Ground Water Hydrology
Prof. DR. V.R.Desai
Department of Civil Engineering
Indian Institute of Technology – Kharaghpur

Module No # 05
Lecture No # 22
Ground Water pollution from industrial, Agricultural and Miscellaneous sources (contd.)

Welcome to this lecture twenty second.

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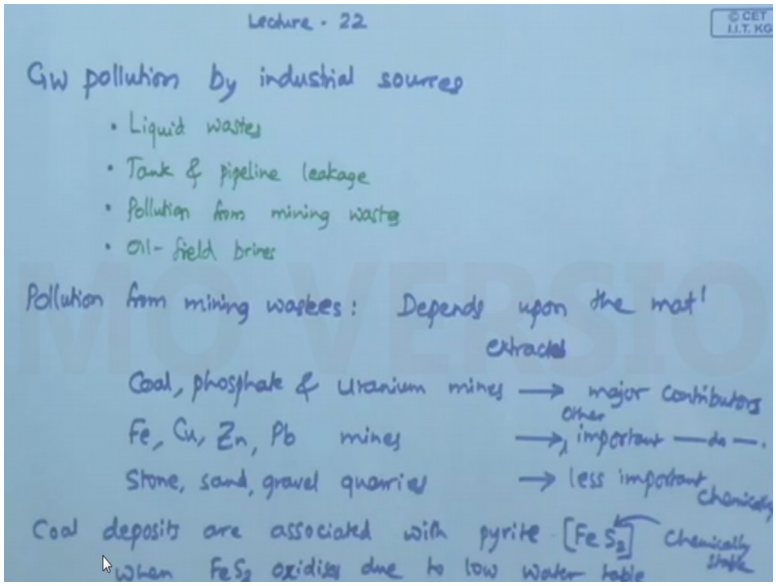

So we will continue with the ground water pollution by industrial sources so we discuss the liquid waste and tank and pipe line leakage yesterday in the where iam sorry the previous class and in this lecture we will continue the discussion and we will go about to that is pollution from mining wastes and oil field brines. So in this pollution from mining wastes. So basically depends upon so this depends upon the material extracted so this coal phosphate and uranium mines.

So these are the major contributors for pollution and iron copper zinc lead mines so these are quite important it is other important contributors here. So the queries of stone sand gravel so their less important chemical simple reason that stone sand or gravel so they are chemically stable compound so therefore they are less important and coming to this coal deposits.

So coal deposits result in are associated with pyrites which is ferrous sulphide and this when this pyrite FES 2 or pyrite oxidises low water table. So this FES 2 as such is quite stable chemically stable.

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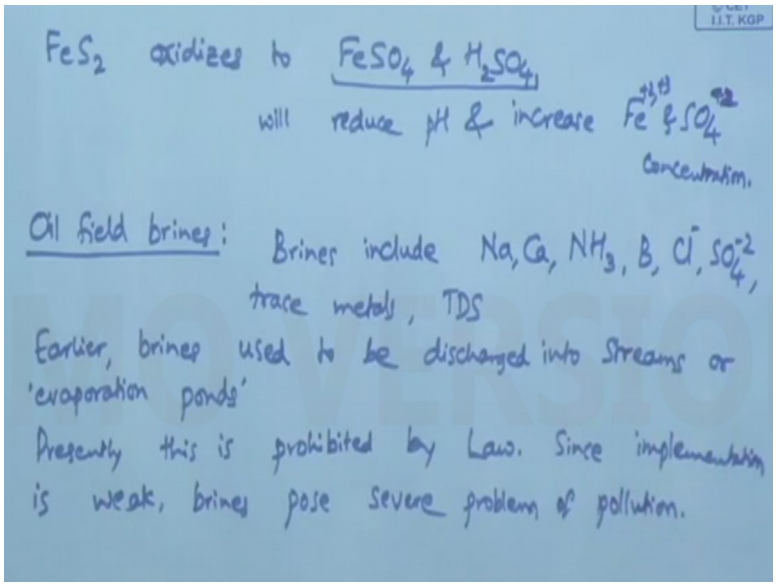

So then you when the water table is quite low then this FES 2 or pyrite oxidises to ferrous sulphide and sulphuric acid and these two this ferrous sulphate and sulphuric acid so their the one which cause the pollution. So these is ferrous sulphate and sulphuric acid will reduce PH because both of them are as this sulphuric acid is antiroll as it and ferrous sulphate is salt is also acidic the solution is acidic.

So therefore they will reduce PH and increase FE as well as FE + 2 or + 3 as well as SO 4 - 2 the sulphate concentration and hence pollution. So therefore so this pollutions are mining waste is important now let us go to the next the last this one that is the pollution by oil field brines.

So this brines include sodium calcium ammonia or on then chloride sulphate trace metals and total dissolve solid so basically brine is a saturated solution of a solid of any of this either sodium calcium or ammonium boron here. So earlier so this brines used to be discharged into streams or evaporation ponds so but presently.

So this is prohibited by law however so because the implementation is not proper since implementation is weak. So this brines do force problems and this context pose severe problem of pollution by increasing the concentration of the methods of the dissolves of which the brine is composed of now we will move on to the ground water pollution

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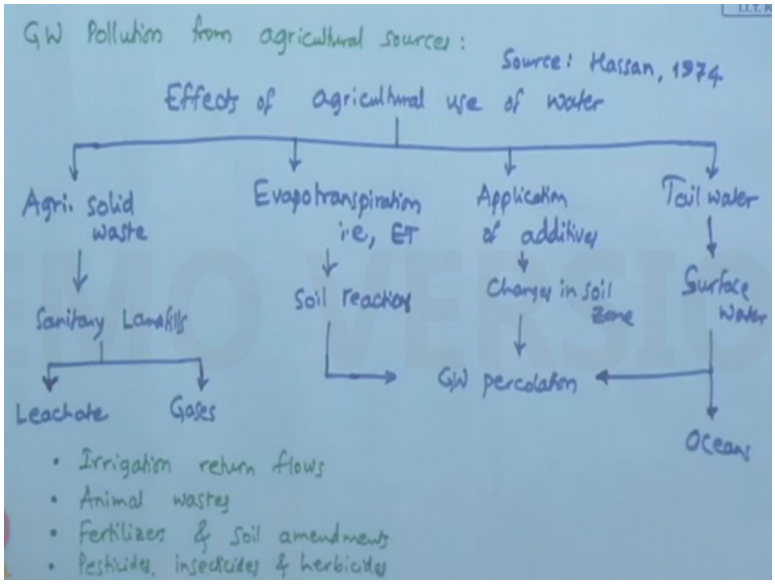

From agricultural sources again here let us consider the effects of agricultural use of water. So here what happens is when the water is used for agricultural infact this constitutes the major use. So it will it may either go as agricultural solid waste or it may join the atmosphere through evopo transpiration or which is abbreviated as ET or it may go as application of additives or it may go as tail water which is the which eventually turns this agricultural return flow .

So this agricultural solid waste they may move on to sanitary landfills from the sanitary landfills the solid portion they move as a leach ate the gaseous portion get release as gases and here this one when this agricultural water discharge into atmosphere through evopo transpiration it may cause soil reactions and so these soil reactions so basically part of it may saturate the soil and then they percolate into ground water ground water peculation while this amplification of additive.

So this will result in changes in soil zone. So in this case this additives may be this soil amendments or fertilizers on pesticides and so they may also peculate into the ground water and this tail water which is which may get into surface water and then from surface water it may circulate into ground water and or it may go to ocean so this is how of course this is also so this diagram this is also from the same source that is a study by HASSAN in 1974.

So where in the effects of agricultural use of water in nicely the picture the flow chart now we will discuss the various components within which cause the ground water pollution from agricultural sources. So they are irrigation return flows followed by animal wastes followed by fertilizers and soil amendments followed by pesticides insecticides or herbicides now let

us discuss these sub components of the ground water pollution from agricultural sources one by one.

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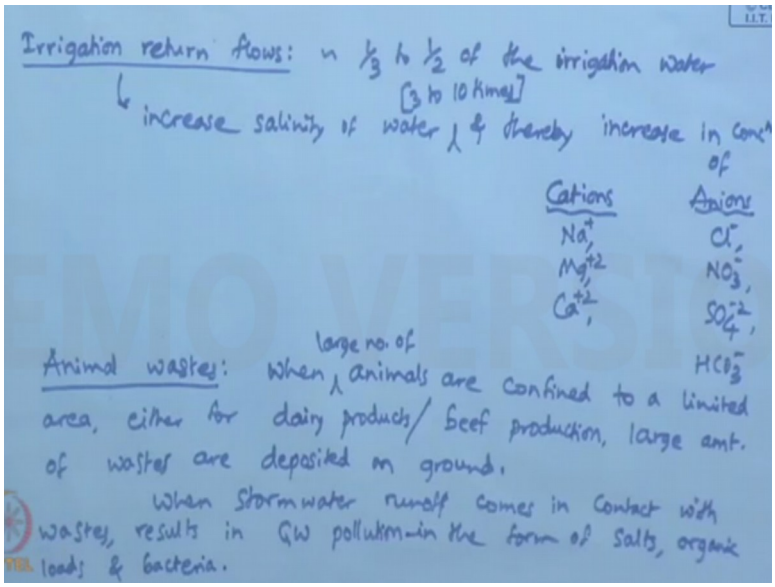

So firstly the irrigation return flows so these irrigation return flow constitute approximately one third to half of irrigation water essentially the irrigation water which does not undergo evopo transpiration will appear as irrigation return flow and here. So these irrigation return flow so what they do is so they increase the salinity of water and thereby increase in the concentration of so the cations and has been estimates so this increase in salinity of water.

So that is it has been estimated as it is 3 to 10 times. So the so there are this increase in the concentration of this cations such as sodium magnesium calcium then these are the major this one whereas anions are say chloride nitrate then sulphate and bicarbonate so because of this reason especially due to the increase in the saline water by three to ten times so this irrigation trend flows are very important.

Now let us go this animal waste how this animal waste will cause will increase the pollution. So here wherever the animals are when animals are confined large number of animals are confined in the very small area or small that is limited area either for dairy production or say milk production or for beef production.

So large amount of waste are deposited on ground so this large amount of waste when storm motor run off comes in contact with wastes it results in ground water pollution and this ground water pollution may be the form of salts organic loads and bacteria. So therefore we need to focus only to the we need to consider this ground water pollution from animal waste.

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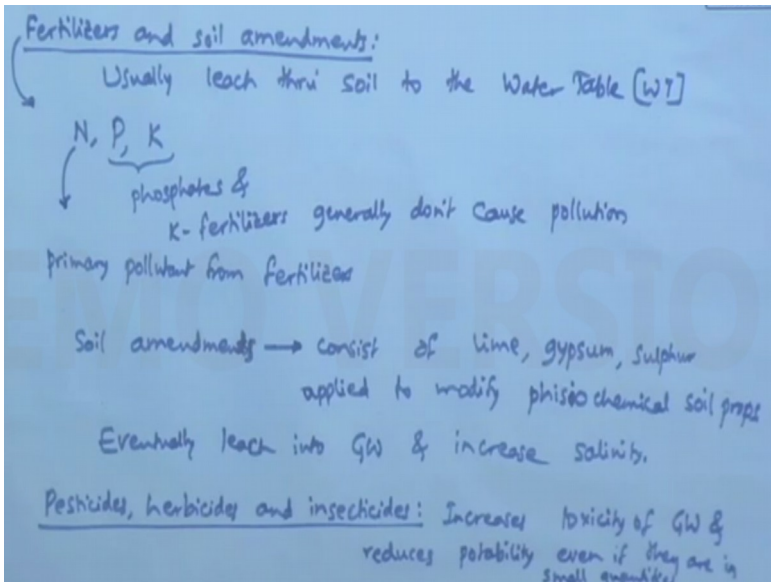

Next we will come to the fertilizers and soil amendments so this fertilizers and soil amendments usually leach into ground water and leach to soil to the water table which is generally abbreviated as WT and obviously the fertilizers so they are mostly consisting of nitrogen phosphorous and potassium and among this so this phosphate and potassium and this potassium fertilizers generally do not cause pollution.

However so this nitrogen is the primary pollutant from fertilizers so now coming to this soil amendments so this soil amendments consist of lime gypsum sulphur applied to modify physical or chemical or physiochemical soil properties so these so they eventually leach into ground water and increase salinity and the last sub component of the ground water pollution from agricultural sources is through pesticides herbicides and insecticides.

So the presence of these pesticides, herbicides and insecticides increases toxicity of ground water and reduces portability even if they are in very small quantity therefore we need to account for the pollution cause by this pesticides herbicides and insecticides.

So these four sub components that is irrigation return flows animal waste fertilizers and soil amendments as well as the pesticides insecticides and herbicides they constitute the pollution caused by agricultural use of water now let us come to the last source of the last major source of pollution.

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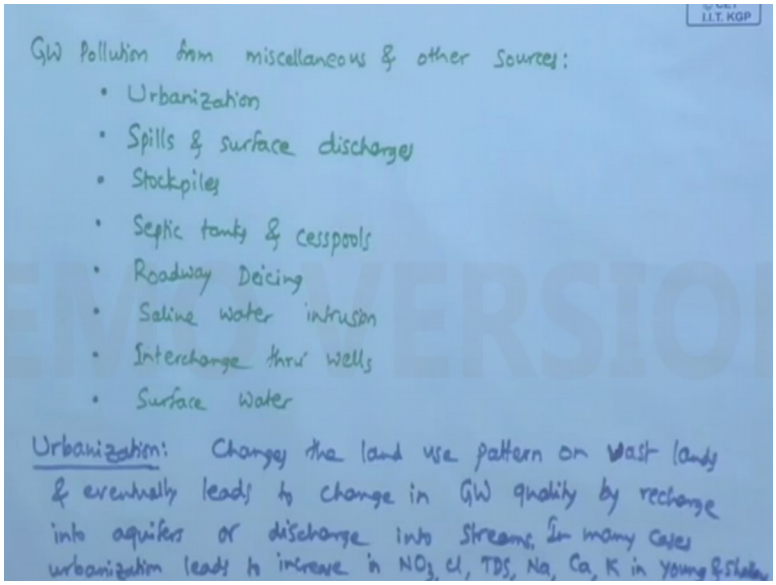

That is the ground water pollution from miscellaneous other sources so here consider the effect of urbanization and how it results n ground water pollution we will consider this spills and surface discharges stockpiles they move on to septic tanks and cesspools followed by this roadway deicing followed by saline water intrusion then interchange through wells and lastly the surface water.

Now we will briefly consider each one of this one by one first we will ho to this urbanization we know that so in these urbanization changes the land use pattern on vast lands and so eventually leads to change in ground water quality by recharge into aquifers or discharge in streams and it has been found that this urbanization in many cases urbanization leads to increase in nitrate chloride dissolve solids that is total dissolve solids sodium calcium potassium especially in young and shallow waters especially in young and shallow.

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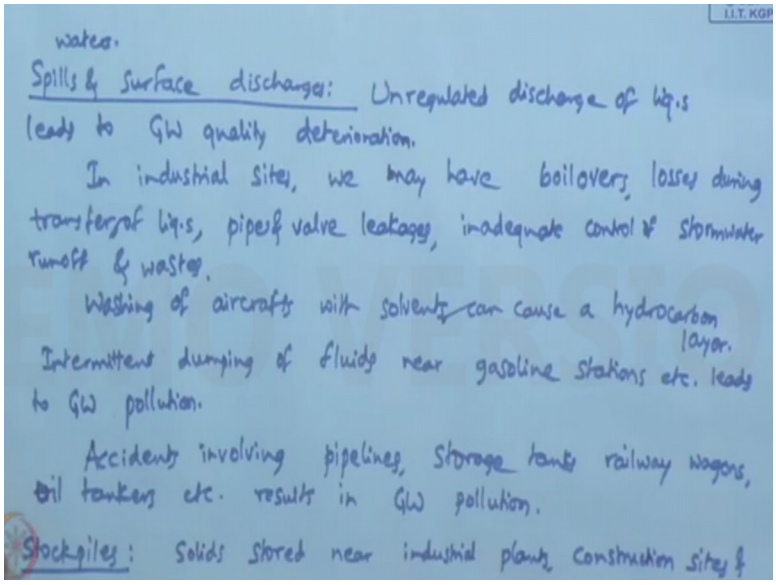

Waters now let us come to the ground water caused by the spills and surface discharges especially in this liquids which are discharged on the surface in the unregulated uncontrolled manner it results in lots of degradation of ground water so that is unregulated discharge of liquids leads to ground water quality deterioration or degradation. So in industrial sites we have we may have boilovers.

Transfer losses during transfer or transportation transfer of liquids pipe and value leakages inadequate control of storm motor run off and wastes also so the washing of air crafts with solvents can cause a hydro carbon layer. So that is additionally this intermittent dumping of fluids near gasoline stations gasoline or say petrol stations etc leads to ground water pollution lastly it is the accidents involving pipelines storage tanks railway wagons boil tankers etc.

Results in ground water pollution obviously this spills and surface discharges the concept one of the major source of ground water pollution.

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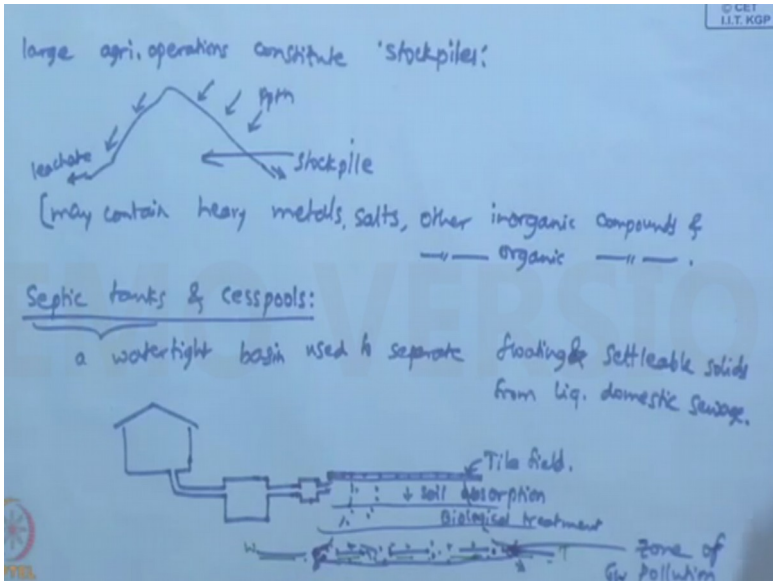

Now let us move on to this stockpiles so the solid stored near industrial plants construction sides and large agricultural operations constitute these stock piles what are known as stock piles so when precipitation say suppose this is the stock pile. So when precipitation falls the precipitation when it falls on the stock piles then the stock piles cause leaching it causes leaching so this is the stock pile.

So it causes this is the leachate and it flows into the soil and this leachate may contain heavy metals salts other inorganic compounds and other organic compounds. So they will result in this ground water pollution. Next we will go to the ground water pollution caused by septic tanks and cesspools a septic tank so this is a water tight basin used to separate floating and settle able solids from liquid domestic sewage.

So suppose so this is an individual house here from this individual house. So there could be a pipe leading through a septic tank and then so generally what happens is from the pipe of a septic tank there will be a distribution box and this distribution box followed by the tile fields.

So this is the tile field and here the this is under the tile field so there will be soil absorption followed by this will over Interco this biological treatment layer and there will be so this could be the water table and here when this septic tank moves and it reaches the water table and there it is the it constitutes the zone of ground water pollution. So in the briefly discuss this cess pool

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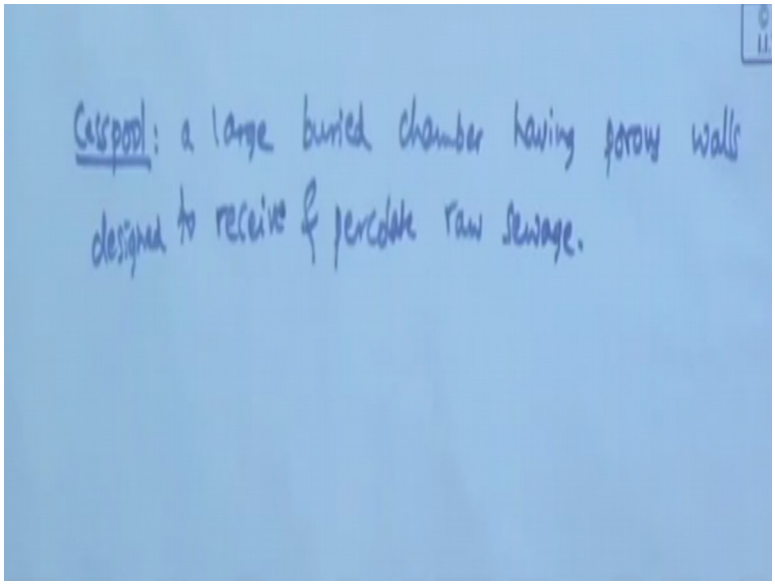

Cess pool is essentially a large buried chamber with having porous walls designed which have designed to receive raw sewage receive and peculate raw sewage. So obviously it is septic tank cess pools so there will be peculation and result in the ground water pollution so in the next lecture will discuss about the further components of the ground water pollution caused by agricultural sources and move on to the attenuation measures for the ground water pollution thank you.