, other parameters like PM 2.5 particulate matter having an aerodynamic diameter less than or equal to 2.5 micrometer, that carbon monoxide amonia, lead, Ozone Benzene, Benzene pyrene, Arsenic and Nickel are being monitored at selected locations, and are slowly being added to the monitoring network under NAMP, National air quality monitoring program.

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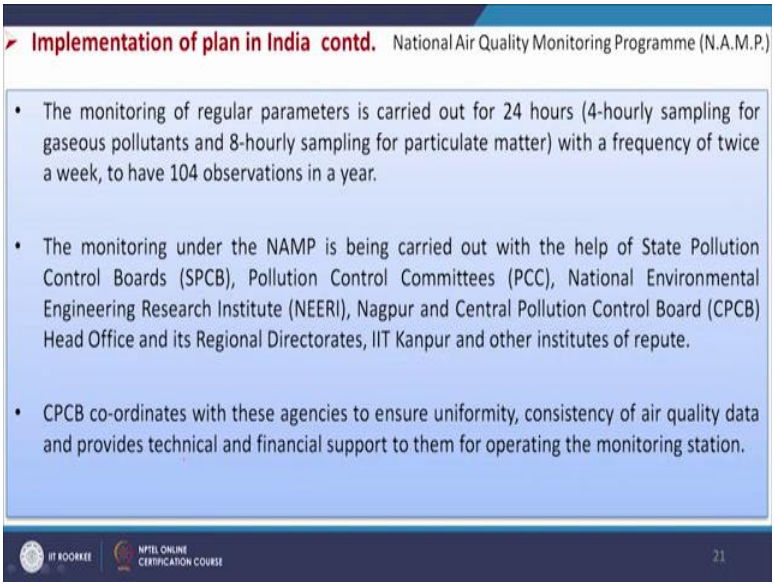

Now, the monitoring of regular parameters is carried out for 24 hours, 4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter with a frequency of twice a week, to have 104 observations in a year. Already this information is provided in the ambient air quality standard we have discussed in our earlier classes.

The monitoring under the NAMP is being carried out with the help of state pollution control boards, Pollution control committees, National Environmental Engineering Research Institute, Nagpur and central pollution control board. Head office and its regional Directorates, IIT Kanpur and other institutes of repute.

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

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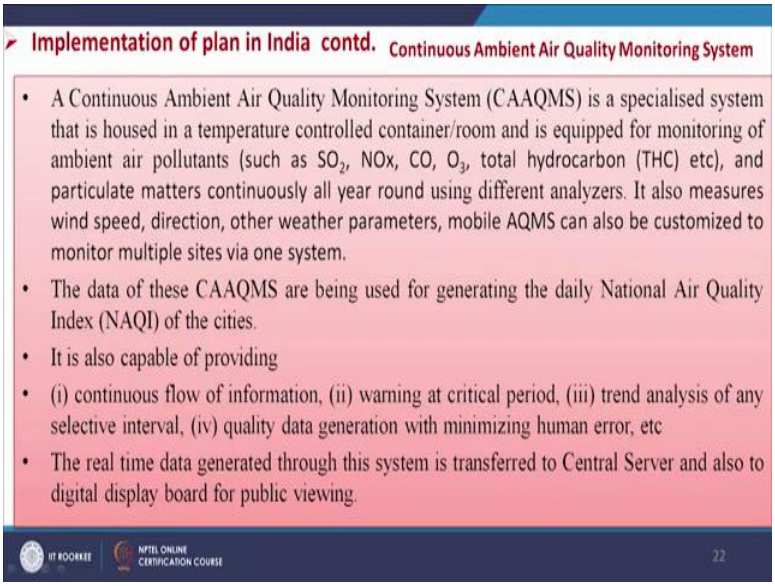

Now, we will see the continuous ambient air quality monitoring system. So, this system is also a part of the national air quality monitoring program. And a continuous ambient air quality monitoring system is a specialized system that is housed in a temperature controlled container, room and equipped for monitoring of ambient air pollutants such as SO_2, NOx, CO, O_3, total hydrocarbon etc. and particulate matters continuously all year around using different analyzers.

It also measures wind speed, directions, other weather parameters, mobile AQMS that is air quality monitoring systems can also be customized to monitor multiple sites via one system. The data of these CAAQMS are being used for generating the daily National Air Quality Index of the cities.

So, we will be discussing in the next class that National air quality index that is developed on the basis of the data which are generated through this continuous ambient air quality monitoring systems. It is also capable of providing continuous flow of information, warning at critical period, trend analysis of any selective interval, quality data generation with minimizing human error etc. The real time data generated through the system is transferred to central server and also to digital display board for public viewing.

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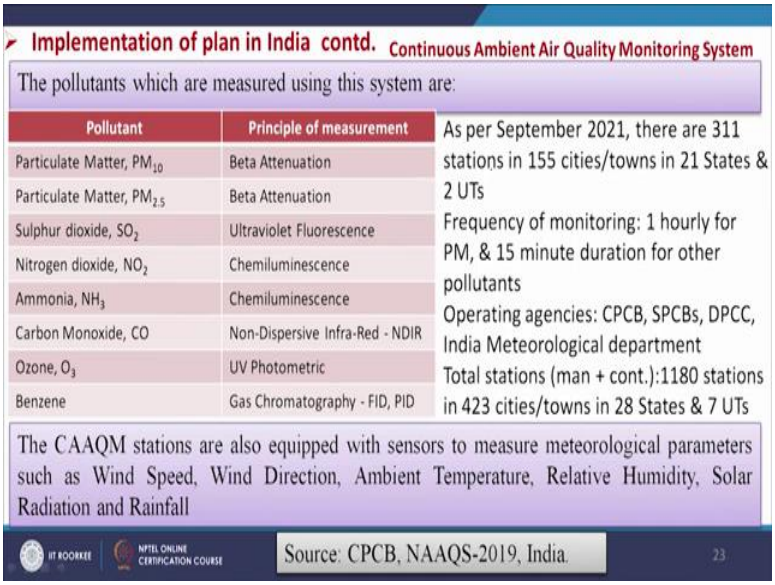

And the pollutants which are measured during these systems already I have been mentioned. So, there are different pollutants which are measured. And as per September 2021, there are 311 stations in 155 cities and towns in 21 states and 2 union territories. Frequency of monitoring is 1 hourly for particulate matter and 15 minutes duration for other pollutants.

So, which we have seen in case of manually operated stations, the frequency is not that, with respect to the continuous monitoring system, cooperating agencies like CPCB, SPCB, DPCC, India metrological department they are responsible for this and total stations.

This manual and continuous if you consider 1180 stations in 423 cities or towns or villages in 28 states and 7 and union territories, out of these 11 are in continuous system and remaining are the manually operated system.

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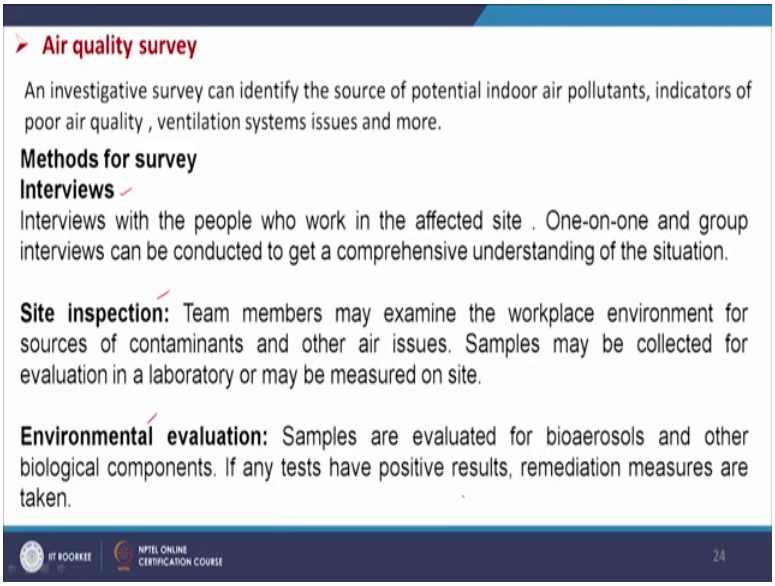

Now we will discuss the air quality survey. So, survey is necessary to understand the air quality, it may be indoor air or outdoor air. An investigative survey can identify the source of potential indoor air pollutants, indicators of poor air quality ventilation systems issues and more.

And the methods for indoor air quality survey is interviews, it may be site inspection or maybe environmental evolution. So, interviews with the people who work in the affected site. So, one on one and group interviews can be conducted to get a comprehensive understanding of the situation and site inspection the team members may examine the workplace environment for sources of contaminants and other air issues.

Samples may be collected for evolutions in laboratory or maybe measured on site and that Environmental evolution samples are evaluated for bio aerosols and other biological components. If any tests have positive results, remediation measures are taken.

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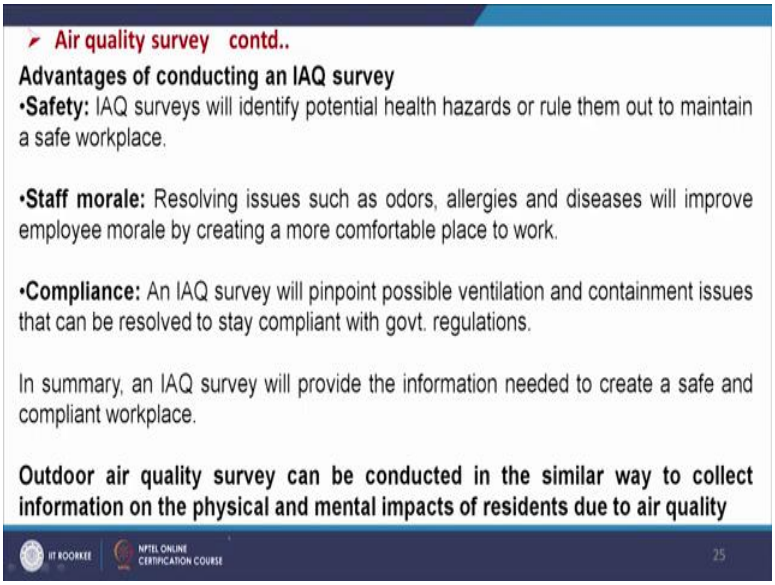

Due to this indoor air quality survey, some advantages we can get that is safety. The IAQ surveys will identify potential health hazards or rule them out to maintain a safe workplace staff morale.

The resolving issues such as odors, allergies and diseases will improve employee morale by creating a more comfortable place to work. And compliance and IAQ survey will pinpoint possible ventilations and containment issues that can be resolved to stay compliant with government regulations.

And in summary, an IAQ survey will provide the information needed to create a safe and compliant work place that can be applicable for office or any individual household as well. An outdoor air quality survey can be conducted in the similar way to collect information on the physical and mental impacts of residents due to air quality.

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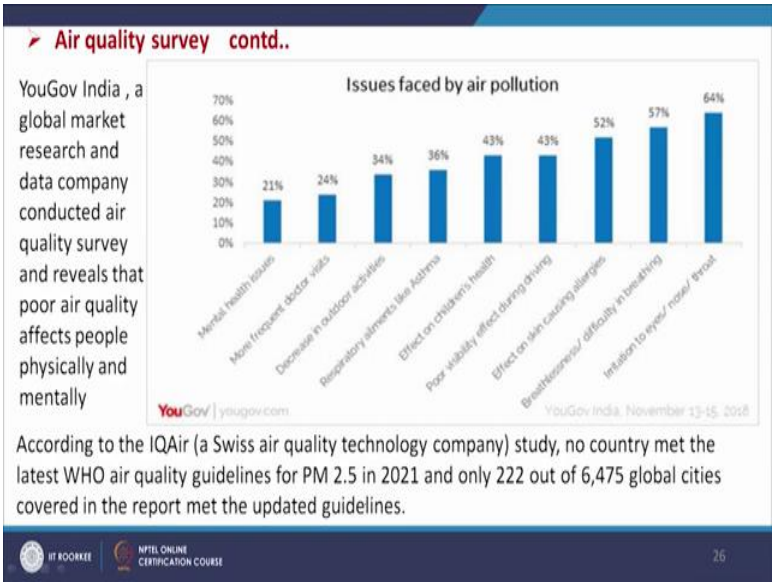

So, this slide gives us some information on the air quality survey made by YouGov India a global market research and data company, they conducted air quality survey and reveals that poor air quality affects people physically and mentally.

So, this is the data. So, mental health issues, more frequent doctor visits, decrease in outdoor activities, respiratory ailments like Asthama, effect on children's health, poor visibility effect during driving, effect on skin causing allergies, breathlessness, difficulty in breathing and irritation to eyes, nose, throat that is the percentage of people who have responded for these different effects due to out door air quality.

According to the IQAR, so, this organization, a Swiss Air Quality technology company as well as IQAR study, no country made the latest WHO air quality guidelines for PM 2.5 in 2021. And only 222 out of 6475 Global Cities covered in the report met the updated guidelines. So, this is some another air quality survey report by international agency or foreign agency.

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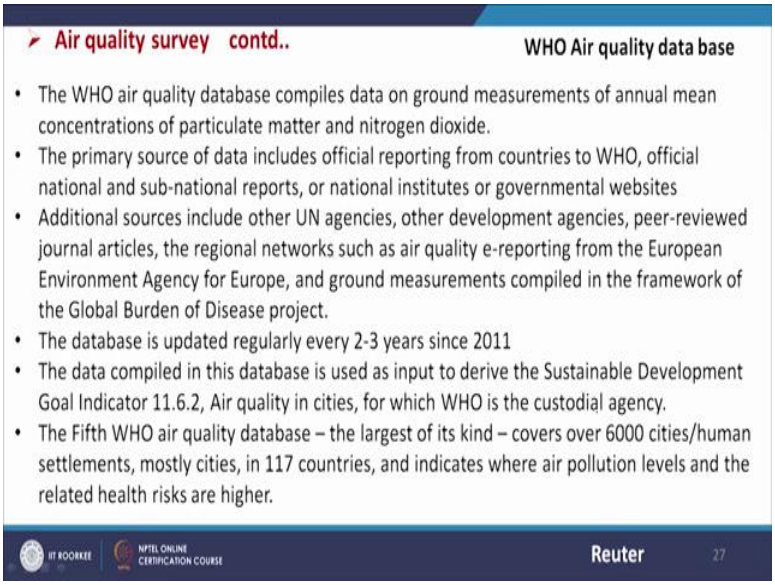

Now we will see WHO air quality database, WHO is also working on this and they are collecting data and preparing a database on the basis of which the decision can be taken. So, the WHO air quality database compliance data on ground measurements of annual mean concentrations of particulate matter and Nitrogen Dioxide. The primary source of data includes official reporting from countries to WHO official national and sub national reports or National Institutes or governmental websites.

Additional sources include other UN agencies, other development agencies, peer-reviewed journal articles, the regional networks such as air quality, e-reporting from the European Environment Agency for Europe, and ground measurements compiled in the framework of the global burden of disease project.

The database is updated regularly every 2-3years since 2011. The data compiled in this database is used as input to drive the Sustainable Development Goal indicator 11.6.2. That is air quality in cities for which who is the custodial agency. The fifth air quality database, the largest in its kind covers over 6000 cities or human settlements, mostly cities in 117 countries and indicates where air pollution levels and the related health risks are higher.

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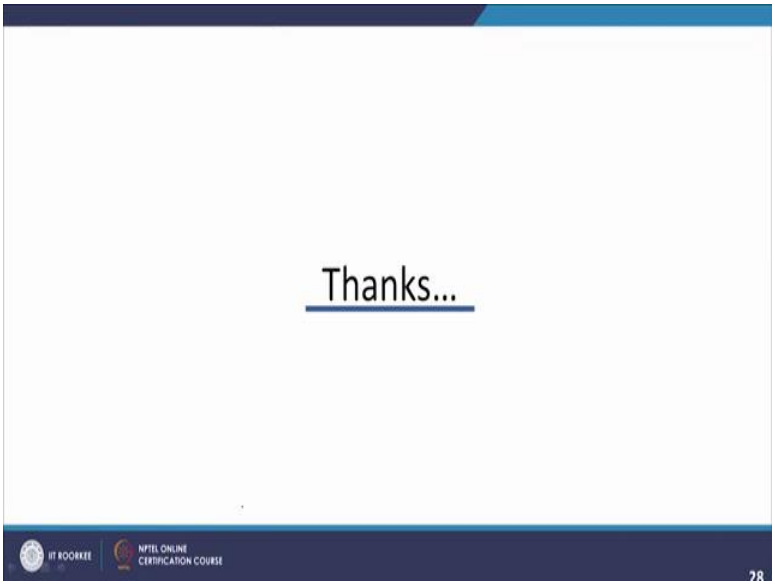

So, we see that air quality management is a very, very important aspect and both when national and international level, many efforts are going on to manage the environmental air quality. So, up to this in this class, thank you very much for your patience.