# Nepal Environmental Health Action Plan 2011

Prepared by Nepal Health Research Council

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Supported by World Health Organization Country Office, Nepal

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## Nepal Health Research Council (NHRC)

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## Study Team

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Prof. Dr. Chop Lal Bhusal

Executive Chairman

# List of Acronyms

| | |
|---|---|
| AQM | Air Quality Management |
| AAQS | Ambient Air Quality Standards |
| CBS | Central Bureau of Statistics |
| CEN | Clean Energy Nepal |
| CKV | Clean Kathmandu Valley |
| COPD | Chronic Obstructive Pulmonary Disease |
| DDC | District Development Committee |
| DoHS | Department of Health Services |
| DoTM | Department of Transport Management |
| DHM | Department of Hydrology and Meteorology |
| DWSS | Department of Water Supply and Sewerage |
| EIA | Environmental Impact Assessment |
| EPA | Environment Protection Act |
| EPC | Environment Protection Council |
| EPR | Environment Protection Regulations |
| ESPS | Environment Sector Programme Support |
| GTZ | German Agency for Technical Cooperation |
| HCI | Health Care Institution |
| KMC | Kathmandu Metropolitan City |
| MDG | Millennium Development Goals |
| MPPW | Ministry of Physical Planning and Works |
| MoE | Ministry of Environment |
| MoF | Ministry of Finance |
| MoI | Ministry of Industry |
| MoLD | Ministry of Local Development |
| MOHP | Ministry of Population and Health |
| NDWQS | National Drinking Water Quality Standards |
| NEPAP | Nepal Environment Policy and Action Plan |
| NHRC | Nepal Health Research Council |
| NPC | National Planning Commission |
| NWP | National Water Plan |
| NWRS | National Water Resources Strategy |
| NWSC | Nepal Water Supply Corporation |
| SWC | Social Welfare Council |
| SWMRMC | Solid Waste Management and Resource Mobilization Centre |
| WECS | Water and Energy Commission Secretariat |
| WHO | World Health Organization |

## Contents

## 1. Background and Rationale

The fundamental link between environmental protection and economic development was first recognized in the 1972 *Declaration of the UN conference on the Human Environment (Stockholm Declaration).* It has focused world-wide attention on the environmental hazards that threaten human beings. WHO compiled a wide –ranging survey of environmental hazards to human health. Numerous documents have developed the concepts in the *Stockholm Declaration* into strategies for managing the serious environmental problems facing the international community.

After 20 years, in June 1992, the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janerio. It came up with declaration of Principles on Environment and development and an agenda for change during the 21st century, referred to as Agenda 21. Chapter 6 of Agenda 21 deals with sustainable development and health. *Agenda 21* acknowledges the dependence of human health on a healthy environment. It requires all countries to have programs to identify environmental health hazards and to reduce the risks. It has been used as a priority-setting tool for the policies of many international agencies and countries. In response to *Agenda 21*, Government of Nepal prepared the Nepal Environmental Policy and Action Plan (NEPAP)-1993 which was endorsed by the Environmental Protection Council, was the first program to comprehensively articulate the environmental polices of Nepal.

The environmental health was recognized as an issue by the government after the introduction of NEPAP. Based on the NEPAP's sectoral environmental strategies, the Nepal Environmental Health Initiative (NEHI) had been prepared as part of Government of Nepal's continuing effort to incorporate environmental concern into the national planning and development process in 1996 with the support of WHO. But due to the lack of initiative on the part of the government, the draft of NEHI was not ever finalized. Therefore, no major breakthrough was made towards integrating health and environmental issues in the development plans in Nepal till 2000.

Environmental health means well being based on the health of the surrounding environment. Environmental health covers the assessment, correction, control and prevention of environmental factors that can adversely affect health as well as the enhancement of those aspects of the environment that can improve human health.

WHO has defined environmental health as "the control of all those factors in man's physical environment which exercise or may exercise deleterious effect on his physical development, health and survival". Environmental health involves those aspects of public health concerned with the factors, circumstances, conditions in the environment or surroundings of humans that can exert an influence on health and well- being. Environmental Health provides the basis of public health. Improvement in sanitation, drinking water quality, food safety, disease control and housing conditions are central to the improvement in the quality of life.

On behalf of Ministry of Health, Nepal Health Research Council (NHRC) with the support of WHO carried out "Situation Analysis of Environmental Health in Nepal in 2002". It has covered major environmental health issues such as water pollution, air pollution, municipal solid waste, noise pollution, food safety, excreta disposal, hazardous waste. Nepal Health Research Council and World Health Organization in coordination with major stakeholders of environment and health sectors prioritized the Nepal Environmental Health Research Areas in 2006 which includes issue of water, air, waste, pesticides, occupational health and safety, food safety/security, climate change, road traffic accident and cross-cutting issue such as knowledge, attitude, practice, policy, economy etc. In 2009, NHRC with the support of WHO conducted and updated "Situational Analysis of Environmental Health in Nepal 2009" covering major issue of Water pollution, air pollution, and solid waste includes hazardous waste and climate change. In order to develop the synergy among the partners working in the field of environment and health to promote environmental health in Nepal, it is aimed to develop Nepal Environmental Health Action Plan (NEHAP). NEHAP is a broader conceptual action plan which provides mandate as well as guidance to all of the environmental health related sectors. Environmental health is a multi sector activity which covers numbers of environmental related sector linking with public health. In the context of Nepal, Environmental Health problems covers Water, Waste water,

Sanitation, Solid waste, Health care Waste, Indoor/Outdoor Air, Food safety, Road Safety, Chemical safety and Healthy setting and Climate Change. In this activity present environmental status has been assessed, linked with public health and action outlined for improvement or maintenance of the required condition. In this action plan following themes are covered.

- Air Pollution
- Water Supply and Sanitation
- Food Safety
- Climate Change
- Solid Waste
- Healthy Setting
- Road Safety
- Health Care Waste
- Chemical Safety

## 2. Objectives

The overall objective was to develop Nepal Environmental Health Action Plan (NEHAP) through assessment and consultation with related stakeholders.

## 3. Methodology

In order to achieve the objectives and obtain the major outcomes of the study, both the primary and secondary data were collected from relevant sources. Most of the data collected were mainly from the secondary sources by visiting concerned organizations/ministries and browsing information from the websites of all concerned organizations. The primary data were collected from the key informant using the method of interview. In order to make the work easier, national experts who have occupied key position in the thematic area were selected and requested to prepare the thematic papers. These thematic papers were finally synthesized to produce draft Nepal Environmental Health Action Plan (NEHAP). Then consultative meeting with stakeholders and experts at Nepal Health Research Council was organized to prepare the final NEHAP. The list of participants is attached in Annex I.

# 4. Present Scenario/Situation

## 4.1 Air Pollution

Air pollution is one of the major environmental health issues in Nepal. The present situation of air quality in Nepal is not available except in Kathmandu valley. The air quality monitoring stations of Kathmandu valley are also not functional since March 2009. The available data reveals that PM10 parameter is high compared to NAAQS 2003.

**Key Intervention to Improve Air Quality in Kathmandu Valley are as follows:**

1991: Ban on registration of new three wheelers to the response of growing problem of air pollution in Kathmandu Valley.

1995: Endorsement of vehicle emission standards & testing and on-road monitoring of in-use vehicles.
Petrol and Gas operated - CO% and HC and Diesel operated- HSU
Provision of green, yellow and red sticker is adopted on emission test results.

1997: Promotion of ZEVs (Zero Emission Vehicles) through custom subsidy on electrical vehicles/parts and trainings to auto-mechanics to reduce vehicle emissions.

1997: Introduce lead free gasoline in Katmandu valley from July 1997 and only unleaded gasoline has been distributed in Nepal from Dec 1999.

1997: Promulgation of Environment Protection Act & Regulations

1999: Phase out of more than 600 Diesel 3-wheelers (Vikram Tempo) from Kathmandu Valley as well as Ban on entrance in Pokhara and Lumbini.

1999: Ban on import of new 2 stroke vehicles and second hand vehicles

1999: Restriction of entrance to the city center in Kathmandu valley for vehicles without green sticker.

2000: Ban on entrance of truck, power taller, tractor, municipal waste transporters etc during 8AM to 7 PM inside the ring road.

2000: Introduction of Nepal Vehicle Mass Emission Standard (Euro I equivalent)

2001: Government announced annual budget including 10% additional tax per year on vehicles older than 15 years.

2002: Establishment of Ambient Air Quality Monitoring System with six permanent stations in Katmandu valley ($PM_{10}$, $PM_{2.5}$, Pb, TSP, NOx, SOx, Benzene)

2003: Introduction of National Ambient Air Quality Standards (NAAQS)

2004: Ban on running Moving Bulls Trench Kiln in Kathmandu Valley and has stopped registration of these kilns.

2005: SDC supported in demonstrating cleaner technology for brick production as a promotion of Vertical Shaft Brick Kilns (VSBK) technology.

2006: Preparation of Action Plan Report on AQM

2008: Introduce standard on chimney height and emission for brick kiln industry.

2009: Indoor Air Quality Standards and Guidelines endorse

**Current situation of Policies and Legislation addressing Air Pollution in Nepal**

**Sustainable Development Agenda for Nepal, 2003** includes various objectives such as; setting strictly enforced ambient air quality standards, exceeding which requires immediate cuts in activities responsible for emission; encouraging shift towards zero-emission vehicles and cleaner fuel in industries; promoting cleaner stove technology and alternative cooking fuels.

**National Conservation Strategy, 1987** mentions the problem of air pollution in urban and industrial areas and highlights the need for EIA of proposed projects.

**Industrial Policy, 1992** mentions the need to minimize adverse environmental effects during industries development and calls for guidelines development to control pollution and tax benefits for investments in activities related to pollution control.

**Industrial Enterprises Act, 1992** declares industries dealing with energy efficiency and conservation and pollution abatement as nationally prioritized industries and can receive tax rebates up to 50% of taxable income.

**Nepal Environmental Policy and Action Plan (NEPAP), 1993** recognizes the need to address urban and industrial pollution and calls for appropriate legal and institutional mechanisms and also stresses the need for EIA.

**Transportation Policy, 2001** pays special attention to reducing harmful emissions arising from public transport operations. Also, it has provisions to expand the use of electric vehicles, limit the traffic density, ban on import of older vehicles, tax and customs' rebates for pollution free vehicles.

**Vehicle and Transport Management Act, 1993** makes road worthiness certificates mandatory and has set standards for emission from in-use vehicles.

**Environment Protection Act, 1997** deals with 'Prevention and Control of Pollution' and restricts people from causing pollution that will have adverse effects on environment and public health. It also has a provision for the appointment of Environmental Inspectors to carry out inspection and examinations and stop activities that cause pollution. It further has a provision to provide additional concessions and facilities to encourage any industry, enterprise, technology, or process that causes positive impacts on environmental protection.

**Environment Protection Rules, 1997** prohibits emission of noise, heat, radioactive material, and waste that cause problem to public health.

**Montreal Protocol** regulatory measures have also been introduced to address the problem of ozone depletion substances (ODS) and Nepal is a signatory to the Montreal Protocol, and the NBSM has been designated to implement it.

**Male Declaration on Control and Prevention of Air Pollution and its likely Trans-boundary Effects for South Asia,** was agreed to initiate and/or carry forward programs of assess and analyze the origin and causes, nature, extent and effects of local and regional air

pollution, building up or enhancing capacities in them where required; Develop and/or adopt strategies to prevent and minimize air pollution; set up monitoring arrangements; work towards securing incremental assistance from bilateral and multilateral sources; Encourage economic analysis; Engage other key stakeholders

## 4.2 Water, Sanitation and Hygiene

One of the three major objectives of the water and sanitation services, as stated in the Rural Water Supply and Sanitation National Policy 2004, is to reduce the water borne diseases and its victims in the nation. Similarly, Urban Water and Sanitation Policy, 2009 which endorses 6 core principles of which Public health is the one, states one of its objectives as "To reduce the incidence of water, hygiene and sanitation related diseased in urban areas".

**Present scenario in water, sanitation and hygiene sector:**

Government of Nepal has been giving the prime importance to the improved water supply and sanitation facilities including hygiene for more than two decades. The budget allocation during the last five fiscal years for Department of Water Supply and Sewerage- the lead agency for the sector shows that the resources allotted for the sector is in increasing trend (DWSS, 2010).

Development of infrastructures for safe water and improved sanitation facilities and implementation of awareness-raising programs aim ultimately to improve people's health and their living standards. The progress so far in water supply coverage (access to safe water) and in sanitation (access to improved toilets) is 80% and 43% respectively (DWSS, 2010).

In order to meet national target in water supply coverage, about 919 thousand people need to get access to safe water every year until 2015. As far as MDG goal (of halving, by 2015, the proportion of the people without sustainable access to safe drinking water and basic sanitation) is concerned in Nepal, the target for access to water has been already achieved, but to meet the target for sanitation, about 612 thousand people (112 thousand HH) still need to get access to improved sanitation facilities every year until 2015. The functional status of water supply schemes seems poor as shown by the data from DWSS. Out of the total water supply schemes only 18 % of the total schemes are well managed, 39 % require minor repair works whereas 12%

requires major repair and about 30% in need of rehabilitated or reconstructed (DWSS, 2010*)*. In addition to providing basic level of water supply service to people un-served till now, the sector has responsibility to upgrade the service level too for people thriving with the socio-economic growth.

**National legislations (acts, regulations), standards, policies and programs:**

*National Sanitation Policy (1994)* stressed for coordination among concerned stakeholders and directed to operate sanitation program in an integrated manner with health, education, water supply and local development program.

*Water Resources Act, 1992, and Water Resources Regulations 1993* forms base for legal framework for equitable use, protection, development and management of surface or ground water resources; for identifying beneficial uses of water resources and to control of pollution and adverse impacts that may arise by such uses and for keeping water resources free of pollution.

*National Drinking Water Quality Standards, 2062 and National Drinking Water Quality Standards Implementation Guidelines, 2062* has provided the maximum and minimum concentrations of various parameters of the drinking water quality as well as the approach and basis for the water quality testing, monitoring and surveillance for water system designers, operators and service providers respectively.

*The Nepal Water Supply Corporation Act 2nd Amendment (2007), Water Supply Management Board Act (2006) and Water Supply Tariff Fixation Commission Act (2006):* These documents facilitate the improved management of Kathmandu Valley's water and sanitation services and give the legal basis for private sector management of schemes and independent fee setting and regulation and are applicable to all urban schemes.

*Rural Water Supply and Sanitation National Policy and Rural Water Supply and Sanitation National Strategy and Sector Strategic Action Plan (2004),* reinforces various means to strengthen partnership, institutional arrangements and sector coordination along with the principles of decentralization and plans to renovate, rehabilitate, improve and expand existing water supply and sanitation systems and to increase the quality of services.

*National Water Plan (2005),* aims at universal coverage of safe drinking water and sanitation by 2017 which is also compatible in line with the Tenth Plan.

*National Urban Policy (2007)* identifies some of the key issues such as poor sanitation, environmental degradation, and lack of services for the urban poor as areas requiring urgent attention.

*Three Year Interim Plan –TYIP (2007-2010),* highlights the need of sector wide approach (SWAP) in water supply and sanitation sector. It has mentioned promotion of sanitation as the integral component of water supply project and has targeted to achieve 60 percent sanitation coverage within the planned period thereby boosting up sanitation movement in the sector.

*Approach Paper of Three Year Plan (2010/11-2012/13)*

In order to improve the general standard of living of the people of Nepal, namely the health status by providing safe and adequate water supply and sanitation in a sustainable manner. The paper emphasized gradually to incorporate the sector wider approach to planning (SWAP) in water and sanitation sector. It further highlights the sanitary sewerage and micro-level treatment plants in the appropriate area to improve the sanitation and hygiene situation.

*Sanitation and Hygiene Master Plan (2010):* a guiding document to create an enabling policy environment for achieving the national target through collaborative efforts of stakeholders in an accelerated manner. The Master Plan has well recognized the roles of the local bodies to coordinate, facilitate, and lead sanitation and hygiene related programs and activities.

## 4.3 Food Safety

Access to safe food is essential for life and is indeed the foundation for health. Unsafe food is hazardous to human life and therefore, food safety needs very careful consideration. Food safety is defined as **"**All conditions and measures that are necessary during the production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, and wholesome and fit for human consumption"**.** It is the basic human rights to have access to safe food.

**Major issues in food safety in the context of Nepal**

In Nepal, the government agency for execution of food legislation is Department of Food Technology and Quality Control (DFTQC) - a government department under the Ministry of Agriculture and Cooperatives. The existing food legislation is not adequate to address the present day realities of issues of food safety.

The agencies involved for the implementation of different activities on food safety under different act/rules is listed below.

**Table 1: Agencies working with food safety**

| **Act/Rules** | **Agencies/Institutes** |
|---|---|
| Food Act 1966 | DFTQC, MoAC |
| Food Regulation 1970 | DFTQC, MoAC |
| Consumer protection Act 1998 | DoC, MoCS |
| Consumer protection Rules 2000 | DoC, MoCS |
| Slaughterhouse and Meat Inspection Act 1998 | DLS, MoAC |
| Slaughterhouse and Meat Inspection Rules 2000 | DLS, MoAC |
| Local self-governance Act 1999 | Local Govts, MoLD |
| Local self-government Rules 2000 | Local Govts, MoLD |
| Nepal Standards (Certification mark) Act 1980 | NBSM, MoI |
| Nepal Standards (Certification mark) Rules 1983 | NBSM, MoI |
| Standard weights and Measures Act 1968 | NBSM, MoI |
| Standard weights and Measure Rules 1978 | NBSM, MoI |
| Animal health and livestock service act 1998 | DLS, MoAC |
| Animal health and Livestock service Rules 2000 | DLS, MoAC |
| Breast feeding substances (Sales & Distribution control) Act 1992 | DH/DFTQC, MoHPP/MoAC |
| Breast feeding substances (Sales & Distribution control) Rules 1994 | DH/DFTQC, MoHPP/MOAC |
| Iodized Salt (Production, Sale and Distribution) Act 1999 | DH/DFTQC, MoHPP/MoAC |

| | |
|---|---|
| Feed Act 1976 | DFTQC, MoAC |
| Pesticide Regulation Act 1991 | DoA, MoAC |

***DFTQC**: Department of Food Technology and Quality Control, **MoAC**: Ministry of Agriculture and Cooperatives, **DoC**: Department of Commerce, **MoI**: Ministry of Industry: **MoCS**: Ministry of Commerce and Supplies, **DLS**: Department of Livestock Services, **MoLD**: Ministry of Local Dev, **NBSM:** Nepal Bureau of Standards and Metrology, **DH:** Department of Health, **MOHPP:** Ministry of Health & Population: **DoA**: Department of Agriculture*

In Nepal, the food contaminants analysis facility is poor. Capacity building in terms of both the physical facilities as well as human resources is essential, so that present challenges of contaminants can be estimated. Recently, some municipalities have initiated for the establishment of food laboratory with basic food testing facilities. Further, food safety education programs for providing information to public are inadequate. There is a strong need of training and education both for the food industry and the consumers.

In Nepal, present situation of food safety is not encouraging. According to DFTQC report, the food adulteration rate in Nepal is 15.6% in the fiscal year 2009/10. Processed drinking water, processed milk and refined edible oil are the major sub-standard food products in the market. In the same fiscal year, in total 3064 food and feed samples were collected as per the Food and Feed Acts during market inspection of 46 different districts from the Quality Control Division under this department, 5 regional offices and 20 food inspection units. Among them 332 samples were found to be substandard, which is 11% of total collected samples (DFTQC, 2010).

## 4.4 Climate Change

Developed countries are mainly responsible for emitting Green House Gases (GHGs) and enhancing the phenomenon of climate change, while developing countries are most vulnerable to the impacts of climate change. Though GHGs emission of Nepal is negligible (0.025%) of global emission, Nepal, being a Least Developed Country, is highly vulnerable to the adverse impacts of climate change. Nepal has experienced temperature warming since the last few decades. The temperature data of 49 stations between 1971 and 1994 throughout the country reveals that there has been a warming trend, particularly after 1977 with 0.06$^{o}$C to 0.12$^{o}$C per year in most of the

hills and the mountains. While in the Terai, the warming trend is less than 0.03$^{o}$C per year (Shrestha et.al 1999). Based on the base year 2009, the mean annual temperature across Nepal is projected to increase by 0.5–2.0ºC with a of 1.4º C by 2030, 1.7-4.1ºC with a mean of 2.8ºC by 2060, and 3.0-6.3ºC with a mean of 4.7ºC by 2090.(NCVST 2009)

Being a mountainous country, it exhibits huge spatial and temporal variations of climatic elements. Based on the findings of various studies, discussions with the communities and perceptions of the people have shown that the variations in temperature have direct impact on health of the people. A number of possible climate change-related impacts can therefore be expected to occur on human health and ecosystems of the various environments in the country. It is also observed the variation in monsoon rainfall pattern, such as the intensity of rainfall pattern has increased but the total volume of precipitation has decreased. It is noted that it has affected the ecosystem such as loss of biodiversity, threatening to food security through adverse impacts on winter and spring crops, shifting of hydrograph cycle, including drying up of water resources, increasing flash floods, possible droughts, and glacial lake outbursts, and changing environmental condition which eventually affecting human health through emerging different types of new diseases (MOPE 2004).

Nepal has prepared the National Adaptation Programme of Action (NAPA) in 2010, which is a requirement under the United Nations Convention on Climate Change for all Least Developed Countries (LDCs) party to the Convention. One of the major components of NAPA is public health. It has identified major public health impacts caused by climate change and adaptation measures to reduce them. Nepal Health Research Council and World Health organization are also involved in climate change and public health impacts research for generating evidences in Nepal.

## 4.5 Solid Waste

Solid waste includes waste arising from human and animal activities that are discarded as useless and unwanted that are solid in nature that includes heterogeneous throwaways from urban communities as well as homogeneous accumulation of agricultural, industrial and mineral

wastes. Waste can be a source of both earnings and savings in the local economy. Along with waterways, solid waste is one of two main carriers and propagators of infectious disease in cities and the main host environment for vermin. Slightly over 14% of the population lives in Nepal's 58 municipalities, they generate more than 80% of all solid waste (SWMRMC, 2004).
In Nepal, according to the Local Self-Governance Act, 1999, municipalities are responsible for managing solid waste, but municipalities generally do not have the necessary skills or resources to manage the waste in the proper manner. On average the 58 municipalities in the country are spending about 13 percent of their total budget on waste management related activities (SWMRMC, 2004), but in most cases this amount is not being spent in an efficient manner.

Municipalities, for managing the waste, are expressing their desire to develop final disposal system even though collection systems are still not in place. They are also promoting waste reduction, reuse, and recycling among the communities. The disposal of waste into local rivers has adversely affected the quality of water and the aesthetic value of rivers and cities. In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries. Direct exposure to chemicals in hazardous waste such as mercury and cyanide can be fatal.

**National Legislations: Acts, standards, Guidelines, Policies and programs**

**Solid Waste Management and Resource Mobilization Act, 1987,** authorizes SWMRMC to take action to control haphazard waste disposal and to collect service fees. Likewise, the act has provisions for various punitive measures against those engaged in activities detrimental to the intentions of the Act.

**The Nepal Environment Policy and Action Plan, 1993 (NEPAP, 1993)** suggests that Solid Waste collection and disposal be organized and managed at the ward level, including the levying and collection of fees from residents. The Sector Action Plans of NEPAP incorporates a number of specific project proposals in relation to Solid waste Management such as: the development of waste exchange and waste minimization program for industries; the development of Waste Act; the development of National Waste Management Policy; Waste Management through Private Sector.

**The Environment Protection Act, 1997** prohibits haphazard waste disposal, which will have an adverse impact on environment or civic health.

**Environment Protection Rule, 1997 (with amendment),** has mandatory provision to conduct Initial Environmental Examination or Environment Impact Assessment of Solid Waste Management Projects depending on their nature.

**National Waste Management Council, 1996,** works as a technical arm of the Ministry, and is responsible for national policy making. The National Solid Waste Management Policy adopted in 1996 is a major step forward in this endeavor.

## 4.6 Healthy Setting

Smart investment in the built environment is the foundation of a healthy community. The location of the parks, supermarket, and schools (among other things) directly affect the health of an individual. And as people gravitate toward urban areas across the globe, we see increased demand on infrastructure, housing, and services.

Urban health is complex because the solutions to health challenges in towns and cities do not lie with the health sector alone but with decisions made by others: in local government, education, urban planners, engineers and those who determine physical infrastructure and access to social and health services. Healthy setting is the setting having provisions/ policies / plans to improve environment and health conditions continuously.

In Nepal, Healthy City Program (HCP) was incorporated in 1994 through Nepal Environment Health Initiative (NEHI) initiated by Government of Nepal in collaboration with WHO. In 2000 Department of Urban Development and Building Construction (DUDBC) and World Health Organization (WHO) began coordinating their programs on Healthy City efforts for the plan of action. Since then, Healthy City Programs have been implemented in thirteen municipalities (DUDBC).

**National Legislations: Acts, Standards, Guidelines, Policies and programs**

**THE TOWN DEVELOPMENT ACT, 1988,** empowers the Town Development Committee to regulate, control or prohibits any act or activity which has an adverse effect on public health or the aesthetics of the town, or in any way pollutes the environment. It contains penalty provisions in the form of fines for the violation of the Act.

**LOCAL SELF GOVERNANCE ACT, 1999** Municipalities are responsible for managing domestic solid waste. Municipalities are also supported to preserve water bodies such as lakes and rivers, assist in controlling water, air, and noise pollution and prevent the spread of infectious disease.

## 4.7 Road Safety

Development of socio-economic, science and technologies has changed the lives and the prosperity of the human being. Today, human activities are not possible without the means of transportation (air, land and sea) but at the same time their safety management has become a global concern. Among them, Road Traffic Accidents (RTA) and related injuries are becoming a silent issue in public health (physical and mental) because of huge economic cost involved in it.

Annual burden of road crash costs is about US$518 billion globally (NHRC, 2009) where five million people were killed due to injuries in 2000, out of them approximately 1.2 million people died of road traffic incidents. In Nepal too, road deaths have been increasing at the rate of 5.41% annually. Traffic injuries and public health is the systematic approach to the motor vehicle related injury which is predictable and preventable public health problem.

Nepal had initiated road safety strategies from 1994/5 but till the date it lacks workable collaborative national policies and implementing guidelines at national to local level. Therefore, a successful Road Safety Audit (RSA) policy needs integrated approach of concerned organizations with considering road safety as public health.

Rapid urbanization, construction of roads and manufacturing of transportation have made livelihood and quality of life easier and faster for world population. Realizing all these adverse impact on sustainable environmental and future of the living being, environment should be protected with a collective action plan.

**Nepal's situation**

**Road Network**

Road transport is the major public transport system in Nepal apart from limited air service to major places in the country. At present, there is about 17,782 km of strategic road network, which includes 5, 402, km blacktop; 4,529 km gravel and 7,851 km earth roads (Three Year Interim Plan 2007/08-2009/10, pp: 365-367). The National Highway from East to West, namely Mahendra Rajmarg, 1024 km, is part of Asian Highway 2. Another National Highway connecting Birgunj to Kodari, 393 km is part of Asian Highway 42, which joins the Indian border in South to the China border at North (DoTM, 2010).

**Vehicle Population:**

First vehicle entered Kathmandu Valley was in the year 1942 which was carried by men. There were 76,378 vehicles registered in 2046/47 B.S. (1990/91) whereas, nearly 20 years later, its number rose up to 10, 15,271 in 2066/67 (2009/10) with highest share of two wheelers 7, 44,727 (63%) (DoTM, 2010).

**Road Safety Problem:**

In Nepal, till 80s more focus was in developing road length by constructing new roads with very low consideration on maintenance and road safety. Most of the roads and bridges did not have walkways and safety features. The road intersections, blind curves, and bridge approaches were the most vulnerable spots for the motorists as well as the pedestrians.

**Road Accidents:**

Only those accidents with high injury, property damage or with disputes are reported and recorded in the police office. A study prepared by the Department of Transportation found that more than 64 percent of traffic accidents are due to human errors and deficiencies. Environmental factors cause approximately 19 percent of traffic accidents, and vehicle causation factors comprise the rest (J.R. Treet, 1979, p. 7). Speeding as a cause of accident appears to be problem with young drivers.

Similarly, in Nepalese context too the causative factors of Road Traffic Accidents (RTA) are found same in nature. Total number of road traffic accidents was 22138 for the period 2006 - 2010 Human factors accounted for 73% of the total RTAs in the period 2006-2010. (Traffic Directorate, 2010)

**National Legislations, guidelines, policies and programs:**

**Road Safety Law and Enforcement:**

Nepal police was the main institution for traffic management in accordance with the first Vehicle Act that was enacted in 1964 followed by Transportation Management Act, 1970. This, later was combined with Vehicle and Transportation Management Act, 1993 (VTMA) and VTM Regulations, 1998 replaced them. Besides VTMA, the Public Road Act, 1975; Local Self-Governance Act, 1999; and Road Board Act, 2002 also considers some part of road safety.

**Vehicle and Transportation Management Act, 1993 (VTMA)** has its with main objectives as to prevent the vehicle accident, compensation to the affected people, manage insurance, and make the transportation service to be easy and cost effective. To fulfill its objective it basically incorporates management of transport, vehicle, drivers, traffic, insurance, education, and certification.

**Local Self-Governance Act, 1999 (LSGA)** empowers the District Development Committees (DDCs) and the Municipalities to manage the district and urban roads. In considerations with road safety it envisages to implement clearing the road from obstacles, confiscation of stray animals, and fixation of streetlights, provide parking facilities, and control registration of non-motorized vehicles.

## 4.8 Health Care Waste

Health Care Institutes generate large amounts of diverse wastes. With the steady increase in the number of health care institutions in Nepal, the amount of health care waste (HCW) generated is also increasing. It was estimated that total amounts of health care risk waste generated by health care facilities in Nepal in 2001 was 20,18,450 Kg per year (with 0.5 kg/patient/day) (MOH, 2003). In addition to increasing quantity, the composition of HCW is also rapidly changing affecting its sound management. However, the majority of the HCI in Nepal do not practice safe waste handling, storage and disposal methods. So far, there is no separate mechanism for the treatment of health care waste. Sound management of health care waste has become a need to safeguard the public health from adverse effects caused due to improper management of healthcare waste. In recent years, healthcare waste disposal has become even more difficult due to increasing number of health facilities and use of disposal needles, syringes and similar items. Review of literature reveals that many studies and surveys have already been conducted related to health care waste management in Nepal. Studies reveal that majority of health care institutions do not practice safe waste handling, segregation, transportation and disposal methods. The key recommendation of almost all studies is to formulate and implement the national legislation of health care waste management. In Nepal, there are many policies, plans and Acts related to health and environment. But, there is no any special policy and Act related health care waste management in Nepal. Though the development plans recognized the importance of solid waste management issues, the policy lack emphasis on health care waste related issues.

**Three Year Interim Plan (2007/08-2010/11)** has a plan mentioning that Program on Health Care Waste Management will be conducted.

**The Environment Protection Act, 1997** states that an EIA is necessary prior to the development of any health care facility with 25 or more beds (Now IEE for hospital with25-100 beds and EIA with100 or more beds (EPR 1997 with amendments). Safe disposal of Health Care waste is also made mandatory for this category of health care facility.

**Fact Sheet on Health Care Waste Generation in Nepal**

- 92 Governmental hospitals among
  - 67 are under MOHPP
  - 3 Community running hospitals
  - 8 Teaching hospitals
  - 14 NGO`s hospital
- 74 private health facilities/nursing homes
- 16 Eye hospital
- Medical Waste composition:
  23% infectious, 3% sharps, 12% Saline bottles, and remaining 62% Non-infectious.

- Infectious waste generation rate is 0.48 kg/person/day
- Total medical waste generation rate is 1.7 kg/person/day.
- Average Incinerable waste is 396.77 gm/day/bed
- On an average, a 150 bed hospital has about 50 to 100 thermometer breakage in a month and each thermometer contains mercury from 0.5 to 1 grams.
- 1 gram of mercury has been used for dental restoration in 4 patients in average for the mercury amalgam filling.
- Similar figures of waste generation can be perceived for the private hospital as well as clinics.

**MOHP 2009, Ale Devika 2005 NHRC 2002, ENPHO 2000, CEPHED 2006, 2008.**

## 4.9 Chemical Safety

Currently about 200 tons of active ingredients of pesticides are consumed in Nepal as more than 300 commercial formulations (MoE, 2007). Government has periodically received pesticide from international sources as donation and aid and also purchased. The pesticide remains unused and stored in several places. Total obsolete pesticide remains in 25 locations in Nepal are about 74 tons, threatening local environment and public health (MoE, 2007).

Chemicals in Nepal (either imported or formulated in the country) are used mainly for four purposes (agrochemicals, industrial chemicals, pharmaceuticals, chemicals in research institutions and academia. An unbalanced use of fertilizers is widespread, especially in areas where commercial production of crops has already started. No specific legislation, except for regulation of pesticides and pharmaceuticals, exists for the regulation of industrial and consumer chemicals (Devkota B. 2010)

### Heavy Metal in the Nepalese Environment and Products

Lead in Paints available in Nepal (CEPHED, 2010).

- In general, all brands (international, multinational and national) and all types (distemper, emulsion, enamel, varnish and touch wood) of paints available in Nepal contains lead.
- Maximum value of lead in paints in all samples is 73966.4 ppm (822 times higher than USA Standard for lead in paints. Minimum value is 3.98 ppm much below than standard.
- All 7 Enamel paints samples with Nepal Standard (NS) marked paints contain very high amount of lead. Lead in NS marked Enamel paints ranges minimum of 2070.99 ppm (23 times higher than standard) to maximum up to 73966.4 ppm (822 times higher than US standard).

Health Care Foundation (HECAF) has conducted a study to assess the level of mercury in different environment media (air, water and soil) in Kathmandu as well as in Pokhara and the result of study shows very high level of mercury contamination in the health care institutional indoor environment, in the soil of the outer environment in waste dumping area of the hospital (HECAF 2010).

# 5. Linkages with Public Health

## 5.1 Air pollution

Health effects of air pollution can be both *short-term* and *long-term*. Young children and elderly people often considered as vulnerable group suffer more from the effects of air pollution. The extent to which an individual is harmed by air pollution usually depends on the **total exposure** to the damaging chemicals, i.e., the *duration of exposure* and the *concentration of the chemicals* must be taken into account.

Examples of **short-term effects** include irritation to the eyes, nose and throat, and upper respiratory infections such as bronchitis and pneumonia, aggravation of existing medical conditions, whereas that of **Long-term health effects** include chronic respiratory disease, lung cancer, heart disease, and even damage to the brain, nerves, liver, or kidneys.

Different types of air pollutants affect the human health in various ways. Apart from the human health impact, other areas of the impact of air pollution include ecosystem health, agriculture, forestry, biodiversity, cleaning and laundry, buildings and monuments, visibility reduction, traffic accidents, aesthetic and tourism.

A study done by NHRC/WHO in 2008 revealed that about 50% cases of acute lower respiratory tract infections (ALRI) were attributed to indoor air smoke in Dhading district and total

Disability Adjusted Life Years (DALYs) was 1284 due to ARI. Existence of similar situations can be assumed across other parts of the country (NHRC, 2008).

Persons exposed to solid bio-fuel smoke show higher prevalence of respiratory abnormalities as compared to clean fuel users and ARI prevalence is found to be 16.8% as compared to processed fuel which is 7% (NHRC, 2004). The total cost of indoor air pollution is US $ 147.3 million which is almost 2% of Nepal's GDP. Furthermore, the total economic cost of urban air pollution in Nepal is estimated at about US$ 21 million (0.29%) of Nepal's GDP (World Bank, 2008).

However, Human health impact, which has two facets – Mortality and Morbidity, are always in the top agenda for the policy makers and hence has the highest influence in the decision making process.

Health impact of air pollution can be various as evidenced by studies. The health burden estimates of $PM_{10}$ (NHRC, 2004), based on Ostro's method for the year 2004 estimates an excess premature mortality per year to be around 212 at the current level of concentrations against NAAQS values. A recent estimate of impact of air pollution on human health by using WHO's Air Quality Health Impact Assessment Tool (Air Q 2.2.2) shows the excess mortality due to air quality situation in Kathmandu is 900 per million populations.

Acute Respiratory Infection (ARI) is one of the major killers of children under 5 years. The total number of new ARI cases among under five children was 2.851,111 in 2008/09. The number was 1,498,359 and 2,274,046 respectively in the year 2006/07 and 2007/08. Similarly, the incidence also had an increasing trend in these three years. The incidence of ARI new cases/1000 was 408, 615 and 765 for the year 2006/07, 2007/08 and 2008/09 respectively (DoHS, 2010).

In the fiscal year 2065/066 ARI constituted the second highest percentage (3.69 % to total population) of OPD morbidity nation-wide (DoHS, 2010).

By reducing air pollution levels, we can help countries reduce the global burden of disease from respiratory infections, heart disease, and lung cancer. More than half of the burden from air pollution on human health is borne by people in developing countries. In many cities, the average annual levels of $PM_{10}$ (the main source of which is the burning of fossil fuels) exceed 70 micrograms per cubic metre. The guidelines say that, to prevent ill health, those levels should be lower than 20 micrograms per cubic metre. (WHO, 2008)

## 5.2 Water Supply and Sanitation

Globally, diarrhea is the leading cause of illness and death, and 88% of diarrheal deaths are due to a lack of access to sanitation facilities together with inadequate availability of water for hygiene and unsafe drinking water (JMP).

Approximately, 80% of all diseases may be attributed to water and sanitation related causes and account for around 10,500 child deaths each year from diarrhea diseases such as dysentery, jaundice, typhoid and cholera (UNICEF 2011).

Diarrhea is still a leading killer disease under five children in Nepal. This can be evidenced by the increasing number of total diarrheal cases in Nepal. The number of total diarrheal cases including HF and Community level was 680,819, 1,398,106 & 1817498 respectively for the year 2006/07, 2007/08 and 2008/09. Similarly, the incidence of Diarrhea/1000 < 5 year population is 185, 375 and 488 in those years. However, diarrheal deaths show a slightly different pattern. The number of diarrheal deaths in the above mentioned years is 113, 206 and 147 respectively (DoHS, 2010).

Extension of access to safe drinking water and basic sanitation is highly cost effective health intervention (WHO, 2000). The quality of drinking-water is a powerful environmental determinant of health. Assurance of drinking-water safety is a foundation for the prevention and control of waterborne diseases.

Water, sanitation and hygiene have important impacts on both health and disease. Water-related diseases include those due to micro-organisms and chemicals in water people drink; diseases like schistosomiasis which have part of their lifecycle in water; diseases like malaria with water-related vectors; drowning and some injuries; and others such as legionellosis carried by aerosols containing certain micro-organisms. In the fiscal year 2065/066 Intestinal Worms constituted the highest percentage (3.76 % to total population) of OPD morbidity nation-wide (DoHS, 2010).

Situation of availability of improved drinking water quality and sanitation services also seems poor as evidenced by national factsheet available from UNICEF. The percentage of population using improved drinking water services in 2008 was 88% in total and 93 % and 87% in urban and rural context. Similarly, the percentage of population using improved sanitation in 2008 was 31, 53 and 27 % respectively for total, urban and rural population (UNICEF, 2011).

Water also contributes to health, for example through hygiene. Poor water quality continues to pose a major threat to human health. Diarrhoeal disease alone amounts to an estimated 4.1 % of the total DALY global burden of disease and is responsible for the deaths of 1.8 million people every year (WHO, 2004). It was estimated that 88% of that burden is attributable to unsafe water supply, sanitation and hygiene and is mostly concentrated on children in developing countries.

## 4.3 Food Safety

Food safety is defined as **"**All conditions and measures that are necessary during the production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, and wholesome and fit for human consumption"**.** It is the basic human rights to have access to safe food. Lack of safe, sound and wholesome food for human consumption may result in direct impact in individual human health. This effect may finally result in massive health impact.

Serious outbreaks of food borne disease have been documented on every continent in the past decade, illustrating both the public health and social significance of these diseases. Food borne diseases most seriously affect children, pregnant women, the elderly and people already affected by other diseases. These diseases not only significantly affect people's health and well-being, but they also have economic consequences for individuals, families, communities, businesses and countries.

Public health impact due to lack in food safety may result from many ways such as microbiological hazards, chemical hazards, food borne disease etc. In many countries significant increases have been reported over the past few decades in the incidence of diseases caused by microorganisms transmitted mainly by food, such as *Salmonella* spp. and *Campylobacter* spp. Serious hazards have emerged in the food chain, such as enterohaemorrhagic *Escherichia coli* and bovine spongiform encephalopathy. Chemicals are a significant source of food borne illness. Chemical contaminants in food include natural toxicants such as mycotoxins and environmental contaminants such as mercury, lead, radionuclide and dioxins, and naturally occurring chemicals in plants, such as glycoalkaloids in potatoes.

New technologies, such as genetic engineering, irradiation of food, ohmic heating and modified atmosphere packaging, can be used to increase agricultural production, extend shelf life or make food safer. However, the potential public health effects of these technologies have raised concern globally during the past decade.

The situation of developing countries seems poor when the matter of food safety and impact in public health is concerned. These countries are poorly equipped to respond to existing and emerging food safety problems.

## 4.4 Climate Change

There is broad consensus that climate changes can affect human health. The IPCC fourth assessment report concludes that climate change currently contributes to the global burden of disease and premature deaths. At this early stage the effects are small, but are projected to progressively increase in all countries and regions (IPCC 2007). The health impacts of climate change in the context of Nepal are noticeable. However, studies on health impacts of climate change in Nepal are limited. The health impacts of climate change in the context of Nepal can be summarized as follows.

The climate change impact and sensitive diseases in Nepal are as follows:

- Extreme weather related health impact: cold waves and heat waves in the Terai – lead to increase morbidity and mortality.
- Climate induced disasters: prolonged droughts and flash floods trigger disasters, famines and diseases outbreaks
- Air pollution-related health effects: respiratory diseases like acute respiratory infection (ARI), bronchitis and asthma are in increasing trend.
- Water borne diseases: they include diarrhoea, dysentery, typhoid, giardiasis, amoebiasis, gastritis, jaundice, and infectious hepatitis. The incidence of these diseases is increasing in Nepal by season (temporal) and places (spatial).
- Vector borne diseases: Japanese encephalitis, Malaria, Dengue and Kala-azar (Visceral Leishmaniasis)
- Nutritional, mental and others: include malnutrition, mental diseases and non-communicable diseases including injuries and accidents, which have an increasing trend.

In order to discern the attribution of climate change on above mentioned heath problem, detail study is needed. There is a need of research in national context to understand the actual health problems induced by climate change and formulate the evidenced based adaption strategies. However, there are a lot of research challenges in vulnerable mountainous countries like Nepal to conduct research on climate change and health. The major research challenges are access of information and data, availability of trained human resources, interdepartmental coordination, financial capacity, geographical situation and research methodology (Dhimal 2008).

## 4.5 Solid Waste

Solid Waste piles become feeding grounds for disease vectors, clog drains generating floods and contaminate aquifers vital to the survival of urban populations. Along with waterways, solid waste is one of two main carriers and propagators of infectious disease in cities.

The disposal of waste into local rivers has adversely affected the quality of water and the aesthetic value of rivers and cities. This further adds to the problem of solid waste when the matter is concerned with public health problem due to solid wastes.
Apart from the regular solid waste, wastes generated from industrial sector too pose huge public health problem. In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries. Direct exposure to chemicals in hazardous waste such as mercury and cyanide can be fatal.

The health implications of solid waste also include the pollutant burden contributed by various forms of waste management (including incineration, composting, etc. Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases. Unattended waste lying around attracts flies, rats, and other creatures that in turn spread disease. Normally it is the wet waste that decomposes and releases a bad odour. This leads to unhygienic conditions and thereby to a rise in the health problems.

The group at risk from the unscientific disposal of solid waste include – the population in areas where there is no proper waste disposal method, especially the pre-school children; waste workers; and workers in facilities producing toxic and infectious material. Other high-risk groups include population living close to a waste dump and those, whose water supply has become contaminated either due to waste dumping or leakage from landfill sites. Uncollected solid waste also increases risk of injury, and infection.

In particular, *organic domestic waste* poses a serious threat, since they ferment, creating conditions favourable to the survival and growth of microbial pathogens. Direct handling of solid waste can result in various types of infectious and chronic diseases with the waste workers and the rag pickers being the most vulnerable.

*Waste treatment and disposal sites* can also create health hazards for the neighborhood. Improperly operated incineration plants cause air pollution and improperly managed and designed landfills attract all types of insects and rodents that spread disease. Ideally these sites should be located at a safe distance from all human settlement. Landfill sites should be well lined and walled to ensure that there is no leakage into the nearby ground water sources.

## 4.6 Healthy settings

The environmental quality of urban areas has a dramatic effect on the health status of all urban residents. High population densities, toxic effluents in the soil and water, air pollution, smoke from cooking fires and lack of adequate water, sanitation and solid waste services contribute to

the poor environmental quality of informal urban settlements and the high morbidity and mortality rates of their residents. Nearly half of the waste generated by urban residents in developing countries lays, unseggregated, in open dump sites and on city streets.

Solid waste is a byproduct of human activities which tends to increase with rapid urbanization, improved living standards and changing consumption patterns. If solid waste is properly used, it can be a valuable resource, but if it is not effectively managed, it can result in serious adverse impacts on environment and public health.

In Nepal the major cities have experienced high rates of population growth and unmanaged urban development, which have resulted in an increasing volume of solid waste. The main sources of solid waste are urban households. The increasing size of population has direct as well as indirect impact on the health status of the people and thus upon the healthy setting.

Urban health is complex because the solutions to health challenges in towns and cities do not lie with the health sector alone but with decisions made by others: in local government, education, urban planners, engineers and those who determine physical infrastructure and access to social and health services.

Healthy city concept means process not just outcomes. Any city can be healthy if it is committed to health and has a structured process to work for its improvement. Inter-sectoral approach to health development that focused on the environmental, social, and economic determinants of health aims to put health issues firmly on to the agenda of urban policy-makers.
The rapid rate of urbanization particularly since 1980 has brought about changes in physical and social determinants of health. Effectively addressing health issues in urban areas has become complex and solutions require not only the improvement of the health sector's services, but also changes in the way that the health sector works with other sectors as well as with the community and individuals.

## 4.7 Road Safety

Road Traffic Accidents (RTA) and related injuries are becoming a silent issue in public health (physical and mental) because of huge economic cost involved in it. Traffic injuries and public health is the systematic approach to the motor vehicle related injury which is predictable and preventable public health problem.

"Public health" is the science and practice of protecting and improving the health of *communities* through education, promotion of healthy lifestyles, and research on disease control, health promotion, and injury prevention. As one of the definitions as aforementioned indicates injury

prevention is one of the important component of public health, it is clear that road safety has a direct linkage with public health.

Road construction and management of traffic safety have close linkages with public health issues. The health impact of insufficient road safety can be direct as well as indirect. The linkages can be outlined as below:

- Environmental degradation, deforestation, water-shortage (sources), landslides, rural to urban and road side migration that can create food scarcity as well as public health related problems.
- Demographic change increases the number of vehicle that can create air, noise, dust, water pollution and diseases.
- High number of vehicle crashes and accidents will increase traffic injuries, disabilities and deaths including major surgeries, and long time medication as well as the burden of economic costs from individual to national.

Tremendous global burden of mortality resulting from road traffic crashes, 90% of which occur in low- and middle-income countries has been recognized.
Recognizing that road traffic injuries constitute a major but neglected public health problem that has significant consequences in terms of mortality and morbidity and considerable social and economic costs, and that in the absence of urgent action this problem is expected to worsen.

Road safety and its relation to public health is just not limited to injuries and their prevention but also incorporates the public health burden due to several other issues such as increasing number of HIV AIDS incidence among the vehicle drivers.

Every year more than 1.17 million people die in road crashes around the world. The majority of these deaths, about 70 percent occur in developing countries. Sixty-five percent of deaths involve pedestrians and 35 percent of pedestrian deaths are children. Over 10 million are crippled or injured each year. It has been estimated that at least 6 million more will die and 60 million will be injured during the next 10 years in developing countries unless urgent action is taken (WHO, 2009).

The majority of road crash victims (injuries and fatalities) in developing countries are not the motorised vehicle occupants, but pedestrians, motorcyclists, bicyclists and non-motorised vehicles (NMV) occupants.

The Global Burden of Disease study undertaken by the World Health Organisation (WHO), Harvard University and the World Bank showed that in 1990, traffic crashes were assessed to be the world's ninth most important health problem. The study forecasts that by the year 2020 road crash would move up to third place in the table of leading causes of death and disability facing the world community (WHO, 2009). The following mentioned facts give a clear picture of burden of poor road safety on public health (WHO, 2009):

- These numbers are comparable to the casualties of major pandemics such as tuberculosis or malaria, and in low- and middle-income countries, they continue to increase.
- Worldwide, road traffic injuries are the leading cause of death among people aged 15 to 29, and the second cause of death for those aged 5 to 14
- Every day, more than 1,000 young people under the age of 25 years are killed in road traffic crashes globally.
- More than 90% of the world's fatalities on the roads occur in low- and middle income countries.
- Almost half of those who die in road crashes are pedestrians, cyclists and motorcyclists, collectively known as "vulnerable road users".
- By 2020, unless action is taken, road traffic injuries are predicted to double in low- and middle-income countries.

## 4.8 Health Care Waste

Exposure to hazardous health-care waste can result in disease or injury. The hazardous nature of health-care waste may be due to one or more of the following characteristics:

- it contains infectious agents;
- it is genotoxic;
- it contains toxic or hazardous chemicals or pharmaceuticals;
- it is radioactive;
- It contains sharps.
- it contains carcinogenic agents and gaseous chemicals

Most importantly, the health care waste is either being dumped by the bank of river and landfill site along with household waste or burned openly or in the locally, or in metal drums as well as branded incineration. In either case it pollutes environment with loading of several toxics gases like Dioxin and Furan as well as with the heavy toxic metals like lead, mercury and cadmium etc. All individuals exposed to healthcare waste are potentially at risk of being injured or infected. They include:

- **Medical staff**: doctors, nurses, sanitary staff and hospital maintenance personnel;
- In and out-**patients** receiving treatment in healthcare facilities as well as their visitors;
- **Workers in support services** linked to healthcare facilities such as laundries, waste handling and transportation services;
- **Workers in waste disposal facilities**, including scavengers;
- The **general public** and more specifically the children playing with the items they can find in the waste outside the healthcare facilities when it is directly accessible to them.

The dumping of HCW in uncontrolled areas can have a direct environmental effect by contaminating soils and underground waters. During incineration, if no proper filtering is done, air can also be polluted causing illnesses to the nearby populations.

Quite apart from fear of health hazards, the general public is very sensitive about the visual impact of anatomical waste that is recognizable human body parts including fetuses. The risk of infection from health care waste among patients and the public is much lower. Certain infections, however, spread through other media or caused by more resilient agents, may pose a significant risk to the general public and to hospital patients.
It is suspected that many cases of infection with a wide variety of pathogens have resulted from exposure to improperly managed healthcare wastes in developing countries.
Radioactive waste as that from nuclear therapeutic materials also may have several impacts on public health. In most cases, the concentration of hazardous chemicals present in HCW is generally too low to be considered an occupational problem or a danger to the public. Physical injuries caused by discarded sharps are a more significant risk associated with HCW and may directly contribute to the transmission of microbial infectious agents. In addition, health risks may be generated through the release of toxic pollutants during waste treatment.
Changes in the delivery of health care also result in increasing quantities of waste, part of which may be generated outside health-care settings. Haemodialysis and chemotherapy are increasingly used in patients' homes. Although the public may not have direct contact with the HCW from health-care facilities, there is a high probability that members of the public could be affected by the ever increasing volume of HCW created through patient care in the home. The impact of HCW in low-income countries is very likely to pose a great risk to workers and the public due to poorer practices of waste management and personal protection of workers.

## 4.9 Chemical Safety

Human health is affected not only by the chemicals from industries and other environmental chemical contamination but also the chemical exposures that result from the presence of toxic substances in consumer products. It has long been known that lead and mercury in consumer products can harm human health and especially children. More recently, scientists and civil society activists have also raised alarms about a number of synthetic organic chemicals that are present in consumer products.

Food contamination can take place at various stages of the food chain. Metal content that affect human health increases in some commodities grown in the contaminated soil or atmosphere. Additionally, use of **excessive pesticide** contaminates soil, water and finally enters the food chain and contaminates the food products.

**Food ripening agents** such as calcium carbide may affect the neurological system. Eating fruits ripened in such way may also cause mouth ulcers, gastric irritation and sore throats.

Chemicals contaminating soil is another concern of chemical safety. The concern stems primarily from health risks, from direct contact with the contaminated soil, vapors from the contaminants, and from secondary contamination of water supplies within and underlying the soil.1

Health consequences from exposure to soil contamination vary greatly depending on pollutant type, pathway of attack and vulnerability of the exposed population. Exposure to certain chemicals, pesticides and metals such as chromium, lead can be carcinogenic.

Chronic exposure to benzene at sufficient concentrations is known to be associated with higher incidence of leukemia. Mercury and cyclodienes are known to induce higher incidences of kidney damage, some irreversible. PCBs and cyclodienes are linked to liver toxicity. Organophosphates and carbamates can induce a chain of responses leading to neuromuscular blockage. Many chlorinated solvents induce liver changes, kidney changes and depression of the central nervous system. There is an entire spectrum of further health effects such as headache, nausea, fatigue, eye irritation and skin rash for the above cited and other chemicals.

Not unexpectedly, soil contaminants can have significant deleterious consequences for ecosystems.

# 6. Proposed Action Plan

The action plan is proposed based on identified gaps and required conditions/standards. The Gaps and required conditions/standards are given in Annex II. The proposed Environmental Health Action Plan for Nepal is as follows:

### 6.1 Air Pollution

| Activities | Responsibility | Partner |
|---|---|---|
| Develop an integrated action plan to meet the NAAQS | MoEnv/MoHP/NHRC | EDPs, I/NGOs |
| Review of AAQM Stations of Kathmandu Valley | MoEnv | EDPs, I/NGOs |
| Develop plans/policy for establishment of AAQM Stations in other cities of country | MoEnv | EDPs, I/NGOs |
| Effective Implementation of existing policies/legislations on air pollution prevention | MoEnv/MoTM/MOPPW, MOI | EDPs, I/NGOs |
| Develop & implement monitoring mechanism for air quality and health status | MoEnv/MoHP/NHRC | EDPs, I/NGOs |
| Compliance Monitoring of on Use vehicle and Industries | MOEnv/MOI/MOTM | EDPs, I/NGOs |
| Develop & implement mechanisms for risk assessment | MoHP/MoEnv | EDPs, I/NGOs |
| Research and technology development in the field of air pollution and health protection | NAST/MoHP/MoEnv | EDPs, I/NGOs |
| Develop the coordination mechanism for conducting multidisciplinary research on air pollution and health | NHRC/NAST/MOEnv/MOPPW/MOTM | EDPs, I/NGOs |
| Develop and implement on road vehicle monitoring mechanism | MoEnv/MoTM/MoLD | EDPs, I/NGOs |
| Coordinate & collaborate with other sectors for traffic management in major cities | MoEnv/MoTM/MoLD | EDPs, I/NGOs |
| Coordinate and collaborate with concerned sectors for industrial management | MoEnv/MoTM/MoLD/MoIC | EDPs, I/NGOs |
| Plan and implement greenery development programs in urban areas | MoEnv/MoLD | EDPs, I/NGOs |
| Develop the Alternatives of Solid Biomass Fuel (SFU) in rural Areas | Ministry of Energy/AEPC | EDPs, I/NGOs |
| Implementation of National Indoor Air Quality Standard 2009 | AEPC/MOLD | EDPs, I/NGOs |

## 6.2 Water Sanitation and Hygiene

| Activities | Responsibility | Partner |
|---|---|---|
| Review the National Drinking water Quality Standards 2006 | MoPPW/MOHP | EDPs |
| Develop and implement water quality surveillance mechanism | MoHP | EDPs |
| Water safety plan implementation in all systems of water supplies | MOPPW/DWSS | EDPs |
| Develop and implement Sector Wide Approach for WASH | MOPPW/MOHP | EDPs |
| Recovery of old water supply systems | MoPPW(DWSS) | EDPs |
| Expansion of facilities of water supply & sanitation to the unreached population | MoPPW(DWSS) | EDPs |
| Provision of adequate resource for WASH programs | MoHP/MoF | EDPs |
| Up keeping the newly built /old systems of the water supply and sanitation | MoPPW(DWSS) | EDPs |
| Implementation of unified plan of action of stakeholders under leadership of local bodies | MoHP/MoLD/MPPW | EDPs |
| Enhance PPP/Private sector involvement in WASH | MoHP/MoF/MPPW | EDPs |
| Promotion of cost sharing & resource pooling arrangements at action level to fulfill resource gap | MoPPW/MoLD | EDPs |

## 6.3 Food Safety

| Activities | Responsibility | Partner |
|---|---|---|
| Formulate a national policy on food safety | MoAC (DFTQC)/MoHP | EDPs |
| Update existing Act on Food Safety | MOAC/MOHP/MOLJ | EDPs |
| Develop & implement a surveillance mechanism of food quality and food borne diseases | MOAC/MoHP/MOLD | EDPs |
| Develop & implement a risk assessment mechanism | EDCD/MoHP/NHRC | EDPs |
| Develop a risk communication strategy | MoHP/MoAC/NHRC | EDPs |
| Develop & implement coordination and collaboration mechanisms on food safety on national and international levels | MoAC (DFTQC)/MoHP(EDCD) | EDPs |
| Capacity Development of DFQTC in term of Human and Financial resources | MoF/MoAC | EDPs |

## 6.4 Climate Change

| Activities | Responsibility | Partner |
|---|---|---|
| Integration of health impacts due to climate change into broader developmental plans and programs | NPC | Related Ministries of Nepal Government |
| Develop Climate Change Policy | MOEnv | |
| Research to generate evidence on climate change and health | NHRC/ Research Institutes | MOHP, UN Organizations, EDPS |
| Awareness raising programs on climate change and health to policy makers of health sectors to grass root level health personnel | NHEICC/NHTC/NGOs | MOHP, UN Organizations, |

| | | |
|---|---|---|
| | | EDPS |
| Development of Information, Education and Communication (IEC) and Behaviour Change Communication (BCC) program on climate change and health for public awareness | NHEICC/NHTC/NGOs | MOHP, UN Organizations, EDPS |
| Enhancing the capacity of Disease Outbreak/Investigation and Emergency Response team at all levels in Nepal with the perspective of changing climate | EDCD/NHTC | MOHP, UN Organizations, EDPS |
| Strengthening Forecasting/Early Warning and Surveillance System on Climate Change & Health in Nepal | EDCD/DHM/NHRC | MOEnv, MOHP, UN Organizations, EDPS |
| Community Empowerment and Public Education for responding adverse effects of Climate Change in Public Health | DPHOs/Education Institutes/NGOs | MOE,MOHP, UN Organizations, EDPS |
| Establishment of Integrated Diseases Surveillance | EDCD/MD | MOHP, UN Organizations, EDPS |

## 6.5 Solid Waste

| Activities | Responsibility | Partner |
|---|---|---|
| Advocating for implementation/ enforcement of National guidelines on solid waste management | Municipalities /NGOs | MoLD/NGOs |
| Endorse and enforce Solid waste management Act drafted in 2007 | MOLJ/Parliament | MoLD |
| Develop programs for public awareness on waste management | MoEnv/Academic Institutions/Media | NHEICC/NGOs |
| Develop awareness/training programs in various small and large scale industries on Cleaner Production (CP) | MOI | EDPs/NGOs |
| Develop a mechanism to implement 4R(Reduction, Reuse, Recycle and Recovery) principle | MoLD | EDPs |

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| in all levels | | |
| Promotion of solid waste segregation and composting activities at source level | MOLD/Municipalities | |
| Upgrade the existing facilities for solid waste management | MOLD | |
| Develop proper landfill sites as well as recycling system for management in large scale | MoEnv/MoLD | |
| Develop the Plan for management of electronic waste | MOI | |
| Promotion of Public Private Partnership for waste management | MoEnv/MoLD/MoI | |

## 6.6 Healthy Settings

| Activities | Responsibility | Partner |
|---|---|---|
| Development of national guidelines on healthy city/settings | MOPPW/MoEnv/MoHP/MoLD | EDPs/NGOs/INGOs |
| Have a strategic planning for: Healthy city action plan, Health impact studies of city policies /programs and Environment assessment | MOPPW/MoLD/MoHP | EDPs/NGOs/INGOs |
| Develop health awareness program, Support public initiatives, Build partnerships with CBOs /NGOs/ Business groups | MOPPW/MoLD/NHEICC | EDPs/NGOs/INGOs |
| Strengthen community participation in healthy setting | MoHP/MoLD | |
| Develop plans so as to promote innovation, Support and reward good innovations and replicate successful examples | MOPPW/ MoHP/MoLD | EDPs/NGOs/INGOs |

## 6.7 Road safety

| Activities | Responsibility | Partner |
|---|---|---|
| Develop a national policy on road safety incorporating road safety and health issues | MOHA/MoPPW/MoTM /MoHP/MOLJ | EDPs |
| Establish a national policy guidelines for traffic policing | MoTM/MoHA | EDPs |
| Establish a high level road traffic authority to have laws/regulations in line of reducing traffic accidents, injuries and deaths | MOHA/MoTM/MoPPW/MOHP | EDPs |
| Review of prevailing acts/regulation on road traffic system | MoHA/MOTM | EDPs |

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| Review existing plans/policies on issues related to RTAs, injuries/deaths to avoid/prevent unintentional fatal accidents | MoHA/MoTM | EDPs |
| Establish a mechanism for multisectoral coordination & collaboration as outlined by 57th WHA (2004) resolution on road safety and health | MoTM/MoPPW/MoHP | |
| Develop road safety audit systems in all roads via multi agency approach for reducing RTA injuries deaths/economic costs | MoPPW | |
| Develop a surveillance guidelines for injuries/accidents | EDCD/MoHP/MoHA | |
| Plan a national level annual survey on RTA injuries/deaths | NHRC/MoHP/MoPPW | |
| Establish a recording and response system nationwide from public and private medical centers and hospitals on RTA | NHRC/DoHS(MD) | |
| Establish training centers in major urban cities and highways | MoEnv/MoTM/MoLD | |
| Establish an emergency fund through PPP | MoHA/MoTM | |
| Management of highways/roadways emergency ambulances | MOHA/MoTM/MoHP | |
| Establish a mechanism for data recording and reporting from Nepal police about RTA/injuries/deaths | MoHA/NHRC/HMIS | |

## 6.8 Health Care Waste

| Activities | Responsibility | Partner |
|---|---|---|
| Development and enforcement of National Guidelines on Health Care Waste Management in Nepal | MOHP , MOLD, MOE | UN Organizations, EDPS, Private Hospitals, MOLD, MOE, Pharmaceutical companies, health related councils |
| Develop the specific legislation on Health Care Waste Management with clear role and responsibility | MOEnv/MOLD/MOHP/MOLJ | Nepal Government |

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| Development of standards for operation of burning and non-burning technologies for management and disposal of different categories of health care waste | MOHP/Private Hospitals/MOLD | MOF, Private Hospital Association, EDPS |
| Develop the environmental friendly waste management system to suit the geographical regions of Nepal | MOHP/MOEnv | Health Facilities /Municipalities |
| Enforce Compliance Monitoring of IEE/EIA of health facility and medical college for waste management | MOEnv, MOHP | Private Sector / Public |
| Development of central/common treatment facility for health care waste disposal of dense urban areas | MOHP/Private Hospitals/MOLD/MOF | MOHP, UN Organizations, EDPS |
| Establishment of Health Care Waste Management Committee at Each Health Facility headed by chief of health facility | Each Health Facility | |
| Develop Human Resource for proper waste management | Each Health Facility/NHTC | |
| Develop the inventory of all health institutions, their waste generation and existing practice in Nepal | NHRC/ Management Division | MOHP, UN Organizations, EDPS |
| Awareness programs on health impacts of health care waste to staffs involved on health care waste management and general public | Each Health Facility/NHEICC/NGOs | |
| Develop training and courses for upgrading HR working in this sector and developing new groups | MOHP/NHTC | |

## 6.9 Chemical Safety

| Activities | Responsibility | Partner |
|---|---|---|
| Development and enforcement of National Guidelines on chemical safety and chemical Management in Nepal | MOHP/MoAC/MoI/MoEnv | UN Organizations, EDPS, Private Hospitals, MOLD, MOE, Pharmaceutical companies |
| Develop the specific legislation on chemical safety with clear role and responsibility | MOEnv/MoAC/MoI | Nepal Government |
| Development of standards for management and disposal of different chemical products | MOHP/MoEnv/MoI | Academic Institutes/Research Institutes |
| Development of policy guidelines for safe use and disposal of pesticides | MOEnv, MOHP/MoAC | |
| Development of central/common disposal for chemicals remnants of agricultural and industrial origin | MoEnv/MoAC/MoI | MOHP, EDPs |
| Develop the environmental friendly chemical management system to suit the geographical regions of Nepal | MOHP/NHRC | |
| Update the inventory of hazardous chemicals | NHRC/ MoEnv | MOHP, Bilateral Organizations, EDPS |
| Awareness programs on health impacts of chemicals to staffs in the industrial sector, agricultural sector and general public | MoEnv/NHEICC/Media | |

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# Annexes

## Annex I: List of Participants

Sharing Meeting on Nepal Environmental Health Action Plan (NEHAP)

Date: 17 January Venue: NHRC Meeting Hall

| S. N | Name | Organization | Designation | Email | Phone/Fax |
|---|---|---|---|---|---|
| 1. | Prof. Dr.C.L Bhusal | NHRC | Executive Chairman | nhrc@nhrc.org.np | 4254220 |
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|---|---|---|---|---|---|
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| 23. | Er. G.P Gorkhali | KUTDC | Chief | gp.gorkhali@gmail.com | |

# Annex II: Gaps and Required Standards/Conditions

| Areas | Gaps | Required Standards/Conditions |
|---|---|---|
| **Air Pollution** | Lack of integrated Environmental Policy for air pollution management | • Maintain the air quality within the National Ambient Air Quality Standards 2003 and National Indoor Air Quality Standards 2009 |
| | Air Quality Monitoring Stations are Limited only in Kathmandu valley and are not functional continuously | |
| | Inadequate institutional development for air pollution management | |
| | Inadequate research and development work in the field of air pollution especially in areas of source apportionment, dispersion modeling, risk assessment, pollution carrying capacity | |
| | No integrated action plan to meet the NAAQS | |
| | No timely and frequently review of NAAQS | |
| | Inadequate communication, awareness, stakeholder consultation on health impacts of air pollution | |
| | | |
| **Water supply, sanitation and Hygiene(WASH)** | A large number of people are yet unreached by the facilities of water supply and sanitation | • Establishment of mechanism to meet the national target of water and sanitation by 2017 AD |
| | Inadequate resource allocation within the stipulated timeframe for WASH Programs | • Establishment of mechanism to meet the MDG Sanitation goal by 2015 AD |
| | Inadequate actions towards recovery of old water supply systems | |
| | Lack of effective mechanism to monitor the sustainability of the Water Supply and Sanitation Systems/Schemes | |
| | Inadequate implementation of Water Safety Plan(WSP) in all systems for ensuring the safe water for all time | • Ensuring the actions to improve the service level of water supply system |
| | Lesser and inadequate involvement of local bodies in executing water and sanitation program. | |

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| | Inadequate implementation of unified plan/plan of action (of stakeholders) under the leadership of local bodies.<br><br>Very less involvement of private sector<br>National Information Management and Monitoring Project under DWSS not fully operated<br>No implementation of water quality surveillance by health sector as per the provision in the Legislation<br>Inadequate cooperation and coordination of WASH with Health Sector | • Establish the national drinking Water Quality Surveillance System<br><br>• Maintain the Water Quality of Drinking Water within NDWQS 2006 |
| | | |
| Food Safety | Lack of surveillance systems of food quality and borne diseases<br>Lack of risk assessment mechanism<br>Inadequate risk communication and advocacy<br>Inadequate international and national cooperation on food safety<br>Inadequate Capacity in the sector of food safety | • Incorporation of risk analysis based on better scientific knowledge of food borne illness and its causes<br>• Establishment of mechanism for dissemination of information on the most appropriate and effective means to control food borne hazards<br>• Develop the Standards on Food safety and ensure the surveillance mechanism of food borne diseases<br>• Establishment of mechanism of assessment, communication and management of food borne risks in cooperation with other sectors and national and international partners to build capacity in the area of food safety |
| | | |
| Climate Change | Lack of integration of health impacts due to climate change into broader developmental plans and programs | • Generate the evidences on health impacts of climate change on Nepalese context and integrate health impacts of climate change on broader development plans to mitigate health risks |

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|---|---|---|
| | Lack of a national policy in climate Change | • Develop the Guidelines on Protecting Health from Climate Change and Implement it. |
| | Inadequate research to generate evidence on climate change and health | • Every citizen of the country should be aware about impacts of climate change on public health |
| | Inadequate awareness raising programs on climate change and health to policy makers of health sectors to grass root level health personnel | • Develop early warning system and integrated diseases surveillance |
| | Inadequate Information, Education and Communication (IEC) and Behaviour Change Communication (BCC) program on climate change and health for public awareness | |
| | Inadequate capacity for Disease Outbreak/Investigation and Emergency Response team at all levels in Nepal with the perspective of changing climate | |
| | Inadequate Forecasting/Early Warning and Surveillance System on Climate Change & Health in Nepal | |
| | Inadequate Community Empowerment and Public Education for responding adverse effects of Climate Change in Public Health | |
| | Lack of Integrated Diseases Surveillance | |
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| **Solid Waste** | Inadequate implementation of solid waste management policy 1996 | • There should be proper segregation at source level and dispose the wastes separately as per the nature of wastes |

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| | Poor practice of solid waste management in all the levels starting from household to municipality | • Develop practical guidelines and standards on municipal and industrial waste management |
| | No proper practical guidelines for industrial waste management | • Emphasize on resource recovery from waste rather dumping |
| | Lack of an official definition of hazardous and non-hazardous industrial wastes | • There should be proper time for routine collection and trasportation of wastes |
| | Inadequate information and practice of proper handling of industrial waste | |
| | Inadequate practice of cleaner production in factories | |
| | Inadequate awareness and training programs to factories | |
| | | |
| **Healthy Setting** | Lack of awareness on healthy setting and its relation to health | • Establishment of mechanism to support the public initiative programmes and to build partnerships with other actors |
| | Inadequate strategic planning | • Develop the standards on healthy setting and implement it |
| | Inadequate intersectoral plan on development of healthy setting | • Establishment of mechanism to share experiences through activities such as seminars, workshops, meetings representing key players |
| | Inadequate community participation | • Development of mechanism to ensure community participation |
| | Lack of promotional activities and plans of innovative works | • Establishment of mechanism to acknowledge, support and reward good innovations and replicate successful examples |
| | Lack of implementation and sustainability of healthy public policy | • Establishment of mechanism to ensure strong and continual political support |
| | | |
| **Road Safety** | Lack of a national policy on road safety | • Establish a national policy |

| | | |
|---|---|---|
| | incorporating road safety and health issues | guidelines for traffic policing<br>• Establish a high level road traffic authority to have laws/regulations in line of reducing traffic accidents, injuries and deaths<br>• Ensure a mechanism of multi sectoral coordination<br>• Establishment of Specific Act and regulations on HCWM<br>• Promotion of source segregation of infectious waste<br>• Establishment of a centralized system for treatment of infectious waste<br>• Implementation of awareness and training programs in hospitals and clinics |
| | Inadequate review of prevailing acts/regulation on road traffic system | |
| | Inadequate review of existing plans/policies on issues related to RTAs, injuries/deaths | |
| | Lack of a mechanism for multisectoral coordination & collaboration as outlined by 57th WHA (2004) resolution on road safety and health | |
| | Lack of road safety audit systems | |
| | Lack of a surveillance guidelines for injuries/accidents | |
| | Inadequate survey on RTA injuries/deaths at national level | |
| | Inadequate recording and response system on national scale | |
| | Lack of an emergency funding mechanism | |
| | No system of emergency ambulance provision in major highways | |
| | Lack of a mechanism for data recording and reporting from Nepal police about RTA/injuries/deaths | |
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| **Health Care Waste** | Lack of a national guidelines on Health Care Waste Management in Nepal | There is need of specific Legislation on Health Care Waste Management |
| | Lack of a specific legislation on Health Care Waste Management with clear role | Develop the national standards of |

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| | and responsibility | disposal of Health Care Wastes<br><br>Develop National Guidelines on HCWM integrating existing ones |
| | Lack of standards for operation of burning and non-burning technologies for management and disposal of different categories of health care waste | |
| | Lack of a environmental friendly waste management system to suit the geographical regions of Nepal | |
| | Inadequate enforcement of Compliance Monitoring of IEE/EIA of health facility and medical college for waste management | |
| | Central/common treatment facility for health care waste disposal of dense urban areas not in place | |
| | Lack of a special committee in HF for HCWM<br>(Establishment of Health Care Waste Management Committee at Each Health Facility headed by chief of health facility) | |
| | Inadequate Human Resource for proper waste management | |
| | Inadequate recording system of waste generation and waste management practice<br>(Develop the inventory of all health institutions, their waste generation and existing practice in Nepal) | |
| | Inadequate programs on awareness about health impacts of health care waste to staffs and general public | |
| | Inadequate training and courses for upgrading HR working in this sector and developing new groups | |
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| **Chemical** | Lack of National Guidelines on | • Develop national standards on |

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|---|---|---|
| **Safety** | chemical safety and chemical Management in Nepal | chemical safety ranging from procurement/import to final disposal<br>• Public should be aware about hazards of different chemical used in daily life |
| | Lack of specific legislation on chemical safety with clear role and responsibility | |
| | Lack of standards for management and disposal of different chemical products | |
| | Lack of policy guidelines for safe use and disposal of pesticides | |
| | Lack of disposal mechanism for chemicals remnants of agricultural and industrial origin | |
| | Inadequate review and upgrading of the inventory of hazardous chemicals | |
| | Lack of awareness programs on health impacts of chemicals | |