Guidance for Chemicals Transport Hazard Mapping on a National Level

1 Introduction

The UNEP-ICCA Project "Promoting Chemicals Safety Management in the African region" supports the identification of the main hazards and risks related to the transport of chemicals between the ports of Mombasa and Tema and their surrounding sub-regions respectively; the Mombasa Port acts as a main entry way for chemicals to Kenya and the surrounding land locked countries while the Tema Port similarly acts as a main entry way for chemicals to Ghana and the neighbouring land-locked countries.

The mapping exercise provides a means to identify what enters into the respective sub-region through the two port areas, in what quantities, the actors that are responsible for the transport of the different chemicals that are imported, where the chemicals are stored/warehoused including their final destinations.

The guidance given in this document outlines a method to identify and map hazards related to the transport of chemicals on a national and sub-regional level. The methodology presented is based on the TransApell[1] approach and elaborates on certain aspects of the approach that are relevant for the chemicals transport hazard mapping on a national level.

Throughout the document, Kenya is used to illustrate specific steps and possible results of the process.

1.1 Objectives of the Hazard Mapping

The ultimate goal of the project is to prevent accidents with chemicals in the East African sub-region, looking at the flow of chemicals from the Port of Mombasa to destinations in Kenya and in the sub-region (Uganda, Tanzania, Rwanda, Burundi, and South Sudan). To achieve this objective, measures are required to reduce the risks that might occur while chemicals are transported, stored, handled or processed. In general „risk" is understood as the likelihood of being exposed to a hazard. Therefore the specific risks depend on various factors including both the hazard properties of a chemical, the volumes managed as well as other measures to control exposure like training for truck drivers, safe packaging and appropriate process control.

The Hazard Mapping exercise aims to provide a first screening of the hazards and will reveal the chemical substances that are most relevant for the transport and warehousing in the sub-region as a whole and will identify the related hazards. This will provide a preliminary mapping of hazard hotspots.

For this purpose, the report gathers data on the most relevant chemical hazards and the quantities of chemicals transported and stored in Kenya in large volumes. Subsequently, this information forms the basis for identifying priorities for risk assessments taking into account both chemical hazards and exposure parameters like volume, mode of transport and storage areas. Based on the outcomes of the risk assessment, it will be possible to identify priorities for further actions.

[1] http://www.unep.fr/scp/publications/details.asp?id=2679

1.2 Expected results

The hazard mapping specifically aims to:

- Identify the major stakeholders related to the transportation of chemicals and their warehousing/production.
- Identify the main types of chemicals entering through the Mombasa Port
- Identify the routes (rail and road) through which chemicals are transported from / to the Mombasa Port
- Identify transporters and distributors and any warehousing/storage taking place along the routes
- Collect cases of transport related accidents that have taken place along the identified routes (rail and road)
- Conclude and summarize hazard hotspots related to transport and warehousing of chemicals in the sub-region and display graphically
- Recommendations for further actions to alleviate hazard hotspots.

With the results of this hazard mapping it will be possible to

- Gain an overview on most significant amounts of chemicals transported, stored and produced in Kenya
- Hazardous properties of the most significant chemicals transported or stored
- Transport routes and mode of transport
- Warehouses and storage areas (official as well as unofficial)

Note: the objective is to identify most of the major hazards, NOT ALL hazards.

1.3 Scope

1.3.1 Geographical boundary conditions

The focus of the study is on the country level including a screening assessment on the situation in neighbouring countries. For example, in Kenya, the geographical boundary conditions are:

- Points of entry/exit in Kenya:
  - The Mombasa Port and surrounding CFSs (Container Freight Stations)
  - Border areas
- Major industrial areas (warehousing or industrial site): e.g. in Mombasa, Nairobi (main industrial area, Athi River), Nakuru, Kisumo, etc. and surrounding their surrounding areas.
- Transport routes between border areas / ports and industrial areas (storage or industrial sites)

Additionally, the screening will involve regional countries. For the case of Kenya, the recommended countries are: (i) Uganda, (ii) Rwanda, (iii) Tanzania. In each country, the following will be briefly screened:

- Main border crossings
- Main industrial destinations (e.g. mines, industrial areas, etc.)

1.3.2 Chemicals of interest

The following table outlines the chemicals to be considered in the hazard mapping activity. The major emphasis on transport hazards should be placed on road transport with rail, pipelines, and water being secondary. Although petroleum is not a chemical of interest for this study, it should be included in the identification phase since: a) refineries are transit points for petrochemicals, b) petroleum-related stakeholders can provide relevant data (e.g. accidents), c) combined hazards (e.g. if a petroleum pipeline is located near a chemicals transportation hotspot)

Table 1. Scope of the chemicals to be considered for the hazard mapping exercise

Product Category	Industrial Site		Road Transport		Rail Transport		Pipelines		Water Transport[1]	
	Identify	Evaluate	Identify	Evaluate	Identify	Evaluate	Identify	Evaluate	Identify	Evaluate
Typical Chemicals (e.g. solvents, acids, etc.)	Yes	Yes	Yes	Yes	Yes	Yes	n.a.	n.a.	Yes	Yes
Minerals	Yes	Yes	Yes	Yes	Yes	Yes	--	--	Yes	Yes
Petrochemicals (e.g. olefins, aromatics)	Yes	Yes	Yes	Yes	Yes	Yes	n.a.	n.a.	Yes	Yes
Petroleum	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Other Fuels (NG, Coal, kerosene, etc.)	No	No	No	No	No	No	n.a.	n.a.	No	No
Explosives (Class 1)	No	No	No	No	No	No	n.a.	n.a.	No	No

[1] Identification of Hazards in and around the port, including water transport, shall be done in cooperation with the Pilot Demonstration in Emergency Preparedness & Response at Mombasa Port. The ICCA is leading this activity.

2 Methodology

The stakeholders should be used as a major source for obtaining data in order to make the exercise as effective and efficient as possible. Furthermore, the stakeholders are the natural end-users of the hazard mapping activity.

2.1.1 The Hazard Mapping Process

The implementation of the hazard mapping process is as follows:

1. Identification and evaluation of stakeholders
2. Setting up a Chemicals Hazard Mapping Group (this can be updated after the Chemicals Hazard Mapping Workshop)
3. Chemicals Hazard Mapping Workshop
4. Identification and evaluation of hazards relating to the transportation and storage of chemicals
    a. Identify and quantify accident blackspots
    b. Transportation pattern analysis
    c. Assessment of accident history
    d. Chemicals transport analysis
    e. Presentation of hazard results graphically. This should be map cut-outs of different regions in Kenya with, marking the major hazards and surrounding receptors (human population, environment, property).
5. Recommendations for further actions to alleviate hazard hotspots.

2.1.2 Identification and Evaluation of Stakeholders

Step 1: Identification of the major relevant stakeholders for chemicals management in the East- and West-African sub-region respectively, including contact persons and information. If possible, explore whether they have been involved in any major activities promoting sound chemicals management in transport and warehousing in the past. Stakeholders may be grouped into the following categories:

- Government (sub-regional level)
- Authorities (sub-regional and port level)
- Inter-Governmental Organization (sub-regional level)
- Non-Governmental Organization (sub-regional and port level)
- Industry Associations and Trade Chambers (sub-regional and port level)
- Industry:
    - Major Players in Transport and Warehousing of Chemicals (Sub-Regional and Port Level)
    - SMEs in relevant downstream industry and SMEs in transport and logistics (port level)
- Labour Unions (sub-regional and port-level)
- Others (sub-regional and port-level)

A more complete list of additional general suggestions for stakeholders to be included (adapated from TransAPELL) is found in Annex A as well as stakeholders specific to Kenya. If the country has

performed a National Chemical Profile (as in the case of Kenya[2]), the persons and stakeholders involved should be a high priority for this Hazard Mapping process.

Step 2: Evaluate stakeholder relevance and importance for chemicals management. Use the following ranking system and assign each stakeholder with a classification, from 1 (highest) to 3 (lowest):

1= they can have significant impact on the successful implementation of (a) chemicals management, (b) chemical accident prevention; (c) emergency preparedness

2= they can influence certain areas of (a) chemicals management, (b) chemical accident prevention; (c) emergency preparedness

3= they can only have a very limited influence on (a) chemicals management, (b) chemical accident prevention; (c) emergency preparedness

2.1.2.1 Expected Results

The end result should be a summary table of stakeholders. The following information is suggested to be included in the SH summary table:

- Stakeholder (SH) title
- Type of SH (industrial company, trade association, NGO, government ministry, government department or authority, etc.)
- General purpose of organization
- Potential or current role(s) of SH with respect to chemicals management, chemicals accident prevention, emergency preparedness
- Information SH can provide to study (e.g. number and severity of road accidents per year at given locations). Information categorized as:
    - Transportation of chemicals
    - Storage/warehousing of chemicals
- Level of influence of each SH on: (a) chemicals management, (b) chemical accident prevention; (c) emergency preparedness separately for both the transportation and storage/warehousing of chemicals.
- Contact person and their contact information. It is important that the "right" contact person from each stakeholder is contacted (i.e. depending on stakeholder, the contact must have a certain level of decision-making ability)

Information on the types of governmental, non-governmental, and industry representatives that should be included in the Stakeholder workshop along with a preliminary list of possible stakeholders for Kenya is presented in Annex A.

[2] http://www.environment.go.ke/saicm/

2.1.3 Setting up a Chemicals Hazard Mapping Group

It is suggested to set up a small and Hazard Mapping Group consisting on the NCPC, a government authority or authorities, and a UNEP representative. For example, in the case of Kenya, it is suggested that NDOC and NEMA could be key members of the Chemicals Hazard Mapping Workshop.

The KNCPC will work with and have the support of the following internal project partners:

1. UNEP (ROA / DTIE):
    a. Help liaison with high level government and industry stakeholder contacts to facilitate active participation.
    b. Provide information from the Report of the 2013 Kenya Hazard Identification mission performed by the Joint UNEP/OCHA Environment Unit.
2. ICCA
    a. Help liaison with known industry stakeholder contacts to facilitate active participation
    b. Will assist in obtaining information for the Mombasa Port Authority relevant for the hazard mapping.

The Chemicals Hazard Mapping Group can be expanded to include other key stakeholders if appropriate.

2.1.4 Chemicals Hazard Mapping Workshops

The suggested Chemicals Hazard Mapping Workshop methodology is based on TransAPELL and is outlined here in detail. The project kick-off workshop already accomplished the goal of raising awareness for promoting safe chemicals management.

Due to the large role that competent authorities have to play in the national hazard mapping activity, a closed-door workshop with the appropriate competent authorities is suggested first before holding a full Stakeholder Chemicals Hazard Mapping Workshop.

Experience shows that due to the complex nature of governments, it is advantageous that appropriate governmental agencies and departments meet privately in order to work together to integrate the information existing in each agency/department/ministry. A closed-door setting also allows the competent authorities to discuss and exchange information openly with one another. Once the majority of the data has been collected from the competent authorities and the information gaps are identified, a targeted full Stakeholder Chemicals Hazard Mapping should be conducted.

The following guidelines are general and for both workshops. The list of participants should be based on the results from the stakeholder mapping activity and organisers should try to guarantee that stakeholders with decision making ability attend the workshop as this is crucial for moving forward. Having a senior level person (e.g. official) open the workshop is one way to indicate “top level” support for this project. An effort should be made to invite regional stakeholders as well since they can provide local knowledge.

The invited stakeholders should receive a short information package including goals, benefits and duration of the project prior to the workshop. The information package will also briefly specify the

desired contribution from stakeholders and provide them an opportunity to contribute even if they are unable to attend the workshop.

The workshop must be organised to encourage an open and cooperative environment. The chairs should be experienced in guiding large workshops and allow all participants to express views and adhere to the timetable. Adequate time for group discussions and bilateral discussions (eg. coffee breaks) should be planned into the agenda. For this purpose, it is recommended that each workshop last a full day; if this is not possible then a minimum of 4 hours in duration is advised. The desired outcome of each individual workshop is:

1. Identification/confirmation of what information each Stakeholder can provide
2. A map of all accident blackspots
3. A map of indicating all major origins / destinations of chemicals.
4. A map indicating all major routes for the transport of chemicals and other dangerous goods
5. The formation/expansion of the Chemicals Hazard Mapping Group
6. A list of action items with priorities and deadlines for individual stakeholders (e.g. NCPC to send a follow-up questionnaire to the Freight Forwards Association to assist in filling in specific missing information gaps; or the Transportation Authority to provide a table with detailed accident statistics)

Support material should be printed out and provided for all participants (e.g. relevant maps for the entire country and different regions, a questionnaire to fill in preliminary information (e.g. accident blackspot locations, amount and type of chemicals transported, type of information the stakeholder can provide, etc.)). Shortly after the workshop (1 week), a report summarizing the presentations and conclusions of discussions, as well as action-items should be circulated to all participants.

An example of a workshop agenda is included in Annex B. A preliminary list of blackspots in Kenya broken down on a regional basis is found in Annex C.

Refer to the following section for more details on what types of information could be requested from stakeholders.

2.1.5 Hazard Identification and Analysis

The goals of the hazard identification are to:

- Determine the major routes for the transport of chemicals
- Determine the types and quantities of chemicals being transported
- Compile and study information about and actual accidents in order to identify the blackspots (locations with high frequency of accidents)
- Overlay the major routes for the transport of chemicals with identified blackspots: their intersection will be termed hotspots and is the focus of this hazard mapping exercise.

2.1.5.1 Step 1: Transport Pattern Analysis

The major transport links that are used for chemicals and other dangerous goods should be identified on detailed maps including road, rail, pipelines, water, and air. Since most dangerous goods are

transported via road in Kenya, this mode of transport will be the focus of the hazard mapping exercise.

The Chemicals Hazard Mapping Workshop should have provided most of the information required for the Transport Pattern Analysis which should be expanded upon via follow-up actions with the appropriate competent authorities and/or other stakeholders such as a questionnaire (also for the Chemicals Transport Analysis) targeted for road haulage associations as well as national & local haulage companies.

2.1.5.2 Step 2: Estimating the probability of accidents

The hazard identification and analysis takes the accident blackspots[3] identified during Hazard Mapping Workshop, including any additional blackspots identified following the workshop, as the starting point for a more detailed analysis.

The most important routes for the transport of chemicals and other dangerous goods have been identified in step 1. The focus of the subsequent hazard identification and analysis activities will be on the overlap of accident blackspots with these important routes transporting chemicals - in this exercise referred to as "hotspots".

Where appropriate, incorporate national as well as local representatives (governmental, non-governmental, industry) in the data gathering process. Police as well as transport authorities should be able to provide statistical data regarding accidents. A section targeting blackspots should be included in the questionnaire for haulage companies.

If specialised data on transport accidents involving chemicals is available it should be used. Failing this, accident data involving dangerous goods should be used and if that if no data on accidents involving dangerous goods is available, then use total heavy vehicles data as a proxy estimate assuming the ratio of accidents is the same as the ratio of chemicals transport to heavy vehicles.

Optional:

The following road and traffic data *can be* collated for hotspots in order to help determine possible reasons for the accidents and provide possible solutions to prevent future accidents.

1. Road characterisation (available from public authorities):
    a. Road classification (depends on the country's own classification system. For Kenya: international and national trunk roads, primary roads, secondary roads, etc.)
    b. Road surface (paved, unpaved)
    c. Road conditions (depends on the country's own categorisation system. For Kenya: good, fair, poor)
    d. Road properties: Number of lanes, unofficial side roads / pedestrian walkways, etc.
2. Traffic characteristic parameters (if data unavailable, then estimates are encouraged):
    a. Traffic composition (e.g. cars, tankers, trucks, "public" transport (buses, matatus, etc.)
    b. Speed (permitted, maximum, mean + variation)

[3] A preliminary list of accident blackspots in Kenya are shown in Annex B and are broken down on a regional basis.

    c. Vehicle density = [vehicles per lane km]
    d. Vehicle flow = [vehicles per lane hour]
3. Account for the following in 1. and 2.:
    a. Daily variations
    b. Monthly variations
    c. Seasonal variations
    d. Unique influences: construction, extreme weather, etc.
    e. Future plans: upgrading of infrastructure

2.1.5.3 Step 3: Chemicals Transport Analysis

Determine the general types and quantities of chemicals being transported in and throughout the country. The Chemicals Transport Analysis involves performing a "chemical inventory balance" on a national level and contains the following elements:

1. Determining the quantity and characteristics of chemicals entering and leaving the country including to the sub-region (e.g. from port authorities and customs).
2. Determining the quantity and characteristics of major chemicals produced in the country and their locations (e.g. from environmental authority, statistics authority, or ministry of economy)
3. Determining the quantity and characteristics of the chemicals transported throughout the country and sub-region broken down to transportation corridors between major regions and industrial areas (e.g. from industrial associations and shipping companies).
4. Accounting for seasonal or yearly variations in the transport of chemicals, if possible.

The method recommended in this guidance has varying degrees of accuracy and is dependent on the information available. It is recommended that the entire country be treated as the control volume and that a chemical inventory balance be performed in order to systematically quantify the amount of chemicals being transported into and throughout the country. Obtaining data from different sources for the purpose of cross-verification is highly recommended.

In order to perform a systematic analysis of the country, the following identification system is recommended. The highest level of categorization is Region and Border:

- R = Region (R1, R2…). Example of a region is Nairobi or
- B = Border (B1, B2…)
- N=Node (N1, N2…). A node is where major transport corridors meet/separate. A node is useful for designating transport corridors.
- H=Hotspots (H1, H2…)

Each region can be further divided

- IA = Industrial Area (IA1, IA2…)
- P=Producer of chemicals (P1, P2…)

The Hazard Mapping Group may choose other more suitable designations for distinguishing locations.

An example of the identification system is shown in Annex D.

Step A: Perform a country-wide chemical inventory balance using the chemicals data from border and from large manufacturers of chemicals

A mass balance is performed on the most important individual chemicals entering and leaving the country. All the inputs and outputs for the chemical balance are available except for country wide consumption, which can be calculated as follows:

Consumption of Chemical X = $\sum B_{i,in} + \sum P_i - \sum B_{i,out}$,

where i represents different Borders or Producers of chemicals. The appropriate stakeholders to contact with regard to Borders and Producers data are mentioned above.

With this information, it is possible to estimate where the consumed chemicals are being transported (e.g. acids used for steel pickling is likely being transported to a steel mill or other industrial areas with large steel works).

Furthermore, this information allows estimation of the maximum flow of chemicals along routes between the border areas for a worst case analysis.

An example calculation of this is shown in Annex D.

The following information per chemical should be collated in tabular form that allows the sorting and filtering of parameters (e.g. Excel table):

- UN Number
- CAS number
- Proper Name cross-referenced with UN Number
- Class according to ADR[4]
- Classification code according to ADR
- Packing Group according to ADR
- Hazard identification number according to ADR
- Total quantity
- Quantity of cylinders
- Quantity of drums
- Quantity of IBCs (intermediate bulk containers)
- Quantity of Tankers
- Quantity of others (specify which)

Step B: Determining the transport of chemicals between major fixed sites and along transport routes

The main chemicals entering and leaving the country have been identified in the preceding step. Furthermore, main destinations and the amount of the main chemicals have been identified.

[4] The ADR content can be found using the UN Number
http://www.unece.org/trans/danger/publi/adr/adr2013/13contentse.html

This step aims to determine which chemicals flow along which transportation corridors and will mainly involve the transport authorities, any major industrial users/producers, and transport associations/companies.

It is recommended that a questionnaire for transporters be developed after the Stakeholder Workshop to support this aim. The information requested in the questionnaire should include but not be limited to:

- UN Number
- CAS number
- Proper Name cross-referenced with UN Number
- Class according to ADR[5]
- Origin / Destination according to the nomenclature selected in step A (e.g. R1, IA2, etc.)
- Number of transports per year
- Per transport (truck), the total amount of chemicals specifying the packaging type:
    - cylinders
    - drums
    - IBCs (intermediate bulk containers)
    - Tankers
    - others (specify which)
- Specify variations with respect to transport if there are patterns (e.g. Friday evenings, high transport in certain months, etc.)

Input from individual transport companies and transport associations should be sought in drafting the questionnaire. Reference material in the form of maps and nomenclature (e.g. region, industrial area, etc.) should be provided with the questionnaire. Using an online questionnaire (e.g. surveymonkey) can facilitate the compilation of results much faster and usually generates a higher response rate.

When compiling the survey data, further classification the data as in step A based on the UN number:

- Classification code according to ADR
- Packing Group according to ADR
- Hazard identification number according to ADR

All results should be collated into the excel table and the amount of each major chemical between destinations estimated. It will be possible to compare the results from step A (at the borders) to the results from step B (going to the borders); a large discrepancy in results requires re-examination of the data.

In order to help estimate the probability of a chemicals transport accident, obtain heavy truck transport data or best estimates along the most important hotspot corridors from the transporter associations. This can be used as a ratio to estimate the probability of a chemical transport accident.

Step C: Combining the results

[5] The ADR content can be found using the UN Number
http://www.unece.org/trans/danger/publi/adr/adr2013/13contentse.html

The end result will be a national map and regional maps with the major routes and destinations of chemicals designated according to the stated nomenclature accompanied by the chemicals database containing the previously listed information (e.g. the quantity transported and stored, classification, type of containers, etc.). The flow of chemicals can be grouped according to ARD class (or classification code) and be displayed on the maps in order to show the relative amounts of specific chemicals classes that are transported throughout the country.

2.1.5.4 Presentation of results and recommendations for further actions

The main results of the hazard mapping study should be summarized graphically with hotspots and the flow and storage of chemicals. A filterable and referenced database will form the basis for the information contained on the maps. The maps should be shown in varying degrees of resolution where appropriate, e.g.:

- Country and the sub-region
- Major Kenyan cities and surrounding areas
- Major industrial parks / storage areas

The maps should also show human settlements, environmentally sensitive areas (waterways, protected areas), and property in order to help prioritize hotspots for future assessment.

2.1.6 Recommendations for further actions to alleviate hazard hotspots

The results should also include a section recommending actions to alleviate hotspots. Such recommendations should address official and unofficial issues. Examples of official issues include the training of drivers of chemicals or other dangerous goods, or positioning of a properly trained first responders station in appropriate locations (near major industrial area with a hotspot). Unofficial issues could include unofficial/temporary storage areas.

Although a full risk analysis is not expected here, hotspot priorities for a detailed risk assessment should be suggested and the main factors involved in the hotspots should be highlighted.

3 Suggested Report Outline

Suggested Report Outline

Chapter I: Introduction: Problem and methodology

Chapter II: Inventory of the main types of chemicals present in Kenya and the approximate location of production and storage facilities

Chapter III: Summary of the modes of transport for chemicals in Kenya and Graphic representation of main routes of chemical transport

Chapter IV: Suggestion of hazard hotspots and recommendation of further actions

Annex A

General list of Stakeholders to be included in the Hazard Mapping Analysis

A list of possible stakeholders include (according to TransApell):

- Rescue service departments
- Civil defence organisations
- Enforcement authorities
- Transport authorities
- Health agencies and hospitals
- Red Cross
- Airport authority
- Port authorities
- News organisations (TV, radio, newspapers)

Representatives from the following sectors should also be included in the stakeholder analysis:

- Road haulage industry
- Rail industry
- Petroleum industry
- Explosives and fireworks manufacturers
- Metal producing industry
- Soda and beer manufacturers
- Mining industry
- Fish processing industry
- Pharmaceutical industry
- Fertiliser manufacturers
- Specialty chemical manufacturers
- Cement manufacturers
- Chemical/agricultural storage
- Public works authorities
- Regional planning authorities
- Public works using chemicals, e.g. power generators, water treatment plants
- Cargo consolidators
- Cleanup contractors

List of potential Stakeholders specific to Kenya to be included in the Hazard Mapping Analysis

ICCA
UNEP – DTIE
UNEP – ROA
SAICM
Ministry of Environment and Mineral Resources
National Disaster Organisation Centre (NDOC)
National Environment Management Authority (NEMA)
Ministry of Transport
National Transport and Safety Authority
Kenya National Highways Authority (KeNHA)
Kenya Ports Authority
Government Chemist Department
Ministry of Agriculture
Ministry of Industrialization
Central bureau of statistics (CBS)
Kenya Bureau of Standards (KBS)
Occupational Health & Safety Department
Kenya Plant Health Inspectorate Service
National Public Health Laboratories
Ministry of Water and Irrigation
University of Nairobi
National road safety council
iLima Kenya
Red Cross
Kenya Transporters Association (KTA)
Kenya Independent Petroleum Distributors Association
Agricultural Association of Kenya
Agrochemicals Association of Kenya (AAK)
East African Community (AU)
Kenya Freight Forwarders Association

In addition, the following table from the SAICM Chemical Inventory report outlines the roles of different actors (http://www.environment.go.ke/saicm/).

	Stages of Life Cycle						
Ministry or Agency	Importation	Production	Storage	Transport	Distrubtion	Use/Handling	Disposal
Ministry of Environment and Mineral Resources							
NEMA	x	x	x	x	x	x	X
Mines and Geology			x	x	x	x	x
Ministry of Public Health and Sanitation	x	x	x	x	x	x	x
Government Chemists Department	x	x	x	x	x	x	x
National Public Health Laboratories			x			x	
Division of Vector Born Diseases			x			x	
National Public Health Laboratories Services			x			x	
Kenya Medical Research Institute			x			x	
Ministry of Medical Services							
National Quality Control Laboratories			x			x	x
Ministry of Agriculture	x	x	x	x	x	x	x
Kenya Agricultural Research Institute			x	x	x	x	X
Kenya Plant Health Inspectorate Services			x			x	
Pest Control Products Board	x	x	x	x	x	x	x
Directorate of Occupational Health and Safety Services	x	x	x	x	x	x	
Kenya Bureau of Standard	x		x	x	x		
Export Processing Zones Authority		x					
Ministry of Finance	x						
Ministry of Transport			x	x			
Kenya Ports Authority	x		x	x			
Kenya Air Port Authority	x		x	x			
Office of the Attorney General							
Ministry of Nairobi Metropolitan		X	x				x
Ministry of Local Government		X					x
Local Authorities			x			x	x
Ministry of Higher Education			x			x	
Universities	x		x			x	x
Intergovernmental Organisations							

Annex B – Hazard Mapping Workshop Support Material

Suggested elements for a condensed agenda are presented below:

Duration	Topic & Description
15 min	General Hazard Mapping Project & Objectives in the context of the chemicals management
10 min	Brief Introductions indicating why the stakeholders are here
30 min	Presentation of Hazard Mapping Methodology including: required information (with examples), level of detail sources of uncertainty,
30 min	Group Discussion on Methodology and identifying any potential problems and improvements
15 min	Coffee Break & Snacks
30 min	Identify Accident Blackspots on a national and regional level
30 min	Identify major industrial sites storing/using chemicals on a national and regional level. Indicate regional factors affecting storage and hazards
30 min	Identify major transport routes for chemicals and other dangerous goods on a national and regional level
15 min	Coffee Break & Snacks
30 min	Next Steps: the Chemicals Transport Analysis – who can provide what information?
30 min	Open discussion on the main causes of accidents involving chemicals and possible actions to improve chemicals transport safety
10 min	Closing remarks

Annex C – Preliminary List of Accident Blackspots in Kenya

The following accident blackspots are taken from the Kenya Roads Board[6] (KRB).

Nairobi

1. Kasarani G.S.U Stretch
2. Westlands Museum Roundabout
3. Westlands Kabete Road
4. Mombasa Road - between Zain Hqrs and City Cabanas
5. Jogoo Road Near Maziwa Stage
6. Waiyaki Way Near Kangemi Fly Over

Nyanza

1. Awasi Ahero Road Section
2. Kiboswa Kisumu Road Section
3. Daraja Mbili - Bondo Junction
4. Oyugis - Katitu Road Section
5. Migori Kakrao Road
6. Gucha Bridge
7. Migori Township
8. Ogembo Nyanguso Road
9. Kisii Township Main Road
10. Mwembe Area Kisii Town
11. Kisii Daraja Mbili

Western

1. Mbale - Vihiga Road Section
2. Kakamega - Chavakali Road Section
3. Kakamega - Kisumu - Ilesi Museno
4. Kakamega - Mumias Rd - Makunga
5. Kakamega - Webuye - Lubao, Kambi Ya Mwanza Ejinya Corner, Malava Forest
6. Bungoma - Eldoret - Chemoi
7. Kitale Webuye - Lugulu Misikhu

Eastern

1. Nkubu - Embu Road Section
2. Konza Junction To Salama Road Section - Mombasa/Nrb At Chumvi Area
3. Salama - Sultan Hamud Road Section
4. Emali Simba Market To Kibwezi
5. Mtito To Tsavo River Stretch
6. Nanyuki To Isiolo Junction At Subuiga

[6] http://www.krb.go.ke/road-conditions.html

7. Machakos - Wamunyu Road Section At Kithangathini
8. Mlolongo - Small World Club - Juction To Namaga And At Mto Wa Mawe Bridge

North Eastern

1. Garissa Madogo - Kbc Station
2. Modogashe - Habaswein
3. Ukasi - Bangale
4. Bangale - Hola Road Junction
5. Buna – Gurar

Central

1. Kiganjo - Narumoru Road
2. Kibirigwi - Sagana Road Section
3. Limuru - Uplands Section
4. Thika Blue Post - Sagana Bridge Road Section
5. Kiriaini - Muranga Road Section
6. Nyeri - Nyahururu Road
7. Makongeni (Along Thika - Garissa Road)
8. Makutano Embu Road
9. Kiambu - Muthaiga Road

Rift Valley

1. Kinungi - Naivasha - Gilgil Toll Station
2. Gilgil - Mbaruk Road Section
3. Molo G.S.U Camp - Salgaa
4. Salgaa To A.D.C. Farm Section
5. Timboroa - Burnt Forest Section
6. Chepsir - Kipkelion Junction
7. Kericho - Litein Road Section
8. Kericho - Kaitui Section
9. Endebes Eldoret Road Section
10. Nanyuki Isiolo Junction
11. Nyeri - Nyahururu Wiyumiririe Area
12. Gilgil Nakuru Road Kasambara Area

Coast

1. Tsavo - Maungu - Voi Road Section
2. Wundanyi - Mwatate Road Section

3. Maungu - Tsavo East Gate Road Section
4. Maktau - Taveta Road Section
5. Mazeras Miritini Road Section
6. Rabai Ribe Road Section
7. Kaloleni Dzitsoni Road Section
8. Kilifi - Vipingo Road Section
9. Kibarani - Changamwe Makande
10. Kwale Matuga Junction Road Section
11. Tembo Disco Area Along Msa - Malindi Road
12. Kengeleni Traffic Lights
13. Buxton Traffic Lights
14. Saba-Saba Lights
15. Kibarani Area
16. Sportsman Changamwe Area
17. Navy Junction Long Lunga- Lunga/Likoni Rd
18. Shika - Adabu Area
19. Waa Sec. School Area
20. Gede Area Along Msa-Malindi Road

Annex D – Example Map & Example Calculations in Support of the Chemicals Transport Analysis

Example of nomenclature

The following figure is an example of the nomenclature recommended to be used in the study.