



**SRBM.06.05.13**

**QUALITY CONTROL AND MONITORING GUIDELINES FOR THE  
ZAMBIAN PETROLEUM FUEL INDUSTRY**

**DECEMBER 2013**

**LIST OF ACRONYMS**

<b>COQs:</b>	Certificates of Quality
<b>ERB:</b>	Energy Regulation Board
<b>ISO:</b>	International Standardisation Organisation
<b>LPG:</b>	Liquefied Petroleum Gas
<b>LSGO:</b>	Low Sulphur Gas Oil
<b>SEG:</b>	Standard Export Grade
<b>OMC:</b>	Oil Marketing Company
<b>TBP:</b>	True Boiling Point
<b>NFT:</b>	Ndola Fuel Terminal
<b>ZABS:</b>	Zambia Bureau of Standard

## DEFINITIONS

For the purpose of these guidelines, the following definitions shall apply:

- Consumer facility:** An installation in which the storage facility is for own use.
- Depot:** Premises also known as marketing installations, on which the capacity for above ground storage of petroleum products is above 250 cubic meters and on which supplies are normally received from a refinery or from other bulk depots by road, rail, sea or pipeline (or by a combination of these) and from which such petroleum products are delivered directly to consumers. Such installation shall be equipped with loading and offloading facilities.
- Feedstock:** Suitably commingled mixture of pure crude oil and petroleum products to be imported by the importer for final processing in the Refinery meeting the required specifications.
- Importer:** Government or any undertaking licensed by the ERB to procure petroleum products from outside Zambia.
- Petroleum Products:** Unleaded petrol, Automotive Gas Oil (Diesel), Low Sulphur Gas Oil (LSGO), Kerosene, Propane, Butane, Jet A1, Heavy Fuel Oil (HFO), Liquefied Petroleum Gas (LPG) and blends of petrol and diesel.
- Retail Site Operator:** A Licensee or the duly appointed agent of the Licensee authorised to conduct the Licensed activity at the Licensed site.

## **1.0 INTRODUCTION**

The first revision of the Quality Control and Monitoring Guidelines for the Zambian Petroleum Fuel Industry was prompted by the need to address the following:

- i) Weaknesses of the existing guidelines as identified by the various stakeholder in the supply chain; and
- ii) Challenges associated with quality assurance in the wake of emerging issues.

Quality Control and Monitoring of biofuels and blended petroleum products is outside the scope of these guidelines.

## **2.0 COMPOSITION OF THE TECHNICAL COMMITTEE**

The guidelines were revised by the Quality Control and Monitoring Technical Committee comprising the following members:

- i) Engen Petroleum (Z) Limited - Chairman
- ii) INDENI Petroleum Refinery
- iii) TAZAMA Pipeline
- iv) Puma Energy (Z) Plc.
- v) Total (Z) Limited
- vi) Zambia Bureau of Standards
- vii) Alfred H Knight (Zambia) Laboratory
- viii) Ministry of Mines , Energy and Water Development- Department of Energy
- ix) Biofuel Association of Zambia; and
- x) Energy Regulation Board – Secretary

## **3.0 THE ZAMBIAN PETROLEUM CHAIN**

All petroleum products in Zambia are imported either as feedstock or finished products and supplied to the Zambian market through a supply chain as illustrated in Appendix 1.

### **3.1 Feedstock Handling**

Systems and procedures at different points of feedstock handling are as follows:

#### *3.1.1 Loading of Feedstock Components at Loading Port*

Feedstock cargo composition is currently formulated by INDENI Petroleum Refinery and is availed to the importer who subsequently forwards the same to the supplier. Cargo formulation is based on models of behaviour of different components based on data collected from processing of the respective components in the past.

The Refinery is able to establish the following from their analysis of the feedstock:

- i) Compliance of all finished products with respective Zambian petroleum product quality standards; and
- ii) Yields from the feedstock with respect to the physical limits in terms of throughput for refining units.

The different components to be supplied are expected to conform to the Standard Export Grade (SEG) specified in assay sheets provided by the supplier. In order to ensure adherence to the aforesaid, the standard industry practice is to have all loadings verified by an independent inspector. The responsibilities of the inspector are as follows:

- i) To determine the quantity of components loaded on the ship; and
- ii) To certify that the quality of the components that are loaded satisfy the SEG.

The Bill of Lading and the Certificates of Quality (COQs) are deposited in a sealed packet with the master of the vessel.

After the ship has been loaded, there are two possibilities for mixing:

- i) On board commingling; and
- ii) Commingling at discharge.

Whichever methodology of mixing is used, the objective is to ensure that a homogenous cargo is received at the Tank Farm in Dar-es-Salaam. This will result in the expected yields being achieved and also that the expected refinery requirements are met.

### *3.1.2 Discharge of Feedstock at Discharge Port*

The ship arrives at the discharge port and tenders Notice of Readiness. TAZAMA Pipelines, as an agent, currently handles the receipt and preparation for receiving feedstock on behalf of the importer. An independent inspector also inspects the vessel before discharge and then determines how much has been received in the shore tanks. The inspector will also verify that seals applied at point of loading are intact. TAZAMA Pipelines collects samples of the feedstock from the vessel and the tank farm for True Boiling Point (TBP) testing at INDENI Petroleum Refinery Laboratory. Offloading of the cargo should only be done upon validation of the conformance to the expected cargo quality.

### *3.1.3 Receipt and Evaluation of Feedstock at INDENI Petroleum Refinery*

Feedstock is received at the INDENI Petroleum Refinery in Ndola, measured through a meter and subsequently stored in storage tanks. The Refinery monitors the pipeline contents.

## **3.2 Finished Products Handling**

Systems and procedures at different points of handling finished products from INDENI Petroleum Refinery are as follows:

### *3.2.1 Certification of finished Products at INDENI Petroleum Refinery*

The feedstock is refined into finished products at INDENI Petroleum Refinery. The products are tested and certified on a batch by batch basis by the INDENI Laboratory as conforming to the requirements of Zambian petroleum product quality standards. Thereafter, the following products are pumped over to the Ndola Fuel Terminal (NFT):

- i) Unleaded Petrol;
- ii) Automotive Gas Oil;
- iii) Kerosene; and
- iv) Jet A-1.

The following petroleum fuel products are batched and dispensed from the INDENI Petroleum Refinery:

- i) Liquefied Petroleum Gas;
- ii) Butane;
- iii) Light Fuel Oil; and
- iv) Heavy Fuel Oil;

### *3.2.2 Re-certification of finished products pumped over to Ndola Fuel Terminal (NFT)*

Finished products are received at the NFT for distribution to the market. Upon receipt of each batch, the tank is allowed to settle before a sample is taken for re-certification at the INDENI Petroleum Refinery Laboratory. The Certificates of Quality (COQs) for the product shall be availed to Oil Marketing Companies (OMCs) on loading.

### *3.2.3 Transportation of finished products*

Loaded road tank vehicles and rail wagons are sealed and transported to OMC depots, filling stations and consumer facilities.

### *3.2.4 Re-certification at OMC Depots*

Depots operated by OMCs receive product from INDENI Petroleum Refinery, government owned bulk storage facilities and through imports. Road tank vehicles and rail wagons carrying imported petroleum products shall arrive with batch COQs from the source. In some cases, the product from INDENI Petroleum Refinery is mixed with imported product at depots. In such instances, this 'mixed' product shall be subjected to re-certification.

### 3.2.5 Receipt and handling of Product at Consumer Sites and Filling Stations

On receipt of petroleum products, the receiver is expected to ensure that all seals are not tampered with. The seals are then broken and ullage marks inspected. The receiver conducts quality checks prior to offloading of petroleum products. Quality checks shall include temperature, density, colour and presence of water.

### 3.3 Handling of Imported Petroleum Products

Imported petroleum products shall be dispatched from the source with batch COQs. The COQ shall be presented to the Zambia Bureau of Standards (ZABS) inspectors at the point of entry for preliminary quality checks. Thereafter, quality checks of varying levels of detail shall be conducted on the product prior to offloading at the final destination.

## 4.0 CRITICAL STAGES IN THE SUPPLY CHAIN FOR QUALITY CONTROL AND MONITORING

Several stages in the handling of both feedstock and finished products are critical when it comes to ensuring that the quality of petroleum products reaching the consumer conforms to respective Zambian standards. These are as outlined in the subsequent subsections:

### 4.1 Critical Stages during Feedstock handling

The following stages are identified as being critical during feedstock handling:

- i) Loading of petroleum feedstock components at loading port;
- ii) Discharge of petroleum feedstock at discharge port (Dar-es-Salaam); and
- iii) Receipt and evaluation of feedstock at INDENI Petroleum Refinery (Ndola).

FEEDSTOCK HANDLING STAGE	NECESSARY QUALITY CONTROL MEASURE	RESPONSIBLE ENTITY
Feed stock loading point	Certification of product by independent inspector	Importer
Discharge point (Dar-es-salaam)	Quality checks by an independent inspector	Importer
Receipt point at Refinery	Full quality analysis	INDENI Petroleum Refinery Operator

### 4.2 Finished petroleum products handling

#### 4.2.1 Handling of Finished products from INDENI Petroleum Refinery

The following are the critical points in the handling of finished products from INDENI Petroleum Refinery for quality assurance purposes:

- i) Certification of all finished products;
- ii) Re-certification of finished products pumped over to NFT;
- iii) Re-certification of Petroleum Products at OMC depots; and
- iv) Receipt of Petroleum Products at both retail sites and consumer facilities.

<b>HANDLING STAGE FOR FINISHED PRODUCT FROM INDENI</b>	<b>QUALITY CONTROL MEASURE</b>	<b>RESPONSIBLE ENTITY</b>
Production	Certification	INDENI Petroleum Refinery Operator
Receipt of petroleum products from the Refinery at NFT	Re-certification	Ndola Fuel Terminal Operator
Receipt of petroleum products at OMC depots	Quality checks	Depot operator
Receipt of petroleum products at retail sites or consumer facilities	Quality checks	Retail site or Consumer facility operator

#### 4.2.2 Handling of Imported Petroleum Products

The source of finished products on the Zambian market is wide. However, the following points are identified as common critical points in the handling of imported finished products for quality assurance:

- i) Certification of product at source;
- ii) Certification of product at point of discharge;
- iii) Certification of recipient storage tanks upon discharge;
- iv) Re-certification of Petroleum Products at OMC Depots;
- v) Receipt of Petroleum Products at both consumer and retail sites.

<b>HANDLING STAGE FOR IMPORTED FINISHED PETROLEUM PRODUCTS</b>	<b>QUALITY CONTROL MEASURE</b>	<b>RESPONSIBLE ENTITY</b>
Dispatch point from source	Certification	Supplier
Port of entry	Inspection	ZABS
Discharge point at the: <ul style="list-style-type: none"> <li>• Government depots</li> <li>• OMC depots</li> </ul>	a) Re-certification b) Re-certification	Importer OMC
Receiving point at retail sites and consumer facility	Quality checks	Retail site or Consumer facility operator

## 5.0 SAMPLING OF FEEDSTOCK AND PETROLEUM PRODUCTS

Sampling of feedstock and liquid finished petroleum products shall be undertaken in accordance with the requirements stipulated in the Zambian Standard **ZS 396: Sampling Petroleum Products Part 1: Manual sampling of liquid hydrocarbons**. In the absence of a Zambian Standard for sampling of gaseous hydrocarbon, sampling shall be conducted in line with internationally accepted best practice.

## 6.0 TESTING OF FEEDSTOCK AND PETROLEUM PRODUCTS

Testing of petroleum products shall be done by any laboratory that is accredited against **ISO 17025: General Requirements for the Competence of Testing and Calibration Laboratories**.



## **7.0 RESPONSIBILITIES OF STAKEHOLDERS**

In order for the consumers to get a product of acceptable quality, all stakeholders shall play their role effectively. The following subsections highlight the said responsibilities:

### **7.1 Importer of Petroleum Feedstock**

The importer of feedstock shall ensure the following:

- i) Homogeneity of feedstock upon commingling in accordance with best practice by the time cargo is offloaded into the tanks in Dar-es-Salaam ;
- ii) COQs for all components loaded on each cargo are filed with the Energy Regulation Board (ERB) before the ship docks in Dar-es-Salaam;
- iii) Samples collected for True Boiling Point (TBP) testing are a composite of upper, middle and bottom level samples; and
- iv) TBP test results are filed with the ERB before processing of the cargo is commenced.

### **7.2 Refinery**

The operator of the refinery shall:

- i) Simultaneously submit to the importer and the ERB a copy of the cargo formulation for the consignment to be procured;
- ii) Certify all batches of petroleum products produced. COQs for each batch (identified by a number) shall be filed with the ERB. The following information should be clearly indicated on the COQ:
  - a) Date of sampling;
  - b) Date of analysis;
  - c) Certificate Number;
  - d) Batch Number;
  - e) Batch Size;
  - f) Tank Number.
- iii) Clean tanks at least once every three (03) years for Jet A1 and ten (10) years for other products. However, if there is reason to believe that petroleum product quality in the tank is likely to be compromised by excessive sludge accumulation, tank cleaning shall be undertaken earlier than the aforesaid period.

Tank cleaning shall be undertaken in accordance with the provisions of

all relevant Zambian standards including but not restricted to the following:

- a) **ZS 604 Part 2: Tank Cleaning Safety Code**; and
- b) **ZS 671: Environmentally Sound Management of Waste Oils – Guidelines**

### **7.3 Government bulk storage facilities**

The operator of Government bulk storage facilities shall:

- i) Clean tanks at least once every three (03) years for Jet A1 and ten (10) years for other products. However, if there is reason to believe that petroleum product quality in the tank is likely to be compromised by excessive sludge accumulation, tank cleaning shall be undertaken earlier than the aforesaid period.

Tank cleaning shall be undertaken in accordance with the provisions of all relevant Zambian standards including but not restricted to the following:

- a) **ZS 604 Part 2: Tank Cleaning Safety Code**; and
  - b) **ZS 671: Environmentally Sound Management of Waste Oils – Guidelines**
- ii) Provide COQs as issued by an ISO 17025 accredited laboratory for all products sold to OMCs. The following information should be clearly indicated on the COQ:
    - a) Date of sampling;
    - b) Date of analysis;
    - c) Certificate Number;
    - d) Batch Number;
    - e) Batch Size;
    - f) Tank Number.

The said COQs shall be filed with the ERB.

### **7.4 Importers of finished petroleum products**

The importer of finished products shall:

- i) Ensure that all imports are accompanied by a COQ issued by an ISO 17025 accredited laboratory. Copies of the said COQs shall be submitted to ZABS officers at the point of entry for inspection ~~for~~ onward transmission to the ERB;

- ii) Ensure that all imported petroleum products meet or exceed the relevant national standards; and
- iii) Re-certify all tanks that have received imported product using an ISO 17025 accredited laboratory prior to dispatch into the market. The following information should be clearly indicated on the COQ:
  - a) Date of sampling;
  - b) Date of analysis;
  - c) Certificate Number;
  - d) Batch Number;
  - e) Batch Size;
  - f) Tank Number.

## **7.5 Oil Marketing Companies**

The operator of OMC depots shall:

- i) Conduct quality checks prior to receipt of locally sourced petroleum products. Checks are to include temperature, density, colour and water testing;
- ii) Maintain documentation that clearly shows the chain of custody of all petroleum products. Refer to the Products Stock Transfer sheet in appendix 2; and
- iii) Clean tanks at least once every three (03) years for Jet A1 and ten (10) years for other products. However, if there is reason to believe that petroleum product quality in the tank is likely to be compromised by excessive sludge accumulation, tank cleaning shall be undertaken earlier than the aforesaid period.

Tank cleaning shall be undertaken in accordance with the provisions of all relevant Zambian standards including but not restricted to the following:

- a) **ZS 604 Part 2: Tank Cleaning Safety Code**; and
- b) **ZS 671: Environmentally Sound Management of Waste Oils – Guidelines**

## **7.6 Transporters**

The transporter of petroleum products shall:

- i) Ensure that the road tank vehicle complies with all the relevant Zambian Standards including but not restricted to the following:
  - a) **ZS 371: ROAD TANK VEHICLES FOR PETROLEUM BASED FLAMMABLE LIQUIDS – Specifications**;

- b) **ZS 372: TRANSPORTATION OF PETROLEUM PRODUCTS :Operational Requirement for Road Tank Vehicles – Code of Practice;** and
- c) **ZS 429 Part4: THE HANDLING, STORAGE AND DISTRIBUTION OF LIQUIFIED PETROLEUM GAS (LPG) IN DOMESTIC, COMMERCIAL AND INDUSTRIAL INSTALLATIONS – Transportation of LPG in Bulk by Road – Code of Practice.**
  - ii) Ensure that all road tank vehicle compartments are free of debris;
  - iii) Flush the compartments of the road tank vehicle whenever there is a change in loading from :
    - a) Any petroleum product to another; and
    - b) Any chemical to petroleum products.
  - iv) Ensure that petrol and kerosene are not carried on the same trailer; and
  - v) Monitor the movement of their loaded road tank vehicles from point of loading to point of discharge.

## **7.7 Operators of retail sites and consumers facilities**

The operators of retail sites and commercial consumer facilities shall:

- i) Conduct quality checks on petroleum products on the truck and receiving tanks prior to offloading. Checks shall include temperature measurement, density measurement, colour and water testing;
- ii) Maintain a record on site (for at least three months) of all deliveries showing the measurements mentioned in (i) above. A sample of the record has been included as Appendix 2; and
- iii) Clean tanks at least once every three years for Jet A1 and ten years for other products. However, if there is reason to believe that petroleum product quality in the tank is likely to be compromised by excessive sludge accumulation, tank cleaning shall be undertaken earlier than the aforesaid period.

Tank cleaning shall be undertaken in accordance with the provisions of all relevant Zambian standards including but not restricted to the following:

- a) **ZS 604 Part 2: Tank Cleaning Safety Code;** and
- b) **ZS 671: Environmentally Sound Management of Waste Oils** <sup>12</sup>  
**Guidelines**

- iv) The OMC/ independent retailers shall be responsible for the quality assurance of petroleum products being offered to the consumers.

## **7.8 Energy Regulation Board**

The Energy Regulation Board (ERB) shall:

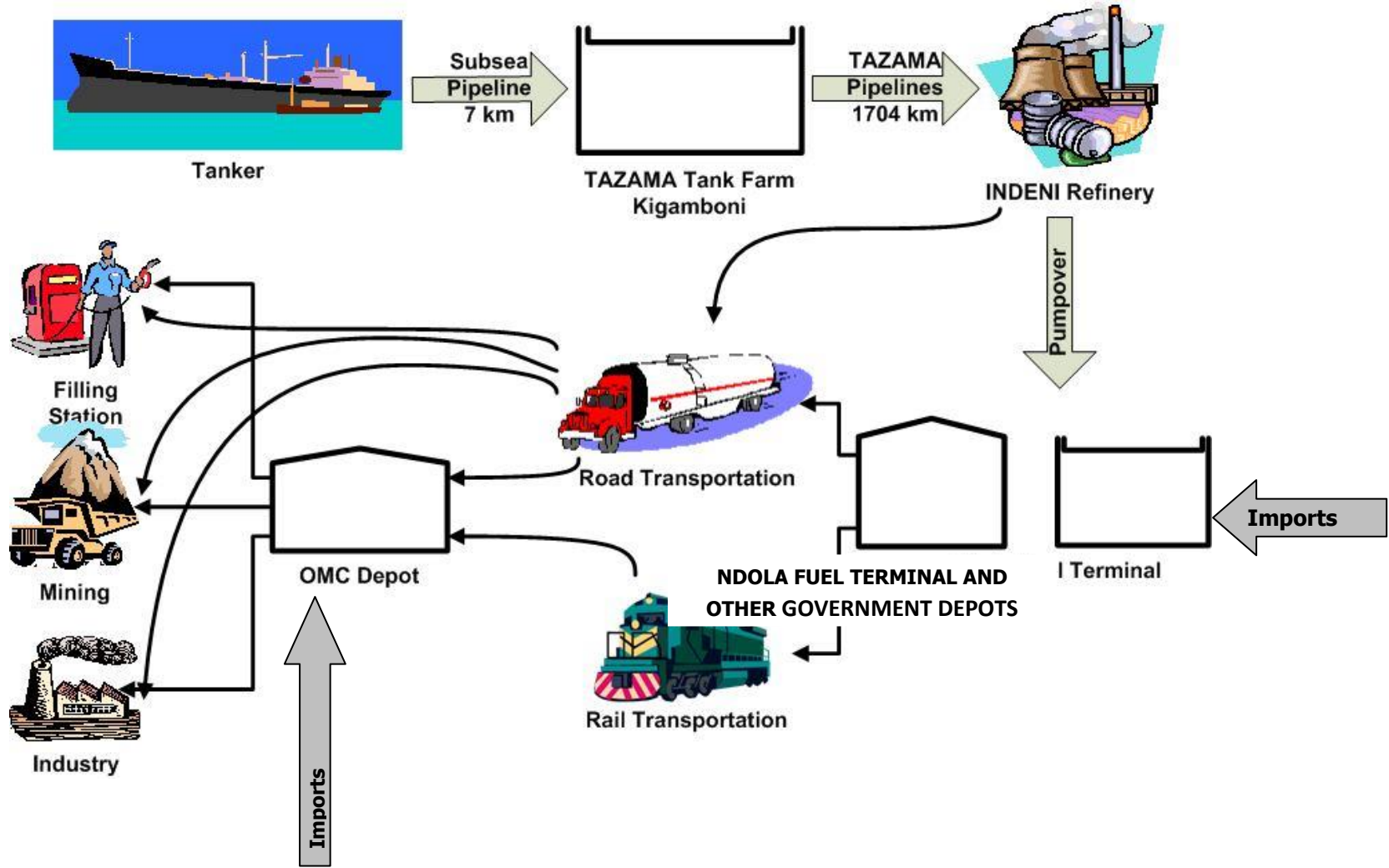
- i) Ensure that the guidelines herein are adhered to;
- ii) Conduct random sampling and testing of petroleum products from the following facilities:
  - a) Refinery (at least twice a quarter);
  - b) Government depots (at least twice a quarter);
  - c) Oil Marketing Company depots (at least once a quarter); and
  - d) Consumer sites and retail sites (at random).
- iii) Conduct an audit of the quality control procedures of industry players as provided for by these guidelines at least once every two (02) years;
- iv) Obtain, interpret and maintain a database of all quality related information from all industry players; and
- v) Ensure that petrol and kerosene are not carried on the same trailer.

## **7.9 Zambia Bureau of Standards**

The Zambia Bureau of Standards (ZABS) shall:

- i) Enforce all mandatory road tank vehicle and petroleum products standards through inspections, sampling, testing and certification; and
- ii) Collection of COQs from importer at the point of entry and copies of the certificates forwarded to the ERB. The quality certificate(s) shall be issued by an ISO 17025 accredited laboratory

**APPENDIX 1: The Zambian Petroleum Chain**



**APPENDIX 2: SAMPLE OF A PRODUCTS STOCK TRANSFER SHEET**

<b>PRODUCT STOCK TRANSFER SHEET</b>			
<b>BULK PRODUCT BY ROAD AND RAIL</b>			
<b>1.0</b>	<b>ISSUING DEPOT:</b>	<b>OIL MARKETING COMPANY:</b>	
	Date:		Temperature $^{\circ}$ C:
	Product:		Density
	Batch certificate No.:		Water test
	Delivering Tank No.:		Colour
	Observed Volume (Litres):		Suspended particles:
	Transporter:		<u>Seal Numbers</u>
	Vehicle Registration No:		1
			2
			3
	Dispatching Depot Operator's Name and Signature		4
			5
			6
	Tanker Driver's Name and Signature		7
<b>2.0</b>	<b>RECEIVING SITE</b>		
	Date:		
	Observed volume recieved (Litres):		
	Temperature $^{\circ}$ C:		
	Density:		
	Colour:		
	Suspended particles:		
	State of seals:		
	Receiving official Name and Signature		Driver's Name and Signature
<b>3.0</b>	<b>TO BE FILLED IN BY THE RECEIVING SITE</b>		
	Volume dispatched (Litres):		
	Volume received (Litres):		
	Loss/ gain (Litres):		
	% Loss/ gain:		
<b>4.0</b>	<b>COMMENTS BY THE RECEIVING SITE:</b>		