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The Committee recalls with gratitude the spirited guidance and enlightened advice given by Dr. C. R. Soman, who could attend only two meetings before his demise. We pay our respectful homage to him.

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Foreword

Plachimada, a remote village in Palakkad district has today become synonymous with a long struggle for justice. Ever since the inception of the Hindustan Coca Cola Beverages Private Limited (HCBPL) factory in this village, the fabric of life of the people was torn and the environment has been violated. Water and soil quality deteriorated. Agriculture and allied activities declined. What started as a concern and resentment among the people soon became a major resistance movement while the fears of short-term contamination and long- term damages were confirmed by scientific studies. Several studies have come to the conclusion that the over-extraction of ground water by the factory has depleted the water resources and the indiscriminate disposal of sludge containing cadmium and lead has created immediate loss and suffering and long term consequences.

It is evident that the damages caused by the Coca Cola factory at Plachimada have created a host of social, economic, health and ecological problems, cutting across different sectors. Though the extent of damages and their inter-sectoral linkages were understood and the culpability of the Company was established, the earlier studies lacked two major dimensions. Firstly, no attempt was made to quantify these damages. Secondly, there was no well defined proposal about a legally tenable institutional mechanism to claim compensation from the Company. Government of Kerala, on a recommendation by the State Ground Water Authority, constituted this High Power Committee on 23.5.2009 with the mandate of 'assessing the scale and nature of the damages'. The Committee had members from different

disciplines so as to facilitate a proper appreciation of this multi-sectoral crisis.

It is pertinent to remember that such an exercise has no precedent in the State. The Committee had, therefore, to evolve its own strategies and methodology to arrive at a meaningful assessment, rational conclusions and practical recommendations. The High Power Committee held eight meetings and conducted a public hearing at Perumatty Panchayat Office after publishing notice. In the public hearing attended by hundreds of affected people, voluntary workers, concerned citizens and Panchayat representatives, the various woes experienced by the people on account of the functioning of the Company were presented. In these presentations, the insensitivity of the Company and its continued denial of problems were self-evident. The Committee evaluated all the available Reports on Plachimada and carefully studied the various representations received.

It was felt that in order to take stock of the scientific and legal ramifications of the various hardships highlighted, discussions with specialists were necessary. Accordingly, two Panel discussions with experts were organized. One at Trivandrum focused on the various issues related to water resources, agriculture and health. The second discussion was solely on the legal and environmental aspects. Large number of eminent scientists, lawyers, doctors, environmental engineers, academicians and experts participated in these Panel discussions which provided to the Committee an update of the various aspects. The Panelists also shared similar experiences which gave a useful perspective to the Committee. In between, the Committee also made a day-long visit to Plachimada

to have a first hand knowledge of the issues highlighted. During the visit the Committee inspected several wells, spoiled farms, met a large number of people and listened to the narrations of hardships. Local leaders and activists as well as the officials of various departments provided a proper perspective to the Committee on the suffering of the people and the current situation.

On publishing the notice for the public hearing, the Coca Cola Company had issued a letter questioning the validity and justification of the constitution of a High Power Committee. It was decided to ignore this ill-advised letter. Though the letter did not pose any difficulty or obstruction to the functioning of the Committee, it displayed an intransigent and unrepentant attitude on the part of the Company. Judging from this dismissive and questioning attitude to a High Power Committee set up by the State Government, it is not difficult to imagine the extreme insensitivity of the company towards the grievances of the affected people.

With the help of the advice and assistance received from various experts and the capabilities available within the Committee, it has been possible to delineate the extent of damage on water, soil, agriculture, animal husbandry, public health and employment. The Committee also made an attempt to appreciate the educational and social damages inflicted on the people. Though the Committee received a large number of petitions, individual claims have not been evaluated for arriving at the compensation, which is beyond the mandate of the Committee. However, these representations and several interactions had revealed the true

face of the problems and the magnitude of deprivation. Using objective as well as well grounded yardsticks, the Committee has calculated the overall money value of the damages. It is not claimed that the amount of compensation arrived at by the Committee is in any way final or absolute. It is only indicative in nature. Actual compensation will have to be calculated by an Authority duly set up for this purpose.

No amount of money can be true compensation for the damages incurred. But that at least would serve to acknowledge that the people have been wronged and deserve to be compensated. The well entrenched 'polluter pays' principle and the right to life as enshrined in Art. 21 of the Constitution of India have been used by the Committee as the bedrock for arriving at the culpability of the Company.

Individual claimants pursuing legal action in courts against the Company is not a practical approach, considering the extent of the damage and the large number of affected people. Instead a legally constituted dedicated agency is essential to assess the actual compensation due to every applicant and issue orders to the Company for compliance.

As per Art.323 B of the Constitution of India, State Legislature has powers to create tribunals for any dispute. A Plachimada Claims Tribunal can be created by the State legislature for claiming compensation to the affected people from the Coca Cola Company.

An alternative suggestion that could be explored is the setting up of an Authority as envisaged under section 3(3) of the Environment (Protection) Act, 1986. A similar Authority has been

created to deal with damages by pollution arising from tanneries in Tamil Nadu. State Government may have to decide on a befitting course of action in setting up an empowered and dedicated agency to adjudicate the individual claims to be invited from the affected people and agencies.

On behalf of the High Power Committee I submit this Report for the consideration of Government of Kerala.

K. Jayakumar IAS
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Chairman, High Power Committee

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22 March 2010

EXECUTIVE SUMMARY

Though Palakkad district in Kerala, where the Coca Cola plant is situated is considered as the 'rice bowl of Kerala', a part of the district falling in the rain shadow region of the Western Ghats is drought prone. Plachimada, where the Hindustan Coca Cola Beverages Private Limited (HCBPL) factory was set up had been classified 'arable'. The villagers are predominantly landless agricultural labourers with almost 80 percent of the population depending on agriculture. It is natural that an industrial plant with heavy consumption of water set up in a socially and economically backward and drought prone area would disrupt the ecological balance and adversely affect the life and livelihood of the people.

The Coca Cola factory situated in an area of around 34 acres of land has been drawing water from 6 bore wells and 2 open wells. There are varying estimates of factory's demand for water. According to the 2002 report of Dr. R.N. Athavale, a consultant for Coca Cola , the factory would require at full capacity 6.35 lakh litres per day. The interim report says that the Plant would use roughly 5 lakh litres per day. The waste water released was to the tune of 1.5 to 3 lakh litres per day.

The extraction of over 5 lakh litres of water daily has upset the natural balance and adversely affected availability of water. Bore wells and shallow open wells dried up. The quality of water deteriorated with reported increase in salinity and hardness of ground water. The toxic chemicals in the waste water have contaminated the ground water making it unsuitable for irrigation.

The Company had obtained a license from Perumatty Grama Panchayat for installing 2600 HP electrical motor for running the Coca Cola bottling plant. However, no license has been obtained from the Panchayat for installing motor for drawing water, though the Company was extracting water from the bore wells and open wells without any license obtained from the Panchayat.

The committee has found that the operation of the factory has caused excessive depletion of the groundwater resource. We have also found that it has caused the pollution of the ground water and it will take years to mitigate the pollution

Besides the problems created by drawal of huge quantity of water, the solid waste (ETP sludge) from the factory exacerbated the crisis. Part of this material was dumped in landfill sites within the factory compound. Large quantities of it were trucked out and disposed off in the farmlands all around and far off places. The factory had impressed upon the peasants that it was good manure. The sludge had no nitrogen content but dangerous levels of cadmium and high levels of lead makes it a hazardous waste. Too much of cadmium in the soil has lead to the leaching into the wells. The presence of excess cadmium in the farmland has lead to nutrient imbalance in the soil. The farmlands, which had apparently very good soil structure got deteriorated in due course.

Farming households have suffered a steep decline in yield to less than half the levels of what obtained before 2000. Further, the number of coconut palms assigned for toddy tapping also declined to nearly half during this period, since tapping contractors selected only the irrigated trees. Ninety-one percent of the farming households reported that owing to reduction in crop productivity, their agricultural income declined drastically. So they had reduced

employment of hired labour. Consequently, the number of days of employment of agricultural labour dwindled. Of the 916 workers who moved to other villages in search of work, 72% reported that they experienced severe unemployment in their own village since 2000. In other words, migration was forced upon most of them.

The fodder and water in Plachimada and surrounding areas were contaminated with copper, cadmium, lead and chromium, more than the admissible level by the World Health Organization (WHO). The Kerala Agricultural University (KAU) has found that the fodder, milk, meat and egg samples collected from Plachimada area contain the above elements, at a toxic level and that would explain not only the loss of animals and birds but also the reduction in the productive capacity of the animals. Production of milk, meat and egg declined which in turn affected the household income and health of the people.

There is abundant evidence to conclude that the operation of the Plant has exacerbated the drinking water crisis of the Plachimada Panchayat by excessive pumping and over-extraction of ground water. Further, it polluted drinking water by its careless and irresponsible disposal of sludge and treated effluents. Particularly hard hit are the dalits, tribals, women and children of the surrounding area. As the water supply deteriorated, the women had to travel about 5 kms to fetch drinking water. This has resulted in loss of wages for these women. Serious damage caused by the contamination of aquifers and springs had adversely affected agriculture yield and productivity.

The deterioration in the quality and quantity of groundwater and the consequential public health problems, displacement and migration of labour and the destruction of the agricultural

economy are the main problems identified in Plachimada which have been caused and contributed by the Coca Cola Factory. The people living in the vicinity of the Company have been the worst affected. The problems were further aggravated by the deterioration of agricultural lands by depositing the hazardous wastes at the behest of the Company. During the rainy season, these deposits have spread into paddy fields, canals and wells, causing a serious health hazard. The Company abandoned this practice and began pumping dirty water into dry bore holes that had been drilled on the site for the disposal of solid waste. This polluted the aquifers.

In 2003, the District Medical Officer advised the people of Plachimada that their water was polluted and unfit for consumption. The natural water resource at Plachimada has been ruined beyond immediate replenishment. It will take decades for natural replenishment. At present water in the open wells in the area, which were the sources of drinking water, is unfit for drinking. All these point to the gross violation of pollution control laws, basic human rights and the right to life as guaranteed in Art. 21 of the Constitution of India.

HCBPL has neither acknowledged the existence of any of these problems nor shown a readiness to appreciate the truth behind these findings. On the other hand the Company has always been eager to downplay public agitation against these human problems. But the fact that the Company has violated a number of provisions in the various laws is irrefutable. Some of the major Acts which have been violated by HCBPL are as below:

(1) Water (Prevention and Control of Pollution) Act, 1974

(2) The Environment (Protection) Act ,1986

(3) The Factories Act, 1948

(4) Hazardous Waste (Management and Handling) Rules , 1989

(5) The SC-ST (Prevention of Atrocities) Act 1989

(6) Indian Penal Code

(7) Land Utilization Order, 1967

(8) The Kerala Ground Water (Control & Regulation) Act, 2002

(9) Indian Easement Act, 1882.

The fact that Coca Cola factory at Plachimada has caused immense damage to the environment and people and their livelihood and health is supported by impeccable evidence. In fact any other finding can only be a figment of imagination. Though the Company is liable to be proceeded against the various sections of several Acts, an institutional mechanism to address each representation of the victims is necessary for achieving speedy justice.

Two recommendations put forth in this Report are:

Government may constitute by legislation a Claims Tribunal for the adjudication of disputes relating to compensation due to water and air pollution, loss of agricultural crops and animals, diseases affecting human beings in the surrounding area due to the excess drawl and pollution of groundwater and surface water by the Company.

The other option is to approach the Central Government to constitute an Authority under section 3 (3) of the Environment (Protection) Act, 1986. The Authority can be vested with all the powers necessary to deal with the situation created by the Company as was done in Tamil Nadu to deal with issues arising from the tanneries and other polluting industries.

The Committee has come to the conclusion that the Company is responsible for these damages and it is obligatory that they pay the compensation to the affected people for the agricultural losses, health problems, loss of wages, loss of educational opportunities, and the pollution caused to the water resources. The value of water extracted and depleted has not been calculated though it needs to be compensated. These calculations are only indicative in nature and should not be treated as the outer limit of compensation to be claimed which has to be arrived at by the dedicated adjudicating agency to be created. However, on an estimation based on available inputs, the following amounts could be claimed as reasonable compensation.

Agriculture loss:	Rs. 84. 16 crores
Health damages:	Rs. 30. 00 crores
Cost of providing water:	Rs. 20.00 crores
Wage loss and opportunity cost:	Rs. 20.00 crores
Cost of pollution of the water resources:	Rs. 62.10 crores
Total:	**Rs. 216.26 crores**

1. INTRODUCTION

1.1. The Coca Cola factory at Plachimada in Palakkad district has become the centre of attention of the civil society due to the multifarious problems it caused to the local population and environment. Water level dipped in the wells and the available water was polluted. The long drawn out agitation against the factory drew international attention. The people, the Panchayat, various courts of law, various Government agencies, Universities, political parties, voluntary organizations and the media were all drawn to the vortex of the issue in one role or the other.

1.2. The damage created by the functioning of the Cola factory did not cease with the closure of the factory in March 2004. Perception of pollution has undergone a drastic change over the last two decades and no society can ignore the damages caused to the environment and its perpetrators. “Polluter pays” has become an accepted dictum, world over.

1.3. The present report is an attempt in this direction and would hopefully serve as a platform from which the process of fixing the responsibility can commence and lead to the payment of compensation. The report has been prepared by relying on the empirical data, available reports and by avoiding speculations.

1.4. There have been several studies, by the Legislature Committees, Supreme Court Monitoring Committee, scientific bodies as well as civil rights groups and concerned individuals about the damage caused by the Coca Cola Plant at Plachimada. These Reports have conclusively established that the Company is liable for all these damages. Even after the closure of the

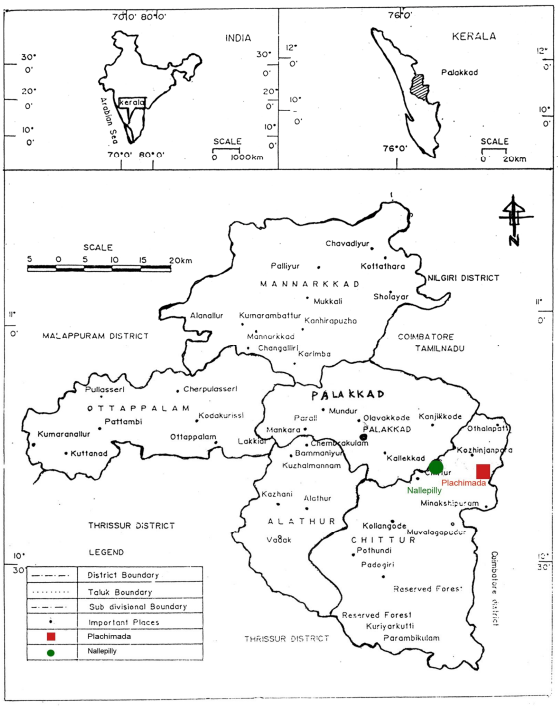
Company, the life of the people of the area has not regained its original rhythm and robustness. The Kerala Ground Water Authority which undertook a study in 2009 also reveals that groundwater levels have fallen and have been polluted. It was felt that studies to establish the liability and responsibility of the Company are not required any more but an attempt to quantify the multi-sectoral damages caused by the Company has become imperative. It was also necessary to explore institutional mechanisms with legal sanctity to make the polluter pay for the damages.

1.5. This study has therefore not examined fresh evidence to prove the role of the Company in creating the damages which stand proven. The Committee concentrated more on the extent and valuation of the damage. The Committee received a large number of individual petitions outlining the extent of damage sustained by them. But the Committee has not gone into the merits of each of these complaints. Instead those petitions were used as a mirror of the situation to estimate the damage.

1.6. Besides an institutional mechanism with legal backing is a necessary prerequisite to claim the damages from the Company. The Committee confined its mandate to identifying the overall extent of damage, making an estimation of the damages and explored the legal framework within which these individual claims can be adjudicated.

2. PROFILE OF PLACHIMADA

2.1 Moolathara village in Perumatti Panchayat, where the Coca Cola plant is located, falls within the Palakkad Gap of the Western Ghats. The densely populated hamlets of Plachimada and Vijayanagaram colony abut the western and eastern sides of the plant, respectively, and located behind the plant is Madhavan Nair colony. Across the main road are the hamlets of Thottichipathi and Rajiv Nagar, the latter two falling within the Pattenchery Panchayat. These areas collectively have come to be referred to as Plachimada. The plant occupies a land area of about 13 hectares with the ground sloping towards north.



Location Map of Coca- Cola Company at Plachimada

The gently slopping terrain of the Plachimada watershed has an area of 14.89 sq km and it drains to the perennial Chiturpuzha river which flows westward about 2 kms north of the plant. The river is dammed upstream at Moolathara and the left canal feeds the twin reservoirs of Kampalathara and Vengalakkayam which are about 500 meters northeast of the Coca Cola factory. The lined left canal, that irrigates the eastern part of the Panchayat, passes about 10 meters north of the plant. Meenkara irrigation dam is located 3 km south of the Plant.

The soil composition of Perumatty Panchayat is characterized by the presence of black cotton soil (which allows little rainwater infiltration), red soil and clay soil. The soil depth is seldom more than 2-3 meters. The plains and the Poonthalpadams are the prominent physiographic forms. Poonthalpadams are wet paddy fields where two and sometimes three crops are raised. These paddy fields, with irrigation support in summer, make a significant contribution to production of paddy in Palakkad famed as the rice bowl of Kerala. Almost the whole Panchayat is classified as arable land.

2.2. Hydrogeology

Biotite gneiss with pegmatite veins is the main rock type in the area. Weathered rock occurs below a soil cover of about 1 to 3 mts. The weathered zone thickness varies from 4 to 12 mtrs and includes partially weathered and jointed hard rock and it forms the main phreatic aquifer of the area. The occurrence of jointed rocks at shallow depth could facilitate percolation of shallow ground water to deeper fracture zones in the bed rock. Thickness of weathering is comparatively less in the area immediately south of the factory. Depth to water table ranges from 0.65 mtrs. in the

valley to more than 13.27 mtrs. on the elevated area. The bore wells in the area mostly tap the semi-confined aquifer system developed by the secondary porosity in the crystalline rock.

On account of the relatively low rainfall and low recharge rate, the area has a rather low groundwater potential. The Central Ground Water Board and the Kerala Ground Water Department have assessed the rainwater recharge in the area as 5 to 8 percent[1]. Following the identification of Chitoor block as over-exploited area[2], Government of Kerala declared Chitoor block as a notified area under the Kerala Groundwater (Control and Regulation) Act 2002, with effect from19th November 2005. Government declared Palakkad district as drought affected in March 2004 and imposed temporary ban on drawing groundwater for industrial purpose at Plachimada as well. The district has been continuously falling under seasonal drought spell since 1998.

2.3. Population

The total population of Perumatty Grama Panchayat as per 2001 census is 29500 and the total population of Pattanacherry Panchayat is 24735. The estimated population of the study area is 3870 (comprising 2013 females and 1857 males), as per a sample survey conducted in 2004 (Nair et al, 2008).

2.3.1. Scheduled Caste and Scheduled Tribe Population

31% of the population of the study area belong to SC and ST with 24% comprising tribals belonging to Eravalan community.

[1] The Dynamic Groundwater Resources of Kerala. Central Ground Water Board and Kerala Ground Water Department. March 2004. This was further affirmed in : Plachimada Water. By Saleem Romani (Chairman, Central Ground Water Board) *Economic and Political Weekly*. Dec 3, 2005

[2] The Dynamic Groundwater Resources of Kerala. Central Ground Water Board and Kerala Ground Water Department. March 2004

Scheduled caste house holds are around 7%. They are predominantly land less agricultural labourers living in conditions of deprivation, which have been exacerbated by the depletion of water resources and degeneration of agricultural land.

2.4. Socio - Economic Condition

The social composition of the inhabitants of Plachimada is rather complex due to their origin, caste-class differences, economic standard and labour pattern. Some of them have migrated from the rural areas of the adjoining State of Tamil Nadu and settled here about 20-25 years ago. Other than SC and ST population, people of the area belong to socio-economically backward castes, which consists of Ezhavas, Tamil Hindus (such as Goundan, Muthaliyar, and Chetti) and Muslims. The educational background of the community is also significant. As large as 32% of the population in the area are illiterate. Barely 5% of the population have attained secondary education and only 5 % have gone beyond the secondary level. A caste wise breakup shows that the tribals and the OBC communities account for the majority of the illiterates (Nair et al, 2008). The majority of the SC and ST population have their own dwelling units with very limited amenities. Agriculture dominates in the occupational structure of the population. Around 68% of the households depend directly on agriculture for their livelihood. Only 14% of the households depend on non-agricultural wages. The number of labour days recorded show high variations.

2.5. Domestic water sources

There are 179 agricultural wells in Plachimada, 2753 open domestic wells, 66 public wells and 37 bore wells. The entire

population depends on conventional sources of water for their domestic needs. The open wells act as the main source for water. People have started using bore wells only when they began to experience contamination of open wells. It is pertinent to note that there is no pipe water supply system in the area even today.

2.6. Rainfall and drought proneness

Plachimada which falls in the rain shadow region of Palakkad district has relatively warmer summer temperatures than the rest of Kerala. Whenever drought condition hits Kerala, Palakkad is the first and most severely affected district. This is due to the natural discontinuity in Western Ghats through which the warm wind is blown to Palakkad area. In 1998 the average rainfall in Palakkad District was 2425.8mm, which has shown a considerable decline to 1750.3mm in 2002. At the same time, the average rainfall of Kerala during the year 2002 was 2515mm. The rainfall is considerably less than the average annual rainfall of 3000 mm occurring in the mainland of Kerala. The average rainfall obtained during 1995-2005 has been 1666 mm, and about 65 per cent of this has been from the southwest monsoon. Plachimada is a drought prone area with a history of poor and less than average rainfall. The monthly rainfall obtained during 1995-2005 period, as measured at Meenkara Dam about 6 km southwest of Plachimada is presented in table 1 (Source: Irrigation Department, Govt. of Kerala) is a clear indication of low rain fall experienced in Plachimada area. The heavy demand on ground water for irrigation in the upper and lower reaches of the area normally gets worse with less than average rainfall. It got further aggravated with the huge extraction of ground water by the factory.

Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1995		5	13	51	204	141	279	316	105	81	159		1354
1996	1		4	192	51	246	509	317	243	288	82	95	2028
1997			28	14	132	306	670	434	52	549	348	21	2554
1998			5	83	116	530	670	371	456	327	204	152	2914
1999		12	2	123	315	279	1040	391	77	734	154	13	3140
2000	7	167	7	106	44	665	610	546	151	56	94	112	2565
2001	2	75	8	227	133	396	275	142	10	103	202		1573
2002					86	162	163	218		103		14	746
2003		92	113	70		201	281	107		342	103	28	1337
2004	13		38	55	260	470	338	440	48	76	102		1840
2005		5	6	324	161	369	850	282	141	106	171	113	2528
2006	5		154	66	195	254	435	292	148	118	168		1835

Table 1. Rainfall during 19995-2005 measured at Meenkara Dam
(Source: Irrigation Department, Govt. of Kerala)

3. ASSESSMENT OF WATER LEVEL DEPLETION

3.1. Water Level Analysis

For analyzing the ground water quantity and water level fluctuation of Plachimada area in comparison with other parts of Palakkad district, 43 representative wells have been selected. These wells include the additional wells identified exclusively for studying the impact on the local environment due to the functioning of Coca Cola factory. All the wells selected are only the open wells, to study the effect of pumping by the factory on the phreatic aquifer system.

In order to get a clear picture on water level scenario in the Chittur block area during post monsoon period, the water level data collected by Groundwater Department has been analysed using GIS techniques. The water level zonation map developed using December 2002 data indicates that the water level decline is highest in the area near to the Coco cola factory (fig. 1). Zonation map also indicates that during December 2002 the drop in water level in the phereatic aquifer system was 10.6-12 mts in the area. In the north and central part of the block, the depletion in the groundwater resources was comparatively very less during post monsoon period. This is a clear indication of the exploitation of ground water by Coco cola Company

Water level data for May 2003 has been analyzed using GIS tools to get a scenario on the water level during Pre-monsoon period. Generated water level zonation map clearly indicates that the maximum depth to water level in the phreatic aquifer was near to the Coco cola factory area and the value ranges from 11.4-13 mts

bgl (fig 2).This also substantiate the over exploitation of ground water by the factory. It may also be noted that the area other than the neighbouring area of Coco Cola Company are less affected.

On analyzing the water level data for May 2004 (Fig 3) it is clear that water level is showing a rising trend when compared to the previous years .During May 2004 the average depth to water level ranges from 8.63 -13 mbgl. This can be interpreted as an indication of stoppage of groundwater extraction by the Coca Cola, resulting in recuperation trend. This is further confirmed by the results of the data for May 2006 which show the water level in the phreatic aquifer system around the Coco Cola factory area as ranging from 5-6 and 6-7 mts below ground level (fig.4). This indicates that the water level in the area has recouped by natural recharge mechanism. The water level zonation maps for different periods depict a clear picture of the trend of water level during the period when the factory was in operation.

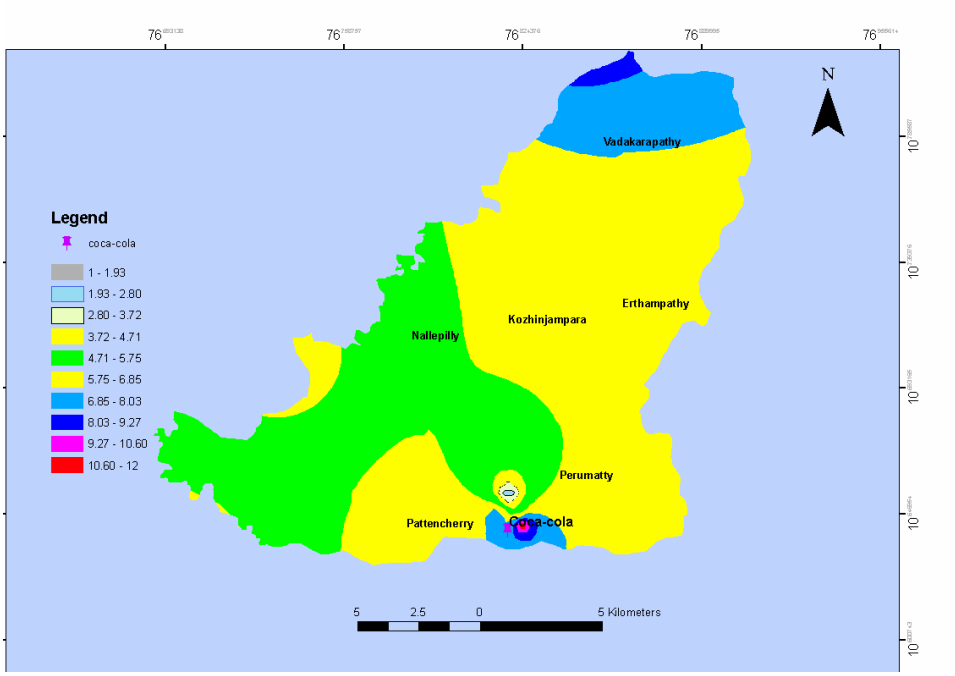


Fig. No:1 Water Level Zonation map during December 2002

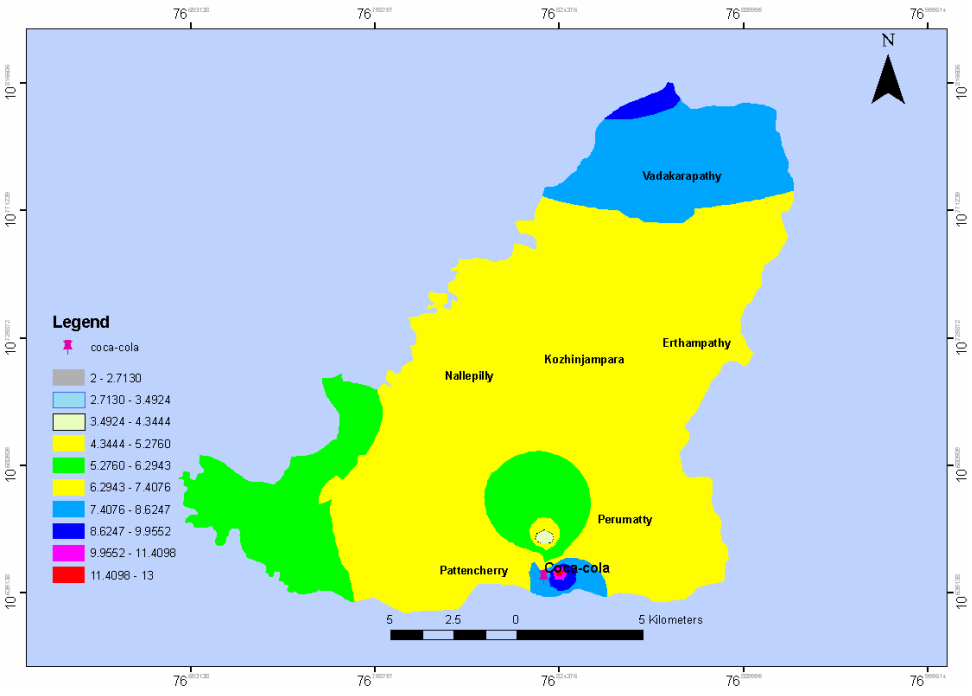


Fig. No. 2. Water Level Zonation map during May 2003

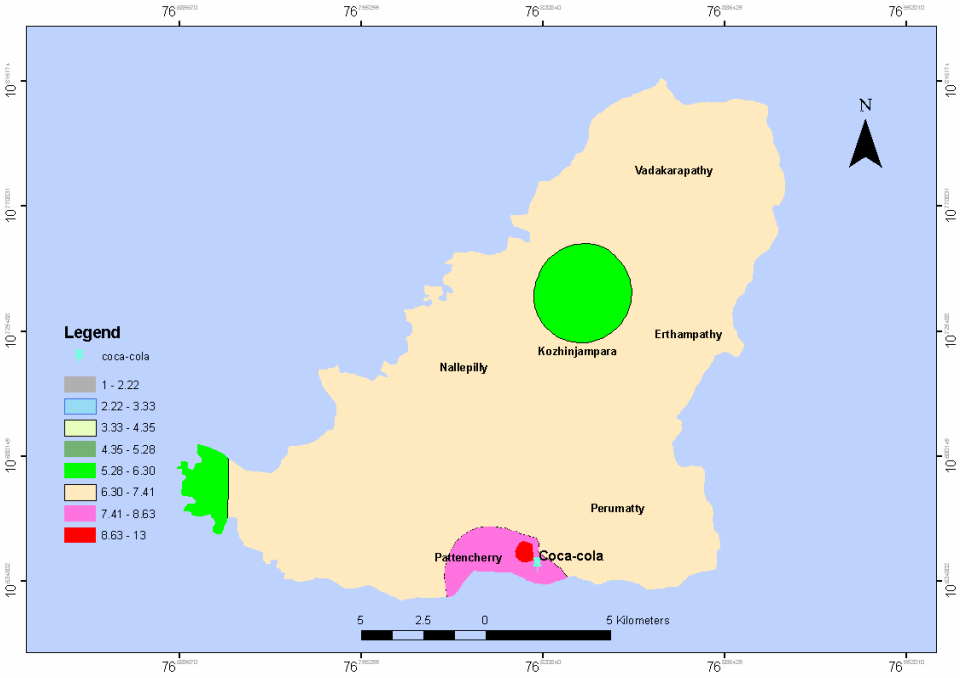


Fig. No.3 . Water Level Zonation Map during May 2004

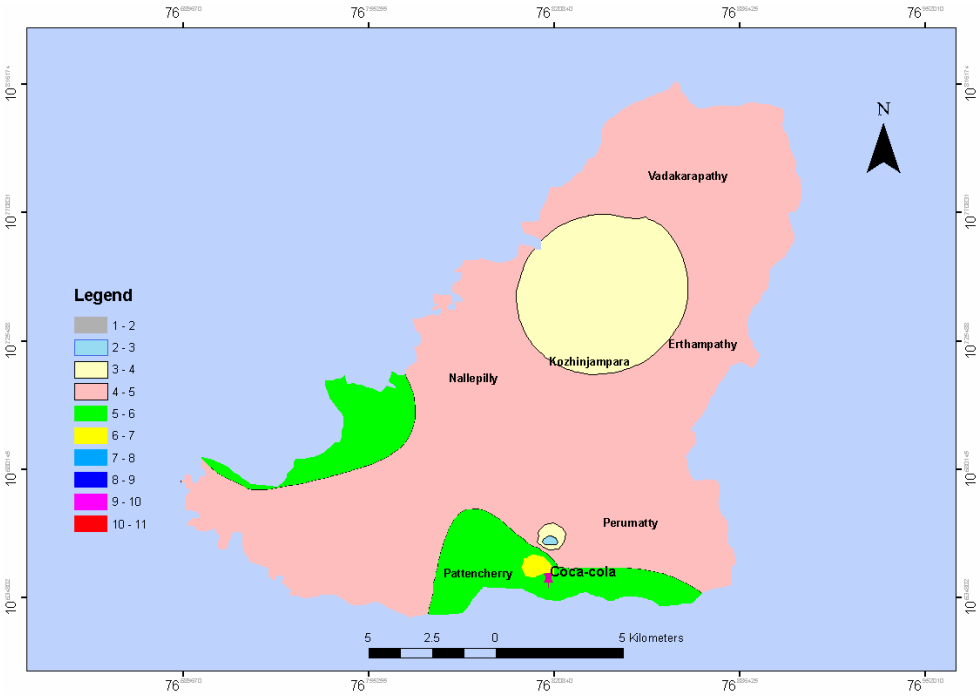


Fig. No.4 . Water Level Zonation Map during March 2006

These findings have only confirmed the earlier reports which have indicated that water levels have depleted in the area by the extraction of water by the Coca Cola factory. Some of these earlier reports are discussed briefly below.

3.2 REPORT OF KERALA STATE GROUNDWATER DEPARTMENT (2003) (ANNEXURE-II)

1. Of the 16 open wells monitored, 6 wells showed a rising trend and 9 wells showed a falling trend and one well was dry (during March 2003)
2. In July 2003, two more wells became dry. The decline is due to combined effect of lower than normal rainfall and groundwater draft by wells.
3. It was recommended to control the intake of groundwater by the firm.

3.3 REPORT OF CGWB (MAY 2005) (ANNEXURE III)

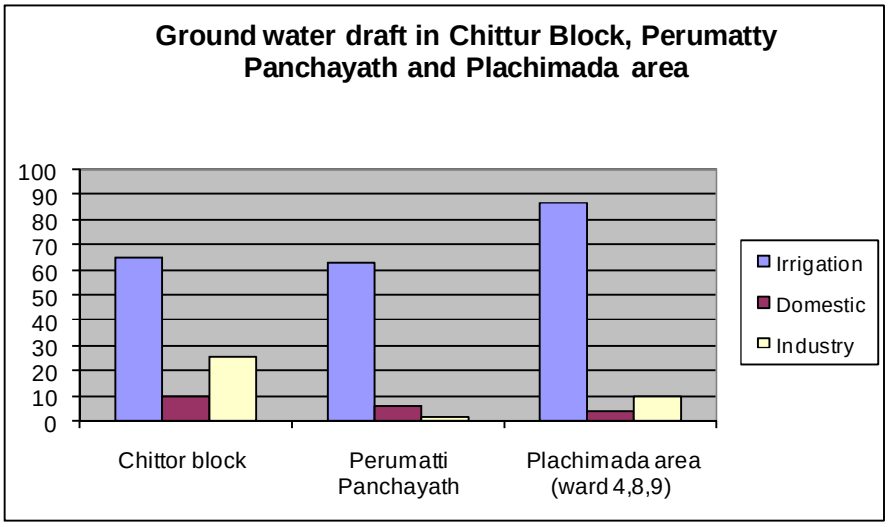
Even though ground water draft has been estimated for the entire Panchayat, the actual Plachimada area comprises only Wards 8,9 and 4 with a total area of 14.511 sq.km. M/S Hindustan Coca Cola Beverages Pvt. Limited is in ward 9, where three wards meet together. There are 71 irrigation wells in Ward No 4, 47 in Ward No 8 and 95 in Ward No 9. Hence the total ground water draft for irrigation in Plachimada area is 4.86 MCM (92.64%). The total ground water draft for domestic use is 0.203 MCM (3.87%) and for the industry it is only 0.183 MCM (3.49%). In Ward 9 where the M/S Hindustan Coca Cola Beverages Pvt. Ltd is situated, the gross ground water draft for all uses is 1.889 MCM. The ground

water draft for domestic, irrigation and industrial purposes in Ward 9 are 3.55 %, 86.76% and 9.69% respectively.

Sl. No.	Assessment Unit	Area (Sq. Km)	Annual Gross Groundwater draft						
			Irrigation (MCM)	%	Domestic (MCM)	%	Industry (MCM)	%	Total (MCM)
1	Chittur Block*	261.46	39.38	65.05	5.96	0.84	15.2	5.1	60.54
2	Perumatty Panchayat*	60.91	16.125	62.94	1.08	0.20	0.201	0.15	60.54
3	Plachimada Area (Ward 4,8,9)**	14.511	4.86	86.76	0.203	0.55	0.183	0.69	5.246

** Dynamic Groundwater Resource as on March 2004 ** Based on the CGWB study*

Table 3.1 The drafts for various uses in Chittur block, Perumatty Panchayat and Plachimada area



3.3.1 CONCLUSIONS OF CGWB REPORT

Entire Perumatty Panchayat consisting of 15 wards has been taken for the study. Ward wise details of total draft for all uses were calculated. The irrigation draft for the Panchayat is 16.125 MCM, domestic draft is 1.08MCM and the industrial draft is 0.201 MCM. The total draft of the Panchayat is 17.406MCM. Since the Panchayat is an agrarian type, the groundwater requirement for irrigation purposes is very high. The Coca Cola factory is located in Ward no 9 of the Panchayat and the ground water demand for irrigation purpose is high in this ward. Though the area is a rain shadow region, the demand for groundwater and its exploitation is quite high. To sustain the actual irrigated crops, groundwater is highly essential in the event of failure of monsoon or stoppage of canal flow. Though the major part of the area is practicing drip irrigation, an estimated amount of 16.125 MCM of ground water is necessary to meet the irrigation demand of the area. The principal source of ground water recharge is rainfall, canal water and return flow from irrigation.

Even though the ground water draft has been estimated for the entire Panchayat, the actual Plachimada area comprises only ward no.8,9&4 with a total area of 14.511sq.km. M/S Hindustan Coca Cola Factory is situated in ward no.9 where three wards meet together. There are 77 irrigation wells in ward no.4, 47 in ward no.8 and 95 in ward no.9 and the total ground water draft for the irrigation is 4.86 MCM (92.64%), Domestic draft is 0.203MCM (3.87%) and industrial draft is 0.183MCM(3.49%).

On the eastern side of Coco Cola factory, the hydraulic gradient is towards northwest. Maximum number of bore wells are seen in ward no.8 and the phreatic groundwater source is negligible. Most

of the dug wells used for irrigation went dry. Now the farmers are using these dry dug wells as storage tank for storing the water pumped from the bore wells. This is not only giving added expenditure on pumping but also a significant quantity of water is lost as recharge. Hence the farmers have been advised to construct separate storage tanks.

There is no deeper peizometer in the Plachimada area to monitor the peizometric head of the deeper aquifer. But local enquiry with the farmers revealed that during 2002-03 they have lowered the submersible pumps since the water levels in the bore wells have gone down and majority of the bore wells are being pumped using submersible pumps from 120 – 200 meters. Hence the entire groundwater draft in ward no.8 (i.e. 1.674 MCM) can be treated as exploitation from the static resource. This ward is located on the eastern side of the Coco Cola factory. Over dependence on the static resource in the area may lead to future groundwater crisis. Hence adequate groundwater recharge measures have to be adopted in the Panchayat.

3.4 REPORT OF KERALA STATE GROUNDWATER DEPARTMENT (2006) (ANNEXURE-IV)

Comparison of depth to water table observed in the monitored wells in the month of March in 2002 and 2003 showed decline of water level in majority of cases and rise in water level in a few cases (Annexure II). The decline was attributed to the combined effect of lower than normal rainfall and groundwater draft, especially by the wells in the factory. The rise in level in a few wells was probably the localized effect of recharge from percolation ponds and the effluent discharged from the factory.

This rise would also depend on the pumping pattern of irrigation wells in the area. Three dug wells (nos. 3, 5 and 17) became dry. Comparison of water levels in March 2006 with those of March 2003 shows rise in most of the wells. Slight decline was observed in only two cases (nos. 1 and 14). The good rainfall in 2005 and the absence of draft in the factory have both contributed to the improvement in water level.

Comparison of depth to water table in dug wells in May, 2003 and May, 2004 shows a fall in most of the wells and one well was dry. Rise is seen only in three cases (nos.6, 7 and 20). Well 20 is near the percolation ponds inside the factory, and wells 6 and 7 are located near the area where effluent is discharged. The factory was working till the summer of 2004. The higher rainfall in 2003 (1566 mm as compared to 757 mm in 2002) does not seem to have improved the position of groundwater resources in the summer of 2004. However, there was a significant rise in water level in May,05 due to another good monsoon in 2004 and the closure of the factory.

All these reports confirm that the groundwater extraction by M/S Hindustan Coca Cola Company has directly caused depletion in the groundwater availability in the area.

3.5 REPORT OF THE COMMITTEE CONSTITUTED BY THE HONOURABLE HIGH COURT OF KERALA (2004) (ANNEXURE-V)

In order to regulate the drawal of water by M/S Coca Cola factory, committee evolved a method through an X factor calculation. The inference of the calculation is that if the derived X is positive, the Company can draw water at the rate of 5 lakhs litres per day. If X is between 0 and -10 % ,then the drawl can be 4 lakhs and If X is

between -10 and -20 , then 3 lakhs litres per day and if it is between -20 and -30 percent ,then the withdrawal can be permitted for 2 lakhs per day. If X is less than -30 percent ground water withdrawal can be fully stopped.

For calculation of X factor, committee chose Chitturpuzha rain gauge station which is located at about 6 kms towards north from the Coca Cola factory area. They didn't consider the rain gauge station at Meenkara which is about 6 kms (according to committee) towards south from the study area. The committee have chosen the Chitturpuzha rain gauge station on the ground that at Chitturpuzha the average annual rainfall is 1413 mm which is lower than the average annual rain fall at Meenkara, which is 1513 mm. As both these rainguage stations are at equal distance from the Company area, it would have been fair if committee had taken the average value of rainfall of both stations, ie (1413+1513)/2 = 1463. The calculation done using this average value for the annual period is given as table.

Table: Calculation of X factor by the Committee

Sl. No.	Year	Rainfall During					
		Monsoon-Season (Jun-Nov)		Non-Monsoon Season		Annual Period (Jun-May)	
		Rainfall (mm)	Deviation from the mean as a % of the Mean 'X'	Rainfall in Millimeters (mm)	Deviation from the Mean as a % of the Mean X	Rainfall in Millimeters (mm)	Deviation from the mean as a % of the Mean 'X'
1.	1994-95	1932	58.8	203	3.6	2135	51.1
2.	1995-96	1265	3.9	185	-5.6	1449	2.5
3.	1996-97	1198	-1.6	232	18.4	1430	1.2
4.	1997-98	1400	15.0	93	-52.6	1493	5.7
5.	1998-99	1422	16.8	337	71.9	1759	24.5
6.	1999-00	1207	-0.8	137	-30.1	1344	-4.9
7.	2000-01	1048	-13.9	137	-30.1	1185	-16.1
8.	2001-02	1087	-10.7	194	-1.0	1281	-9.3
9.	2002-03	812	-33.3	219	11.7	1031	-27.0
10.	2003-04	798	-34.4	223	13.8	1021	-27.7
Mean Rainfall in mm		1217		196		1413	

Source : Annexure V, page no.19

Regulations of groundwater withdrawal based on 'X' factor

Sl.No.	Range of 'X'	Permitted Groundwater withdrawal in Lakhs of litres per day
1	' X' less than Zero % and greater than or equal to -10%	4.0
2	'X' less than -10 % and greater than or equal to -20%	3.0
3	'X' less than -20 % and greater than or equal to -30%	2.0
4	'X' less than -30%	0

Source : Annexure V, page no.23

Calculation of 'X' Factor using the average of combined average rainfall value of 1513 mm at Meenkara rain gauge station and average rainfall value of 1413 at Chitturpuzha rain guage station (Average 1463mm).

Sl.No.	Year	Annual Period (June to May	
		Rainfall (mm)	Deviation from the mean as a % of the Mean 'X'
1	1999-00	1344	8 – 8.1
2	2000-01	1185	-19.0
3	2001-02	1281	-12.44
4	2002-03	1031	-27.5
5	2003-04	1021	-30.2
Mean Rainfall in mm			**1463**

If this principle is applied for the past years, we can arrive at the conclusion that the Company couldn't have drawn water at the rate of five lakhs litres per day during the beginning of operation of the Company and during 2003-04 they should not have drawn any water. It is evident that the drawal of water by the Company at the rate of 5 lakhs litres per day during the years from 2000 to

2004 was not scientifically permissible and the drawal of water by the Company had deeply depleted the ground water availability of the area.

3.6 CALCULATION OF ANNUAL GROUND WATER AVAILABILITY USING RAINFALL INFILTRATION AT THE RATE OF 8 PERCENT

Assuming that the Company was extracting a daily volume of only 5 lakh litres, the Committee finds that this was far beyond the carrying capacity of the watershed. The annual water requirement for the Company at this conservative rate was 0.1825 mcm. The ground water balance in Plachimada can be calculated using the data contained in the report titled Investigation on the Extraction of Ground Water by M/s Hindustan Coca Cola Beverages Pvt Ltd at Plachimada (Annexure V) authored by an investigation team constituted by the Hon High Court of Kerala (hereinafter referred to as committee). The committee has estimated the annual available ground water resource in the Plachimada watershed covering 14.89 sq km area as 3.67 mcm. This is 90 per cent of the total annual recharge of 4.08 mcm from all sources (rainwater infiltration and return flows from domestic and irrigation water supply), but uses the rate of rainwater infiltration as 11 per cent which has subsequently been corrected by the Chairman of the Central Ground Water Board[3] as between 5 and 8 per cent, which is the accepted infiltration rate in an area like Plachimada. This is the rate accepted by the joint study of ground water resources of the area by the Central Ground Water Board and Kerala Ground

[3] Plachimada Water. By Saleem Romani (Chairman, Central Ground Water Board) *Economic and Political Weekly*. Dec 3, 2005

Water Department[4]. If we take the estimated maximum rate of rainwater infiltration (ie 8%) then the amount of total annual recharge becomes 3.45 mcm (ie.1.68 mcm rainwater recharge + 0.20 mcm return flow from domestic water supply + 1.57 mcm return flow from irrigation water). The annual available ground water resource in the area can thus be realistically estimated as **3.105** mcm (ie. 90% of 3.45 mcm).

3.7 CALCULATION OF WATER BALANCE

The ground water use in Plachimada watershed can be determined primarily based on the data provided in the report of the investigation team (mentioned above), with additional data. The investigation team has estimated the annual ground water allocation for domestic use as 0.81 mcm and irrigation needs as 2.61 mcm, totaling 3.42 mcm. This estimation does not factor in the water needs of livestock in the area. The Plachimada watershed area has about 4000 cattle heads and 4500 goats. At the rate of 50 litres per capita per day (lpcd) for cattle and 30 lpcd for goats the annual ground water requirement for livestock in the area would be 0.1168 mcm (ie.73000000+ 43800000 litres making the total ground water requirement 3.5368 mcm. The annual water balance of Plachimada watershed has thus a deficit of 0.1168 mcm, which means that the Company was using up the already scarce water legitimately required for domestic and agricultural purposes.

The Committee therefore concludes that the annual draft of 0.1825 mcm (at the rate of 5 lakh litres per day) by HCBPL has

[4] The Dynamic Groundwater Resources of Kerala. Central Ground Water Board and Kerala Ground Water Department. March 2004.

been a severely damaging perturbation on the ground water resource of this watershed; the draft being heavily localized, its impact was severely felt in the adjoining areas of HCBPL premises.

Thus all the available scientific evidence leads the Committee to conclude that the water crisis in Plachimada was caused and compounded by the excessive pumping of ground water by the HCBPL plant. It is also pertinent to observe that the Company was taking away the scarce ground water resources, over which the domestic and agricultural needs have first and second priority respectively.

4. ASSESSMENT OF POLLUTION OF THE ENVIRONMENTAL RESOURCES

Depletion of groundwater coupled with pollution has not only created a water crisis but has also precipitated a serious social crisis in Plachimada. The soil has been contaminated by the sludge generated by HCBPL and distributed to the innocent farmers as manure. The heavy metal contaminants got leached into the groundwater sources. The Committee listened to the accounts of water turning unusable, after the establishment of the factory. A large number of people have complained of persisting skin diseases, nausea, and frequent illness of different kinds and low birth weight of children. Food cooked in the water also gets spoiled quickly.

The Committee examined the various scientific studies conducted in the area on the quality of groundwater to assess the pollution caused to the ground water as well as by the sludge containing heavy metals.

4.1 HEAVY METAL POLLUTION OF WATER AND LAND

It was the detection of heavy metal pollution that drew world attention to Plachimada. Heavy metal pollution causes serious health problems in the long run as discussed in the following section. The source of heavy metal pollution is the sludge distributed (some times sold, some times given free) by HCBPL to the unsuspecting villagers in the guise of fertilizer, as well as the sludge accumulated in the Company premises.

The presence of toxic metals cadmium (Cd) and lead (Pb) in the sludge generated by the plant was noticed for the first time in an

analysis of the sludge by the University of Exeter (UK) on behalf of BBC in July 2003 when a sample of sludge dumped on a farm near the Cola factory was found to have 100 mg/kg cadmium and 1100 mg/kg lead[5]. The maximum permissible limit, as set by the Hazardous Wastes (Management and Handling) Amendment Rules (2000) for cadmium is 50 mg/kg and for lead 5000 mg/kg (Annexure VI). Though the level of lead was within the permissible limit, its quantity was too high to be used as manure. The sludge that the Company was distributing was actually hazardous waste according to this law. The well water collected near to the farm where the sludge sample was collected also showed unacceptable level of lead. The sample had 65 micrograms/litre (0.065 mg/l) of lead, which is well beyond the permissible maximum of 0.05 mg/l set by the Bureau of Indian Standards for drinking water and way beyond the WHO guidelines of 0.01 mg/l. The Company had also dumped the toxic sludge on the river bed of Chitturpuzha, as recorded by the BBC team.

A subsequent study conducted by the Kerala State Pollution Control Board (KSPCB), under the leadership of its chairman, gives further scientific evidence for the heavy metal pollution caused by the HCBPL plant. The analysis of the sludge from the plant done by the KSPCB found the level of cadmium at 201.8 mg/kg (Annexure VI), which was actually double the quantity detected by Exeter University. This was a clear violation of the terms stipulated by the State Pollution Control Board.

There was, however, a subsequent study led by the Member Secretary of the Board, immediately following the study led by the Board's Chairman, which produced results negating the Board's

[5] Reports of lab analyses obtained from University of Exeter

previous findings and that of the Exeter University. This study[6] had incongruous results and inappropriate interpretations. For example, normal soil showed more levels (3.9 mg/kg) of cadmium than the dense sludge (2.9 mg/kg) itself, and it interpreted the level (0.02mg/l) of cadmium in the common Panchayat well of Vijayanagar colony which was exactly double the maximum permissible level (0.01 mg/l) as 'a small quantity'. It is to be noted that this well which was polluted by cadmium at double the permissible level is situated close to the plant had been the source of water for a large number of households in the Plachimada hamlet. The report further writes off the presence of cadmium at 0.01 mg/l (permissible maximum) in the well water sample collected from a farm where the sludge was used as manure, saying 'only 0.01mg/l'. Needless to say this study which did not provide a truthful picture and proper interpretation attracted widespread criticism.

Realising the gravity of the pollution problem at Plachimada, the Central Pollution Control Board (CPCB) conducted a study on the heavy metal pollution, in November 2003 immediately following the controversial study by the Member Secretary of the KSPCB. This study[7] (Annexure VI) had the startling finding that the cadmium in the sludge generated by HCBPL was 333.8 mg/kg more than five times the permissible limit and asked KSPCB to treat the sludge as hazardous waste. It is obvious that the farmlands of Plachimada were contaminated by the toxic sludge distributed by the Company to the unsuspecting farmers as 'valuable manure'. The contamination of the Panchayat well water and the well near the sludge-treated farm was due to the leaching

[6] Presence of Heavy Metals in Sludge Generated in the factory of HCBL. KSPCB Sept 2003
[7] Report on Heavy Metals and Pesticides in Beverages Industries. CPCB, November 2003

of the high cadmium content sludge. The pollution of the soil and drinking water of Plachimada by the lethal cadmium could have been averted or significantly reduced if only the HCBPL acted in a responsible manner by treating the hazardous waste as was required by Hazardous Wastes (Management and Handling) Rules. Dispersal of damage and pollution could have been prevented if the Company had refrained from distributing the toxic sludge as 'manure' to the unwary farmers. As the Company has acknowledged to have been conducting tests of the sludge, it is only natural to infer that they were aware of the presence of toxic substances in the sludge.

Following the direction of the CPCB, the KSPCB has asked the Company to retrieve all the sludge dumped on the farms and to stop the distribution of sludge outside the plant. As the sludge has been identified as hazardous waste, KSPCB asked the Company to obtain authorization as required by the Hazardous Wastes (Management and Handling) Rules after installing the necessary facilities for the safe handling and disposal of the toxic waste. The application for authorization submitted by the HCBPL was refused by KPCB on 23 February 2004 on the ground that the required facilities were not installed by the Company, and subsequently on 23.8.2004 directed to close down. This was also in line with the order issued by the Hon Supreme Court on 14.10.2003 on the enforcement of the Hazardous Wastes (Management and Handling) Rules.

The Supreme Court Monitoring Committee on Hazardous Wastes (SCMC), on its visit to Plachimada on 10-13 August 2004 and after examining all the available evidence and hearing the views of the Company and affected people had in its report dated 14.8.2004,

confirmed the toxic nature of the sludge and the pollution it has caused on land and water. The Committee directed the Company to provide piped drinking water to the local people at its own cost in addition to directing the KSPCB to enforce the Supreme Court order of 14.10.2003. Besides it was critical of KSPCB for its laxity in enforcing the Hazardous Wastes (Management and Handling) Rules and the order of the Supreme Court.

4.1.1 THE SPREAD OF TOXIC HEAVY METALS

The industry had disposed the sludge generated by spreading it within the 31 acre factory premises and by distributing it (mostly free of cost) to farmers for use as manure or soil conditioner. The information on heavy metal contamination of the sludge was not revealed to the farmers. The Board instructed the Company on 07-08-2003 (Annexure VI) not to dispose the sludge by distribution as manure and to collect back the sludge already disposed. The Company, vide letter no. HCCBPL/PCB-08 dated 22-04-2004, stuck to its stand that the sludge was not hazardous and that it had the right to sell it as manure (Annexure VI). It was disallowed by the Board again vide letter no. PCB/H&R/PLKD/257/02 dated 19-05-2004 (Annexure VI). In the context of the finding of high concentration of cadmium in neighboring wells, the Company was again instructed by the Board vide letter no. PCB/PLKD/HW-5/2001 dated 20-08-2004 to collect back all the sludge (Annexure VI). The Company stopped the distribution of sludge after a period of nearly 5 years. Going by the Company's own statement to KSPCB that the sludge generated is 50 tonne per annum, at least 200 tonne of sludge was by then distributed in the locality. By a simple calculation it becomes evident that this much sludge contained about 338.8 x 200 x 1000 = 67,760,000 mg or 67.76

kg of cadmium and 1100 x 200 x 1000 = 220,000,000 mg or 220 kg of lead.

By the time a part of the sludge was collected back, almost all the cadmium would have been discharged into the environment. It would have been airborne by on drying over 10 dry spells and leaching into sub-surface, surface and ground water over 10 monsoon seasons. Cadmium is highly toxic on inhalation and its tolerance limit in air is as low as 0.05 mg per cubic metre of air. Cadmium is soluble in acids, especially nitric, and in ammonium nitrate solution. Formation of nitric oxide in the atmosphere on lightning and dissolution thereof in rain water to form nitric acid is a natural phenomenon. Ammonium salts or urea applied as fertilizer is a source of ammonia for formation of ammonium nitrate in combination with nitric acid. Thus circumstances conducive for the cadmium to become airborne and inhaled and for dissolution and leaching were prevalent and damage to environment causing severe health problems.

A study[8] conducted by the Kerala Agricultural University at Plachimada during 2004-06 on the level and impact of heavy metal pollution in the village found consistently and significantly higher levels of cadmium and lead in the well waters and in the samples of soil, fodder, milk, meat and egg collected from the area. This shows the extent of the spread of the heavy metal pollutant which is further discussed in the section on agriculture.

[8] Village Level Livestock and Poultry Production Under the Industrialisation Scenario, 2004-06. Research Report by ….. Nair, Kerala Agri. University.

4.1.2 CONTAMINATION OF GROUND WATER

The lead pollution of the well water in the area was first reported by the Exeter University study referred earlier. The KSPCB has found the leaching of cadmium into the well water. The tolerance limit for cadmium in drinking water is, according to Bureau of Indian Standards, 0.01 mg per litre. Concentration of 0.02 mg/l was observed in the nearby Panchayat well in August 2003 (Annexure VI) which came down to 0.007 mg/l in October 2005 (Annexure VI) and to BDL in August 2007 (Annexure VI) and November 2009 (Annexure VI) after arresting the source of pollution.

It is relevant to note that the concentration of lead measured by Central Pollution Control Board in the sludge in December 2003 was 3471 mg/kg. As it was below the 5000 mg/kg limit stated in Schedule 2 of the Hazardous Wastes Rules, it was not considered a hazardous constituent. But lead is known to dissolve slowly in water containing a weak acid. It is also a cumulative poison (Annexure VI – pages 604 and 505 of the Condensed Chemical Dictionary, 10th edn., Gessner G. Hawley). The tolerance limit for lead in drinking water is 0.05 mg/l. The actual concentration in the panchayat well water was 0.58 mg/l in October 2005 (over 11 times the limit), BDL in August 2007 and 0.142 (thrice the limit) in November 2009. This shows that the effect of heavy metal contamination due to spreading of sludge on land continues to persist. The cumulative effect of discharge of lead and cadmium was clearly on account of the Company's failure to install reverse osmosis system in the effluent treatment plant.

An extensive study of the presence of heavy metals in the ground water was conducted by the New Delhi based Hazards Centre and Dehra Dun's Peoples Science Institute in November2005, the results of which were published[9] in June 2006. The analysis done at PSI's lab has found the toxic metals cadmium, lead and chromium at levels far higher than the permissible levels in nearly all of the 9 well water samples it had collected from Plachimada. The results of this study are as follows:

Water Sample analysis results : (analysis was done in PSI Lab)

Sample No.	Source, location	Distance	Parameters (bold italic values are above permissible limits)					
			PH	EC	Total Fe	Pb	Cd	Cr
1	Open well, Tottichelli	700 m	8.1	860	0.024	*0.06*	*0.138*	*0.48*
2	Open well, Plachimada Colony	400 m	8	1023	0.09	NC	0.114	0.912
3	Open well, Vijaya nagar	100 m	7.8	865	0.196	*0.26*	*0.143*	*1.702*
4	Open well, Plachimada Colony	50 m	8.6	2800		*0.05*	*0.134*	*1.702*
5	Open well, Kambalithara	15 m	7.7	967	0.018	*0.235*	NC	*1221*
6	Bore well, Plachimada Village(40 ft)750 m	750 m	7.6	1439		BDL	*0.09*	*2.37*
7	Bore well,Tottichelli (300 ft)	750 m	8.2	1106	0.027	*0.144*	*0.174*	*1.625*
8	Hand pump, Totichelli (250 ft)	500 m	8.5	956	*6.284*	0.046	*0.264*	*2.868*
9	Bore well, Vijayanagar(380 ft)	10 m	9	1958	0.109	*0.243*	*0.116*	*0.667*
NC: Not completed(sample needs further treatment and digestion for the particular parameter), BDL: Below detectable limit								
Notes	1, PH and Electrical Conductivity was measured on -site							
	2.Lead and Cadmium concentration in water was measured by using the Air-Acetylene flame Atomic Absorption Spectrophotometer method							
	3.Total Iron was measured by the 1, 10 Phenanthroline method using the visible range spectrophotometer.							

[9] Ground Water Resources in Plachimada. Hazards Centre and Peoples Science Institute. June 2006

4.1.3 REFUSAL BY HCBPL TO PROVIDE DRINKING WATER

The KSPCB constituted a Local Area Environment Protection Committee (LAEPC) on 14.9.2004 that included two representatives of the HCBPL, following the direction of the SCMC, to ensure, among other things, that the Company provides uninterrupted piped supply of safe drinking water to the affected people and directed the Company to take immediate measures to provide this (Annexures VI). The Company blatantly refused to comply with this direction which was originally issued by the Supreme Court Monitoring Committee. They wrote to the SCMC on 20.11.2004 arguing unconvincingly and rather naively that they have not caused pollution. The KSPCB rejected the argument of HCBPL and asked them to strictly follow its direction to provide piped drinking water and to install the reverse osmosis system or any alternative water purification technology. The Company was further asked not to restart operations until the directions were fully complied with. On 8-2-2005 the KSPCB again directed (Annexure VI) the Company to comply with its orders as the role of the Company in polluting water and soil has been irrefutably established.

The Company not only refused to comply but also refused to divulge to KSPCB the source of cadmium in the sludge (667% above permissible limit) on the ground that the information they had submitted did not contain any material likely to have cadmium content and the Company has claimed that its intake water was free from cadmium.

4.1.4 REFUSAL TO INSTALL ADEQUATE EFFLUENT TREATMENT FACILITY

In view of the finding of the presence of cadmium in excess of the tolerance limit of 50 mg/kg in sludge and the recommendation of Supreme Court Monitoring Committee (SCMC) (Annexure VII), the Kerala State Pollution Control Board had instructed the Company to install Reverse Osmosis System in their effluent line. (Annexure VI). The Company refused to comply on the intransigent plea that the effluent quality was meeting the standards stipulated in the 'Consent to Operate' (though there was no mention of heavy metal pollution therein). However, even if the concentration of the constituents of the effluent were within the qualitative tolerance limits, the large quantity of the effluent implied that the resultant pollutant load (calculated by multiplying concentration with effluent flow rate) would still be high. The impact on the recipient environment (land to sub-surface water to ground water) would be amplified by the cumulative effect due to continuous discharge of the effluent. Therefore installation of Reverse Osmosis System was imperative. The refusal of the Company to heed this directive has led to the degradation of the environment, ill health of the people and decline in their income and well being.

4.2 HIGH CONCENTRATION OF HARDNESS, CHLORIDE AND ELECTRICAL CONDUCTIVITY

An analysis[10] of the ground water samples collected from the wells of the area by Jananeethi, Thrissur in July 2002 had found the hardness of water as 1120 mg/litre (CaCO3 equivalent), far above

[10] *Jananeethi Report – On the Amplitude of Environmental and Human Rights Ramification.* Jananeethi. 2003

the desirable level of 300 mg/l and the permissible maximum of 600 mg/l. The chloride level observed at 540 mg/l was more than double the desirable level of 250 mg/l and the total dissolved solids were also fairly high at 551.6 mg/l. A few months later the District Medical Officer at the local Public Health Centre, noticing an abnormal increase in the number of patients from Plachimada, conducted an analysis of water samples collected from three wells in the vicinity of the Coca Cola plant at the Regional Analytical Laboratory at Kozhikode on15.1.2003. The analysis had found that the hardness of water and the levels of chlorides were too high to be used for drinking purpose. The chloride levels were 770 mg/l, 860 mg/l and 910 mg/l for the three different samples, while the hardness of the respective samples were 1130 mg/l, 1190 mg/l and 1060 mg/l. Based on the results of this analysis, he advised the Panchayat to inform the local people not to use the water for drinking purpose[11] (Annexure VIII). There was an obvious increase in the level of pollutants from the Jananeethi study which indicates the growing impact of pollution from heavy metals such as lead and cadmium.

Samples of water from the Panchayat well in Vijayanagar colony and a farmer's well were conducted as early as on 25.2.2002. The water in the Panchayat well was found to be unfit for human consumption due to high level of chlorides and hardness. This analysis was done by the accredited Sargam Labouratory Services, Chennai (Annexure IX). The level of chlorides was 500 mg/l and total hardness was 896 mg/l. These values have, in the subsequent period, increased drastically, due to the Panchayat well's proximity to the HCBPL plant, as found in the well water

[11] Palakkad DMOs letter to Perumatti PHC MO dt 8.4.2003; PHC MO's letter to Perumatti Panchayat dt 13.5.2003 and the reports of the analysis of the three water samples.

quality monitoring studies conducted by the Ground Water Department.

The studies conducted by the Ground Water Department from 2002 to 2006 too clearly demonstrated an increase in the level of hardness and chlorides as the Plant's operations progressed and a gradual reduction in the level of pollution intensity a couple of months after its closure in March 2004. The full text of the report is in Annexure IV

The intensity of pollution with increasing proximity to the HCBPL plant once again proves that the Plant is certainly the source of pollution of ground water. The increase in hardness is presumably a result of the depletion of ground water. With reduced availability of water, the rate of flow of water in the aquifer increases and this causes the break up of some of the limestone or clay through which it passes. This accelerates dissolution of calcium and magnesium in ground water which are the determinants of hardness. This study also has however not covered the heavy metal pollutants in the water samples.

An analysis of the water quality in the area was conducted on the basis of the data provided by the Central Ground Water Board and KGWD, from their observations done on 43 representative wells in the area. These wells include the additional wells identified exclusively for studying the impact on the local environment due to the functioning of Coca Cola factory. Only the open wells were selected so that the effect of pumping and discharge of effluents by the Coca Cola factory on the phreatic aquifer system could be analyzed in a systematic manner.

Using GIS tools, zonation maps were generated for different parameters for different periods. The results of this study are presented in figures 5 to 10. The analysis found high levels of chloride and electrical conductivity. The objective of the analysis was to compare the water quality scenario of Plachimada area with that of other neighbouring areas to assess the Electrical Conductivity (EC) parameter during the pre monsoon period of 2002. Zonation maps clearly indicated that the highest value in the Chittur block was observed near the Coca Cola factory. Close to the Coca Cola factory the observed EC value ranges from 1986 to 3469 µ mhos/cm, whereas in majority of the area average EC value 950 µ mhos/cm (Fig. 5). Similarly the zonation map prepared for the chloride parameter during May 2002 indicates that the highest value was observed in the area near to the Coca Cola factory. The highest value observed ranges from 621 to 1564 mg/l (fig. 6), whereas the average chloride value for Chittur block area was 300 mg/l.

The water quality zonation map for the electrical conductivity (EC) during May 2003, indicates an increasing trend around the Coca Cola factory area (Fig. 7). The highest value ranges from 2170 to 3592 µ mhos/cm, whereas the average value for the rest of the area in Chittur block remained same as in the previous year at 1000 µ mhos/cm. Similarly Chloride parameter value for the same period ranges from 307 to 806 mg/l. The water quality zonation map for the Electrical conductivity during May 2004, indicates that the EC ranges from 1576 to 2672 µ mhos/cm, and the average value for the rest of the area is around 1250 µ mhos/cm. Similarly, the Chloride parameter for the same period around the Coca Cola factory ranges from 297 to 561mg/l.

The analysis of the water quality data based on various parameters clearly and irrefutably shows that there was substantial deterioration in the groundwater quality during the period of the functioning of the Coca Cola factory. The deterioration is more pronounced in the area lying close to the factory and while the factory was in operation. There is no cause other than the discharge of the effluents by the Company that was responsible for the deterioration of quality.

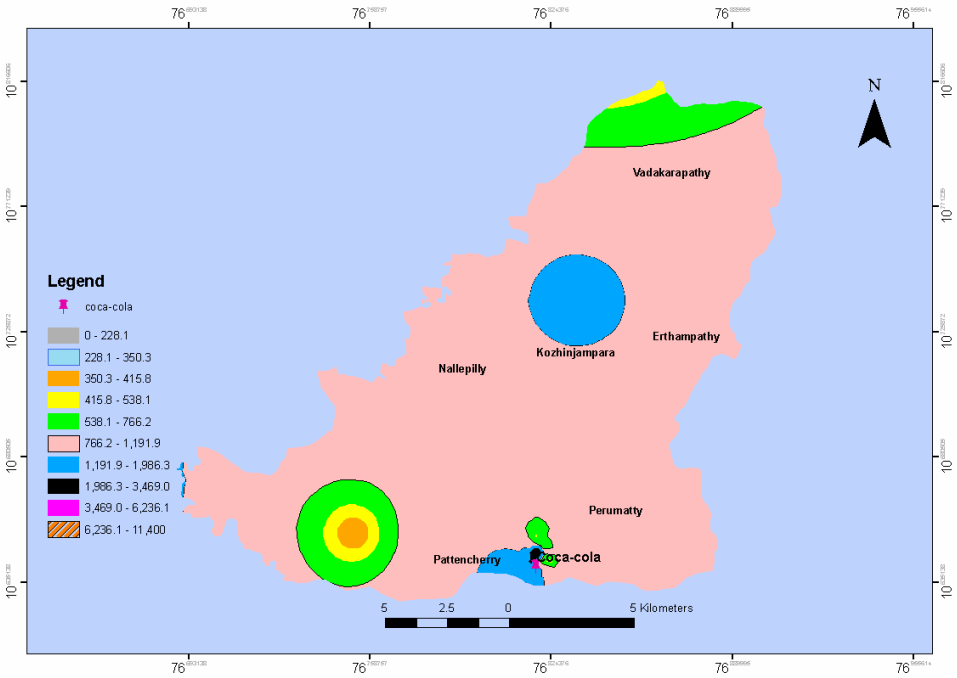


Fig. No. 5 Zonation map of Electrical Conductivity for May 2002

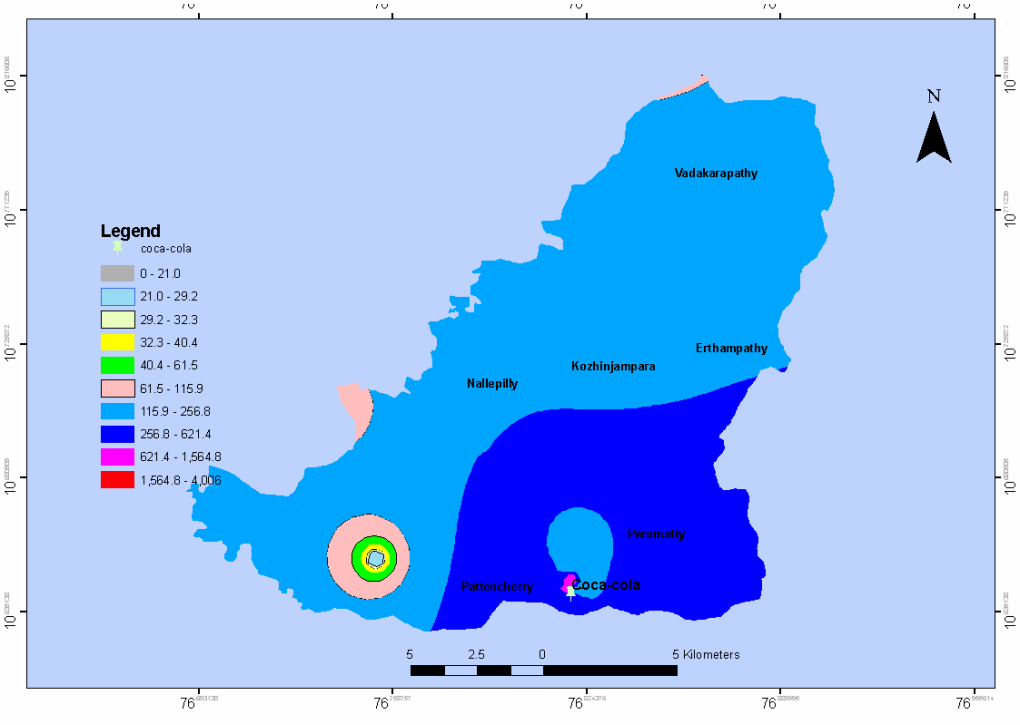


Fig. No. 6 Zonation map of Chloride Parameter for May 2002

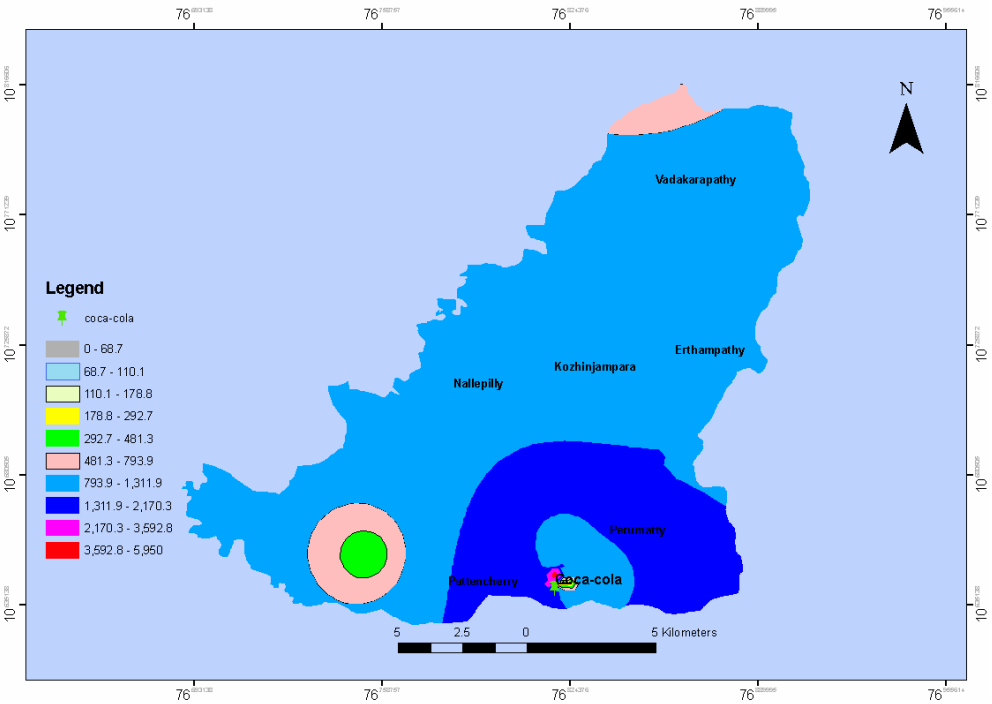


Fig. No. 7 Zonation map of Electrical Conductivity for May 2003

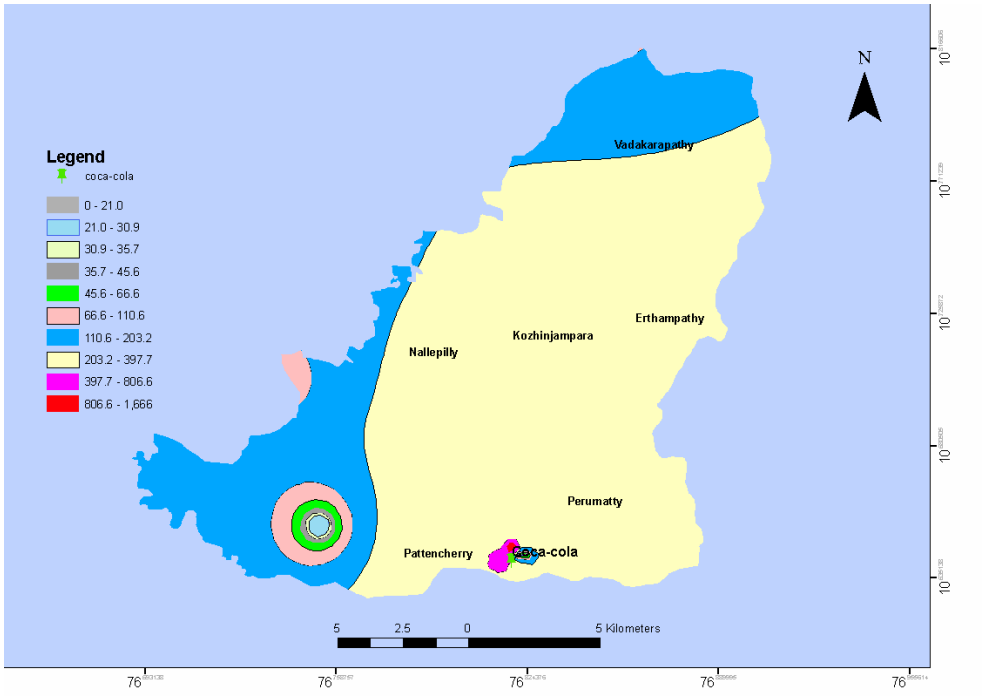


Fig. No. 8 Zonation map of Chloride for May 2003

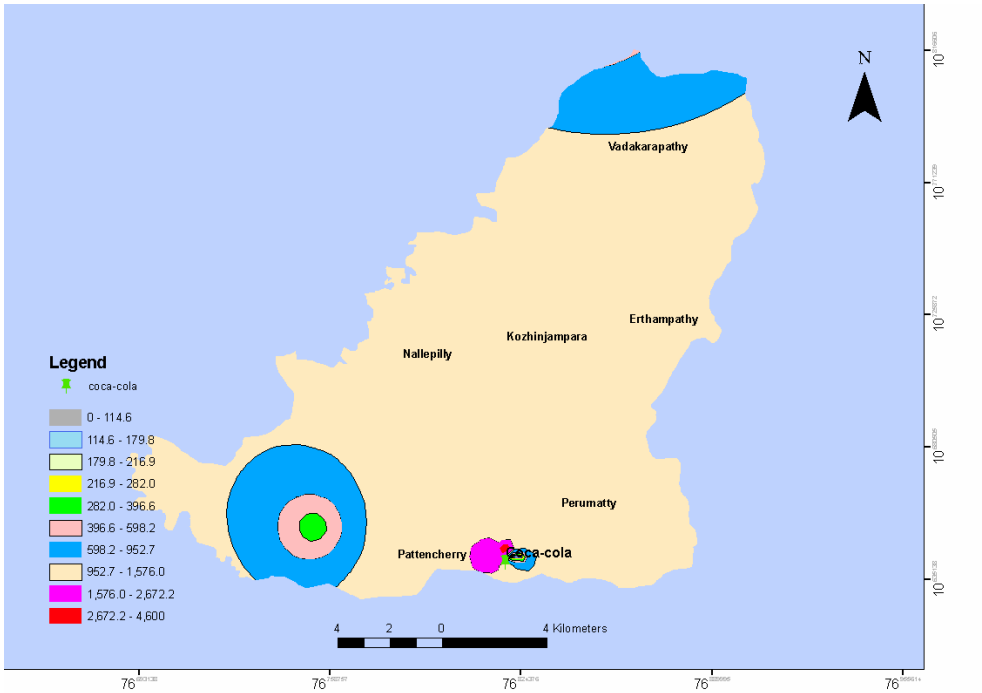


Fig. No. 9 Zonation map of Electrical Conductivity for May 2004

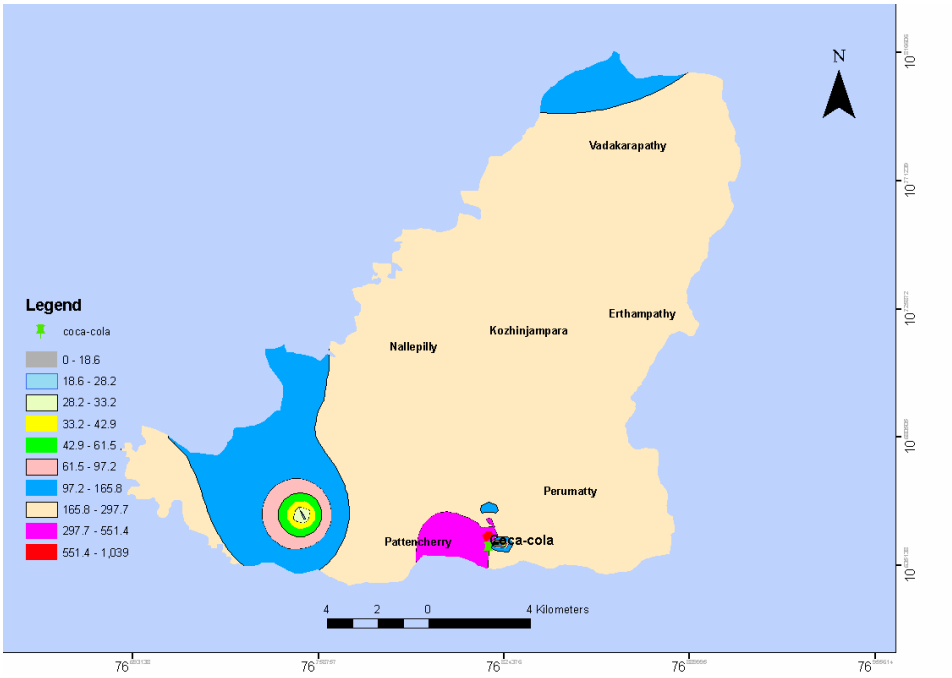
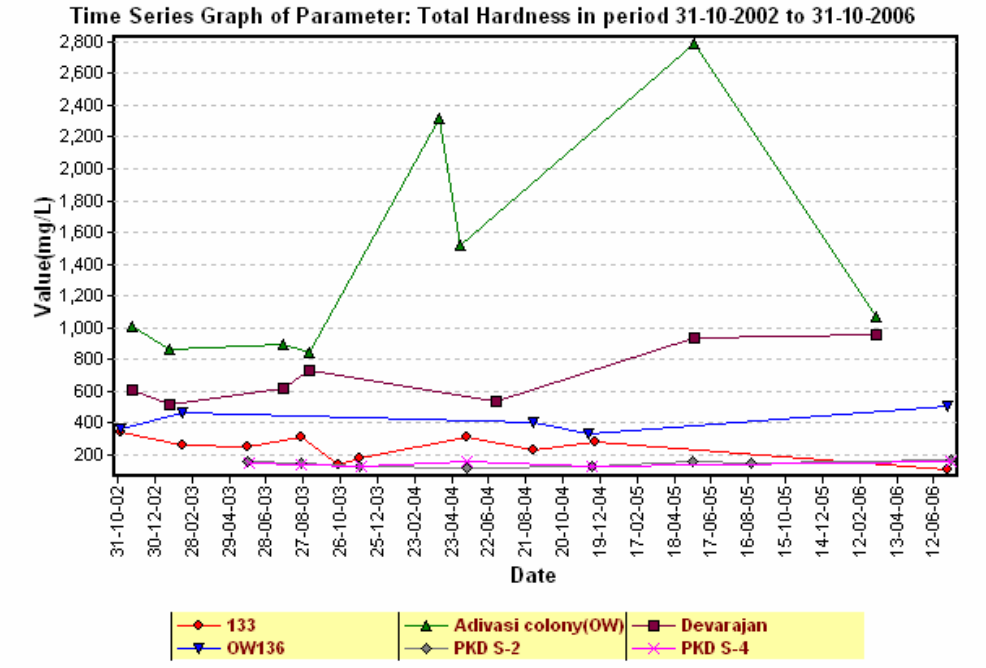
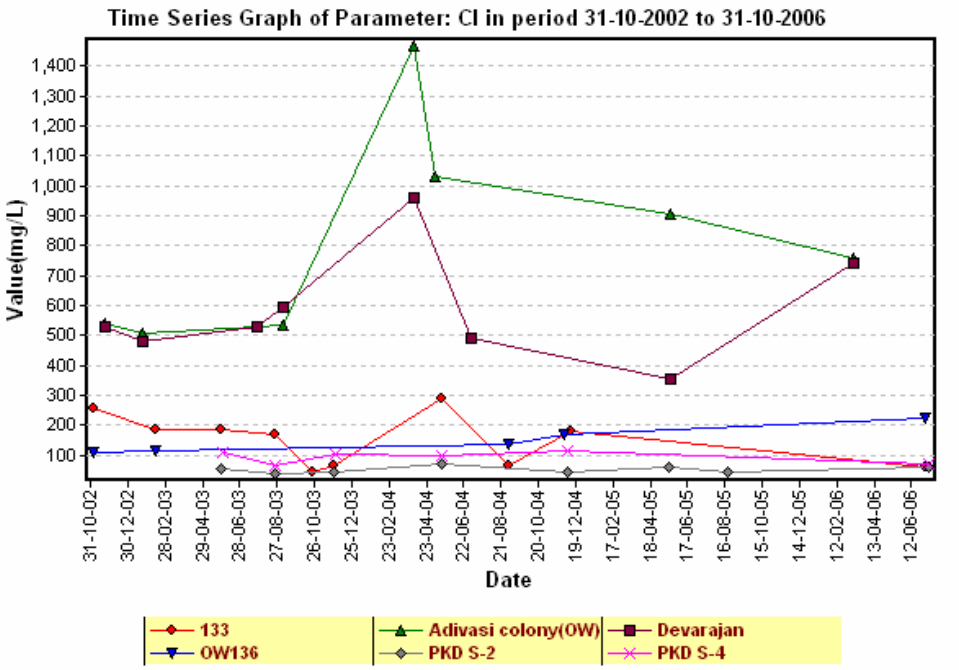
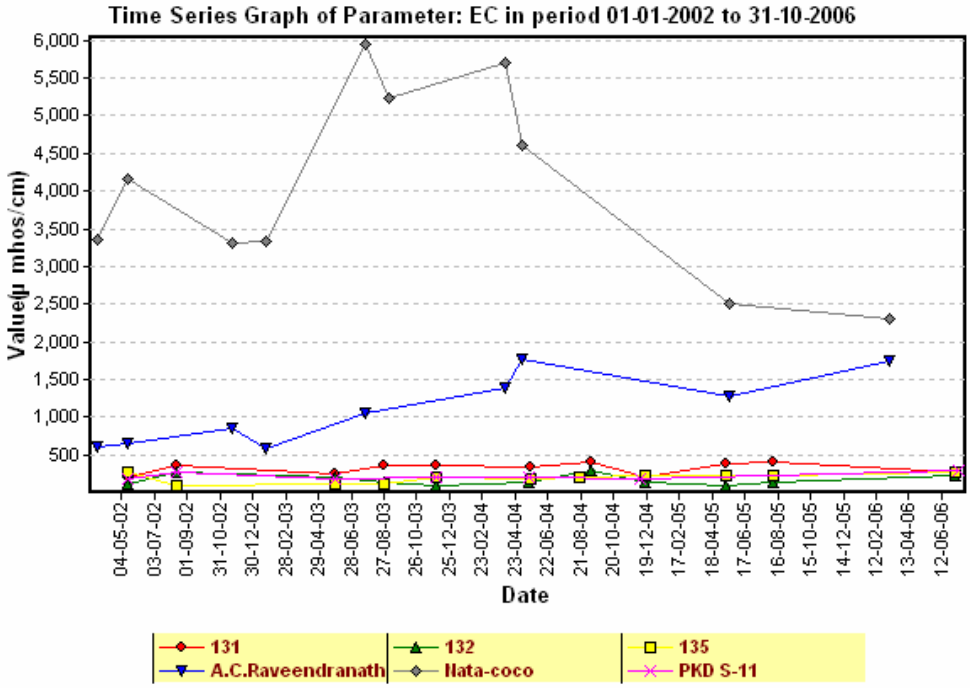
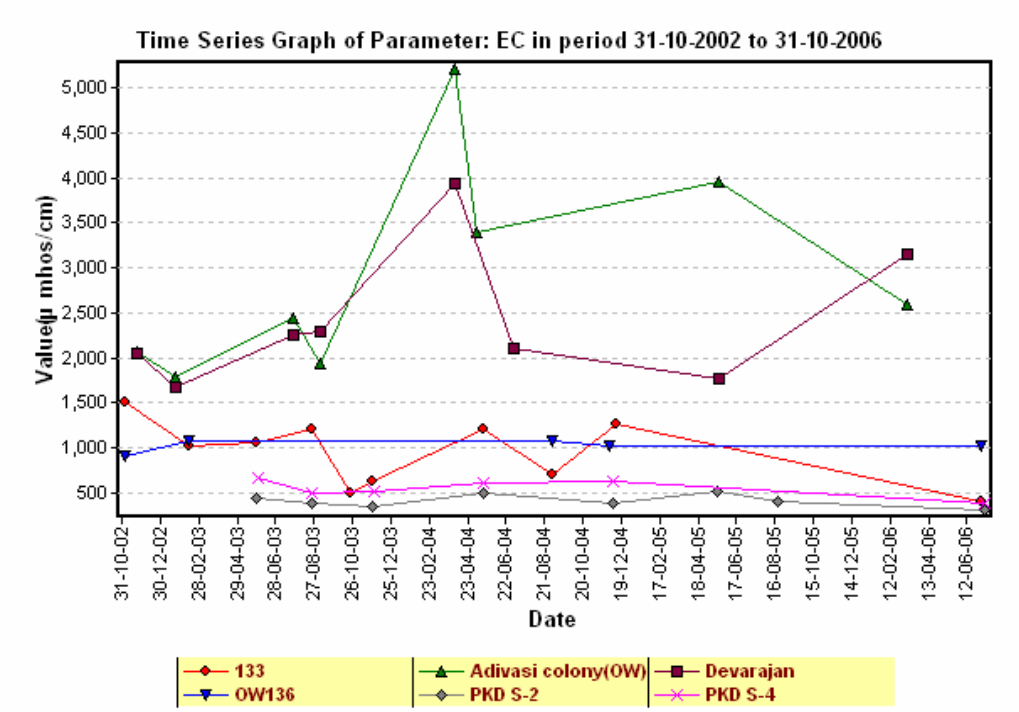


Fig. No. 10. Zonation map of Chloride for May 2004




Time Series Graph of Parameter: Cl in period 31-10-2002 to 31-10-2006
Value(mg/L)
Date
133
Adivasi colony(OW)
Devarajan
OW136
PKD S-2
PKD S-4


Time Series Graph of Parameter: EC in period 01-01-2002 to 31-10-2006
Value(µ mhos/cm)
Date
131
132
135
A.C.Raveendranath
Nata-coco
PKD S-11



The time series graph of EC for the period from January 2002 to December 2006 representing well no. 133 (Pudussery), well no. OW 136 (Pudussery) PKD S 2 (Alathur), PKD S-4 (Kuthannur) and that of well owned by Sri.Devarajan at Adivasi Colony are shown above. Electrical conductivity is the measure of the concentration of dissolved or associated substances. Though there is no upper limit according to BIS or WHO standards, the higher electrical conductivity makes the water unsuitable for drinking. Here, the area around Coco Cola factory shows a higher value of electrical conductivity much greater than in other areas and the maximum reported is above 5000 micro mhos/cm making it unsuitable for drinking purpose. In another graph, the wells located in the plots of Sri.A.C.Ravindranath and Natarajan located close to the factory, EC values are high and the maximum value is above 5500 micro mhos/cm. The time series graph of chloride in

the area shows that when compared to other wells in Palakkad district, the chloride values are much higher in the area around coco cola and is represented by the well data of Sri.Natarajan near to Coco Cola area. The value of total hardness of certain wells located near Coco Cola factory plotted above, at Adivasi Colony and that of Sri. Devarajan, show a higher value above permissible limit (600 mg/l).

An academic study[12] conducted by the Centre for Development Studies has found that of the 33 open wells situated within a radius of 500 meters from the Coca Cola plant, water in 31 (94%) wells had become non-potable during the period 2000-2004. The dug wells survey conducted by the study also revealed that the local people had no experience of well water turning non-potable prior to the establishment of the factory.

The Committee thus has compelling evidence to conclude that the HCBPL has caused serious depletion of the water resources of Plachimada, and has severely contaminated the water and soil. Water resources were severely polluted by lethal heavy metals contained in the toxic sludge generated by the Company. A substantial part of Plachimada's soil have also been polluted by the hazardous sludge illegally distributed by the Company to unsuspecting farmers. The Company is obviously liable to pay compensation, as explained in the section on legal issues, for the heavy damages they have caused to the natural resources of the area.

[12] *Water Insecurity, Institutions and Livelihood Dynamics: A Study in Plachimada.* K N Nair, et.al CDS/Daanish Books.2008 (table 2.2 on page 24)

4.3 WATER POLLUTION AND ITS IMPACT ON HEALTH

The heavy metal pollutants cause severe health damages, though the initial symptoms may seem to be mild. According to the US Occupational Safety and Health Administration, cadmium pollution can cause flu-like symptoms of weakness, fever, headache, chills, sweating and muscular pain. Acute pulmonary edema usually develops within 24 hours and reaches a maximum by three days. If death from asphyxia does not occur, symptoms may subside within a week.

Chronic poisoning can cause cancer of lungs and prostate. The first observed chronic effect is generally kidney damage, manifested by excretion of excessive (low molecular weight) protein in the urine. Cadmium is also believed to cause pulmonary emphysema and bone disease (osteomalcia and osteoporosis). The latter has been observed in Japan ("itai-itai" disease) where residents were exposed to cadmium in rice crops irrigated with cadmium-contaminated water. Cadmium may also cause anemia, teeth discoloration (Cd forms CdS) and loss of smell (anosmia). Journal of Perinatal Medicine (30(5):395-9;2002) had reported that cadmium exposure of pregnant women causes low birth weight in infants.

According to the Industrial Toxicology Research Centre, Lucknow (Toxicity Data Handbook Vol – I & II by Farhat N. Jaffery, et al), anemia, encephalopathy, hepatitis, and nephritic syndrome occur due to lead pollution. Woman exposed to lead in white lead industries showed evidence of infertility, abortion, still birth, premature delivery, poor postnatal development, increased infant mortality. Women occupationally exposed showed a high

prevalence chromatid and chromosomal anomalies, and an increased susceptibility of the peripheral nervous system.

Arsenic: ITRC (Toxicity Data Handbook Vol – I & II by Farhat N. Jaffery, et al) has reported cancer, gastritis, gastroenteritis, neuropathies, melanosis, jaundice, neuritis and psoriasis to occur due to arsenic pollution.

Hardness, Chloride and Electrical Conductivity: High levels of hardness render the water unpotable. It affects the taste of water and makes washing using soap difficult. High chloride level gives salty taste to water, making it unpalatable. High electrical conductivity also makes the water unpotable.

4.4 QUANTIFICATION OF WATER POLLUTION AND COMPENSATION

Pollution has affected not only the environment but impacted the biological systems. It will take at least two decades for the ground water to thin down the level of pollutants leached into it. Water crisis due to pollution will continue to affect the people of the area for a long time to come. The pollution estimation thus has three temporal phases: impact of pollution during the operation of the plant, persisting pollution during 2004-2010 and the persisting pollution for 15 years beyond 2010 before attenuation clears the water of the heavy metal pollutants.

It can conservatively be estimated that at least one fourth of the available water of the Plachimada watershed had been affected by pollution, and this amounts to 0.77625 mcm (ie 25% of 3.105 mcm). Assigning a modest compensation of Rs. 0.80 for each litre of water polluted for the entire period of 2000 to 2025, the total

amount of compensation to be secured from HCBPL, on the basis of the well entrenched polluter pays principle, amounts to Rs 62.1 crores with respect to subsurface water pollution.

A monetary compensation will never substitute the right for pure natural water but the compensation is intended to be a means to at least partially pay for the injury caused to the natural resource upon which a whole community was dependent. In order to arrive at the rate of compensation we have also looked at some existing norms maintained elsewhere in this respect. In the US State of New Jersey, the Environmental Protection Department uses a rate of $ 59.4 per 1000 gallon of water injured (polluted) for 15 years. Here in a water scarce watershed, pollution especially by heavy metals, takes longer period for attenuation to the original quality of water. The total period for restoration in Plachimada is 25 years and hence the rate we have used is considerably lower than the rate used elsewhere.

5. AGRICULTURE AND ANIMAL HUSBANDRY

5.1 AGROCLIMATIC CONDITIONS

Agriculture and agro-based labour are the core source of livelihood of the people of Plachimada. Rice, coconut and groundnut are the major crops. Vegetables, horse gram, ragi, chama, gingelly, maize, mango, sugar cane and banana are also cultivated intermittently.

The Panchayat has a diverse soil profile ranging from red soil, black cotton soil, clay soil etc. The farmers have an average land holding of 3 to 5 acres. The agricultural area is predominantly wetlands. The labour communities catering the needs of agriculture sector live in colonies with holdings of 4 to 5 cents of land per family. Until the end of the 1970s, the wet lands as well as the dry lands of Plachimada were pre-eminently paddy growing areas. The types of rice cultivated here were mostly local varieties. Channiyakam, matta, chamba, cherumani and Chitteni were the main rice varieties used in Poonthal padam (marshy lands) during the earlier years.

Coconut cultivation became the most favoured agricultural activity throughout the area since the early eighties. By the early 1990s, coconut began to occupy not only the dry lands but also some paddy fields. Nearly 350 acres of garden land (about 40 percent of the cultivable area) came under coconut cultivation. Tapping of toddy became one of the important income generation activities of agricultural labourers of Plachimada along with the massive migration of toddy-tappers to Trichur and Palakkad districts. It is learnt that in Plachimada alone, there were about 450 tappers of

whom more than 60 percent were migrants from the southern districts during the early 1980s. Farmers found the rentals from leasing out their coconut trees for tapping are quite profitable.

Plachimada watershed is 14.69 sq.km with 10.42 sq. km of cultivable area and an irrigated area of 5.21 sq.km. Hindustan Coca Cola Beverages Company has taken up 34 acres of land. The factory was constructed in the Poonthalpadam area by reclamation which was not legally permitted under the Kerala Land Utilization Order 1967. Major portion of the factory compound was previously irrigated, multi-cropped paddy lands belonging to one or two large land owners.

The water requirement of Coca Cola factory was more than 5 lakh litres per day. The factory was releasing waste water to the tune of 1.5 to 3 lakh liters per day (Joint Committee on pesticide residues in and safety standards for soft drinks, fruit juice and other beverages, tabled in the Lok Sabha on 4th February, 2004. It was reported that the effluent from the factory was used for irrigation which damaged to the crops and caused serious health hazards to the residents of the area.

It has been established that the drawal of water by Coca Cola Company has depleted water sources and has caused salinity and hardness of the ground water. With high levels of chloride and electrical conductivity the water in the Panchayat wells have become unsuitable for irrigation of crops grown here.

The solid waste (ETP sludge) from the factory composed partially of dried sedimented slurry which was a yellowish white granulated substance with a faint sulphuric acid smell. There was also a foul smelling hard dark gritty stuff mixed with fibers, pieces of fabric,

synthetic insulating material etc. Local people reported that part of this material was dumped in landfill sites within the compound. Large quantities of it were trucked out and disposed off in the farmlands all around and far of places.

The samples of waste collected from the farmlands were tested for its manurial value since the factory had impressed peasants that it was good manure. The cream coloured and tar black residues which were spread in the farmlands appeared as a clay like matter with 28 to 30% calcium and 4 to 5% phosphorus. There was no nitrogen content in the ETP sludge, proving that its manurial value was nil. Too much of calcium in the soil might have leached into the wells and ponds by heavy rains creating secondary problems. The presence of excess calcium in the farmland also leads to nutrient imbalance in the soil. The farmlands, with an impressive soil structure thus were spoilt in due course.

The presence of high levels of lead and cadmium, discussed in section 4, is of great concern. Lead is a developmental toxin in humans, particularly noted for its ability to damage the developing nervous system. Cadmium is especially toxic to the kidney and liver. It is classified as a known human carcinogen. Repeated applications of sludge, containing high levels of cadmium and lead would undoubtedly lead to a build up of these toxic metals in the soil, from where cadmium could then be transferred to plants and from there into the food chain. Cadmium also interferes with the enzyme activity in plants. The Kerala Pollution Control Board has reported a high cadmium concentration of 201.8 mg/kg. The possibility of biomagnifications of toxic elements in plants and other biological forms cannot be ruled out.

5.2 INFORMATION ON THE TOXICITY OF HEAVY METALS IN PLANTS

Cadmium acts as a cumulative poison and is listed by the Environmental Protection Agency as one of 129 priority pollutants. Cadmium is also listed among the 25 hazardous substances thought to pose the most significant potential threat to human health at priority superfund sites. Cadmium is taken up by plants, and is toxic to the kidneys and liver and can cause cancer. (Source: Environmental contaminants encyclopedia cadmium entry July 1,1997 Roy J. Irwin, National Park Service)

Lead in plants is absorbed through roots and builds up in both leaf and root tissue. It causes lower concentration of chlorophyll. As a result biomass declines, which includes roots, shoots, and fruits. When lead reaches the acidic environment of the gizzard (ducks, geese and swans) or the ventriculus (loons), it is worn down, dissolved, and absorbed into body tissues. Once the lead reaches toxic levels in the tissues, muscle paralysis and associated complications result in death. (Department of Natural Resources, Michigan Government)

Lead is particularly bad for children, affecting their nervous system. Lead interferes with the haem biosynthetic pathway, producing haematological effects, and competes at the molecular level with calcium. The central nervous system and kidneys are particularly sensitive to lead. The central and peripheral nervous systems are affected; gastrointestinal structures are also damaged; and there is strong evidence of effects on the reproductive system. Lead also may have a role as a cofactor in carcinogenesis (Putnam, 1986; Sax, 1989; ATSDR, 1990; Goyer, 1990).

People who were forced to depend upon the brackish bitter water, complained a variety of illnesses. Women who used this water reported that rice and dhal could not be cooked properly but became hard and the food prepared with such water got damaged quickly. They also mentioned a burning sensation on the facial skin and a greasy sticky feel on the hair after taking bath in the water so polluted.

Report by KAU & National Bureau of Soil Survey and land wise Planning by the Kerala State Soil Survey Organisation during 2004-2007 showed that 72% of the area in this Panchayat comes under near neutral to alkaline category. These soils had medium organic carbon status and available phosphorus. Potassium availability was low. Copper deficiency was seen in 31% of the samples. Zinc deficiency is noted in 45% of the samples. Liming was not required. Addition of organic matter @5t/ha and standard recommendations for nitrogen and potassium could have been followed. Ammoniac forms of nitrogen should be preferred. Recommended dose phosphorus was sufficient and could have been given preferably as soluble phosphorus fertilizers. Potassium at 125% of the recommended dose had to be applied. Foliar application of zinc sulphate was recommended. Need-based supplements with copper sulphate was also recommended. (RSVY Report, Kerala Agricultural University, Oct 2008)

5.3 PG RESEARCH PROJECT REPORT, KERALA AGRICULTURE UNIVERSITY.

The PG Research Project entitled, “Village Level Livestock and Poultry Production Under the Industrialization Scenario” 2004-06 reported the effect of industrialization and pollution at the village

level livestock and poultry production. Toxic heavy metals content was studied in water, soil, fodder and in biological samples studied in Plachimada and Nallepilly villages during 2004-06. Nallepilly village is about 10 kms away from Plachimada and is having similar geomorphological and hydrometeorlogical conditions. A comparative study of the heavy metal concentration in water samples, fodder samples, egg samples, meat samples of these two villages will give a clear picture on the impact due to the functioning of the Company. The results of the study are given below in Tables 1 to 6. All the results confirm that the samples of water, soil, fodder, milk, meat and egg from Plachimada had shown higher traces of cadmium, lead and copper than the corresponding samples from Nallepilly, with similar geomorhological characters but located away from the Coca Cola factory. All these were higher than what was recommended by WHO.

Table 1. Mean heavy metal content in water (Study of KAU 2005)

Heavy metals	Mean ± SE Industrial area ppm	Mean ± SE Control area ppm	WHO Values ppm
1) Copper	0.24 ± 0.065^{NS}	0.16 ± 0.018^{NS}	2.0
2) Cadmium	0.063 ± 0.002**	0.024 ± 0.003**	0.003
3) Lead	0.17 ± 0.005*	0.044 ± 0.004*	0.01
4) Arsenic	0.020 ± 0.004^{NS}	0.015 ± 0.003^{NS}	0.01

* Significant (P<0.05) at 5% level ** Significant (P<0.01) at 1% level

Table 2. Mean heavy metal content in soil

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values ppm
1) Copper	0.86 ± 0.061**	0.49 ± 0.038**	2.0
2) Cadmium	1.39 ± 0.052**	0.21 ± 0.003**	0.05
3) Lead	1.87 ± 0.23**	0.17 ± 0.023**	0.01
4) Arsenic	0.021 ± 0.003^{NS}	0.033 ± 0.006^{NS}	0.01

* Significant (P<0.05) at 5% level

** Significant (P<0.01) at 1% level

NS–Not significant

Table 3. Mean heavy metal content in fodder

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values ppm
1) Copper	9.93 ± 1.51**	3.13 ± 0.51**	2.0
2) Cadmium	7.73 ± 1.00**	2.45 ± 0.41**	0.05
3) Lead	7.61 ± 0.79**	2.18 ± 0.41**	0.01
4) Arsenic	0.02 ± 0.003**	0.008 ± 0.002**	0.01

** Significant (P<0.01) at 1% level

Table 4. Mean heavy metal content in milk

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values in ppm
1) Copper	0.58 ± 0.06**	0.029 ± 0.005**	0.05
2) Cadmium	1.33 ± 0.07**	0.020 ± 0.003**	0.01
3) Lead	1.32 ± 0.13**	0.026 ± 0.004**	0.02
4) Arsenic	0.02 ± 0.003*	0.007 ± 0.002*	0.05

* Significant (P<0.05) at 5% level

** Significant (P<0.01) at 1% level

Table 5. Mean heavy metal content in Meat

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values in ppm
1) Copper	0.07 ± 0.005**	0.03 ± 0.003**	0.05
2) Cadmium	0.09 ± 0.007**	0.02 ± 0.003**	0.05
3) Lead	0.05 ± 0.006**	0.02 ± 0.003**	0.1
4) Arsenic	0.03 ± 0.01	0	0.05

** Significant (P<0.01) at 1% level

Table 6. Mean heavy metal content in egg

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values in ppm
1) Copper	0.070 ± 0.011**	0.030 ± 0.003**	0.05
2) Cadmium	0.12 ± 0.005**	0.013 ± 0.002**	0.05
3) Lead	0.037 ± 0.005**	0.01 ± 0.002**	0.01
4) Arsenic	0.01 ± 0.004	0	0.01

** Significant (P<0.01) at 1% level

The blood samples of lactating cows collected from Plachimada and Nallepilly showed highly significant quantities of Copper, Cadmium, Lead and Arsenic in both zones as shown in Table 7. The presence of heavy metals in the blood samples from Plachimada was found to be more than that of Nallepilly and the permitted limits.

Table 7. Mean heavy metal content in blood

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values in ppm
1) Copper	0.12 ± 0.011**	0.06 ± 0.007**	0.5
2) Cadmium	0.094 ± 0.007**	0.016 ± 0.002**	0.05
3) Lead	0.10 ± 0.008**	0.026 ± 0.004**	0.01
4) Arsenic	0.024 ± 0.004**	0.003 ± 0.001**	0.01

** Significant (P<0.01) at 1% level

Heavy metals present in dung samples collected from Plachimada and Nallepilly are given in Table 8. The presence of copper, cadmium and lead in the dung of Plachimada was more than that of Nallepilly and varied from that of WHO recommendations on minimum permitted levels.

Table 8. Mean heavy metal content in Dung

Heavy metals	Mean ± SE industrial area ppm	Mean ± SE control area ppm	WHO Values in ppm
1) Copper	0.166 ± 0.018**	0.103 ± 0.009**	0.05
2) Cadmium	0.159 ± 0.013**	0.010 ± 0.002**	0.05
3) Lead	0.100 ± 0.008**	0.017 ± 0.003**	0.01
4) Arsenic	0.019 ± 0.004	0	0.01

** Significant (P<0.01) at 1% level

In correlation tests, only fodder and blood and heavy metals content showed significant correlation. Fodder-lead level showed a highly significant correlation (P<0.01) with milk-lead content. Fodder-cadmium and blood- cadmium were significantly correlated. The dung-lead and fodder-lead were also significant. Fodder-arsenic and milk-arsenic were significant whereas blood-copper and milk-copper was highly significant (P<0.01). Blood-copper and dung-copper correlation were also found significant (P<0.05).

5.4. AVERAGE HOUSEHOLD LEVEL PRODUCTION OF CROPS DURING 1998-99 TO 2003-04

Farming households experienced vulnerability due to the drastic decline in crop productivity caused by insufficient irrigation and other factors. The crop production in this area had come down drastically. (Nair et al, 2008)

Crops	Mean annual production	
	During 1998-99	During 2003-04
Coconut	10,839 nuts	4239 nuts
Paddy 1	3085 kg	1389 kg
Paddy 2	2360 kg	1180 kg
Vegetable	644 kg	285 kg
Maize	1400 kg	1000 kg

The figures show that farming households have suffered a steep decline in yield to less than half the levels that prevailed before 2000. Further, the number of coconut palms assigned for toddy tapping also declined to nearly one-half during this period, since tapping contractors selected only the irrigated trees.

91% of the farming households reported that owing to reduction in crop productivity, their agricultural income had declined. This forced them to reduce the employment of hired labour. Consequently, the number of days of employment of agricultural labour dwindled since 2000. Of the 916 workers who moved to other villages in search of work, 72.38% reported that they experienced severe under-employment in their own village since 2000. In other words, out-migration was forced upon most of them.

5.5. CALCULATION OF COMPENSATION

Item	Area	Production	Price (Rs)	No.of years	Total Loss (in Crores)
Agriculture					
Paddy	2350 ha	4500kg/ha	10/kg	4	42.3
Coconut	420 ha	175 no of plants*	200(Production Cost)	4	5.88
Banana	85 ha	15 kg/plant**	Rs.15 x 12 per plant	4	15.3
Vegetable	55 ha	5000kg/ha	Rs.12/kg	4	1.32
Soil health	2910 ha	10000/ha***		4	11.64
Animal Husbandry					
Cattle	1000 nos		10000/cattle	4	1
Goat	1200 nos		2000/goat	4	0.24
Loss of agriculture-related livelihood					
Total no of labourers: 900 Average daily wage: Rs 150/day Normal annual employment: 150 man-days/person Labour loss per year: 120 man-days/person Loss of income= 900x120x150x4					6.48
Total amount					**84.16**

* Cost of Productivity- 150 nuts per plant				
**2500 plant per hectres				
*** Average cost of cowdung and other nutrients required				

6. HEALTH ISSUES

The pollution of water and soil, as discussed in the foregoing sections, has caused widespread health problems among the people of Plachimada. The impact of pollution became particularly acute since a large section of the population are poor agricultural labourers and small and marginal farmers. Most of them live below the poverty line, and a significant number of them belong to Scheduled Tribes and Scheduled Castes. The increasing morbidity had prompted the Primary Health Centre to conduct an analysis of the well water of the area which showed that the water was not potable, as discussed in section 4.

There is striking evidence that the heavy metal pollution caused by the factory generated sludge has reached livestock and plants, as detailed in sections 5 (agriculture) and 4 (environment), and it must therefore have reached the human system as well. The health implications of the various pollutants have been discussed in sections 4 and 5.

A systematic study of the health issues arising from pollution at Plachimada was done for the first time in November 2003 by a medical team led by Dr. M. N. Anuvarudheen, Dr. K. Muralidharan and Dr. T. P. Jayaraman[13]. The team has found the prevalence of symptoms like hair loss, burning of eyes, cough, vomiting, pain in abdomen etc. which the team has attributed to the pollution caused by HCBPL. The results of a morbidity survey conducted by them are presented below.

[13] As reported in *The Saga of Plachimada* by Dr P R Sreemahadevan Pillai Vikas Adhyayan Kendra. 2008

Results of morbidity survey conducted in Plachimada in 2003

Disease	Number people affected in Plachimada
Hair falling	1355
Burning eye	677
Cough	677
Vomiting	677
Pain in limbs	508
Asthma	339
Blood Pressure	339
Stomach Ache	217
Diarrhea	203
Fatigue	169
Skin disease	145
Giddiness	131
Fever	72

In addition to the morbidity survey, the team also conducted a medical camp where 212 patients were treated. In the children's group of patients, anaemia was observed in almost half of the group. Most patients had complaints of stomach pain and several patients complained of falling hair. Itching was widespread among the people. Many of the cases observed were the results of the pollution caused by heavy metals and other contaminants from the Coca Cola factory.

During the site visit by the Committee, several people mentioned the occurrence of 17 deaths due to diseases such as kidney failure, cardiac diseases, etc during the period 2002-2004. The death of the Smt Maylamma of the Vijayanagar colony who had led the people's agitation and who had been suffering from psoriasis had been emblematic of the health problems caused by the Cola factory. Arsenic, detected by the Hazards Centre study

mentioned in section 4, is known to cause psoriasis. A review of the complaints submitted by the affected people shows high level of morbidity in the area.

6.1 LOW BIRTH WEIGHT

An analysis of the birth weight of children born in Plachimada after and immediately before the operations of the factory was done in 2003 by a team of researchers- V T Padmanabhan, Omji John and Mustafa (Annexure-X). The study found a highly significant fall in the birth weight of babies born after 2000, which it attributes to the impact of cadmium on the health of the mothers.

The study was conducted using the data available in the register kept at the Anganwadi of Vijayanagar colony which had details of 118 children (63 boys and 55 girls) born between 1996 and 2003 in Vijayanagar and Plachimada colonies. Median birth weight of all children of the sample is 2.5kgs. According to WHO stipulations, infants weighing less than 2.5 kgs are considered as low birth weight (LBW). Birth weight of 73% of the children was below 2.5kgs.The median weight observed here was considerably lower than the national average. There was no difference in birth weight between girls and boys.

In order to see if there was any temporal change in the birth weight attributable to the operation of the factory, the study placed the children in two groups- those born during 1996-2000 (73 children) and those born during 2001-2003 (45 children).The median birth weight of these two groups was 2700 grams and 2500 grams respectively. The difference was satisfactorily significant at 0.05 level.

As the table below shows that while 15% of the children born before the operation of the factory were LBW, this rose to 31.1% during 2001-2003.

Period	Under 2.5 kg	Over 2.5 kg	Total	Under 2.5(%)	Over 2.5(%)	Total
1996-2000	11	62	73	15.1	84.9	100
2001-2003	14	31	45	31.1	68.9	100

Birth-weight of children near Cola Factory during 1996-2003

The sharp increase in the percentage of LBW is attributable to the cadmium pollution in the area. The following scientific studies (in research journals) link maternal cadmium to low birth weight: Journal of Perinatal Medicine: 30(5):395-9.2002; Acta Obstet Gynecol Scandinavia 78(10):852-60.1999; and Toxicology April 30, 1993 79(2): 109-118.

6.2 COMPENSATION

Almost every individual of the area who met the Committee complained of having suffered or suffering from health problems. A total claim of Rs 13.74 crores have been raised, on account of health problems, when 857 affected households have submitted complaints. However, each case has to be studied in detail to assess the exact damage, quantify the loss and estimate the compensation. The Committee therefore recommends that the proposed Tribunal or Authority examine the individual and household claims for compensation that will be submitted before it and decide on the compensation amount based on the following observations and principles:

a) There is a clear linkage between the prevalence of diseases in the area and the pollution caused by the Company;
b) Diseases can be current, past or future as the critical impact of heavy metal pollution takes time to appear. Besides, the biomagnification process in relation to heavy metal pollutants is likely to affect more people in the future;
c) The compensation involves not only the pain but also the long term suffering, costs of treatment, loss of employment and the psychological impact;
d) Children born with low birth weight is likely to have long term health problems.

The actual compensation due to the people on account of the various ailments and debilities is not the sum total of the amount spent by them on treatment. It also cannot be said that all the threats arising out of the contaminating situation are a thing of the past. The ailments continue and some more could manifest in future. The Committee after an evaluation of the situation and based on the inputs received from experts arrived at a figure of Rs. 30 crores which would be necessary to compensate the loss of health and consequential medical expenses.

7. LOSS OF WAGES AND OPPORTUNITY COSTS

The acute water shortage due to depletion and contamination forced the people, particularly women, to walk long distances, even outside the Panchayat. The distribution of drinking water by the Grama Panchayat in tanker lorries started only after the water problem began to be articulated collectively. Even after the distribution of water by the Panchayat, all areas are not adequately covered. People still have to fetch water from far of places. Walking long hours to fetch water was not only physically

stressful but it also drained these families financially. They had to forego their wages on such days. When women had to go to fetch water for long hours, children had to be looked after and some member of the family, sometimes an earning member had to stay at home.

On account of the crisis situation that threw the life of the village out of gear, with water shortage, economic deprivation, health problems and gripping anxiety, children had to lose their school days. With recurrence of sickness for them or any member of the family, school attendance became erratic. Many children who thus lost several days had subsequently discontinued their studies. The opportunity cost inherent in this situation can be assessed only on a door to door survey. The affected families who claim compensation are often not sensitive to the foregone opportunity of the children by disrupted education.

As agricultural economy of the village got distorted the employment opportunities dwindled. This forced the workers to move out of the village in search of gainful employment. The resultant reduction in net wages and the social and economic cost of out migration also could not be fully assessed. However, the Committee acknowledges these crucial parameters, the value of which is yet to be correctly estimated. But going by the population and demographic profile of the village, the committee has arrived at a figure of Rs. 30 crores as compensation on account of the foregone wages of women, lost educational opportunities, and reduction in real income by out migration of labourers.

7. LEGAL IMPLICATIONS OF THE FINDINGS AND RECOMMENDATIONS

7.1. It has been rightly pointed out by the Supreme Court in *Research Foundation Science Technology Natural Resource Policy vs. Union of India* in a writ petition No. 657 of 1995 that the "law is not always the problem; often it is the implementation of the law". The Plachimada problem could have been solved with existing laws. If the powers as per the legal provisions (as they existed) had been used properly and with environment-sensitivity, the damages caused by the factory could have been controlled if not eliminated fully. The limited interpretation of the laws coupled with official delays and apathy resulted in grave injustice and denial of the fundamental human rights to the people of Plachimada and caused irreparable damage to the environment. The legal war between Coca Cola and the local people began when the single bench of Kerala High Court ruled on 16th Dec. 2003 that the Company would have to seek alternative source of water for its bottling plants in Plachimada. The plant has been closed down due to the denial of permission to operate issued by the Kerala State Pollution Control Board vide order of 20 -09- 2004.

The Water (Prevention and Control of Pollution) Act 1974, the Environment Protection Act 1986, and the Hazardous Wastes (Management and Handling) Rule1989, as amended in 2003 are the main laws that could have been invoked to deal with the issues arising from the operation of the Coca Cola factory at Plachimada. The Pollution Control Board is armed with sufficient powers to carry out the objectives of the Act, which is the

prevention and control of water pollution. More over the KSPCB has also the power to issue any order, which includes the order requiring any person concerned to put in place sufficient mechanisms for the safe disposal of sewage and trade effluents or to modify, alter or extend any such existing system or to adopt such remedial measures as are necessary to prevent, control or abate water pollution. The term 'appropriate remedy' includes compensation as well. The Supreme Court, in *Vellore Citizen's Welfare Forum v. Union of India* held that the 'polluter pays principle' is implied in the environmental legislations of India. On this principle, the State Pollution Control Board has implicit powers to take measures to make the polluter compensate the victims of pollution and also to redress the environment.

7.2. 'Polluter Pays principle'

Pollution Control laws are meant for maintaining and protecting the quality of the environment. The pollution problem still remains unsettled, though the Company had stopped its activities. Surprisingly no serious efforts have been made to seek legal remedy. Even when the pollution problem was produced before the Kerala High Court, the pollution aspect and compensation issues were not brought in as the focal point. Instead of giving more emphasis to the compensation principle available under the tort law, it would have been better to rely upon the 'polluter pays principle', as implied in the environmental legislations as clarified by the Supreme Court. Therefore, the violation of the right to life and right to livelihood due to the pollution caused by the Company, and the duty of the

state to protect and preserve the environment ought to be the core points of decision.

The Kerala Ground Water (Control and Regulation) Act enacted in 2002 and which came into force one year later. The Act prescribes only the traditional penalties of nominal fine and imprisonment. Though the Act can be considered as a 'late comer', the Committee is of the view that the 'polluter pays principle' should be incorporated in the Act at least for the future. The Indian legal system in respect of ground water has two important characteristics. First, it is a 'mixed' system which includes statutory provisions, precedent Court decisions, doctrines and principles deriving from the British common law system, international agreements, religious (personal) law and customary law and practices. Secondly, there are overlapping regulations in many areas. In such cases where an activity in a private property affects the life and well being of another person, the law needs to be interpreted in favour of the victim, ensuring the maintenance of human rights and basic amenities to citizens.

State and its instrumentalities should act as trustees of this great wealth. The State has got a duty to protect ground water against excessive exploitation which arises from the right to life guaranteed under Art. 21 of the Constitution of India. The Apex Court has repeatedly held that 'the right to clean air and unpolluted water forms part of the right to life under Art.21 of the Constitution. The Panchayat and the State are bound to protect ground water from excessive exploitation'.

The State Government has the jurisdiction and the authority to control and regulate the development of ground water within the territorial jurisdiction of the State concerned. However in

pursuance of the provisions of the Environment (Protection) Act, 1986 and the decisions of the Hon'ble Supreme Court of India the Central Government , acting through the Ministry of Water Resources, has devolved a role to oversee the overall planning for the development of groundwater resources and formulation of policies of exploitation and for overseeing and supporting State level activities in groundwater development on a basis that groundwater is a prime natural resource and its planning, development and management need to be governed by national perspectives.

As per the Indian Easement Act, 1882 the ownership of the ground water will be governed by the ownership of the land to the extent the uses (exploitation) of ground water is not causing depletion in the ground water levels so the similar rights of the adjoining land owners and public at large are not encroached upon as this natural resource is meant for public use and it should not be allowed to be exploited beyond replenishable level. Pursuing this position, courts have held that the State has got a duty to protect ground water against excessive exploitation. At Plachimada, precious agriculture lands have been despoiled and water in their well polluted. In such situation, it is the constitutional obligation of the State to make necessary legislation to safeguard the interest of the affected persons/victims.

Honb'le Supreme Court while elucidating the 'polluter pays principle' in Indian Council for Environ - Legal Action vs. Union of India J.T. 1996 (2) 196 observed that 'once the activity carried on is hazardous or inherently dangerous, the person carrying on such activity is liable to make good the loss caused to any other

person by this activity irrespective of the fact whether he took reasonable care while carrying on his activity. The rule is premised upon the very nature of the activity carried on'. It is evident that the polluter companies are 'absolutely liable to compensate for the harm caused by them to villages in the affected area, to the soil and to the underground water and hence, they are bound to take all necessary measures to remove sludge and other pollutants lying in the affected areas'. The absolute liability for harm to the environment extends not only to compensation to the victims of pollution but also the cost of restoring the environmental degradation. Remediation of the damaged environment is part of the process of sustainable development and as such polluter is liable to pay the cost to the individual sufferers as well as the cost of reversing the damaged ecology.

7.3. Culpability of the Company under various laws.

This Committee is convinced that the Company is responsible for widespread ecological degradation. Coca Cola Company has caused water scarcity in the area by over- extraction of groundwater and has polluted drinking water and spoilt agriculture land by the disposal of sludge and untreated effluents. Particularly hard hit are the adivasis and the dalits and women who have to travel long distances to fetch potable water. During the visit to Plachimada, the Committee was given graphic details about the drudgery involved in fetching water and the consequential loss of a day's wage by one member of every family. The body of irrefutable evidence available makes the Company liable for ecological degradation, ground water pollution, drinking water contamination, soil despoliation,

consequential health damages, decline in agriculture income and loss of livelihood. In view of the clearly established principles, the Government of Kerala has the legal right and responsibility to initiate steps to make Hindustan Coco Cola Beverages Private Ltd. pay compensation on 'polluter pays principle' for the following damages.

- Rendering of the Water in the wells and bore wells useless and harmful for drinking, washing and cooking in a radius of two kilometers of the factory.
- Rapid depletion of ground water
- Rendering the land toxic by dumping the waste sludge and slurry extensively on the land.
- Causing health problem to the people in that area as a result of the presence of heavy metals.
- Destruction of agriculture
- Rendering vast numbers of agricultural laborers unemployed, especially the scheduled castes and scheduled tribes and other poor labourers.
- Rendering drinking water unsafe for cooking purposes and compensating for this loss until such a time the surface and ground water is reversed to the safe limit.
- Incurring additional expenditure to the state Exchequer for provision of clean drinking water as coping up mechanism in lieu of pollution.

The following laws confer sufficient power on the Government to initiate action against the Company.

1. Water (Prevention Control of Pollution) Act 1974
2. The Environment (Protection) Act 1986
3. The Factories Act 1948
4. Hazardous Waste (Management and Handling) Rules 1989

5. The SC-ST (Prevention of Atrocities) Act 1989
6. Indian Penal Code
7. Indian Easement Act 1882.
8. The Kerala Ground Water (Control & Regulation) Act, 2002

The report of Joint Parliamentary Committee dated 11th February 2004 were informed that ”due to operation of Coca Cola and Pepsi Company plants in Palakkad District in Kerala, agricultural operations have badly affected. Operations of these plants have resulted in causing pollution of water depletion of ground water; reduce yields in crops, skin disorders and other ailments among the inhabitant. Hence when the enjoyment of property of one person causes harm to the life and property rights of the adjoining owner, the liability under tort is invoked and the victim is entitled to compensation. In view what has been stated above there is urgent need for the enactment of a general legislation on creation of an authority with adequate power to assess compensation to be paid to the family /individuals and compensation to be recovered from polluters as cost of reversing the damaged environment.

With reference to The National Environment Tribunal Act, 1995 that provides for compensation for death of, or permanent/temporary or total/partial disability due to injury to, a person and damage to property and environment where “environment” includes water, air and land and the inter relationship which exists among and between water, air and land, human beings, other living creatures, plants, micro organism and property with liability to pay compensation in certain cases on principles of no fault with heads under which compensation for damage may be claimed are: Death, loss of

wages Medical expenses ,incurred for treatment , Damages to private property, business or employment or both

7.4. CRIMINAL LIABILITIES

Apart from the liability to pay compensation as discussed above, the Coca Cola Company has violated other provisions of law for which the Company has to be made answerable. The compensation for damages suffered in tort as well as remediation does not in any way affect the criminal liability of the Company under various laws. The compensation is not to be viewed as a quid pro quo for not initiating criminal charges. Therefore, Government may proceed against HCBPL in accordance with various laws, some of which are discussed below.

The land in possession of the HCBPL was in possession of different cultivators from whom it was got registered for the Coca Cola Company. This transfer is a clear violation of the Kerala Land Utilization Order 1967. HCBPL had obtained a license from Perumatty Grama Panchayat for installing 2600 hp electric motor for running Coca Cola bottling plant for manufacturing, storing and sale of aerated water and cool drink. However, no licenses have been obtained from the Panchayat for installing motor for drawing water. The Company started extracting water from the bore well and the open wells by using electric pumps without any license obtained from the Panchayat. In such activities, the Company has violated the provisions of the Kerala Land Utilization Order 1967. In unlawfully depleting ground water and polluting the water resources, the Company has violated the provisions of the Water (Prevention and Control of Pollution) Act of 1972, The Environment (Protection) Act, 1986

and The Kerala Ground Water (Control & Regulation) Act, 2002. In having dumped hazardous sludge in an irresponsible fashion and in giving it away to farmers as beneficial manure the Company is liable under the Indian Penal code, The Factories Act, 1948 and Hazardous Waste (Management and Handling) Rules, 1989. These acts of the Company have affected the economic and social well being of SC and ST people and thus the Company is liable to be proceeded under the SC/ST (Prevention of Atrocities Act) 1989. Further the Company has been blatantly violating the order of Supreme Court dated 14/10/2003.

7.5. RIGHT TO CONSTITUTIONAL REMEDIES

The rights granted by article 32: Article 32 confers widest amplitude of power on the Supreme Court in the matter or granting relief. It has power to issue directions or orders or writs and there is no specific indication, no express language, limiting, or circumscribing that power. Although article 32 can not be used as substitute for enforcement of rights and obligations, the Supreme Court can, in exercise of its jurisdictions under this article, pass an order for the payment of money if such an order is in the nature of compensation consequential upon the deprivation of a fundamental right. The only effective method open to the judiciary to prevent violation of that right and secure due compliance with mandate of article 21 is to mulct its violators in the payment of monetary compensation. The right to compensation is thus some palliative for the un lawful acts by an entity. This has been amplified in *Rudul sah v .state of Bihar (1983) 4 sec 141,147,148.*

The equitable principle insists that a person should not benefit at the expense of another. In a pollution case, this principle holds a

defendant liable for the benefit it has received (here, economic benefit/profit that the factories gained from not installing proper pollution control devices) and does not focus on the harm sustained by the victim. Therefore, HCBPL, by not installing proper pollution control devices and by not taking adequate precautions has benefited economically in terms of savings which therefore are liable to be paid to the affected community.

In addition, the Company is liable to remediate the damage it has done under Rule 16 of the Hazardous Waste Rules, 1989 which states that the occupier/operator of a facility which has improperly handled hazardous waste is liable to reinstate or restore damaged or destroyed elements of the environment, over and above its liability to pay a fine and cease operations. This is a requirement under the Schedule to the National Environment Tribunal Act, 1995, and a part of the polluter pays principle as well.

7.6. INSTITUTIONAL MECHANISMS

PART XIV A of the Constitution of India deals with Tribunals; Article 323 A with administrative tribunals and 323 B, with tribunals for other matters. The Legislature has the powers under this article to 'provide for the adjudication or trial by tribunals of any disputes, complaints, or offence with respect to all or any of the matters specified in clause(2) with respect to which such Legislature has power to make laws.' Among the matters in clause (2) are (c) Industrial and labour disputes and (i) any matter incidental to any of the matters specified in sub-clauses (a) to (h). In order to asses and claim the compensation for the suffering and damages caused by the Coca Cola factory in

an expeditious and focused manner, the following options of institutional mechanisms are being suggested.

The State Government may, by legislation or an ordinance constitute a **Plachimada Claims Tribunal** for the adjudication of disputes relating to compensation due to water & air pollution, loss of agricultural crops, loss on income from animal husbandry, loss of health by pollutants and contaminated water, and ecological and other damages due to the excess drawal and pollution of groundwater and surface water by the Company.

The proposed Tribunal can attempt possible settlement through negotiation in public adalats where the claimant and respondent should be present. Government agencies should not be a claimant. The Claims Tribunal may, if it considers necessary, direct any person from any discipline as witness.

Alternatively the Central Government can be approached to constitute an Authority under section 3(3) of the Environment (Protection) Act, 1986. Central Government can confer on the said Authority all the powers necessary to deal with the situation. It has been established that such an Authority constituted by the Central Government shall implement the “precautionary principle” and the “Polluter pays” principle. Such an Authority was created to deal with the damages caused by the tanneries and other polluting industries in the state of Tamil Nadu. The Authority shall be headed by a retired Judge of the High Court and may have other members, preferably with expertise in the field of pollution control and environment. The Central Government shall confer on the said Authority the powers to issue directions under section 5 of the Environment (Protection) Act, 1986. The Authority shall, with the help of expert opinion

and after giving opportunity to the concerned polluters, assess the loss to the ecology/environment in the affected areas and shall also identify the individual/ families who have suffered on account of the pollution and shall assess the compensation to be paid to the individuals/families. The Authority shall further determine the compensation to be recovered from the polluters as cost of reversing the damaged environment. The Authority shall compute the compensation under two heads namely for reversing the ecology and for payment to individuals.

8. Recommendations

The recommendations and observations of this Report can be summed up as follows:

- The Coca Cola Company at Plachimada has been causing environmental degradation by over extraction of ground water and irresponsible disposal of the sludge.
- The Coca Cola Company is culpable under several laws in force.
- The water resources of the area have been affected and the water scarcity has been compounded.
- By passing off the sludge as manure, the Company has not only misguided the farmers but has become responsible for the soil degradation, water contamination and consequential loss of agriculture.
- There has been a steady decline in the agriculture production in the area.
- The production of milk, meat and eggs also has suffered.
- Metals like cadmium, lead and chromium have been detected in the sludge and this has affected the health of the people.
- The general health of the people has been affected with skin ailments, breathing problems and other debilities.
- Low birth weight of children has also been noticed.
- Environment of the Village has acutely been damaged by polluting water and soil.
- Drinking water has become scarce and women have to walk long distances and this has deprived them of their wages, and this needs to be compensated.

- Children have dropped out of the school on account of the social, health and economic factors caused by the pollution caused and this opportunity cost has to be compensated.
- The Grama Panchayat has been providing drinking water in tanker lorries ever since the wells and water bodies have been rendered useless by the Company by its extraction of water and disposal and effluents.
- The actual economic loss on account of the depletion of water resources has not been quantified but its proxies have been used.
- The compensation that could be claimed on various losses has been calculated as below:

Agriculture loss:	Rs. 84. 16 crores
Health damages:	Rs. 30. 00 crores
Cost of providing water:	Rs. 20.00 crores
Wage loss and opportunity cost:	Rs. 20.00 crores
Cost of pollution of the water resources:	Rs. 62.10 crores
Total:	**Rs. 216.26 crores**

- There are sufficient provisions under the existing laws to claim this compensation of these damages from the Company under the 'polluter pays principle'.
- However it is desirable to set up a dedicated institution to adjudicate the individual claims. Such a dedicated mechanism could either be a Tribunal under Art. 323 B of the Constitution of India to be legislated by the state legislature or an Authority under section 3(3) of the Environment (Protection) Act, 1986 to be created by the Central Government.
- Once Government decides on a suitable mechanism and it comes into being, individual claims will have to be

assessed and actual compensation decreed and the polluter Company made to pay it.

- The company located in this drought-prone area, should not resume its operation.

ABBREVIATIONS USED

ETP	Effluent Treatment Plant
WHO	World Health Organization
KSEB	Kerala State Electricity Board
KSGWD	Kerala State Ground Water Department
CGWB	Central Ground Water Board
MCM	Million Cubic Meter
CWRDM	Center for Water Resources and Development and Management
HCBPL	Hindustan Coca Cola Beverages Private Limited
KSPCB	Kerala State Pollution Control Board
CPCB	Central Pollution Control Board
SCMC	Supreme Court Monitoring Committee
BDL	Below Detection Level
LAEPC	Local Area Environment Protection Committee
CaCo3	Calcium Carbonate
GIS	Geographical Information System
EC	Electrical Conductivity
OW	Open Well
BIS	Bureau of Indian Standards
US	United States
ITRC	Industrial Toxicology Research Center
PAP	Parambikulam Aliyar Project
KAU	Kerala Agriculture University
RSVY	Rashtriya Sam Vikas Yojna
SC/ST	Scheduled Caste/ Scheduled Tribe