Regional Overview and Regional Programme of Action for the Implementation of the Global Programme of Action for the Protection of the Marine Environment from Landbased Activities

Submitted to

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Prepared by

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Abbreviations:

NRB: National Report of Bangladesh

NRI: National Report of India

NRP: National Report of Pakistan

NRS: National Report of Srilanka

NRN: National Report of Nepal

SOUTH ASIAN ENVIRONMENTAL EDUCATION AND TRAINING ACTION PLAN 2000 - 2005

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A. REGIONAL OVERVIEW OF ENVIRONMENTAL PROBLEMS

The South Asian countries bordering, the Arabian Sea and the Bay of Bengal have some of the largest and biologically rich marine ecosystems like Gulf of Mannar, Atolls of Maldives and Mangroves of Sundarbans. Presence of perennial rivers like Brahmaputra, Ganges, Godavari, Indus, Kelani, Magna, etc. have contributed to large network of backwaters, estuaries, salt marshes and mangroves. The Sunderbans is one of the largest mangrove formations in the world. The mangove area of Sunderban in Bangladesh is reported to be 571,508 hectares and the Indian side of Sunderban form an area of 418,888 hectares (NRB and NRR 1999). Atolls of Maldives and a few areas of beaches of Sri Lanka, east coast of India, Pakistan and Bangladesh form habitat for endangered marine turtles like green and olive ridley turtles. Some of the largest coastal lagoons of the world like Chilka lake (India) and Puttalam lagoon (Sri Lanka) are located in the South Asian Seas region. The region has one of the world's finest coral ecosystem with the atolls constituting the entire country of Maldives. The Lakshadweep and Nicobar group of islands of India and a few regions of Sri Lanka have fringing reefs.

1.0. Oceanographic Characteristics of South Asian Seas

1.1. Circulation

The environmental characteristics of South Asia Region have been described in UNEP Regional Seas Report and Studies No.82 (1987). The seas bordering South Asian countries, namely, Bangladesh, India, Maldives, Pakistan and Sri Lanka cover the Northern part of the Indian Ocean with the Bay of Bengal and the Arabian Sea as their Northern limits and South of Equator as their

southern limit. The countries have bays, gulfs and straights. The geo-morphological nature of the South Asian continent greatly influence the oceanography of the area.

Monsoons are the characteristic features of the South Asia. Annually, two monsoons occur, namely, South-west (May - September) and North-east (October - December). The South-west monsoon current flows eastward along the west coast of India and reaches upto 3 knots of South of Sri Lanka. The funnel shaped continent at its tip in India and Sri Lanka makes the current to flow clock-wise, both in the Arabian Sea and in the Bay of Bengal. The Somali current prevailing along the East African coast is influenced by the stronger wind and causes this current to flow towards northerly direction in the Arabian Sea, resulting in a cold, nutrient-rich upwelling along the Somali coast. The South-west monsoon, which is active over the Arabian Sea region of India and Pakistan, brings heavy rains, especially in the South-west and Central part of the West Coast of India with an average annual rainfall of 3000 - 3500 mm. During the period of south-west monsoon, strong upwelling currents are noticed particularly along the south-west coast of India. The north-west monsoon is stronger in the Bay of Bengal and weaker in the Arabian Sea. Annually, it brings at least 2 - 3 cyclones with an intensity of wind reaching upto 100 knots with a surge of nearly 10 m.

The littoral drift is prominent in the western part of Bay of Bengal with a drift from south to north during March - November and north to south during December - February. The upwelling, monsoonal currents, cyclones and littoral drifts influence the physical aspects of coastline of south Asia significantly.

1.2. Salinity

The salinity of coastal waters is influenced by the monsoon, especially along the Bay of Bengal, where traces of low salinity is detectable in the river

mouth, however, it is insignificant in the offshore areas. In the Arabian Sea, evaporation exceeds precipitation and excess of evaporation over precipitation is maximum (100 - 150 cm) in the Arabian Coast and gradually decreases towards south-east part of the Arabian Sea. The high salinity water noted in the Persian Gulf enters into the Arabian Sea and is detectable upto a depth of 300 m. However, beyond 63°E longitude, it loses its characteristics in the southern Arabian Sea. The Bay of Bengal, where the precipitation exceeds evaporation, due to heavy discharge of fresh water from the rivers especially during the monsoon months exhibit lower levels of salinity. This is prominent in the northern part of the Bay of Bengal.

1.3. Tides and Waves

Both diurnal and semi- diurnal tides have been observed in the South Asia Seas Region. High tidal ranges from 3 -8 m and 6 - 12 m observed in the north-western part of India. The tidal amplitude decreases gradually towards South and, along the east coast of Sri Lanka, the mean spring tide is about 1 m.

2.0. Coastal Fishery Resources

The fishery of South Asian Seas comprises mostly of fishes, shrimp, squids and crabs. The coastal waters are rich in fisheries and provide livelihood to a large number of fishermen and personnel employed in the allied industries.

In Bangladesh, demersal fishing potential of offshore areas is estimated to be 20,000 tonnes. Fish ranks next to rice as a staple food constituting 80% of the daily per capita annual production. It provides employment to about 10 million people. The fish landing as of 1981 was 13000 tonnes. Large number of people are engaged in the estuaries and mangrove area fishing. The annual yield from Sunderban mangrove areas alone is 7160 tonnes. At present 19% of the total fishing is from coastal and marine areas, 64% from rivers, 15% from small fresh water bodies and 1% from large fresh water bodies and 1% from

brackishwater ponds. It has been recorded that the Bay of Bengal part of Bangladesh has 475 species of fish and 10 species of prawns (NRB, 1999).

In India, the estimated fishery potential at 0-50 m is 2.25 million tonnes and beyond 50 m depth it is 1.4 million tonnes. The current yield is 2.95 million tonnes at an estimated value of US$1250 million. The resources upto a depth of 50 m are being fully exploited. Out of available potential of 1.4 million tonnes in the offshore region, it is estimated that only 1.13 million tonnes is of commercial value. About 86% of this potential is estimated to be of low commercial value. Over the years, commercial fisheries, primarily exploit high priced shrimp, lobsters and certain finfishes found in coastal areas upto 50 m depth. The coastal fishermen with an estimated population of 22 million consume fish as staple food next to rice and vegetables (NRI, 1999).

In Pakistan, 0.4 million metric tonnes of fishery resources were exploited during the year 1998. The fishery resource of the mesopelagic waters is estimated to be 1 million tonnes. The technology for harvesting is yet to be developed. Still the traditional methods of fishing is common. The primary gear used is gill net. (NRP, 1999).

The estimated fishery production in the coastal waters of Sri Lanka is 153000 tonnes. Of this about 3250 tonnes were exploited during the year 1997. The estuaries and lagoons present throughout the coastline also support fishery. In 1997 export of prawns generated foreign exchange to the tune of Rs.2.2 billion equivalent to 51% of total exports (NRS, 1999).'

3.0. Coastal Ecosystems

3.1. Mangroves

In Bangladesh, coastal zone is extensively covered with dense mangrove forest. The ancient travel documents of 19th century describes presence of

mangrove forest all over the coast especially in the central and west region (NRB, 1999). The Ganges, Brahmaputra and Magna Delta has provided largest mangrove forest of the world covering an area of 571,508 hectares of which in 70000 hectares consist of tidal channels and rivers (NRB, 1999). The area termed as sunderbans represent 12.5% of the forest cover of the country. Mangrove forest also occur in the central part of the delta. Mangrove ecosystem support coastal fisheries and other economic activities of the local population. In India, the mangrove formations are found in the Gangetic West Bengal termed as Sunderbans (418,888 hectares), Andaman & Nicobar islands (15000 hectares) in the deltaic region of Krishna, Cauvery and Mahanadhi rivers and in the Gulf of Kachchh. The west coast contains patchy mangroves (NRI, 1999). Mangroves form one of the natural defence against the cyclones along the east coast. In Pakistan, along the 990 km coastline, mangrove formations are found in the Indus delta and in Baluchistan covering an area of 18,150 acres (NRP, 1999). In Sri Lanka, Mangroves serve as a narrow inter-tidal belt in estuaries and lagoons. The total coverage of Mangroves in the country was 8687 sq.km in 1993 (NRS, 1999). Most extensive coverage of mangroves occur in the Puttalam district followed by Triconomallee and Batticoaloa.

3.2. Coral Reefs

In Bangaldesh, coral reef formation has been reported from St.Martin islands which is about 6 miles off from the main land of Bangladesh and is situated closely to Myanmar (NRB,1999). In India, the coral formations are in Lakshadweep Islands which is a group of islands of coral origin, Andaman & Nicobar group of islands, 19 islands of Gulf of Mannar and a few areas of Palk Bay and in the southern part of Gulf of Kachchh (NRI, 1999). 342 species of corals belonging to 76 genera have been reported from the seas surrounding India. The Maldives, being an island country formed out of corals, has about 15 atolls. In Pakistan, very few patchy corals present mostly in the coastal and offshore areas of Balochistan (NRP, 1999). In Sri Lanka, coral reef are formed

as fringing reefs and they are centred around the entire coast. The major ones are in Arippu, Point Pedro, Foul Point, Thennady Bay etc. Coral coverage is more in the northern and eastern part of the country compared to the west and southern part (NRS, 1999). (NRS, 1999)

3.3. Sea grasses

Sea grass ecosystem in India is present in the Gulf of Mannar, Lakshadweep and Andaman & Nicobar and Gulf of Kachchh. Abundance is estimated to be 700 to 800 metric tonnes. 14 species of seagrasses have been reported (NRI, 1999). In Sri Lanka, seagrass beds are abundant along the open coast as well as within estuaries and lagoons. Large bed covers are reported from the Dutch Bay to Jaffna lagoon. At Mannar, the seagrass beds extend to the northwest, towards islands in India (NRS, 1999).

3.4 Coastal Lagoons

In India, coastal lagoons like Chilka,Pulicat, Vembanad lake etc are the prominent coastal lagoons which support both urban and rural population to meet their livelihoods. While the Vembanad lake is surrounded by urban settlements, part of Chilka lake are encircled by rural settlements with very less industries in these areas (NRI, 1999). In Pakistan, the south eastern parts of Sind province has a belt of low lying areas measuring 4000 sq.km area. There are shallow/brackishwater lagoons adjacent to the mudflats between Indus delta and Rann of Kachchh (NRP, 1999). In Sri Lanka, the coastal lagoons are prominent along the west coast. Puttalam, Jaffna, Kudaimanu, Batticolaoa and Negamboo lagoons support the wide variety of fishing activities benefitting the local population (NRS, 1999). The settlements are mostly semi-urban to rural in nature with very few industries in these areas. However, usage of lagoons as harbours and disposal of sewage is also seen.

3.5. Estuaries

In Bangladesh, estuarine formations are in the Ganges-Brahmapura-Magna river system which result in Sunderban mangroves. The Karnaphuzhi estuary is one of the major estuarine systems of the country with human settlements all along the estuary (NRB, 1999). In India, the estuaries are prominent all along the east and west coast and the major ones are Hooghly, Mahanadhi, Godavari, Mandovi, Zuari, Tapi, Cochin backwaters and Narmada. Urban, semi-urban settlements and industrial developments are found on the banks of most of these estuaries. The mega city of Calcutta is located along the bank of Hooghly. There are number of small estuaries which are fed by monsoonal fresh water flow. In Pakistan, estuarine formations are mostly in the Indus delta and human settlements and developments are also found along the estuaries. In Sri Lanka, prominent estuaries are also formed as lagoons, the example being Negomboo estuary, Kelani estuary and Valaichchenal estuary(NRS, 1995). Urban and semi-urban settlements are found around these estuaries.

4.0. Environmental problems in the coastal marine regions of South Asia

Large cities like Karachi, Mumbai, Chennai, Calcutta, Dhaka and Colombo are located along/near the coastal areas of the South Asia. Besides fast developing cities like Goa, Mangalore, Cochin, Visakhapatnam, Male, Chittagong are also located along the coastline. The total estimated population living along the coastline areas (10 – 40 km from coastal line) of the South Asian region is as follows:

S.No.	Country	Population in Million	Length of Coastline
1	Bangladesh	30.00	
2	India	184.00	
3	Maldives	0.20	
4	Pakistan *	13.00	
5	Sri Lanka	6.12	
	TOTAL	**233.32**	

* Data available for Karachi only

It may be noted that the population density varies from country to country, more towards higher density. The presence of large population is due to developmental activities attracting the coastal areas, due to obvious reasons of using the sea as a place for waste disposal/dumping. Such combinations of increasing population and rapid industrial growth, combined with inadequate efforts in the management of wastes, have led to moderate to serious threat to the quality of coastal and marine environment.

4.1. Solid Wastes

Considering the large size of population living along the coastal areas, the estimated solid waste generated by the population is about 11650 tonnes per day (estimated average of 0.5 kg per person per day) The solid waste generally arises from domestic and industrial sources. The composition of the solid waste for most of the urban in the region is almost the same as given in the National Report of Pakistan, for Karachi (NRP, 1999).

Paper	:	3.6%
Plastic	:	2.1%
Rags	:	7.1%
Metal	:	0.2%
Glass piece	:	2.5%
Fine piece	:	18.2%
Composed matter	:	52%
Moisture	:	43.1%

The domestic waste also includes waste from the hospitals which pose a serious threat of infection and communicable diseases. The waste from the rural areas mostly composed of paper, plastics and bio-degradable matter. The solid waste generated is only partially collected and the rest are dumped in a haphazard manner in the open areas (NRB, NRI, NRP &NRS, 1999). The collected wastes are dumped in open areas outside the city/town limits and incinerated in the open air. Even though the quality of emissions are to be checked, most often it is believed that it contains certain toxic compounds as well as harmful bacteria, as the wastes also contain hospital wastes, plastics and composed matter.

4.2. Sewage

Estimates indicate that an average of 50 litres of water is used by an individual in a day, out of which 30 litres results in waste, giving an approx. figure of the total waste water generated as 7000 Million Litres Day (MLD) in the coastal areas of all the South Asian countries.

Domestic waste carried through municipal sewerages are either released in the rivers, creeks or directly into the coastal areas with or without treatment. Except in few urban areas, the sewage collection facilities are far inadequate compared to the volume generated and most of the sewage from the coastal towns and villages is disposed in open drains which gets connected with the tidal creeks or other aquatic system. Out of the estimated 7000 MLD sewage generated, it is reported that treatment is made to a limited extent and such a facility in Mumbai (300 mld out of 2000 mld) Karachi (47 mld out of 757 mld).

It is also found that in the South Asian Seas region, the municipal sewerage system whether closed or open are also being used for disposal of untreated waste from small and medium scale industries. A review of National reports submitted by the countries in the region indicate that the constitutents of sewage

remains more or less the same and typical municipal waste water characteristics is given in the table below:

Characteristics of a Typical Domestic Sewage mixed with Effluents From Small and Medium Scale Industries (eg.Mumbai)

Parameter	mg/l
Dissolved Solids	1450
Suspended Solids	245
BOD	258
Sulphate	75
Nitrogen	35
Phosphorus	6
Chloride	587
Manganese	507
Iron	2.5
Cobalt	0.030
Nickel	0.081
Copper	0.110
Zinc	0.251
Lead	0.011

The major sources of sewage contamination in the South Asian Seas countries are as follows:

In Bangladesh, the domestic sewage from Chittagong city is dumped in Karnapuzhi river and the BOD load is estimated to be 3500 kg BOD per day. It has been projected that by the year 2000, 5070 kg BOD per day is expected to be released into the river, from Chittagong and surrounding areas. When combined with industrial waste, BOD load in the river reaches 40000 kg BOD per day and along with other sources, the total BOD is estimated to be 45500 kg

BOD per day. As a result of heavy load of BOD, the resultant BOD level in the river is 3 ppm and at times the dissolved oxygen also drops to 0.1 ppm. No treatment of sewage is reported (NRB,1999).

In India, the source of sewage pollution is disposal of municipal waste through rivers, creeks, and the shore disposal is either through pipelines or creeks. The volume of waste water generated in major cities and large towns is estimated to be 4300 MLD out of which 3860 MLD is collected through sewerage systems. The remaining load is disposed into the open drains and canals. In case of small towns, the waste water generated is estimated to be 330 MLD out of which 200 is collected through sewerage system and remaining are disposed into open drains which finally reaches adjoining rivers/creeks/backwaters. As a result of the disposal of raw sewage into the rivers, very high levels of BOD values are observed in several freshwater zones of the estuaries and at times even at the mouth of estuaries. In most of the estuaries, due to sand bar formation at the mouth, the waste water remains within the estuary during the dry season (7-9 months). Monsoonal flow in the river removes the sand bar and the waste is carried towards sea by the run off. Sewage is disposed in raw condition and a low volume of 390 MLD out of 1800 MLD generated alone is treated. During such occasions, high concentration of pathogenic bacteria and marginal decrease of dissolved oxygen, prevail in the coastal water for a short period of time. In general, except in the sea off Mumbai, the quality of seawater along the Indian coast is fairly good.

In Pakistan, most of the sewage is generated along the coast of Karachi and the adjacent coast of Hub and Gadani in the southern Baluchistan. The coastal towns other than Karachi do not have any sewerage system and hence use the storm water drains adjacent to rivers and creeks, for disposal of untreated local domestic and urban waste. In Karachi where 200 Million Gallons per Day(MGD) of sewage is generated, it is discharged through sewerage system and canals. This sewerage system drains into Lyari river which reaches

Karachi harbour. The sewage discharged into the Malir river reaches Gizri creek. Besides, several canals and stormwater drains also carry the sewage directly to the coastal waters. Out of the sewage generated, only 20% is treated and the remaining 80% is disposed untreated. In Sri Lanka, properly planned sewerage systems are not yet been developed except for the Colombo municipal area. In Colombo only 60% of the households are connected with sewage collection systems and the remaining is disposed the waste in open areas and in streams and canals. Sewage collected from the Colombo city are disposed through 2 ocean outfalls located in Wellawatta and Modar. The squatter settlements along the southwest coast leads to faecal pollution and solid waste on beaches and nearshore areas.

The above situation of sewage generation, disposal and treatment clearly indicates that in most of the countries, the sewage collection facilities are far inadequate compared to the quantity generated and the treatment facilities are almost negligible.

4.3 Industrial Waste

South Asia is one of the fast developing industrial region with several industrial sites and power plants located along the coastal areas. The industrial cities like Chittagong, Karachi, Mumbai, Cochin, Chennai, Calcutta and Colombo are located on/near the coast. The country wise details of the nature are industrial pollution is given below:

In Bangladesh, industrial zones are mostly located along the Chittagong area and the waste from the industries are released at several points in the Karnapuzhi river. The majority of the industries include textile, paper and leather. The tanning industries dump the waste in the surrounding areas which finally find their way through open drains to Karnapuzhi river. The waste contains BOD value of 600-1200 ppm for vegetable tanning waste and 800-1200 ppm for chromium tannium waste.. The other waste include sulphur and mercury. A

prominent DDT industry located in the area also releases the waste into the river. No treatment of waste is done before disposal.

In India, a variety of industries such as Chemicals, Fertilisers, Pharmaceuticals, Textiles, Soda Ash, Petro-chemicals, Dyes, Engineering, Automobile, Plastics and Metallurgical etc are located in and around industrial zones of Tapi, Hazira, Mumbai, Mangalore, Alapuzha, Cochin, Calicut, Tuicorin, Pondicherry, Cuddalore, Chennai, Visakhapatnam, Paradip and Calcutta. The estimated waste water that are generated by industries is 0.7×10^3m (as of 1994). This does not include the waste that are generated by innumerable small and medium scale industries which are located within or outside the city/town limits. Wastes from such industries are mostly drained into municipal sewers or in creeks. It has been found that the waste load from industrial estates containing a group of industries have a BOD load of 500 to 1050 and COD of 800-1200. The load of suspended solids are also found to be high. Due to disposal of raw waste from these industries, the concentration of heavy metal in sediments at river mouths in few areas and in the creeks of Mumbai have reached at alarming rates. The disposal of industrial waste particularly from the large industries is through ocean outfalls and they are located from 500 mts to 2 km into the sea. While most of the major industries treat their wastes, large number of small and medium scale industries do not treat the wastes before disposal. Establishment of Central Effluent Treatment Plants by a group of small and medium scale industries is also prevailing in a few areas in Gujarat, Maharashtra, Kerala, Tamil Nadu, Andhra Pradesh and West Bengal (NRI, 1999)

In Pakistan, most of the coastal industries are located around Karachi in the form of industrial sites like Sindh Industrial Trading Estate(SITE) and Landal Industrial Trading Estate. In SITE 5000 registered industrial units and several units that are not registered are functional. These industries include textiles, chemicals, iron, steel and dyes. The waste from these industries and other areas enter into the coastal environment through rivers, canals and streams. It has

been estimated that the stream releases 200 MGD along with heavy metals such as iron, copper, zinc and cobalt etc into the neighbouring creek. It is reported that most of the waste are released as untreated (NRP, 1999).

There are 60,000 industries in Sri Lanka ranging from large scale industries to small, minor and quarrying and repair shops. 2 of the 3 Investment Treatment Zones and 2 primary industrial estates are located in the coastal area near Colombo. The export processing zones are provided with central waste water treatment facilities. All effluents discharged from the industrial areas are collected through a network of sewerage connected to the central treatment facilities. The effluent from similar industries at Kokanal and Karpore industries are released in adjoining coastal waters. The waste water contain high value of BOD. It has been estimated that the waste water loads from industrial areas of Colombo city is about 10737 m^3/day (NRS, 1999).

The above situation of non-treatment of waste from most of the industries with their effluents containing heavy metals, high BOD materials are released into the creeks, coastal waters etc. result in contamination of seawater especially the sediments with high amount of cadmium, mercury etc.

4.4. Agricultural Run-off

The South Asia is one of the major agricultural regions in the world. Besides for local consumption, a few varieties of rice, wheat, cereals, etc. are also exported, mostly from India and Pakistan. In recent years, in order to cope up with the increasing food demand, high yielding varieties of rice, wheat, cereals etc., are grown in the region, which need substantial quantity of fertilizers and insecticides. The run-off from agricultural fields containing large amount of nutrients in the form of nitrogen and phosphorous and residues of insecticides mostly belonging to organo-phosphorous and synthetic pyrethyroid groups reach the rivers and finally to the coastal waters.

In Bangladesh, the cropping area in the region is about 4.3 million acres. The major crops being rice, wheat, jute, cotton, vegetables, species etc. The yield per acre is about 0.7 t per year for wheat. The estimated per capita annual requirement is about 1.65 t. The agricultural lands along the coastal areas are mostly reclaimed from the low lying regions. India is basically a agricultural country with rice, wheat and cereals as prominent crops in the interior as well as coastal areas. The agricultural sector consumes about 70% of the water from the rivers and the underground sources. It has been reported that the average fertilizer consumption is about 75 kg per hectare. The insecticide consumption is about 13.3 kg per hectare. The insecticides are mostly of organo-phosphorous and synthetic pyrethyroid in nature. Even though DDT is banned for agricultural use, HCH is still being used as an insecticide in some of the agricultural fields (NRI, 1999).

In Pakistan, agricultural activity is sparse in the coastal areas. However, areas adjoining to Sindhu coast, large quantity of rice and other agricultural products are being produced. The fertilizer and pesticides used reach the coastal waters through creeks and rivers, after they are drained into these water bodies (NRP, 1999).

In Sri Lanka, even though the agricultural activities are not widespread in the coastal areas, the use of fertilizers to the level of 77 kg per hectare and the pesticides to the level of 1.6 kg per hectare are being practicised. Since the agricultural fields are close to the rivers and the lagoons, the run-off from agricultural fields are drained into these rivers and lagoons.

4.5. Oil Pollution

The land based activities especially the automobile oriented activities, industrial use of oil in the form of machinery oil, furnace oil and processing of crude oil to petroleum products are the major source of oil pollution in the coastal

water. The inland transport of crude oil from ports to refineries and disposal of oil sludges by tankers in the adjoining water bodies are the prominent sources of oil pollution from the land based activities.

In Bangladesh more than 50% of the oil pollution in the marine environment comes from urban and river runup. The numerous river crafts and the steamers plying along the waterways and discharge of waste of oil wastes and bilge washes reach the ambient environment itself (NRB, 1999). Similar situation are also prominent in Hooghly in India and port waters in other countries.

Oil Pollution by Ships and Maritime Activities

South Asia, particularly, the seas bordering Pakistan, India, Sri Lanka and Maldives is being used as an international tanker route for transport of crude oil from the gulf countries to the Far-east. It has been estimated that nearly 3500 oil tankers originating from the Persian Gulf pass through south of Pakistan, west of India, between Maldives and Lakshadweep islands of India, southern peninsula of India, south of Sri Lanka and reach the Malacca strait after passing between Nicobar and Sumatra islands. About 500 million tonnes of crude oil is transported through this route.

The oil spills due to shipping occur mostly during the accidents and grounding of tankers. However, during the transfer of oil in ports as well as through Single Buoy Mooring Stations and bunkering also, oil enters into the coastal waters and the port areas.

4.6. Ship breaking operations

The ship breaking yards are operational in Pakistan, India and Bangladesh. In Bangladesh, ship breaking operations have been started on an industrial scale in the recent years. Nearly 50 ship breaking units are functional in the sea shore from Kulna to Fauzderhat in Chittagong and near Mogla port in

Kulna. The lubricants, engine oils and debris form major pollutants during dismantling operations. The waste oil is not collected properly and disposed in the adjoining sea (NRB, 1999). In India, ship breaking operations are carried out on beaches of Alang in Gujarat, for a distance of about 10km along the coastline. On an average 5 ships are broken per day. Chronic oil pollution due to draining of waste oil into the sea during the breaking operations is evident (NRI, 1999).

In Pakistan, ship breaking industries at Gadani is a major source of pollution to the adjoining coastal areas. Recently, the ship breaking operations are at low level and only a few ships are broken in a month (NRP, 1999).

5.0. Sediment Transport

Sediments form an important source of nutrients for biological organisms in the aquatic environment. It is a major source of substratum for mud flats and mangrove areas. The perennial rivers like Indus, Ganges, Brahmaputra, Magna, Kamili, Kosi, Kelani, Negambu etc bring enormous sediment to the mouth of the rivers and also supply the sediment for beach formation. Loss of sand material occur due to erosion of coastal areas by natural phenomena like cyclones and streams. In the South Asia, due to increase of population and need for water for agriculture as well as for human consumption, man-made structures like dams have been built in all the major rivers which contain the silt carried by the rivers. Since the river water is extensively used for agriculture to sustain food production and to alleviate poverty, discharge of fresh water to the coastal ecosystems have been considerably reduced. Since the sediment particles are transported along with the fresh water, depletion in supply of sediments to the coastal areas also takes place. Such a short supply of sediments has caused wide scale impact, like reduction in sediment supply for beach nourishment, compensation of substratum loss in mangrove areas due to human activities etc.

Further, the human activities in the upper reaches of the river particularly in the mountain regions, like deforestation, use of land for agriculture, has led to floods and erosion of mountain areas causing large scale transport of land debris, sand, stone etc. to the river. At many locations the river course get diverted and leading to diversion of sediments. Such a diversion also reduces natural supply of sediments to the coastal habitats.

6.0. Physical Alteration of Habitats

The upstream activities like regulation of river flow erosion of banks in the downstream, and coastal activities like unplanned coastal structures etc. cause variation in the geo-morphology of the coastal areas by way of accretion and erosion. This also results in reduction of areas of lagoon and other coastal habitats by way of increased sedimentation in the banks and reduced water inflow from sea as well as river. Excessive sediment transports, which are carried to the longer distance, too affect the coral reefs. To sustain the economic growth to cope up with the increasing population, the South Asian countries are now proceeding towards large-scale expansion of existing developmental activities and planning for major investments in coastal areas in the immediate future. For e.g. port activities like breakwater in southern India is posing a threat of erosion constructing in adjoining lagoon which may lead to alteration of lagoon to a bay in the coming future. All such developmental activities tend to aggravate the existing problem of habitat loss or their alteration with negative impact, like reduction of livelihood to local inhabitants.

In Bangladesh, diminishing of mangrove vegetation and mangrove areas, particularly in Sunderbans , which is a source of livelihood for 0.3 million people, is a major concern. It has been reported that, due to the combined effect of natural and human activities like conversion of mangrove areas to shrimp culture ponds, the mangrove areas have been decreasing. The economic losses are easily understood in terms of dependence of population on the resources of the

mangroves, particularly the renewable resources like fisheries. Besides loss of mangroves due to the human intervention, it also leads to imbalance in fisheries production in the adjoining coastal waters, where the fishery resources are shared by India and Bangladesh in their respective jurisdictions. The loss of habitats significantly affect wild life population in the mangrove areas. The Royal Bengal Tiger is already endangered. It has been reported that the Javan Rhinoceros, Wild Buffalo, Swamp Deer, Hog Deer etc. have become extinct. These were available in 1920s. Further, the Muggu Crocodile species are vulnerable. In Chakaria Sunderbans, the deforestation caused large-scale erosion of Maheshkhali island. If these forests are cleared to provide area for shrimp and finfish culture farming, the Kuttubdia and Mehkul islands will be under pressure of erosion and hundreds of thousand people will be exposed directly to severe cyclones and tidal surges. The forest used to cover 7490 hectare as reserved and 10020 hectare as protected forests. But, since 1977, about 3321 hectare land has been released to private firms and individuals for fish production. The Charkaria Sunderbans also faces pressure from the salt manufacturers. The mangrove areas were converted as salt farms. Similar scenario is also reported from other parts of the Sunderbans mangrove areas.

In India, the changing river courses, fluctuation in sediment transport, priority for irrigation of agricultural fields and resulting in diversion of water, has caused siltation of (eg. Chilka) shifting of river months (Godavari), coastal lagoons and the mud flat areas (Gulf of Khambat). The changes of course of Hooghly river and dredging by port authorities to maintain the draft for shipping for Haldia and Calcutta Ports have threatened the existence of Niachara island in West Bengal. Similarly, due to the decreasing of fresh water inflow and formation of sand bar at the mouth of Chila lake, the lake area has been reducing to the extent of 5 - 10% per year. The present area is 1100 sq. km. Such reductions are also reported for Pulicat lake also. The alteration of sediment budget in the coastal areas by the perennial and monsoonal rivers flowing to the beach areas, influence the shoreline changes and in turn has affected the

habitat of endangered species like turtles. For example, the largest turtle breeding grounds along the coast of Gahirmata, which is close to Wheeler island, where annually about 1 million turtles nest are shifting the nesting to nearby areas. This is due to the alternation in the size of Wheeler island. Along the West Coast of India, sedimentation in the Gulf of Khambat and also to some extent in Gulf of Kutch has been reducing the water areas in the Gulf areas by 1 - 2% per year. Further, manmade activities like construction of ports in the Gulf of Kutch are also responsible for habitat loss. The decrease of mangrove areas even though not prominent in mangrove forest rich areas like Sunderbans and Pitchavaram, ingression and aquacultural activities, the reduction in the mangrove area at least by 2-5% are noticed particularly in the Coringa mangroves in the recent 5 years. The human intervention like conversion of seasonal wet lands as human settlement areas, which attract migratory birds, is also common along the coastal areas of the country. Uses of these areas as salt pans and also using the land for shore-based industries have led to the disappearance of some of the seasonal wetlands (NRI, 1999).

In Pakistan, the habitat modification, due to the construction of dams at several places along the Indus river, led to decrease of water supply to mangrove and coastal areas. The mangroves need a minimum of 10 million acre ft. of water to support mangrove vegetation. Even though this water requirement is met during the south-west monsoon during the dry season, due to decrease of water flow, the salt water ingression from the sea area is prominent. As a result, species adapted to high salinity are very prominent. Similarly, the abundance of Hilsha in the upstream prior to damming of Indus river was evident. In case of mangroves, nearly 16000 camels and 11000 cattle graze the mangrove areas leading to exploitation of 16000 t of mangroves per year. The reduction in the mangrove areas is being compensated by several afforestation programmes (NRP, 1999).

In Sri Lanka, in the coastal area sediment extending upto 685 km from Kalpitiya to Yala National Park, about 175000 to 285000 sq.m of coastal area is lost every year due to erosion caused by natural and manmade activities. The impact of erosion is felt in the decreasing habitat area for intertidal animals. The conversion of area around the lagoons for shrimp culture has decreased the lagoon area affecting the abundance of bio-diversity. Mangroves are destroyed for expansion of human settlements and also for expansion of aquaculture. It is estimated that the current mangrove habitat will be reduced by the year 2001. The proliferation of slums and squatter settlements along the coastal areas have affected all the birds and beach fauna (NRS, 1999).

In Nepal, due to natural phenomena like Glacial Lake outburst, soil erosion due to tectonic activities of major mountain ranges and consequent downcoming of the river system, human activities such as deforestation, improper cultivation practices and development work, induces movement of soil and sediments to the downstream areas (NRN, 1999). It has been estimated that the soil loss ranges from 5000 kg per hectare per year on level terraces to 20000 on sloping terraces. During peak river discharges, sedimentation results in abrupt river channel changes, causing huge losses in the arable land in low lying areas. Adoption of the traditional method of top down approach helped in retention of upland terraces due to mixed cropping etc. Due to vanishing of this approach, the density of vegetation in upland terraces is decreasing. Damming reduces to some extent silt load to down stream areas.

B. REGIONAL PROGRAMME OF ACTION FOR SOUTH ASIAN SEAS COUNTRIES

1.0. RECOMMENDED STRATEGIES, PRIORITIES AND TARGETS FOR ACTION

The South Asian countries belong to developing and least developed country categories. The poverty and standard of living is considerably low in Bangladesh, some parts of India and Pakistan. The coastal population is under pressure due to ever increasing aquatic pollution in the estuaries, creeks and to some extent in coastal waters. The degradation of the living environment with solid waste dumps and land-fills containing untreated wastes is a common scenario in all the South Asian countries. The degradation of marine environment including the estuaries due to industrial activities are also in the rising trend despite existence of legislations to control pollution from the industries. The declining of fisheries, which is one of the cheapest source of protein for coastal population, due to the combined effect of over exploitation and pollution has been seriously affecting the socio-economics of the coastal population. The shifting of fishery exploitation zone to the offshore areas, which are not so attractive in terms of economics, makes the fish and fishery products more cost intensive, leading to rising of prices of fish. Under such circumstances, the nutritive intake of the coastal population also decreases, leading to malnutrition and aggravation of poverty. It is needless to say that, unless efforts are made to develop strategies to mitigate pollution from the land-based activities, the basic needs of coastal population in terms of safe drinking water and clean living environment will be a remote reality in the 21st century. The countries in the region need to attend the above task as a priority with political wills and administrative skills. Comprehensive programmes, aiming to alleviate poverty and providing a clean environment through control of pollution, need to be developed and implemented efficiently.

Pre-Requisites

In the foregoing chapter on overview of environmental problems indicates the status of land-based sources of marine pollution like solid waste dumping, disposal of municipal and industrial wastes and habitat loss due to manmade activities, which is based on the available sparse data. The quantification of wastes generated remains grossly approximate. Such non-availability of data or the limited data makes the task of assessment of the pollution difficult in the South Asian countries. As a pre-requisite for systematic identification and assessment of the problems, precise data on various point and non-point sources, nature of the contaminants in cases of direct sources like sewage, sludge, solid waste, industrial waste etc. and indirect sources like agricultural wastes, wastes from upstream areas through rivers etc. have to be collected.

The impact of land-based activities is generally assessed through the survey/monitoring programmes carried out by the regulatory agencies. Due to several technical and financial constraints, these monitoring programmes have limited spatial and temporarly coverage in terms of area. Such shortcomings also contribute to the improper assessment of the impact of waste load on the health of the coastal environment and impact on ground water contamination, biological resources and aesthetics of the environment. As a part of the exercise on development of strategies for control of marine pollution from the land-based activities, systematic work on assessment of the problem has to be taken as a pre-requisite.

The economic status of South Asian Seas countries, even though, has been improving in the recent past, considering the growth of population especially in Bangladesh and India, the percentage of

population remaining below the poverty line tend to remain either at the current level or it may increase. Several programmes for alleviation of poverty and improvement of standard of living of people in all the South Asian Seas countries combined with awareness on human contribution to pollution are essential as they will facilitate the peoples participation in mitigating the effects of land-based sources of marine pollution. Population control, health for all, providing safe drinking water and a clean environment to live, need to be an immediate goal of the countries in the region. Unless programmes targeting towards achievement of such goals are developed and efficiently implemented, the efforts by the South Asian Seas Governments to mitigate the negative impact on marine environment due to land-based activities will remain at the present scale of slow pace, and it will be dampened by the increasing generation of contaminants. As a result, the gap between remedy and degradation will become large.

The above pre-requisites will facilitate development of appropriate strategies and mechanisms for implementation including development of programmes and monitoring action plans. With the available information, the regional programme of action proposes the following strategies:

1.1. Solid Waste

1.1.1 Strategy

The solid waste generated, methods of collection, disposal and treatment in the South Asian Seas countries is rather in primitive stage. Since the solid waste, which contains wastes from municipal sources also includes the wastes from hospitals, pose serious threat to the health of the mankind. In order to mitigate the adverse impacts, the following action programmes are necessary:

i) Formulation of guidelines for collection, segregation, transport and disposal of solid waste both at the urban and rural areas

ii) Identification of suitable technology for incineration/treatment of each kind of waste including the utilization of wastes for generation of energy and compositing

iii) Launching of awareness programmes in minimising the usage of non-biodegradable materials for domestic and industrial use

iv) Development of appropriate technologies for recycling of wastes into the useful products without causing adverse impact on human health for using the recycled materials

Participation of private sector in solid waste management need active consideration as the public bodies like municipalities are finding it extremely difficult to cope up with the mounting of solid waste generation facilities and their management. Involvement of voluntary organizations and NGOs in creation of awareness on disposal of solid wastes is also essential.

1.1.2. Financing

The South Asian countries due to economic constraints still resort into dumping of solid waste in open areas including in beaches close to high tide line. Several economic incentives to municipal corporations to adopt the solid waste management incorporating the above suggested action programmes are necessary till the time the municipalities attain

self-sufficiency in economic resources to implement the solid waste management programmes.

To facilitate income generation by municipalities as well as efficient collection system, co-financing by welfare and commercial organizations are needed. Tax incentives can be given to private corporations for contributing funds for solid waste management programmes. This will facilitate augmentation of financial resources for implementing the solid waste management programmes.

1.1.3 Capacity Building

In the South Asian Seas countries, particularly in the urban areas, expertise is available for organizing the waste collection and disposal. As this expertise is more familiar with conventional method of collection and disposal, they need to be exposed to modern methods of collection, segregation, disposal including treatment.

1.1.4 Legislation

The existing legislation on solid waste dumping in the coastal areas need to be reviewed for their adequacy in facilitating proper disposal of solid waste in the urban and rural areas. Where appropriate, these legislations need to be amended to achieve the aestheticness, leading to provision of a healthy living environment to the local population.

1.2. Sewage

1.2.1 Strategy

The volume of sewage generated by the coastal population of South Asian countries is estimated to be about 7000 million littres per day. As stated in the overview, this is based on the assumption

that about 30 littres of waste water is generated by every individual living along the coastal areas. Since the economy of the South Asian countries is in transition, a funding for collection, disposal and treatment of sewage remains as a low priority. Lack of access to Best Available Technology (BAT) for treatment of sewage and the expertise to handle such technology are some of the major hindrances in the sewage management programmes. Considering the deleterious effects of sewage on human health due to contaminated ground water, river and estuarine waters containing toxic metals and pathogenic bacteria, the urban as well as rural population often suffer from gastroentitis. The South Asian countries have initiated sewage treatment programmes in mega cities like Mumbai in India and Karachi in Pakistan and other cities like Colombo in Sri Lanka. The efforts in this direction are far inadequate compared to the volume of sewage generated. The strategies and priorities required at the National and Regional level in minimising the impact of disposal of sewage in aquatic bodies need to be translated into specific programmes containing the following:

i) To prepare inventories identifying the sources of sewage pollution and assessment of the load of the sewage from cities/towns/ villages

ii) To devise programmes and projects to facilitate collection of sewage through sewerages and pipelines

iii) To determine the Waste Assimilative Capacity for sewage oriented parameters like Dissolved Oxygen, BOD, nutrients and bacteria in the receiving water bodies

iv) To formulate sewage treatment strategies to comply the requirement of Waste Assimilative Capacity. This will also include the formulation and discharge standards, where if needed, location specific standards

v) Adoption of BAT and best suitable technology for primary, secondary and, where appropriate and feasible, tertiary treatment of sewage

vi) To locate coastal outfalls to obtain or maintain agreed environmental quality criteria with an aim to avoid degradation of coastal waters used for fishing, bathing etc.

vii) To draw a comprehensive programme for effective monitoring of implementation of sewage treatment strategies

viii) To identify the productive uses of sewage, sludge such as land spreading and compositing, horticulture and pisciculture etc.

ix) To formulate strategies for avoidance of mixing of non-compatible industrial wastes into the sewage to ensure smooth functioning of the treatment plants specifically designed and operated for treatment of sewage

1.2.2. Financing

Based on the current estimates available for using the Oxidation Pond method for treatment of sewage, which is the least cost method, it would cost approximately US $ 150 million for treatment of the domestic sewage along the coastal towns and

cities, which does not include the cost of the land, installation of treatment plant, as it varies from area to area within the country. The recurring cost to operate such a system is estimated to be US $ 25,000 per Million Litter per year. Considering the economic situation in South Asia Seas countries, their affordability for such a high cost should be fairly understood.

The countries like India and Pakistan are already operating sewage treatment systems with the funding from the multilateral agencies like World Bank and is limited to only Mumbai and Karachi. Unless the funding is provided atleast for the capital cost for treatment system from the multilateral and bilateral donors and with an assurance from the Central/Federal Governments to fund for the running cost, the treatment of sewage to minimise the degradation of water quality in the marine environment will be a remote reality. Continuation of the present level of the dumping of sewage in the rivers, estuaries and coastal waters will further deteriorate the environment and cause serious depletion of edible and non-edible resources. Under such circumstances, improvement of living standard of coastal fishermen from the present low level would be rather difficult.

1.2.3. Capacity Building

The South Asian Seas countries use conventional methods for collection and disposal of sewage and also design the sewerage system based on the best available practices and knowledge including using the information available on the land slope etc. In order to prepare the countries to use BAT, training on sewerage planning using GIS, sewage treatment technologies are essential, for which separate programmes need to be developed.

1.2.4. Legislation

Even though the legal and provincial acts prohibit disposal of untreated sewage in the coastal waters and coastal bodies like lagoons, estuaries etc., due to the paucity of funds for treatment of these wastes, most of the civic bodies continue to violate the legislation. The regulatory authorities have been issuing legal notices to the civic bodies for dumping their wastes. Unless the ground realities like trained manpower, appropriate strategy to facilitate systematic collection, disposal and treatment, with the funds to execute such programmes are made available, implementation of the legal provisions relating to sewage in the South Asia Seas countries will remain as a remote reality. The legislations concerning sewage need to be formulated based on the situation, especially permitting the municipalities to achieve the treatment in a phased manner.

1.2.5. Regional Action

As stated in the overview, the coastal water quality in the South Asia Seas countries is deteriorated only locally and the sea beyond 2 km is fairly clean. The sewage is mostly a national problem and by and large the pollution is confined close to the coast and there are no evidences of deterioration of water quality beyond national maritime boundaries. Therefore, most appropriate strategy for regional action would be

i) Formulation of acceptable guidelines and standards for discharge in the South Asia Seas countries.

ii) Secretariat of South Asia Seas programme should also act as a hub for flow of information relating to BAT, interested donors for funding etc. The formulation of regional training programmes on sewage management would also facilitate the countries to have adequate capacity to deal with the sewage management.

1.3. Persistent Organic Pollutants (POPs)

1.3.1 Strategy

In the South Asian seas countries, it is presumed that some of the POPs are still in use, even though not on a large scale. While the DDT is required mostly for the usage of public health programmes, HCHs still are being used in agriculture. In the absence of alternatives to DDT to control the pests as well as epidemics, the use of DDT will remain in use in public health programmes in these nations. Under these circumstances, avoidance of the excessive use of both the POPs should be a priority. The countries in the region need to formulate research programmes to find alternatives to DDT.

1.3.2. Financing

Adoption of substitutes of POPs is reported to be cost intensive. Further, the technology to manufacture these substitutes rests mostly with the developed nations. Unless the International Bodies like UNEP formulate a strategy to facilitate transfer of technology under non-commercial terms, substitution of DDT etc. by environmentally friendly pesticides would be difficult.

1.3.3. Regional Action

To provide countries that need technical information and advice on the substitutes that are available for these pesticides, clearing mechanism need to be developed at the regional scale. The mechanism should also provide technical information and advice regarding the environmentally sound disposal of the POPs.

1.4. Radioactive Substances

1.4.1. Strategy

In South Asian countries, nuclear thermal power plants are present along the coastal cities of Mumbai and Chennai in India and in Karachi, Pakistan. Discharge from the nuclear plants in both these countries are being done in accordance with the regulations laid down by the International Atomic Energy Commission. The target for such use of radioactive substances should be minimising the generation of radioactive wastes and to eliminate to the fullest possible extent inputs of radioactive substances into the sea. In order to achieve this target, the countries, as a priority, need to promote policies and practical measures to minimise generation of radioactive wastes and provide for their safe processing, storage, transportation and disposal. The countries also need to adopt measures including BAT and BEP for the environmental practices for the reduction or elimination of discharges, emissions and losses of radioactive substances in the adjoining marine environment. The actions at the regional level could be to facilitate exchange of information relating to the quantum of radioactive substances generated, the method of disposal and proposals to adopt technologies that promote BEP. The Regional Forum can also act

as a clearing house mechanism for providing the information relating to BAT.

1.5. Heavy Metals

1.5.1. Strategy

Heavy metals arise from the waste generated by small, medium and large scale industries. The toxic metals are mostly mercury, cadmium and lead. The disposal standards for effluents from various categories of industries have been prescribed by all the countries in the South Asia region through specific legislations. These standards are complied by and large adequately by the large industries. The countries in the region have found it difficult to enforce such standards to the small and medium scale industries, mostly due to cost intensiveness of technology that is used for treatment of waste generated by these industries.

The priority and target for minimising the heavy metal pollution should focus mainly to reduce the discharges containing toxic metals such as arsenic, chromium, mercury, cadmium and lead from all industries by adopting appropriate technologies.

The countries in the region may consider to adopt the following strategies for reduction of heavy metal pollution in the coastal waters:

i) To launch programmes for systematic assessment of the sources of heavy metal pollution and quantum of heavy metals reaching the coastal waters

ii) To prepare national programmes on the reduction and control of pollution by toxic heavy metals in a phased manner

iii) To adopt environmental criteria while selecting sites for establishment of industries

iv) To determine the Waste Assimilative Capacity of ambient water bodies receiving the heavy metal load generated by industries and others in that area and appropriately review and revise the discharge standards to meet the Waste Assimilative Capacity for heavy metals

v) To reduce discharges as far as possible by adopting BEP and using BAT

vi) To introduce Environmental Audit Practices for ensuring the reduction of discharges and emissions of organo metallic compounds and inorganic metals

vii) To develop long-term progress on heavy metal monitoring, including mussel watch

1.5.2. Financing

In order to promote adoption of BAT by the industries, the countries in the region may:

i) Promote adoption of no waste or waste minimising technology for industries and providing financial incentives to industries that are adopting such technologies

ii) Providing the tax exemptions like Custom Duty Exemption for importing the treatment plants, fulfilling the needs of BEP etc.

1.5.3. Capacity Building

i) To provide the details of BAT and BEP through a clearing house mechanism

ii) Where relevant and possible, to promote adoption of common environmental quality criteria and standards for point source discharges and emissions of heavy metals

iii) To conduct inter-calibration exercises for the National Heavy Metal Monitoring Programmes being conducted by the countries concerned in order to ensure the data quality

iv) To formulate legislations for relocation of polluting industries and designation of areas as industrial zones, which need to be determined based on the environmental quality criteria.

v) To promote establishing industrial estates for small and medium scale industries, particularly homogenous industries to facilitate establishment of common Effluent Treatment Plants

1.5.4. Training

The countries in the region mostly adopting low and medium cost technologies to reduce the heavy metal contents in the

effluents discharged primarily from the industries. Appropriate capacity building programmes including on BAT need to be developed and implemented.

1.6. Oil

1.6.1. Strategy

The land-based source of oil and grease, which arises primarily from vegetable oil industries and refineries, accounts for nearly 40 - 70% of oil pollution in the coastal environment, besides oil pollution due to marine transportation, handling of crude oil in ports and and harbours through oil transfer facilities. As a priority, the nations in the region need to eliminate to the fullest possible extent pollution of the marine environment caused by discharges, emissions and losses of hydrocarbons including lubricating oil. In order to achieve the target, the countries in the region may adopt the following strategies:

i) To make an inventory of sources of hydrocarbon pollution in the inland waters and lagoons etc. and assess the load of oil from these bodies to the sea

ii) To prepare National Programmes on the reduction and control of pollution by hydrocarbons and implementation of the programmes

iii) To promote adoption of BAT and BEP in the industrial installations, which are sources of hydrocarbon pollution

1.6.2. Financing

i) The oil pollution that is growing due to marine transportation particularly in the inland waters and ports in Bangladesh and India could be reduced possibly by installation of appropriate oil water separating devices and make available such devices through economic incentives

ii) Tax concession can also be given for crafts, who are installing such devices. The countries also need to create collection facilities for the waste oil collected by these devices.

1.7. Nutrients

1.7.1. Strategy

The nutrients like nitrite and phosphate are mostly generated from the point sources of sewage and industries and non-point sources like agricultural run-off. Even though the quantum of such nutrients reaching the marine environment through estuaries and inland water bodies is yet to be assessed, lack of evidence of eutrophication in the coastal waters of South Asian countries fairly indicates that the problem of nutrients is mainly confined to the inland waters like lagoons, estuaries and backwaters. Therefore, in order to avoid occurrence of harmful algal blooms, the priority and target for the nations should be to minimise the levels of nutrients in the waste water discharged from the sources to the estuaries, backwaters and lagoons. To accomplish the target, the countries may adopt the following strategies:

i) To launch programmes to identify the sources of nutrient origin and estimate the load from each source

ii) To formulate guidelines and standards for discharge of nutrients like ammonia, which is toxic to marine animals

iii) To promote treatment of waste at the primary, secondary and even at the tertiary levels at locations where the nutrients level far exceeds the assimilative capacity and cost eutrophication

iv) To formulate programmes for alternative use of nutrients rich water especially for seaweed culture, algal culture etc.

v) To promote adoption of BAT and BEP while dealing with the waste containing large amount of nutrients

1.7.2. Capacity Building

The capacity building programme could be:

i) To provide information to the countries in the region the details regarding BAT and BEP and concerning also to promote adoption of appropriate guidelines and standards for point source discharges of BOD, nutrients and suspended solids

ii) To provide the countries in the region in participation in the FAOs programme on sustainable use of fertilizers and encourage the countries, the preparation of national

strategies, based on the appropriate and rationale use of fertilizers and pesticides

1.7.3. Training

The countries in the region by and large adopt small area farming in the agriculture. As it will be difficult to ensure adoption of BAT and BEP for such small farms, the system, comprising of group of farmers, need to be formulated and the co-operative system can be provided with adequate training on rationale and appropriate use of fertilizers in agriculture to minimise discharge of nutrients from the agricultural fields. Such training programmes can be organised regionally.

1.8. Physical Alteration and Destruction of Habitats

1.8.1. Strategy

The South Asia region experience large-scale physical alteration of habitats, due to natural events like flooding, storms and manmade activities like construction of dams on rivers and breakwaters for ports and harbours. The reduction of area of coastal lagoon due to heavy siltation as a consequence of lack of flushing of sediments from the lagoons to the coastal waters which is mostly formation of due to sandbar formation at the mouth is common. The ill designed and poorly executed coastal structures like breakwaters have caused erosion as a result of which there is a loss of beaches which form habitat for avariety of marine animals and as nesting ground for turtles. In order to minimise the physical alteration of the habitats, the countries in the region may adopt the following strategies:

i) To adopt Integrated Coastal Zone Management practices incorporating watershed approach while planning irrigation and coastal developmental activities, with due to consideration of minimising reduction or loss of coastal habitats.

ii) To undertake impact assessment studies particularly for upstream activities so as to minimise the loss/alteration of habitats in the lower areas

iii) Where needed, to formulate national legislations to ensure mandatory formulation and adoption of ICZM for area management especially at locations where coastal areas are largely influenced by the upstream activities.

1.8.2 Capacity Building

i) To develop model programmes on ICZM indicating the benefit of adoption of the ICZM concept for minimising the impact arising due to manmade activities

1.8.3. Training

The countries in the region have limited capacity to adopt the concept of ICZM. As a priority, regional and International efforts are required to familiarize the application of concept of ICZM in preventing physical degradation of habitats with examples of success stories, particularly in the developing nations.

2.0 Time Targets

The South Asian Seas Countries are developing countries and even though the conscious of need for clean environment is growing, due to paucity of funds and also existence of other priorities like poverty alleviation etc. the countries are enable to dedicate efforts and allocate funds for controlling land based activities like pollution. Under such circumstances, it is very difficult to prescribe time targets for accomplishment of the strategies and priorities mentioned in the above text. The time targets have to be left with the individual countries. Such a flexibility is also reflected in the Global Programme of Action for protection of marine environment from land based activities, especially in the implementation of the GPA.

References:

1. National Report of Bangladesh (NRB), 1999; National Programme of Action (Bangladesh) for the implementation of the Global Programme of Action (GPA) for the protection of the marine environment from land based activities

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4. National Report of Srilanka (NRS), 1999; National Action Plan for protection of marine and coastal environment from land based activities