1. INTRODUCTION AND PROJECT DESIGN

1.1 BACKGROUND

The Mekong River is one of the greatest river systems on Earth. It is ranked as the twelfth-longest river in the world and eighth in terms of annual discharge. The seasonal variation in the water level and the range of wetland habitats inundated by the Mekong River provide the source of the river system’s productivity. The rich biodiversity within the Mekong River Basin, especially fisheries, is fundamental to the viability of natural resource-based rural livelihoods of the people living within the basin. These livelihoods are founded in the integrated use of a wide range of natural resources, and which are adapted to the seasonal changes of flooding and recession. Maintaining and improving the natural productivity of the river basin is essential to both the local populations and the national economies of those countries within the basin.

For thousands of years, the Mekong River has been an important conduit for people and goods between the many riparian communities situated along its banks. Traditional forms of trade in small boats linking communities continue today. However, the river is also becoming an important link in international trade routes connecting the six Mekong countries to each other and the rest of the world. The Mekong Basin comprises six countries. The four nations of the Lower Mekong Basin – Cambodia, Lao PDR, Thailand, and Viet Nam – are members of the Mekong River Commission (MRC). China and Myanmar, located in the Upper Basin, are dialogue partners of the MRC. The Mekong River Commission (MRC) was established in 1995 by an agreement between the governments of Cambodia, Lao PDR, Thailand and Viet Nam. Article 9 of the 1995 Agreement gives MRC a specific mandate to promote and coordinate water transportation and to encourage freedom of navigation in the Lower Mekong region. A common interest in increasing international trade was the reason that the MRC signatories opted for a separate article in the 1995 Agreement on Freedom of Navigation.

Economic growth, through trade, port developments and passenger services has increased significantly on the Mekong River, benefitting local communities and furthering the development of trade opportunities for Member Countries. It is important that development is balanced with the environmental impacts of increased navigation to ensure shipping on the Mekong River is safe and environmentally sustainable.
1.2 MRC NAVIGATION PROGRAMME

The MRC Navigation Programme (NAP) was formulated in May 2003 in close cooperation with MRC Member Countries and other regional stakeholders to ensure national and regional ownership of the suggested activities. The NAP is based directly on the MRC Navigation Strategy; all NAP components share the development objective of the strategy which is to:

"promote Freedom of Navigation and increase the international trade opportunities for the MRC Member countries’ mutual benefit, and to assist in coordination and co-operation in developing effective and safe waterborne transport in a sustainable and protective manner for the waterway environment."

The Navigation Programme is an integrated body of work consisting of the following five components:

**Component 1 (Socio-Economic Analysis and Regional Transport Planning):** Assess the socio-economic outcome of enhancing navigation on the Mekong River, and to examine and propose cost-effective and practical ways in which cargo and passenger transport on the Mekong waterway network can be increased as a separate transport mode and as a part of the regional multimodal transport network;

**Component 2 (Legal Framework for Cross-Border Navigation):** Establish an appropriate legal foundation and navigation regime for International Mekong Navigation, and to ensure its implementation and sustainability;

**Component 3 (Traffic Safety and Environmental Sustainability):** Provide better facilities and capacity to increase safe and efficient Mekong navigation as a separate transport mode and as part of the regional multimodal transport network. Promote the concept of "clean" river transportation, focussing on strategic prevention of environmental damage from waterway infrastructures or from shipping and port activities;

**Component 4 (Information, Promotion, Coordination):** Establish an integrated Mekong River Information System necessary for navigation development that covers operational data, traffic monitoring and information on navigation development and management throughout the Lower Mekong Basin. Demonstrate the advantages and potentials of the waterborne transport sector, and identify coordination and cooperation mechanisms that include national and regional initiatives and the private sector; and

**Component 5 (Institutional Development):** Establish the institutional structures on the regional level and to provide the necessary resources for the MRC Member Countries to establish the management structures on the national level for implementing NAP. The implementation of capacity building programmes for the waterborne transport sector in the Member Countries.

1.3 TRAFFIC SAFETY AND ENVIRONMENTAL SUSTAINABILITY

The MRC Navigation Strategy calls for harmonisation and enforcement of common rules and regulations on environmental protection and safety measures. The Strategy highlights a strong need for awareness-raising in environmental protection and risk control within the navigation sector. The NAP aims to promote and realise the concept of environmental standards for "green" river transportation, focussing on strategic prevention of environmental damage. The third component of the NAP is ‘Traffic Safety and Environmental Sustainability’ dealing with environmental prevention and protection. The immediate objectives of Component 3 are to:
1. promote and realise the concept of environmental standards for "clean" river transportation, focussing on strategic prevention of environmental damage;

2. balance the environmental consequences of projects against their economic and social significance; and

3. ensure that the ecological health of the river, which is the basis for food security and livelihoods, is not compromised by navigation developments.

Another reason for the MRC to engage in improving and promoting regional navigation is the reference to sustainable development is in Article 3 of the 1995 agreement:

“to protect the environment, natural resources, aquatic life and conditions, and ecological balance of the Mekong River Basin from pollution or other harmful effects resulting from any development plans and uses of water and related resources in the Basin.”

The NAP has also been tasked to assist Member Countries in establishing efficient environmental management systems and contingency plans to deal with emergencies, pollution and accidents on the waterways and inland river ports and petroleum terminals.

1.4 OVERVIEW OF TRANSPORTATION OF DANGEROUS GOODS

The Mekong River and its main tributaries are an important transport corridor for the trade of cargo, particularly in the Upper Mekong between China and Thailand, and in the Lower Mekong between Cambodia and Viet Nam. Cargo and fuel throughput and boat trips have increased significantly in the Mekong Delta with the development of a deep sea port at Cai Mep, which allows exports from Cambodia and Viet Nam to be shipped directly to the US and Europe. Inland transportation along the Mekong River can be divided into two sections.

Upper Mekong Inland Water Transportation

Diesel and other petroleum products are also carried by vessels between the People's Republic of China (PRC), Myanmar and Thailand in the Upper Mekong. Trade and inland waterbone transport(IWT) is increasing in the Upper Mekong, particularly with the development of Chiang Saen Port II in Thailand which will include a tank farm for storing and handling petroleum products for export to the PRC. Ferry crossings continue to provide an important link for carrying tank trucks and gas tankers, mining products, fertilisers and pesticides across the Mekong River between Lao PDR and Thailand. There are no standard practices for loading and unloading these ferries and no environmental safeguards have been developed or implemented to prevent incidents, oil spills or loss of cargo.

Lower Mekong Inland Water Transportation

The trade of oil, gas and petroleum products between Viet Nam and Cambodia has increased significantly over the last few years. Petroleum terminals are located on the Mekong, Tonle Sap and Bassac Rivers in Cambodia and Viet Nam. Most of these terminals have developed standard operating procedures for bunkering, fuel transfer and other critical operations. The carriage, handling and storage of petroleum products are of major concern for the Mekong River. Most terminals have developed response plans for firefighting and other emergencies. But a number do not have contingency plans or sufficient equipment and resources to respond to oil spill emergencies and major accidents. Further investment is required for capacity building and resources to ensure petroleum terminals and ports can prevent and respond appropriately to such emergencies.
Figure 1: Registered Ports in the Lancang-Mekong Agreement on Commercial Navigation
1.5 ENVIRONMENTAL IMPACTS

The NAP is promoting a measured approach to navigation infrastructure development, operations and maintenance to ensure sustainable development.

The environmental impacts of the transportation of dangerous goods need to be carefully evaluated. Increased carriage, handling and storage of dangerous goods can lead to the following environmental impacts and risks:

- increased pollution from transportation of dangerous goods (e.g. cargo residues, spills and leakages, solid and liquid wastes);
- increased risk of spillages and pollution from shipping accidents as well as ports and terminal operations;
- atmospheric emissions from motorised vehicles such as diesel-powered vessels releasing particulates and gases;
- impacts on human health as a result of pollution, fire and explosion;
- loss or damage to habitats and species due to an increase in disturbance, reduced water quality and pollution; and
- health and safety risks for existing users of the river.

It is important that these risks are identified and mitigated to ensure the sustainable development of inland waterway transport. In 2009, the NAP conducted an initial consultation with relevant line agencies including port authorities, vessel associations, petroleum companies, transport operators and the relevant ministries in Cambodia, Lao PDR, Thailand and Viet Nam to determine the situation of navigation activities and the transport of dangerous goods along the Mekong River which is increasing.

Unfortunately, the design of vessels for transporting dangerous goods is lagging in the MRC Member Countries or does not provide sufficient protection for the cargo in case of accidents. If not managed properly, the increased transport of dangerous goods along the Mekong River could have considerable negative environmental impacts. Within the Member Countries, specific legislation on managing navigation spills is limited. Only Thailand and Viet Nam have the necessary personnel and equipment to respond effectively to emergencies. In general, there is limited enforcement or legislative and regulatory guidance prescribing how to prevent navigation spills and what to do in case of an accidental or operational spill. Hence, there is a need to develop adequate regulations, operational plans and procedures to ensure the risks of pollution can be controlled.

1.6 INITIAL CONSULTATION

The initial consultation enabled the NAP team to establish the level of existing controls and environmental safeguards and to further identify hazards related to the transport of dangerous cargo, port operations and petroleum terminals. Trade and cargo figures, statistics on boat traffic, passengers and ship calls were obtained to evaluate areas of economic growth and potential. A questionnaire was developed to determine:

- current port, vessel and navigation activities;
- rules and regulations applying to port and vessel operations;
- existing environmental safeguards and controls;
- management of wastes received from vessels and cargo operations;
- contingency plans and equipment to respond to oil spill and major accidents;
Figure 2: Ports and Regulated Waterways in the Cambodia-Viet Nam Legal Agreement
• incident reporting and investigation systems;
• priority issues and considerations in the port and surrounding areas; and
• future planning and developments of road and inland waterborne transport infrastructure.

The NAP in consultation with the MRC Member Countries selected a sample of the most important ports, petroleum terminals, ferry crossings, vessels and waterways for further risk analysis. To determine the most significant ports, terminals vessels and waterways the following factors were considered:

• possible environmental impacts identified from initial consultation;
• fuel storage capacity and operations;
• current environmental management and monitoring plans;
• future international and domestic trade opportunities involving the transport of dangerous goods; and
• future developments in road and waterway infrastructure.

The initial consultation was used to formulate the terms of reference (TOR) for a risk analysis.

1.7 JUSTIFICATION FOR THE RISK ANALYSIS

The project "Phase 1: Risk Analysis of the Carriage, Handling and Storage of Dangerous Goods" is an output under NAP Component 3 (Traffic Safety and Environmental Sustainability). The carriage of dangerous goods on the Mekong River and its tributaries has been identified as a high-risk activity and any incident would have severe impacts on the environment and safety of riparian populations. Yet environmental protection measures to ensure the safe handling and storage of dangerous goods are limited. Provisions for pollution prevention and contingency plans in case of oil spills and major accidents such as fires and explosions are also limited.

To estimate the efforts and tools needed to manage (prevent, control and combat) pollution associated with the carriage, handling and storage of dangerous goods it is necessary to determine the levels of risk. Such an assessment is important to evaluate which activities could harm the environment, people and local communities, enabling relevant line agencies to determine whether prevention and mitigation measures are sufficient to control risks and minimise impacts.

Under NAP Component 2 (Legal Framework for Cross-Border Navigation), new legal instruments have been established and are being implemented to ensure the standardisation and harmonisation of different rules and regulations for inland water transport. The Goal of the MRC Strategic Plan 2011-2015 is for Member Countries to "implement basin-wide Integrated Water Resources Management (IWRM) approaches in national water and related sector frameworks and development programmes for sustainable and equitable development." The implementation of Phase 1 (Risk Analysis) followed by "Phase 2: Regional Master Plan for Sustainable Management of Dangerous Goods" will achieve the Strategic Plan's Key Result Area 1, which is "application of IWRM-based navigation development and coordination." The results will be shared extensively to ensure exchange of information and dialogue between Member Countries, development partners, the private sector and all key stakeholders.

At the MRC level, there are no specific institutional arrangements for navigation spill control. There is no adequate legislation and no agreements on inland waterway transportation and pollution. The organisational and institutional framework to deal with navigation spill control is also limited.

There are also the trans-boundary aspects of pollution. The development of inland waterborne transport in the Mekong River Basin will inevitably increase the possibility of pollution from vessel operation, oil spills and increase risks of other incidents. As an international river, with stretches where
the international border follows the river alignment and stretches where the river crosses international borders, pollution in the Mekong will often become a trans-boundary issue. It is therefore essential that effective trans-boundary measures for preventing pollution and mitigating impacts of accidents, oil spills and pollution incidents are developed, agreed upon by the countries and enforced.

1.8 OBJECTIVES OF THE RISK ANALYSIS

The objective of the risk analysis is to identify and determine the magnitude of risks associated with the carriage, handling and storage of dangerous cargo in ports, vessels and oil and gas terminals on the Mekong River, and determine feasible prevention and mitigation measures to manage the risks. When applied consistently and uniformly on a number of waterways, the process is expected to provide a basis for making best value decisions for risk mitigation and prevention measures at the regional, national and local level. The aim is to also clearly measure the legal framework and institutional capacity in the MRC Member Countries to develop, implement and monitor environmental prevention and mitigation measures. Table 1 below describes the objectives of Phase 1:

<table>
<thead>
<tr>
<th>Development objective (of the design and implementation of the Risk Analysis)</th>
<th>The overall objective is to increase the efficiency of domestic and cross-border waterborne transport in the Lower Mekong Basin, by reducing the risks for accidents in ports, on vessels and on waterways so that the ecological health of the river, which is the basis for food security and livelihoods, is not compromised by shipping activities, operations and developments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate objectives (of the Risk Analysis)</td>
<td>The objectives of Phase 1 are to identify and quantify the risks associated with the transportation of dangerous goods along the Mekong River and determine the prevention and mitigation measures that need to be implemented.</td>
</tr>
</tbody>
</table>

Phase 1 must detail the likelihood and consequence of an incident occurring and investigate, the effectiveness of existing prevention and mitigation measures that have been implemented to reduce and control risks or minimise environmental impacts and determine further prevention and mitigation measures that need to be developed and implemented. Phase 2 will be to develop the regional master plan including an implementation strategy and project plans for the MRC Member Countries at the regional and national level.

1.9 IMPLEMENTATION ARRANGEMENTS

MRC Navigation Programme

The NAP, on behalf of the MRC, will serve as the Executing Agency (EA) of this project. In Phase 1, it was responsible overall project activities including the recruitment of consultants, financial and technical supervision and monitoring of project implementation. The data and results of the assessment will also be utilised during and after the project by the MRC.
National Working Groups (WG)

National Working Groups (WG) were selected in each of the Member Countries to undertake data collection, risk assessments and be responsible for completing the outputs and overseeing the national component of the project. In Cambodia, Lao PDR and Viet Nam, three national working group members were appointed in each country for *ports*, *vessels* and the *environment*. In Thailand, the WG was established with representatives of the Thai National Mekong Committee (TNMC) and the Thailand Marine Department. The WG members were selected by National Mekong Committees in consultation with the NAP. They were supported by NAP and international experts engaged by the MRC to provide technical expertise to ensure the successful completion of specific outputs and activities of the risk analysis.

International Experts

Four consultants were engaged to develop risk analysis guidelines, project tools and to assist the NAP and national task forces to review and complete the final outputs of the Risk Analysis in the MRC Member Countries. The four international experts recruited were specialists in the fields of *port environmental risk*, *vessel environmental risk*, *waterways* and *law*.

Each consultant was responsible for completing the final outputs to their specific area of expertise and providing technical assistance to the NAP and national task forces as required.
National Mekong Committee

The National Mekong Committee (NMC) of each Member Country served as Coordinating Agency. Through the National Navigation Coordinator (NCC), the agencies assisted the MRC in liaising with the government to obtain any other additional information necessary and will assist the MRC to inform the related line agencies and key stakeholders about the progress and the results of the study.

1.10 THE GEOGRAPHICAL PROJECT AREA

Ports and Terminals

Following the initial consultation and the Regional Risk Assessment the following ports, terminals and ferry crossing were included in the Risk Analysis in the Member Countries:

**Thailand:**
- Chiang Saen Port;
- Keawalee Terminal;
- Chiang Khong/Huay Xay Ferry Crossing;
- Bungkhan/Pakxanh Ferry Crossing; and
- Nakhon Phanom Ferry Crossing.

**Lao PDR:**
- Huay Xay/Chiang Khong Ferry Crossing;
- Luang Prabang Ports;
- Km 4 State Port, Vientiane;
- Pakxanh/Bungkhan Ferry Crossing; and
- Bung Pung Cheng/Ban Tuay Ferry Crossing; and
- Nakasang Passenger Port.

**Cambodia:**
- Phnom Penh Port;
- 3 selected petroleum terminals along the Mekong and Tonle Sap River;
- Krakor Floating Terminal;
- Chnouk Trou Floating Terminal; and
- Chhong Kneas Vessel Fuel Station.

**Viet Nam:**
- Tay Nam Bo Petroleum Terminal;
- Binh Duc Petroleum Terminal;
• Quang Trung Petroleum Terminal; and
• Dong Thap Petroleum Terminal.

Figure 3 on the following page indicates the locations of the ports, terminals and ferry crossings included in the Risk Analysis of the Carriage, Handling and Storage of Dangerous Goods.

Vessels

The risk assessments were completed for a sample of different types of vessels in the MRC Member Countries:

Thailand
• Two Chinese tanker vessels

Lao PDR
• Two cargo vessels

Cambodia
• Two cargo vessels; and
• Two petroleum tankers

Viet Nam
• Two petroleum tankers; and
• Two liquid petroleum gas (LPG) tankers

Waterways

The risk assessment conducted by the National Working Group members focuses on the ports, terminals, ferry crossings and vessels. An international waterway expert was engaged to undertake a risk assessment of the waterways. A desktop analysis and consultation with waterway users was conducted to determine the hazards and risks along the waterways. A hazard classification was designed to determine the waterway stretches suitable for the transport of dangerous goods, those that are not suitable and stretches which require further prevention measures to improve safety. The waterway hazard classification was used to assign hazard levels to the waterways at low and high water levels as well as at day and night to determine risk levels for transporting dangerous goods.

The waterway assessment was divided into a number of sections to allow a more detailed analysis of the waterway stretches suitable for the transport of dangerous goods. The waterway assessment was done from the Golden Triangle (Km 2,373) to Deep Sea Buoy (Km 0).
Figure 3: Location of Ports, Terminals and Ferry Crossings included in Risk Analysis
1.10.1 Lao PDR and Thailand

Section 1: Golden Triangle (Km 2,373) – Chiang Saen (Km 2,364): distance = 9 km

Section 2: Chiang Saen (Km 2,364) – Chiang Khong/Huay Xay (Km 2,314): distance = 50 km

Section 3: Chiang Khong/Huay Xay (Km 2,314) to Pak Beng (Km 2,172): distance = 142 km

Section 4: Pak Beng (Km 2,172) to Luang Prabang (Km 2,010): distance = 162 km

Section 5: Luang Prabang (Km 2,010) – Pak Lay (Km 1,800):

Vientiane (Km 1,585): distance = 425 km

Section 6: Vientiane (Km 1,585) – Savannakhet (Km 1,126): distance = 459 km

Section 7: Savannakhet (Km 1,126) – Pakse (Km 869): distance = 257 km

Section 8: Pakse (Km 869) – Khone Falls (Km 721): distance = 148 km

1.10.2 Cambodia

Mekong between the Lao Border (Khone Falls) and Kompong Cham

Section 1: Section Kompong Cham (Km 448) – Phnom Penh (Km 348): distance = 100 km

Section 2: Phnom Penh (Km 348) – border with Viet Nam (Km 251): distance = 97 km

The Tonle Sap between Phnom Penh Port and Chhong Kneas

Section 1: Phnom Penh (Km 0) – Kompong Chhnang (Km 99): distance = 99 km

Section 2: Kompong Chhnang (Km 99) – Chong Kneas (Km 149 + approx. 55 Km):

distance = 104 km

1.10.3 Viet Nam

Mekong Mainstream

Section 1: Deep sea buoy (Km 0) – My Tho (Km 74): distance = 74 km

Section 2: My Tho (Km 74) – Tan Chau (Km 236): distance = 162 km

Section 3: Tan Chau (Km 236)- border with Cambodia (Km 251): distance = 15 km

Bassac River and the Vam Nao Pass

Section 1: River mouth of the Hau (Bassac Estuary: Km 0) to Can Tho (Km 109): distance = 109 km

Section 2: Can Tho (Km 129) - Long Xuyen (Km 162): distance = 33 km

Section 3: Long Xuyen (Km 162) to Vam Nao Pass and junction with the Mekong mainstream (Km 216 of the Mekong mainstream) = 54 km
risk analysis