

Introduction to Civil Engineering Profession
Prof. Indumathi M N
Department of Civil Engineering
Indian Institute of Technology, Madras

Lecture – 05
Interesting Environmental Projects

So, today in continuation with what I was talking as yesterdays; yesterday I gave you the big picture right about all the domains which we will be covering and if you had reflected back may after the lecture you would have seen that and it covers pretty much everything right, everything around you and including you right. So, its a very very vast domain and that is the biggest attraction in this particular field right.

You can pick and choose from a huge range of subjects which it can for; it you can you can never say that this is not my domain of interest right. There will always be something which is interesting because it is so, huge and it is so, it covers almost everything right from computers to biology.

So, today I want to share with you some of the projects most of them will be our own projects. So, that we are not just talking something which is happening somewhere, it should be real to you right and if you are in going to be; if you want to be involved it is already happening ok. So, I want to share some of the interesting projects which we are doing on the field ok. And also some which has been done outside just to trigger your inspiration ok.

(Refer Slide Time: 01:51)



Civil and Environmental Engineers- Scope of Work

- Built Environment : Water Supply Wastewater Treatment, Solid Waste Management
- Environmental Assessments of Past and Current – Surface water, Groundwater , Land, Air quality , Ocean, Industry
- Environmental Impact Assessment for Projects
- Cleanup of Environment
- Designer, Builders, Consultant, Policy Advisors, Educators, Research



So, go we do not have much time, so I will just go directly. So, this kind of gives you a an idea ok. What you will be doing as a when you graduate as a civil engineer with you or take a few courses in environmental engineering at least three courses you will be taking under lab during your civil engineering program ok.

And if you choose to do dual degree or masters, then you get to specialize and learn more about some of the basics which were taught to you in your undergraduate program. So, what you would expect, when you go out to work as a civil or environmental engineer you will be doing basic stuff, what you learn in your Btech is all about water wastewater and solid waste.

The essence of it and air, you will be introduced to all this more in depth on water and wastewater ok. So, because why it is linked to civil engineering although the hue the domain

is so vast is because it all started there. People started thinking about water, when they started building buildings right.

So, people living in the buildings have to be supplied with water good quality water ok. And then what happens, when you supply water, the wastewater comes back right. You need to have a way to dispose this safely and without any causing any inconvenience. So, wastewater research and engineering started and you also generate a lot of waste right. Solid waste whatever you use you throw right, which in which you do not consume. So, that is that is the that is the very little the crux of what civil engineers learn very very small domain among that huge domain what yesterday I was showing you ok.

So, that is all you will be taught and some exposure to air because, we also breathe air in the indoor environment, we would like to know what; what is that which we should be worried about and how do we how do we manage these things ok, if they are not good, how to make them good for human utilization ok. So, apart from that built environment related environmental engineering, when you go and do a masters or a dual degree or a project in environmental engineering you will be looking at a much larger domain environmental assessments is a very important job of all environmental engineers right.

So, when you go and when you go out you see everything is so, dirty right. So, how do we make an assessment, the soil is dirty the water is dirty in your rivers and lakes. So, we need to have understand have an understanding of how to make assessments, how to sample right what is the sample frequency ok. And how do we analyze these samples take it back to the lab ok. All that fundamentals will be taught to you; obviously, when you are learning about water in your B tech environmental engineering course ok.

So, we do a lot of assessments environmental engineers, if you talk to any of the practicing engineers they do a lot of assessments and they prepare reports about these assessments about the condition not only the condition, we should also know how to treat it how to make it better ok.

So, you know you should know how to do assessments and then, you should also know how to engineer the systems to make it better. And the assessments range from surface water ground, water, soil, air, waste, ocean everything, industry becomes a very important job, when you become regulators right, when you become pollution control board engineers, that is their primary job ok. They are like policemen going after industries ok. Are they polluting the environment discharge is coming from the industries ok. So, we do that and then this is the past spills which have happened in the past and then which is contaminating now. It is contaminating now what is coming out of these industries now so, past and present.

And then the third category what I have listed is environmental impact assessment this is for futuristic projects right. Its a very important role what the ministry of environment and forests is doing right. Planning for there are a lot of development activities happening right from building, large highways, metro projects right huge commercial buildings, apartment buildings, industries, thermal power plants, you can name it anything which is a project a big project has to go through Environmental Impact Assessment we call it EIA ok. And the very word EIA worries all these developers and now, even politicians they are trying to make less and less stringent unfortunately.

So, this is futuristic. So, even before the project goes on paper right detailed design of a project goes on a paper, the idea of the project itself has to be scrutinized ok. If this project of this scale comes up in this particular place right, then what will be the impact to the environment? Water air everything ok.

So, this is futuristic assessment with our knowledge of the past and the baseline conditions of that particular site, if that particular site is already stressed with other developmental activities ok. And can it take this additional; yesterday we talked about carrying capacity right. Can this take this additional load without exceeding the carrying capacity of that environment ok. So, a lot of thought and assessment goes into developing these EIA reports ok which are fundamental for getting approvals for these projects ok.

So, there is there are like big consultants working on EIA reports of upcoming projects ok. And there is a lot of activity good bad around getting all these approvals right. So, that is a better job and then comes clean up ok. Clean up is not very easy, its easy to mess up just like how we mess up our homes ok. We do not like clean up because its a lot of chore right takes a lot of time it takes very little time to mess up right. Same thing happens to the environment right; it takes a lot of time lot of money lot of technology ok.

So, its better we do not mess up in the first place ok, we do it responsibly development can happen responsibly ok. Then that is a whole different area on cleanup, where civil engineers cannot do it alone civil and we need help from chemical engineers, we need help from geotechnical engineers geologists ok. All of them are involved in major cleanup activities ok.

So, and then so, with all this you can end up being whatever you want to be whatever role you want to be play in this array of work, where you want to be involved. You can be a designer, you can be a builder, you can be an on site engineer doing all these sampling and building these remediation systems, you can be a consultant sitting and planning and designing these ok. You can be policy advisors ok, when as you grow up that ladder you can you are called for advising, your expert opinion once you do not have to go grow with age you can grow with knowledge right. Even at a young age you can become a policy adviser if your profile is there ok.

So, you are most sought after person once, you develop yourself into a domain expert ok. People call you consultants call you, the government calls you ok, international bodies call you, Supreme Court calls you like many of us have go to these type of roles ok. When the Bhopal Tragedy happened very recently there was a case again about Bhopal ok. So, Supreme Court wanted opinion from us ok looking at the situation what is your opinion.

So, you are you will become the most sought after person in when it comes to design or litigations or developing a policy document or again there are options, if those who are motivated to become academicians, you can become educators ok. And researchers the whole lot of research, environment is a subject even though a lot of research has gone by we still

have new problems coming up every day right. Every time the chemical engineer or the chemist creates a compound, it may be for pharma or pesticide ok. They have created a problem they have created a job for us ok.

Because that chemical is going to end up in the environment and it becomes the environmental engineers job to see, how to clean it up how to break it down. So, we always both of us chemical engineers and environmental engineers are looking at each other. Chemical engineers can play a dual role, they can also clean up ok, but most of them end up creating the problem and we are the problem solvers ok. So, there is a lot of scope for research ok.

(Refer Slide Time: 11:48)



Clean up of River



So, I just want to show you some projects, do you know where this places can you guess if you look the bottom half of the picture looks like India right, the top looks like somewhere Abroad. Yes?

Student: (Refer Time: 12:03).

This is London, the heart of London and that is river Thames. Can you believe it? You have seen beautiful pictures of Thames, the top half I guess ok. So, this Themes was like our rivers ok.

(Refer Slide Time: 12:36)



What you see here is a real picture, but people got their act together and then made it beautiful right. They made sure that it becomes clean, it becomes navigable and all the whole entire tourist development centered in London is around these Themes ok.

(Refer Slide Time: 12:56)



Dump site to
Energy field and Engineered landfill



- Compost
- Recyclables
- Building materials
- Energy -
- Incineration,
- Biogas,

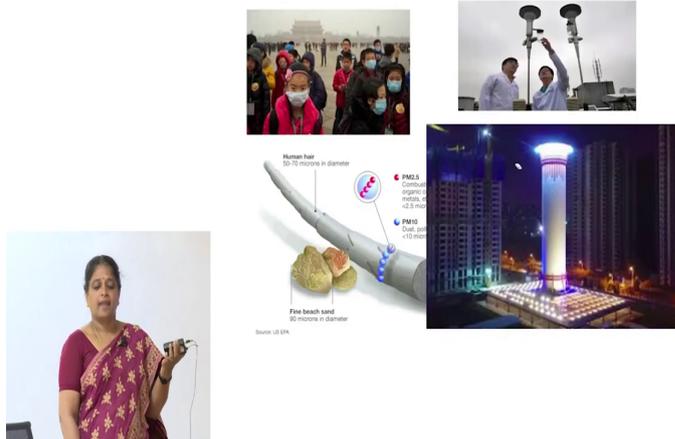


Again we can see a lot of before after pictures in environmental cleanups right. So, this is dump sites typically what we see in every city in India and the after effect. If we engineer a good landfill then, you create landfills like this, where its not just a landfill its protects the environment even though the waste is within there and you can create your creativity can go anywhere, how to use that space ok. Here they have used it as a solar field ok, its generating a lot of solar power some cities they have developed it as golf courses beautiful parks gardens ok. So, you can do whatever you want with the base lying below that safely ok.

(Refer Slide Time: 13:47)



Air pollution Beijing

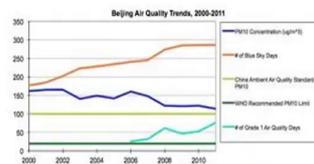


So, air pollution, we know I do not know how many of you know when Olympics happened in Beijing 6 months or 8 months before the Olympics they were going to cancel Olympics ok. Do you know that? Everything was ready, but they had to can they were all the they had taken a decision to cancel the Olympics ok. Why? The only reason was the air pollution in Beijing.

They decided that it is not safe for international people to travel to Beijing and be there that month for Olympics the air pollution was so bad ok. Then China got its act together and immediately they just shut down all the industries in the vicinity of Beijing and inside Beijing which were the major polluters they went they stopped all the polluting cars with in the periphery of the Olympic city and it was made possible ok. They took a commitment and it was made possible ok.

So, we can as I told you we can reverse the damage, but its better to prevent the damage. And nowadays, you know I think you might have seen this picture, what is that? The monument in the middle, it is an air purifier, China has built the largest air purifier we have only seen indoor air purifiers right. This is the largest outdoor air purifier right in the middle of downtown area one of the downtown areas in Beijing ok.

(Refer Slide Time: 15:35)

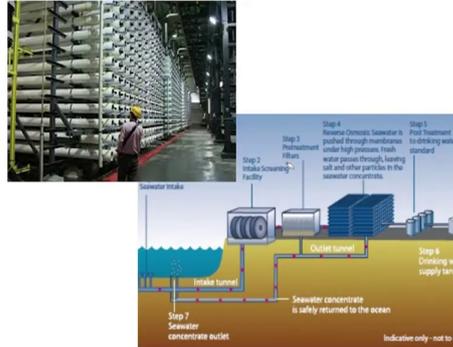


So, technology can make it possible ok. So, Beijings air quality has improved drastically soon after the Olympics, they continued the measures whatever they took for Olympics and you can see the before and after the big picture ok. The smog just 8 months before the Olympics and what happened after that ok.

(Refer Slide Time: 16:00)



Water Supply from Sea



Similarly, we can play a major role in water supply, lakes, rivers, wells and also or water from the sea ok. Environmental engineers are involved in design of large scale our oprah plants not just water from the ocean ok. The recent trend is what if you are not close to the ocean right. If you are in the middle of somewhere in Madhya Pradesh, Uttar Pradesh we can also take water from the waste water which we are discharging or the industries are discharging that can also be purified to domestic use ok, even drinkable.

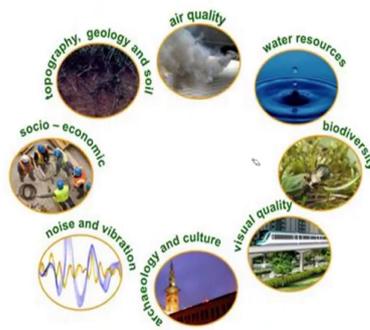
In your environmental engineering class I usually take the students to a industry in Chennai, where they buy wastewater from the municipality the corporation or the metro water ok. That is the household waste water, they just buy it and treat it to RO quality water, it is same as what you get in your cans ok.

And we even I even demonstrated the assurance by drinking the water ok. Some of the students really had the courage to drink it also because they saw what they saw made them believe right. It can be clean to drinkable levels ok.

(Refer Slide Time: 17:30)



Environmental Impact Assessment



So, yeah this is all what I was talking about environmental impact assessment for projects so, they futuristic projects. So, we have to cover all the domain areas ok. So, not only water and air, but also all the other geology socio economic impact of the project, it will not be our domain there will be experts doing that and then yeah culture archeology biodiversity everything has to be put together is in an environmental impact assessment report ok. For approval of upcoming projects ok.

(Refer Slide Time: 18:12)



AgriChem Industry

Andhra Pradesh



So, next I would like to show some of the projects which our group was involved in the recent past a few years from now.

(Refer Slide Time: 18:24)



Nagarjuna AgriChem



So, just to show you the breadth of our projects and what our students get involved in ok. So, many people may be from Andhra Pradesh here right. So, this is a plant in Andhra Pradesh its an AgriChem plant, they call it AgriChem because it is a nice shuttle way of saying they do not want to call it a pesticide plant right. So, I think they call it I agree AgriChem, but they mostly manufacture pesticides ok. And a lot of compounds chemical compounds organic compounds solvents go into manufacturing of pesticides ok.

(Refer Slide Time: 19:02)



Arial View



So, this plant has been operational for at least 5 decades at least 4 decades and as I told you yesterday previously, what was considered a good practice and allowed by other even the government or the regulators was to discharge the effluent from the factory in to within the factory from factory premises they were allowed to discharge in ponds and let it evaporate. That is the only way they knew of disposing their effluence ok. So, these as you see here these are the ponds which were used to discharge all the industrial effluents from the factory; the factory is here ok.

So, but beyond the factory around in this area, it was all villages. It was in the middle of an agricultural domain, there were like 7 different villages around the factory and they had complains about the water quality ok.

(Refer Slide Time: 20:00)



Effluent Disposal Ponds -South of Plant

Pollutants of concern:
Dichloro methane/Methylene chloride, Mono chlorobenzene,
Dichlorobenzene, Chloropropane



So, the industry wanted to do an assessment and we had investigated the quality of water in the pond, in the soil below the pond, below the water and in the industry premises and in the wells which are outside the pond ok. And a lot of different chemicals as you see, you can look up and see what are the toxicity levels of these. These are any chlorinated compound is supposed to be a toxic compound. The more the number of chlorine atoms the more the toxicity ok. So, we got a large number of these chlorinated compounds which are supposed to be carcinogenic also all right.

(Refer Slide Time: 20:49)



Boat Ride on the mighty Krishna



So, this is another project in the river Krishna along the river Krishna there was a paper and pulp unit. And they were discharging the water into an island in the middle of river Krishna ok.

(Refer Slide Time: 21:08)



Paper and Pulp discharges in Island



So, that is not a jolly tour, it was a official trip this is the Island, I wanted to show you how they bring the water across Krishna below the water and discharge it into the land within the Island ok. So, this was an approved process by the regulators, but over period of time the regulations changed, but the practices did not change ok. It continued and now they are paying the price for it and a lot of the river segment, Krishna river segment itself was contaminated because of discharges from this paper and pulp ok.

(Refer Slide Time: 21:40)



Vardhman Industries

Ludhiana Punjab



Punjab this is an industry textile hub for polyester, rayon all those hubs are placed in Vardhman industries in Ludhiana ok.

(Refer Slide Time: 21:56)



So, this is me doing some farming there right. So, you do all fun stuff, when you come to environmental engineering ok. So, what we did there, it was not just another field in Punjab, but they wanted to use their effluent for irrigating field this; this was the tail end of the irrigation. So, they were not getting any water. So, they wanted to you they had a lot of industries in that area Ludhiana the Malva district.

So, this they decided to see whether this is of the quality of their effluent is good enough for agriculture. And most of Punjab they grow, what do they grow? Wheat only wheat, anybody from Punjab?

Student: (Refer Time: 22:42).

It was surprising to me until I went there, I did not realize they were also growing.

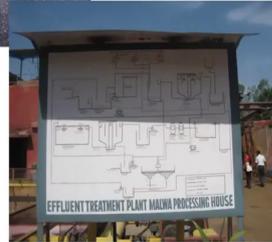
Student: Rice.

Rice right. One season they grow wheat, one season they grow rice ok. So, they we grow the entire year, we did two seasons of farming wheat and rice 6 months it was wheat and 6 months it was rice. And we used the effluent in a managed way treated untreated combinations, we did a lot of trials, we had a lot of trial plots.

(Refer Slide Time: 23:11)



(Refer Slide Time: 23:18)



And this was the engineer who was managing working with us. And this is the quality of the industrial effluent which before treatment. And then they do off treatment several steps of treatment and then it is discharged to the these are the treatment processes ok.

(Refer Slide Time: 23:33)



(Refer Slide Time: 23:38)



The cascade aerator and then at clarifier, aeration tank you learn all about this when you do environmental engineering ok. So, we did a lot of trials not only in the large fields, but we brought them also to IIT Madras and we monitored the growth of plants we monitored what we monitoring here is the infiltration ok. How much is the percolation if we are going to discharge the treated effluent?

We monitored the soil and we monitored the height of the plant, root size how much was the grain content and we also monitored what is in the grains. Because grains are of importance right that is what people are going to eat, did any of the chemicals left over in the effluent and irrigated, it may get trapped in the soil, it may just go below. How much of it is actually ending up in the grains and also in the stem because it is a fodder right. We are not worried about just humans, we should also be thinking about the animals the livestock ok.

(Refer Slide Time: 24:41)



Packing wheat samples for analysis



(Refer Slide Time: 24:45)



So, a lot of experiments were done and we had a report and the report was not good and that is when people do not like us right. Until then everything is fine, industry comes to us we go there, they give us a nice hotel, feeders and all that ok, but when we submit the report they do not like us ok. It happens with every industry ok.

I just wanted to show you the river Sutlej and this progressive farmer ok. Can you believe this house behind is this farmers house? People from Punjab know better I guess I was surprised going from down south ok. And he was using this Chromium Contaminated water. So, that was the sad part.

(Refer Slide Time: 25:16)



Chromium Contaminated Sites

Ranipet, TN and across India



So, yes chromium comes not only from textile industries also from leather all of us have leather products and right in Tamilnadu we have the worst contaminated site for chromium ok.

(Refer Slide Time: 25:45)



Introduction

3

- Chromium : 21st most abundant element on earth's crust
- Exists in several oxidation or valence states from Cr(-II) to (+VI)



Chrome plating

Health effects

- **Human carcinogen** – zinc chromate
- **Ingestion** -Erosive to stomach
- **Eyes** - permanent eye damage
- **Skin** - dermatitis and skin ulcers



Industry river - Cr (VI) in Coal ash



20-08-2019



Research proposal/seminar

Environmental Working Group, "Chromium 6 in Wastewater in U.S. Tap Water," <http://www.ewg.org/press/2012/08/20/ewg-chromium6-in-us-tap-water/> Smith et al. 2009

That is Ranipet there is a place called Ranipet, when I if some of you are going to take the elective, we offer an elective called hazardous waste treatment. We go on site visits to some of these places where you can see firsthand ok, how a contaminated site is and what is the status ok. So, chromium is a very very toxic metal, I do not know if you know or not chromium is everywhere your keychain this is nothing, but the silver finish is nothing, but chrome right.

Student: (Refer Time: 26:18).

Chrome plated. So, everything which is having that stainless steel appearance is chrome plated ok. and while they are plating it electroplating industries also discharge these if they are not taking care about their effluent ok.

(Refer Slide Time: 26:38)



Chromium : Indian context

4

Sukinda valley (Odisha)

- 4th highest polluted site
- Open cast mining: 76 million tonnes of reject minerals
- 97 % chromite in India : 200 sq.km
- 70 % (surface water) & 60 % (drinking water)
- 550 – 1500 mg/L : well water
- 25 -100 mg/L : irrigation reservoirs



- Estd. 26,00,000 people in threat of danger - *Cr induced diseases*.
- 84.75 % mine workers death
- 86.42 % nearby villages death -



<http://www.iiitb.ac.in/institute.org>
Iyer et al., 2006
20-08-2019

Research proposal/seminar

So, chromium is very abundantly present in our environment. This is the color of water in Ranipet ok. Orange it's like an orange juice right. Very shallow aquifer, you will find orange juice directly, you do not ok.

(Refer Slide Time: 26:55)



Contd.,

5

- 2500 tanneries : 80% chrome tanning
- Single tannery can cause GW pollution around 7-8 km radius Ansari et al. 1999



Ranipet Vellore, (Tamilnadu)

- Cr (VI) is **2.1 to 214 mg/L**

Chrompet Chennai, (Tamilnadu)

- Cr (VI) conc between **0.01 mg/L to 0.99 mg/L**

Pune, (Maharashtra)

- Mantarwadi landfill site: **5 -8 mg/L**

Vadodara, (Gujarat)

- **7700 tons** : dumped by Hema Dyechem Ltd
- GPCB : 17 cr



Rao et al. 2011, Brindha et al. 2010

20-08-2019

Research proposal/seminar

So, Ranipet to give you an idea chromium; permissible chromium in your water is 5 ppb. You know what is ppb, right?

Student: (Refer Time: 27:09).

And this is what you find in Ranipet ground water ok. 5 ppb is 0.005 milligram per liter ok, but this is what you found defined in the ground water ok. In Chromepet where there are tanning industries it is lower, but still on the higher side of permissible limit this is what you find in Pune, Vadodara everywhere Vadodara ok.

(Refer Slide Time: 27:36)

Feb-2, 2015, 03:48 AM IST 

Leather for sale, but chromium for free!!

6

- Kanpur is India's 5th largest city ; situated on the banks of the Ganges river
- Leather industry--supply national and international demands of superior quality leather
- Illegal dumping of Cr wastes directly into the Ganges



- Tanneries pump out about 30 crore litres of polluted water into the adjacent Ganges river
- Increasing deformities among new born babies
- Report filed by SPCB to cut power for 98 tanneries

"Kanpur - Cutting power supply to leather tanneries to save polluted waters"

20-08-2019 Research proposal/seminar



So, there are a lot of issues apart from chromium in leather industries not just chromium, but the entire process and the chemicals they use for tanning is really bad ok.

(Refer Slide Time: 27:48)



Petroleum Spill Site

Tondiarpet, Chennai



And that is why you will find you will not find any tannery in any of the western countries right, its only in India Bangladesh Thailand maybe. Similarly you will not find any textile dyeing unit in any of the western countries ok. Paper and pulp, no right they are very smart ok.

(Refer Slide Time: 28:16)



Lubricant oil

Fishermen used pots, thermocol iceboxes, aluminium buckets and plastic cans to remove the oil



Another site close to our home in Chennai, ok. What you see here? This is the biggest fishing harbor of the country I would say, itsa huge fishing harbor with a large export market ok. All you see here in the background is big ships or sailing boats which go for fishing ok. And they bring loads of fish, but one fine day they stopped selling fish and the women usually sell the fish, when the boats bring the fish back to the coast.

The women usually sell fish ok, but one fine day 4 years ago the women stopped selling fish and they were selling lube oil. Guess where they came from? Not from the ship. So, they started when it was actually coming out of their wells ok. There was so, much in their wells ok, lube oil spill had happened.

North Chennai is very if you Google and see Chennai's geography we have the port almost near the beach ok. And from the port; port is a source of lot of oil going in a lot of oil traffic

happens, we have a refinery up north. So, all the crude from the port goes to the refinery it gets.

Student: (Refer Time: 29:38).

It gets refined and then it gets distributed to different parts of the country at least the southern part of India ok.

(Refer Slide Time: 29:51)

**Panic after crude oil leak in
Tondiarpet Chennai Feb 2013**



So, there are a lot of pipelines crisscrossing entire North Chennai ok. If you are coming by train you will not miss these huge cylindrical storage structures right. These are all oil terminals which store these refined and crude ok. So, pipeline spills like this are very very common. If you if you talk to somebody in North Chennai it has been going on for a long time and people have learned to live with it ok.

(Refer Slide Time: 30:21)



Petrol Underground Storage Tank Leak

Fact and fiction **Mogappair – Anna Nagar**

Mogappair residents claim petrol seepage into their wells; bunkum, says IOC

Express News Service
Chennai, June 17

WHILE more than 600 families living behind a petrol filling station at Fourth Block in Mogappair West complained that gasoline (from the fuel outlet) had seeped into their wells and rendered water unfit for consumption, officials of the Indian Oil Corporation (IOC) strongly denied the allegations, saying leakage from the storage tank was not possible.

The residents claimed they had knocked various doors, including the Tamil Nadu Pollution Control Board, Chief Minister's Special Cell and Nollambur Village panchayat, about the seepage since the past six months, but no concrete action had been taken.

On Sunday, the residents resorted to a road rally seeking immediate solutions to their water problems. However, the local police pacified them and prevented immediate action. On Monday, local officials filled water samples from the contaminated wells for tests.

According to the locals, the wells were the sole source of water for the entire locality.

When an Express news team visited the area, residents strongly denied the allegations, saying leakage from this film of petroleum products floating on the water surface.

Through the residents contacted that the contaminated well was petrol from the nearby fuel station, petrol outlet to the nearby area. However, Chennai Branch gave it a different twist. "Ever since the petrol bunk was planned here in 2007, local residents have objected to it. The claims of seepage could be motivated," Ramakrishnan, IOC officials inspected the filling station and enquired about the whole issue.

"We have checked the last one year's stock chart of the filling station. It did not show any such loss due to seepage," the officials said.

Speaking to Express, T. Varadarajulu Rao, IOC's chief divisional retail sales manager said, "Seepage of

Residents of Mogappair West use water drawn from a well in the area to kindle a fire, proving the presence of oil in it

IOC officials inspected the

filling station and enquired about the whole issue.

"We have checked the last one year's stock chart of the filling station. It did not show any such loss due to seepage," the officials said.

Speaking to Express, T. Varadarajulu Rao, IOC's chief divisional retail sales manager said, "Seepage of

filling station and enquired about the whole issue.

"We have checked the last one year's stock chart of the filling station. It did not show any such loss due to seepage," the officials said.

Speaking to Express, T. Varadarajulu Rao, IOC's chief divisional retail sales manager said, "Seepage of



But when it started impacting their water, the groundwater which is the source of their water supply. One fine day they were getting oil in their groundwater they could burn it people even were driving their TVs 50 in the water which they got from their well, it was so high it was just oil ok.

(Refer Slide Time: 30:42)



DIESEL leak makes Tondiarpet ground water flammable

- By Bharath Ram – Indian Express CHENNAI
16th July 2013 08:06 AM



So, yeah this is the oil from the water from their bore well, it is pretty bad.

(Refer Slide Time: 30:48)

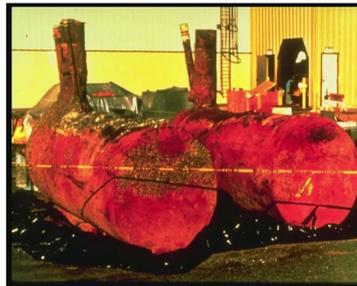


And oil spills happen everywhere not only in pipeline spills in drilling; drilling sites which happen Inland there are not only offshore drilling sites, but also on shore right. This is in Assam, where there are drilling sites and even down south in Tamilnadu, we have onshore drilling sites in Nagaputtnam and other areas ok.

(Refer Slide Time: 31:13)



Leaking underground storage tanks



So, its a really messed up place and everything ends up in the groundwater not only that every petrol bunk, where you go and fill up your gas petroleum ok. There is a huge cylinder at the bottom of these tanks, where we fill in and most it has it is if it is more than 20-30 years old it is corroded. And once its corroding, then you have a spill a constant spill ok.

(Refer Slide Time: 31:39)



Why should we be concerned

- Human Health and Life are at Stake
- Toxic hydrocarbons in significant quantity (BTEX)
Benzene, Toluene, Ethyl Benzene, Xylene, MTBE, PAHs
- **Known and Suspected Human Carcinogens**
- Permissible levels in water – 1-5 microgram/l
- One litre of spilled oil can contaminate a million litres of groundwater
- Small drips like 1 drop/second 410 gallons/yr
contaminating 1,500 tons of soil



So, several ways petroleum goes into the groundwater and again these are having some compounds which are very toxic very carcinogenic. BTEX the nice aroma what you get, when you fill your gas this polycyclic aromatic hydrocarbons ok, PAHs abbreviated and these are all carcinogenic. So, do not make sure that you do not inhale deeply, when you are in a petrol bunk ok. Keep your car doors up make sure you do not get exposed ok. It's sad people work there throughout the day and that is why you know that they are paid very high.

I do not know how many of you know people in the oil sector they are paid very high just like marine engineers they are risking their lives ok maybe they do not know it ok, but it is happening I.

(Refer Slide Time: 32:36)



Why we need to be concerned

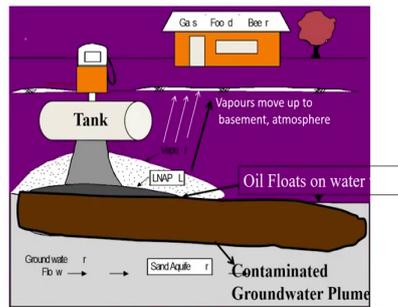
- Ground water is mobile and so is oil and its vapours.
- Complex geo-chemical reactions in subsurface
- Local geology and fluctuating water table depth
- Difficult in timely detection and tracking
- Location of source, extent of soil and groundwater contamination
- *Clean-up is much more difficult than marine spills!*
- *Clean-up is costly and time consuming!!!*
- *Restoration to 100% clean is not possible !!!!*



(Refer Slide Time: 32:38)



Typical Oil spill site



(Refer Slide Time: 32:39)



Drilling with Hand auger



(Refer Slide Time: 32:40)



On site soil VOC monitoring



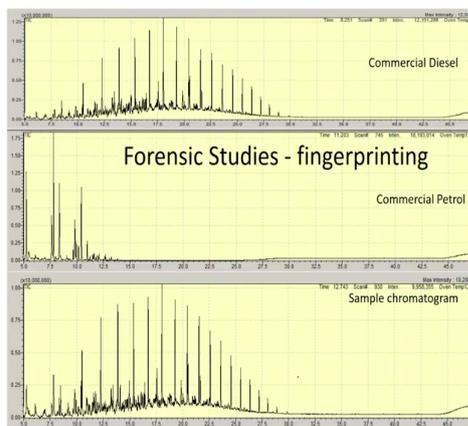
So, I would not go too deep. I just have some slides here to show how we did the investigations in Tondiarpet the oil spill site. So, we had drills, we had like vapor analyzers to check, what is the in the air when the spill had occurred.

(Refer Slide Time: 32:53)



And then this is the actual samples of oil collected from the bore well after we drilled in this is inside the house ok.

(Refer Slide Time: 33:02)



It was right inside the house and so, we do some forensic science also because, when there is a spill and there is no industry nearby, everybody will say its not mine right. So, people were trying to point fingers at a petrol bunk at somewhere they did not accept that it was a pipeline spill.

So, we have to do forensic to see, what is the sample this was the fingerprint of a GC gas chromatograph of the sample collected from the site and then you try to match it with this is petrol fingerprint of petrol petrol has only small carbon compounds like up to about c 9 9 carbon atoms, this is diesel ok. So, you are you know what spilled who is the source of the diesel whose pipeline was carrying diesel, then you know who this origin is who is the culprit ok.

(Refer Slide Time: 34:09)



Spread of Oil plume



So, we do a lot of this forensic anybody is interested in this, I think there is a taste of forensic in environmental engineering ok. And then you do multiple boreholes, we did about 25 bore holes in a particular area. These are the two major highways where the spill had occurred and then once we have the data everything is out there. Exactly mapped what is below the ground by just doing these bore holes and sampling you, we know where the oil has spread and we also know below the groundwater, what is the concentration of the different chemicals ok and how far away they are.

(Refer Slide Time: 34:42)



Pallikaranai Marsh Land



(Refer Slide Time: 34:48)



WETLAND



So, we do not have much time ten more minutes, I would just like to show some of the other projects people interested in biodiversity, we have a very nice beautiful marshland with 100 different species of birds coming there every year. Its called Pallikaranai marshland its just about 5 kilometers from IIT. If you want to spend a nice weekend you should go there ok.

(Refer Slide Time: 35:10)



Location wrt IITM



So, this is IIT Madras and this is the Pallikaranai marshland ok. What we see here in the graph is only about 20-30 percentage of what it was ok. It was like all the way below, it was extending and our it corridor has taken away most of the marshland.

(Refer Slide Time: 35:33)



What is left behind is that and that is also contaminated by what do you see here, do you know? Right in the middle of the marshland; marshland are supposed to be highly rich in biodiversity, they also clean up our environment, they are very valuable. We only talked about lakes, rivers ok. Marshland is also a very important water body, although we do not take water from there. Its highly biodiversity rich and it has a sink for all the waste.

It also acts as a flood protections region ok, its usually between the lake and the ocean and anything which overflows it stays in the marshland ok. So, such a marshland was impacted by what do you see here? Do you know? An aerial view of a its hard to imagine, you should go there last week, we were there on a field trip. It is the Chennais one of the two dumpsites ok.

And the dumpsite is nothing, but a solid waste dump right. Its not an engineered landfill like what I showed nice beautiful landfill ok. 3000 tons of waste come here every day from half of

Chennai ok. And slowly it started growing in 20 years, it is already encroached the entire width of the marshland and its moving ok.

(Refer Slide Time: 37:02)



Leachate



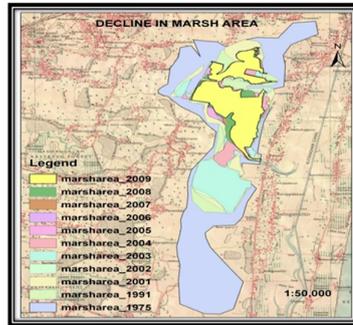
Solid waste landfill



20 August 2019

50

(Refer Slide Time: 37:07)



Picture showing decline in marshland



(Refer Slide Time: 37:11)



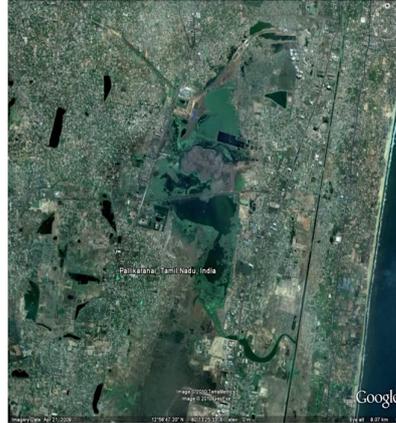
Land Use changes

- 1965 B&W image
- 2006 Colour image.



This is the close up view of the dump site and the marshland and that is how the marshland got shrunk at different times of the year of the decade its another image ok.

(Refer Slide Time: 37:15)



So, yeah there is so, much opportunity to reverse things first starting with the solid waste and then working on restoring the marshland back to its pristine conditions ok.

(Refer Slide Time: 37:28)



Kancheepuram Textile Dyeing Units



(Refer Slide Time: 37:33)



Study Area – Kancheepuram Municipality

- Kancheepuram Municipal
- Class I Town.
- Population of 144955 (19
- Protected Water Supply
- Vegavathi & Palar Rivers through Infiltration Gallery
- Pumping rate: 160 Lakhs l
- Total Daily Supply is 21.5M
- Per Capital Supply is 95 Lj



(Refer Slide Time: 37:36)



Problems – Toxic dye effluents

- Dyeing Industries that are too toxic and of high Pollution load are let into the Drain-cum-Sewage flows
- Affect seriously the Plant and Vegetation growths in sewage farms.
- In addition, in the east zone, about 8 mld of Sewage with dye wastes joins the Vegavathi course, and in the west zone, another 12 mld falls into Manjaneer Channel mainly due to lack of house connection.
- Kancheepuram sewage treatment plant studied recently to evaluate the performance of the plant and effluent sewage quality after treatment



(Refer Slide Time: 37:38)



(Refer Slide Time: 37:41)



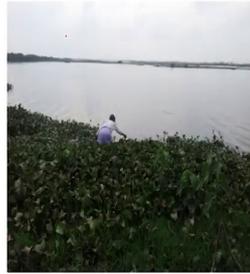
Sampling Effluent from WWTP



(Refer Slide Time: 37:44)



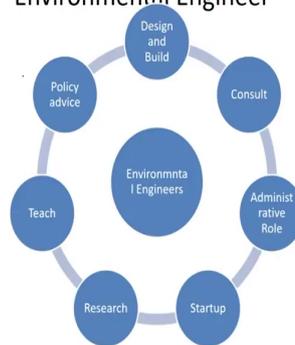
Sampling Lake



(Refer Slide Time: 37:44)



Future Career path of an Civil and Environmental Engineer



So, I think I will skip some of these other projects which we are involved and go directly to the last line. We have only about 5 more minutes left. So, I think I am I have I hope I have given an overview of all the different types of projects which you can be involved, when you become an environmental engineer. And also, I wanted to stop talking about I did this in the first slide, but again I like these circles ok. So, everything is centered around being an learning environmental science and engineering you can go to any of these domains ok. You can choose what you want to be or it can be a combination ok.

You can teach and also do research and consult and do all this assessments just like how we are doing right or you can be a solid engineer who can just be on the site design build put it in place ok. And that will give you a lot of satisfaction to change be the change maker and that impacts the society a lot that is what I want to conclude by telling ok. Being an environmental

engineer, I always felt a great sense of satisfaction talking to people in the site like Tondiarpet site.

I have been visiting them for the last 5 years and my friends always comment that I can become up; I can stand for an MLA position in that location. Everybody knows me right and people welcomed me to their homes and that is the connect you establish, when you work on projects which can impact the community ok. We do a lot of lake restoration projects in south Chennai ok.

So, I will be happy if any of you are interested, you can always join the team, when they go and visit these sites and see for yourself what is happening and yeah I think I conclude with this statement. Environmental engineers we often think why civil engineering, why again the environment seems to be at the bottom of the civil engineering also right. People look at structures and other engineering within and civil engineering ok.

But I often think environmental engineers play a much bigger role, than even medical professionals. Medical they say, its a noble profession right you treat people and you get them overcome their diseases and pain and suffering right. I often value environmental engineers much better than even medical doctors. Can you tell me why? I think you got the answer yes. So, we do not even, we do the prevention rather than taking care of them after they get into some kind of a health issue ok.

So, prevention in the in the true sense I would say ok, not only for humans also for the ecosystem ok. So, I will stop here and I will see you at the discussion session. And one important thing its not just of course, money and development is important, if we are not under playing anything, when you are an environmental engineer.

If you look at you know LNT is the biggest construction company right or one of the biggest go ahead and talk look at LNTS turnover, right now none of their building projects, if you put all their building projects and all their water projects ok. Their biggest turnover actually its 2

to 3 times they are building projects. The water and wastewater components of a LNTS projects are have tripled, then even their building projects ok.

There is so, much infrastructure development going on in the country and there is a lot of scope for water supply, wastewater treatment. The entire country is on a re innovation renovation path right Jawarharlal Nehru Urban Renewal Mission lot of schemes are there which are promoting water projects.

Every town every city every little town should have its own treatment plant waste water treatment plant solid waste management plant. So, I think in the next few years ok there is there is a lot of opportunity and all the big multinationals are setting their base in India environmental companies CDM smith, ERM all these big names right ACOM these are all big environmental multinational companies, who are setting up their base in India ok.

So, they know better they have done their as such. So, that itself will indicate that ok, what kind of a work prospect you will be having, if you choose to specialize in environmental engineering ok.

Thank you.