



IN PARTNERSHIP WITH



## **COLD CHAIN EQUIPMENT (CCE)**

### **Case Studies for Marketplace Analysis**

Prepared by:

IMPERIAL GROUP LIMITED, Trading through its division Imperial Health Sciences and Strategnos CC

## CONTENTS

1. Background .....	3
2. Healthcare sector case study research .....	5
2.1. Overview .....	5
3. Non healthcare sector case study research .....	9
3.1. Overview .....	9
5. Local and multinational manufacturer/agent.....	18
5.1. Overview of capability and reach into Africa.....	18
Annexure 1: Acknowledgements and contact details .....	22
Contacts Details .....	22

## 1. Background

Research was conducted to investigate what preconditions exist for the engagement of the private sector in support of public health initiatives. We sought to understand the models for the deployment of maintenance management of cold chain and related equipment across multiple industries in the private sector. In this document we provide case studies for:

Industry	Healthcare Sector	Non Healthcare Sector
Mining	Kenieba Health Centre	Mining Equipment
Healthcare	The Biovac Institute (TBI) and Litha Healthcare	
	Imperial Health Sciences	
Catering & Hospitality		ATS Group
Retail		Imperial Fast 'n Fresh, South Africa
		Star Bazaar, India
Non Healthcare, Non Cold Chain equipment		Mining:-Randgold Resources- Mine equipment maintenance
Retail-Cold Chain Equipment Manufacturer/Agent	Samsung and Zero Appliances	

We also reviewed a set of five West African countries across multiple industries, to gain insights into the status of equipment maintenance in the region. The final study was of the local and multinational manufacturer/agents providing spare parts.

The findings from the in-country visits and case study reviews provide a high level overview of the marketplace, identifying the achievements and challenges that the cross sector organizations encounter.

### Market challenges:

Market failure often occurs due to inefficiency in the allocation of services, including the provision of spare parts; or price mechanisms fail to account for all of the costs and benefits involved with the required maintenance service. Specific situations that typically contribute to potential failure may include:

- **Regulations:** Restrictions such as price floors or price ceilings prevent the price mechanism from efficiently allocating resources. Example: minimum wage laws.
- **Market dynamics:** The country's maintenance market might feature economies of scale or significant start-up costs, so it is possible for an inefficient market outcome to be reached if one service provider (or a few large service providers) is able to exclude others to the detriment of potential market participants.

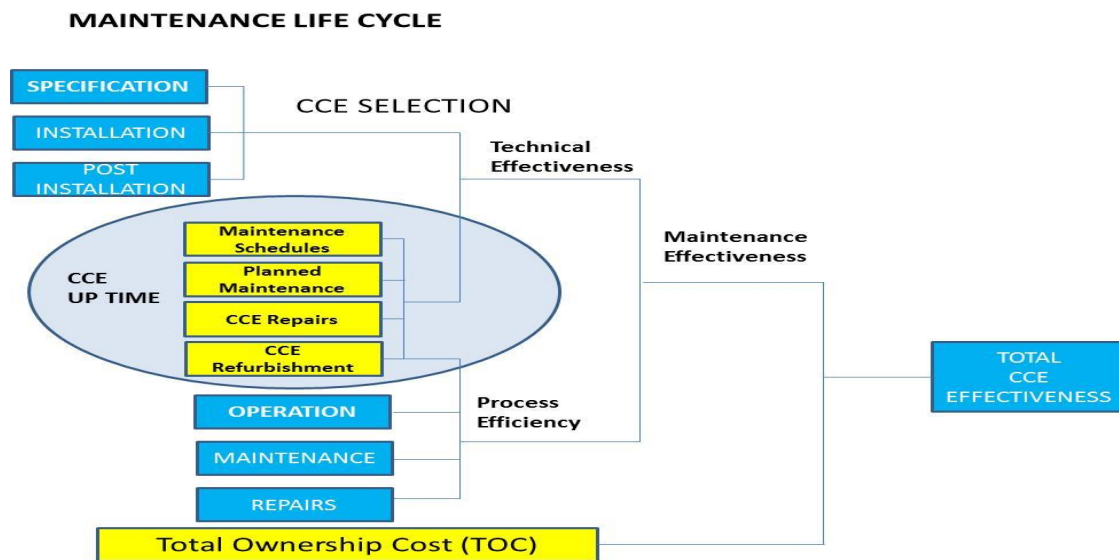
- **Transaction costs:** If the cost of engaging in providing a service is high in the first place, a market cannot function.
- **Poor visibility of information:** One party has material information that the other does not, or both parties lack material information that would affect whether or not the service occurs, or for what price it occurs. Examples: CCE condition information, location of CCE.
- **Poor budgeting and planning:** Factors are weighted inappropriately; long term costs are ignored in favor of short term benefits, etc.
- **Lack of public services:** Public services are where the total cost of providing the service does not increase with the size of the population. As an example of a public service, CCE maintenance has a fixed cost that is the same, whether one hundred vaccines are used or one thousand vaccines use its functionality.
- **Maintenance contracts failure:** Even after all these years of turning over work to contractors, outsourcing maintenance and engineering duties in institutional and commercial facilities is still a small percentage of the total work that departments perform. Organizations tend to consider the maintenance outsourcing path when their existing maintenance departments fail them or appear incapable of keeping the facilities in service, or when labor problems become unbearable to the management team and owners. Outsourcing can be an effective tool to help managers and organizations make progress toward productivity and effectiveness, but outsourcing is not always a more cost effective or successful alternative.

#### Mitigating recommendations

- **Maintenance service agreements:** there are two dimensions to setting up the agreement, the contract conditions and the statement of requirement. Before considering the type of contract that should underpin the service delivery, the management should apply some considerable thought to the relationship they wish to establish with the service provider. A performance based structure will support a more interactive relationship and should incorporate effective mechanisms for managing change and resolving conflict. The statement of requirement is a critical component of the agreement to define performance targets, the SLAs and KPIs.
- **CCE monitoring:** It is essential that the SLA and KPI requirements are monitored and measured, and that the CCE life cycle is created for each item of CCE in the processes applied to the maintenance program. The diagram below highlights the effectiveness and efficiency correlation necessary to enable success. Each activity must be a fixed date in the calendar, in order that the maintenance schedules can be agreed and properly prepared with the selected maintenance contractor(s), together with a determination of the due date for the replacement of the individual piece of CCE.<sup>1</sup>

---

<sup>1</sup> AW.Hayman Imperial Health Sciences



- Communication:** There will be the inevitable unforeseen circumstances, variation or personality change, these require effective management as and when they occur, to ensure that the relationship is maintained. Experience has shown that ineffective communication is one of many key activities that impacts success or failure of many projects. Coach as required, review, monitor, seek facility and contractor feedback (successful and unsuccessful) and report on performance.
- Maintenance provider forums:** Establishing a forum will enable the clients in a market such as the medical stores to network and learn from CCE maintenance contractors participating at events. It will allow for a broad, representative and productive focus on technology updates and information on successes and failures. <sup>2</sup>A typical website will facilitate the creation of community interaction beyond the forums to share ideas, talk about future needs, progress of the project, etc. These activities build trust

## 2. Healthcare sector case study research

### 2.1. Overview

To provide insights into the maintenance approach and strategies deployed across private and public organizations, case studies for the following entities are shared:

1. Private sector mining: Kenieba Health Centre
2. Public/private partnership: The Biovac Institute (TBI) and Litha Healthcare
3. Private sector healthcare: Imperial Health Sciences

<sup>2</sup> Website Toolbox

### **2.1.1 Kenieba Health Centre (Randgold Resources Limited) - Somilo Mine, Loulo region, Mali**

#### Overview

Randgold provides access to healthcare for all of its employees, their families and communities within a 10 km radius of its mines. These mines are located in Kibali in the Democratic Republic of Congo; in Morila, Loulo and Goukoto in Mali; and Tongon in the Ivory Coast. As part of its sustainability policy, the company aims to set up clinics at its mines, as well as in the surrounding villages. Clinics which are set up in villages are handed over to local authorities in the medium to long term. In 2014, the Randgold clinic in Kibali was handed over to provincial authorities. Randgold currently operates seven clinics across Africa. In 2014, approximately 100 000 medical consultations were conducted at these clinics. The company has formed partnerships with local organizations and NGOs where ever possible. In addition to creating clinics, Randgold has assisted CURE with the distribution of medical equipment.

#### Equipment maintenance approach

- All installations and maintenance actions are outsourced to contractors who possess the expertise. There are adequate contractors within the region to address any maintenance failures.
- Typically, most spare parts are not kept on-hand and any maintenance required is of breakdown nature.
- The clinic does not keep any spare parts. The parts will be brought by the contractor when required to perform any maintenance or replacements. An example of a contractor within the region is Samsung.
- Domestic fridges are used to store all vaccines and medication and as such, require less intensive maintenance models.
- Temperature monitoring takes place using min/max thermometers and recording these as per the WHO template for temperature recording.

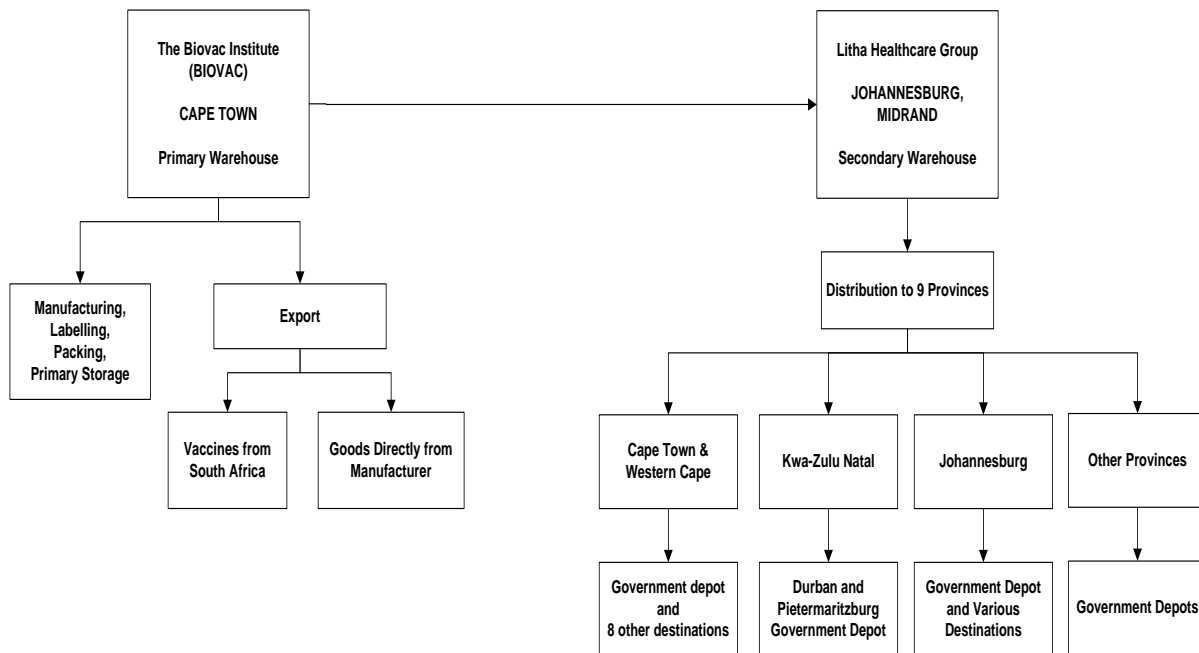
### **2.1.2 The Biovac Institute (BIOVAC) and Litha Healthcare Group- South Africa**

The Pharmacist for Litha Vaccines was contacted order to understand BIOVAC's and its related associates (Litha) cold chain equipment maintenance strategies considering the group's involvement in the manufacture, storage and distribution of thermolabile pharmaceutical products (specifically vaccines).

#### Supply Chain

The BIOVAC-Litha interaction and the cold chain landscape was explained to encompass the following nodes. BIOVAC is responsible for manufacture, labelling and primary storage of vaccines in Cape Town. BIOVAC is a public private partnership and is contracted to source and supply vaccines to the South African government. Public-Private interaction for vaccination programs occurs on this level. BIOVAC utilizes Litha's infrastructure for secondary storage and onward distribution of the EPI vaccines. Certain vaccines are transported by BIOVAC directly to Swaziland, Mozambique, Namibia and Botswana. Litha distributes

vaccines to provincial South African-based government depots on behalf of BIOVAC. The supply chain begins at BIOVAC where BIOVAC transports vaccines manufactured in Cape Town to the main warehouse facility in Johannesburg, Midrand, who is then the main distributor. Cold Chain product is then transported to various government depots in locations such as Cape Town and the Western Cape (there are 9 hub-level destinations in this region), Kwazulu (various destinations) Natal and Johannesburg (various destinations). Please refer to the graphic below.



Equipment Maintenance Approach

In order support the aforementioned supply chain, Litha, specifically, has a large Midrand-based warehouse facility with the following critical equipment:

- 1) 1x cooled receiving area (maintained between 10 °C – 15 °C).
- 2) 3x large temperature controlled walk in cold rooms (maintained between 2 °C – 8 °C).
- 3) 1x small temperature controlled walk in cold room (maintained between 2 °C – 8 °C).
- 4) 1x small temperature controlled area (maintained between -25 °C to -20 °C) – storage of Polio Vaccine.
- 5) 2x small temperature controlled areas (maintained between -20 °C to -15 °C) – storage of frozen gel packs.

Litha employs a hybrid CCE maintenance model to support their cold chain equipment. One (1) staff member has received training from an accredited refrigeration course, who is able to service simple and/or uncomplicated problems and troubleshoot more complicated problems with remote assistance from the service company “Matador Refrigeration” who is the servicing agent. Matador has 27 technicians and provides Litha with 24 hour emergency service. Matador is scheduled to come on site every 2 – 3 months and provide cleaning, checking and preventative maintenance according to their SLA and Litha’s in-house checklist. The only critical spare part Litha maintains on site is an additional Carel controller in case the main system controller fails. This would be considered a catastrophic failure. Furthermore, Litha does not store spare parts on site but rather relies on Matador, who brings their own tools and spares to the facility.

Notably, each Cold Room runs on two (2) compressors, therefore should one system fail the other system may run as a backup. Thus there is no need to keep spare parts on site.

### Skills

After every service or maintenance action, Matador completes a Job Card detailing what has been performed. Litha is happy with Matador as they provide a professional service with skilled technicians who are knowledgeable of the Litha systems. A schedule for preventative maintenance is part of the Litha SOP but Litha do not keep a register of past maintenance details per unit.

### Innovation

Besides for the Carel controller, Litha Healthcare make use of a generator (but do not keep additional fuel on site), which is maintained according to their SOP.

## **2.1.3 Imperial Health Sciences – South Africa**

### Overview:

Imperial Health Sciences is a leader in cold chain management for pharmaceutical supply chain services. From our fully compliant, world class warehousing facilities, we are practicing internationally benchmarked cold chain procedures and raising the bar for cold chain practice across South Africa and for export into Africa.

Many practitioners in the pharmaceutical and healthcare sectors in South Africa are unaware of the critical importance of maintaining an unbroken cold chain in the shipping and storage of temperature sensitive pharmaceutical products, such as essential vaccines. The mission of the Imperial Health Sciences cold chain management system is to ensure that every man, woman or child who is vaccinated or receives essential medication, is assured of being treated with a drug that is fit for purpose.

### Equipment Maintenance Approach

Imperial Health Sciences use the outsourced (Service provider) model for maintaining its CCE. The rationale behind this management decision was based on focusing on core competencies rather than CCE maintenance which is a specialized area of competency. However due to the critical nature of CCE, IHS have internal staff who are responsible for managing the CCE operational performance, compliance and on-going adherence to internal procedures. This is done through internal staff that has been trained in the CCE aspects; they use monitoring equipment (Temperature gauges, weekly performance checks and software (Plantvisor Pro) to ensure CCE is running within the specifications.

The operational and regulatory responsibility sits with the Responsible Pharmacist. Quality Assurance systems staff is responsible for the validation process and daily checks on compliance, reporting to the Responsible Pharmacist on any deviations.



The appointed Service Provider has signed a contract (service level agreement) to ensure scheduled maintenance, emergency maintenance and spares are available to ensure the continued operation of the CCE. Response times are critical in the SLA as are back-up CCE and power generation equipment.

The system installed at our Regional Distribution Centers and at our warehouses in South Africa has full redundancy in the CCE design. This system can accommodate servicing of units whilst no down time on maintaining cold conditions is impacted.

A fully functional alarm/SMS/email system ensures notification of cold room deviations and compressor/condenser alarms (both flashing lights and siren) to responsible staff.

During the design phase it was ensured that CCE was sourced from reputable manufacturers with core competencies in CCE. It was essential to ensure spares availability and location/access to these spares were available and contained in Africa.

In the event of a catastrophic event, we have agreements with similar organizations in the area to move cold chain pharmaceuticals via temperature controlled vehicles to facilities which are temperature compliant.

### 3. Non healthcare sector case study research

#### 3.1. Overview

To provide insights into the maintenance approach and strategies deployed across industries, case studies for the following entities are shared:

1. Cross industry region review - West Africa
2. Catering and hospitality - ATS Group
3. a) Retail - Imperial Fast 'n Fresh, South Africa; b) Star Bazaar, India
4. Non Healthcare, Non Cold Chain equipment-Randgold Resources- Mine equipment maintenance

##### 3.1.1 West Africa

As many countries in Francophone West Africa are identified by Gavi as priority countries, this review of five countries was conducted to establish the status of capability, ideally to gain insights into the potential of a regional approach, or at least to gain learnings from the region.

##### **Guinea:**

There is not a lot of information available about industries in Guinea which may be using cold chain equipment. The food retail industry appears to be made up of supermarkets with French company Leader Price having a presence. This industry, with wholesale, makes up nearly 18% of the country's GDP.

**Ivory Coast:**

There are several industries in Ivory Coast that may already be utilizing cold chain equipment. These are the private pharmaceutical sector, hospitality and entertainment, food retail and fishing industries. The private pharmaceutical industry makes up 1.43% of Ivory Coast's GDP, with a total value of approximately 494 million USD. Many drugs come from Europe and India. Most pharmacies are small and privately owned.

The hospitality and entertainment industry utilizes cold chain equipment in bars and restaurants to keep food and beverages cool. These industries fall into the tourism sector of the economy which employs more than 189 500 people in Ivory Coast and makes up approximately 4% of the GDP. The value of the tourism sector is more than 677 billion XOF. Companies using refrigeration equipment include restaurants, hotels and casinos.

The food wholesale and retail industry in Ivory Coast makes up 15% of the country's GDP. Most companies appear to be independent supermarkets. The fishing industry in Ivory Coast is well developed and is predominantly made up of tuna fishing and canning. Fishing, together with agriculture, makes up 19% of the GDP.

It is likely that one would find the type of infrastructure that is present in the DRC.

**Liberia:**

There are several industries in Liberia that may already be utilizing cold chain equipment. These are the private pharmaceutical, food retail and fishing industries. The private pharmaceutical industry makes up 1.7% of Liberia's GDP, with a total value of approximately 25.74 million USD. Many drugs come from Europe and India. Most pharmacies are small and privately owned.

The fishing industry is under development through the West African Fisheries Development Program, which is funded by the International Development Fund. There is very little information available about the food retail industry in Liberia, but Harbel Supermarket Company appears to be a key player.

**Mali:**

There are several industries in Mali that may already be utilizing cold chain equipment. These are the private pharmaceutical, hospitality and entertainment, food retail and fishing industries. The private pharmaceutical industry makes up 0.7% of Mali's GDP, with a total value of approximately 1 115 million USD. Many drugs come from Europe and India. Most pharmacies are small and privately owned.

The hospitality and entertainment industry utilizes cold chain equipment in bars and restaurants to keep food and beverages cool. These industries fall into the tourism sector of the economy, which employs more than 205 000 people in Mali and makes up approximately 10% of the GDP. The value of the tourism sector is more than 607 billion XOF. Companies using refrigeration equipment include restaurants, hotels and casinos.

The food retail industry in Mali appears to be made up of small independent supermarkets. The fishing industry is under development and the Japan International Corporation has recently opened a fish market in Bamako. A large amount of foreign aid has been invested in livestock agriculture, although it is uncertain whether this industry is using cold chain equipment for animal vaccines.

The International Finance Corporation has set up an initiative to support the growth of small and medium businesses within the pharmaceutical industry. These companies may be using cold chain equipment for thermolabile medicines such as vaccines.

### **Senegal:**

There are several industries in Senegal that may already be utilizing cold chain equipment. These are the private pharmaceutical, hospitality and entertainment, food retail and fishing industries. The private pharmaceutical industry makes up 0.7% of Senegal's GDP, with a total value of approximately 1 154 million USD. Many drugs come from Europe and India. Most pharmacies are small and privately owned.

The hospitality and entertainment industry utilizes cold chain equipment in bars and restaurants to keep food and beverages cool. These industries fall into the tourism sector of the economy which employs more than 130 000 people in Senegal and makes up approximately 5% of the GDP. The value of the tourism sector is more than 886 billion XOF. Companies using refrigeration equipment include restaurants, hotels and casinos.

The food retail industry in Senegal is valued at 3.3 billion USD. Most packaged food originates from the UK and France. Types of companies using refrigeration equipment include the hypermarket in Dakar, supermarkets and convenience stores.

The fishing industry in Senegal is well developed and is predominantly made up of small scale fishing operations. More than 100 000 people are directly employed by this 32 billion XOF industry. Fishing, together with agriculture, makes up nearly 16% of the Senegalese GDP. Most product is exported.

## **3.2 ATS Group - South Africa**

### Overview

ATS has operated catering and hospitality services in Africa since 1996. The ATS group of companies includes subsidiaries in Burkina Faso, Cote d' Ivoire, Ghana, Liberia, Mali, Nigeria, Sierra Leone, Tanzania, Zambia, Guinea, Mozambique and the DRC. This group of companies now employs over 4 000 personnel and it is catering for over 55 000 people daily, with regional offices in each location.

Due to the nature of catering, ATS has an extensive cold chain, with transporting and storing of perishables. A focus on the cold chain equipment as well as the maintenance thereof is prioritized, to ensure uninterrupted services to clients.

## Equipment

Equipment ranges from industrial to domestic refrigeration. 40' reefers are used to transport frozen foods to site locations. Reefers are split between freezers and chillers, depending on the specific requirement. To maintain the cold chain, reefers are always plugged in, and technical staff who are transporting the reefer will continuously monitor the temperature along the supply chain.

At sites there would typically be a combination of reefers both for frozen and chilled food respectively, and domestic fridges for the day-to-day catering requirements. At Kibali mine site, in the northeast DRC, reefer freezers store the frozen food, which is then moved to reefer chillers for thawing and defrosting on a daily basis for the chef's menu. Once taken from the chillers, there are domestic fridges that are used daily for items that are to be cooked.

## Equipment maintenance approach

ATS focuses on both preventative and breakdown maintenance:

- Preventative maintenance is based on schedules to monitor temperatures and the physical condition of the reefers. If maintained and cleaned regularly, the reefers have an indefinite lifespan. These checks are aided by sensors, probes and monitors that provide feedback to the staff on the current performance of the equipment.
- At ATS's mine sites such as Kibali mine in northeast DRC, the chef will do a manual check of the temperature every two hours, to ensure the required conditions are being maintained. If there is any discrepancy, technicians are alerted immediately.

## Spare parts

ATS will keep stock of critical items should a failure occur. Such parts are:

- PC boards
- Thermostats
- Compressors
- Elements
- Sensors

All items are sourced in-country. Local partners are leveraged, but where this is not possible, items will be imported from either RSA or the UK. Should the item be extremely urgent, ATS has a well-developed logistics system to get the item to site within three days.

## Skills

With Ghana being a regional hub for ATS, there are 27 technicians employed on a full time basis. In other counties there are generally two technicians. In terms of skills, ATS hires local people and trains them to their standards, with the only exception being for gas installations, which would require certified artisans as

per HSE regulations. There is a focus on involving local business, creating jobs or using in-country suppliers where possible.

Skills are insourced for the installation and maintenance of equipment.

### **CCE maintenance at an ATS operated facility - Morila Mine Mali**

#### **Equipment maintenance approach**

Morila has a multi-focus approach, depending on the equipment's maintenance requirements:

- Planned maintenance
  - Items that fall under planned maintenance would typically have the following characteristics:
    - Equipment is subject to predictable wear-out and replacement of consumables;
    - The equipment's failure patterns can be tracked and identified; or
    - Equipment that is highly regulated and effectively captured under an SLA.
- Breakdown maintenance:
  - This covers equipment items that are not maintainable and are used until the end of their useful life and then replaced;
  - Items that are cheaper to replace than to maintain and fix;
  - Items with low financial value; and
  - Any item that is likely to fail during the life of the refrigerator, as well be prone to obsolescence.

An example of this type of equipment would be a thermostat.
- Predictive maintenance:
  - Predictive maintenance is applied to items that have measurable performance thresholds;
  - Items not subject to straight-line wear; and
  - Items that do not have random failure patterns.

#### **Skills**

ATS at Morila Mine has been able to **insource the skills** required to:

- Inspect CCE parts and advise accordingly.
- Plan and schedule for maintenance and replacement.
- Complete a replacement or fix a breakdown.

A **full time on-site** technician is responsible for:

- Monitoring stock levels of spares and replacement parts.
- Providing demand data in terms of stock usage regarding CCE.
- Repairing of any CCE.

It can be concluded that personnel have an in-depth knowledge on the upkeep and running of the CCE at the mine, and are supported by a supply chain team that is responsible for the placing of all orders, managing logistics, freight forwarding and clearing of CCE and spare parts.

SOPs that document any maintenance related activities are available, which helps to ensure any transfer of knowledge.

#### Spare parts

The required parts for CCE at Morila are deemed to be generic and are accessible in-country. There are adequate local suppliers within the region. An example would be the presence of Samsung in Mali.

As mentioned above, there is a supply chain team present to order and receive any parts, and the lead time is typically one week. Once received, spare parts are stored on-site, where there is suitable warehouse storage as well as correct storage conditions.

### **3.3 Fast 'n Fresh, a division of the Imperial Logistics group - South Africa**

#### Overview

Fast 'n Fresh operates a fleet of vehicles to service one of the leading retailers in South Africa. It has a footprint across the three main provinces of South Africa - in Cape Town, KwaZulu-Natal and Gauteng. Perishable items are collected from the retailer's distribution centers (DC) and delivered to the stores, with replenishing between the DCs. The retailer expects an uptime of 100% in terms of service to the stores.

#### Equipment

The fleet consists of:

- For the delivery of perishables to stores:
  - In Gauteng: 97 vehicles of which seven are service exchange units (used to ensure that all units can be maintained);
  - In Cape Town: 35 of which two are service exchange units;
  - In KwaZulu-Natal: 20 vehicles of which two are exchange units.
- For inter-DC deliveries, referred to as "trucking":
  - 45 interlink units with 20 "drop" trailers in the event of a breakdown/to facilitate servicing.
- Vehicle type/refrigeration load body:
  - All vehicles are Mercedes Benz.
  - All units are Thermo King except for 10, which when they are due for replacement will be replaced with Thermo King.

- Smaller vehicle/with rigid body; the refrigerated load body is connected to the vehicle (100 and 200 SLX).
- Larger interlinks with horse and trailer (300/400 SLX).

### Equipment maintenance approach

Fast 'n Fresh focuses on preventative maintenance, but breakdowns and ad hoc maintenance is unavoidable at times. To this end, redundancy has been built into the fleet, with around 7 to 8% more vehicles than required in order to achieve the expected uptime.

In addition, the vehicle (horse), the trailer and the refrigerated unit are all linked to each other in order that the services can be effectively scheduled and managed.

The company operates a hybrid model of insourced and outsourced maintenance and planned and reactive maintenance, whereby it conducts certain scheduled maintenance and the accredited agent for Thermo King GES SA schedules and executes the other maintenance.

#### Planned maintenance:

- Smaller vehicles are maintained every 10 000 km by Fast 'n Fresh and by the contractor every 20 000 km. According to the manufacturer's specification, the refrigerated load bodies have an economical life of 20 000 hours. Fast 'n Fresh retires them after 14 000 hours to prevent the impact on service levels.
- The articulated vehicles are maintained every 21 000 km by Fast 'n Fresh and by the contractor every 40 000 km. According to the manufacturer's specification, the refrigerated load bodies have an economical life of 25 000 to 35 000 hours. Fast 'n Fresh retires them after 18 000 hours to prevent the impact on service levels.
- Maintenance is linked to the mileage and the Transport Management System, which is linked to the Thermo King tracking devices which monitor both the hours and the temperature of the refrigerated body, which is in turn linked to the maintenance schedule.

### Breakdown maintenance

The most common malfunction is one due to a gas leak or the evaporator being frosted up, and typically occurs on long haul distribution. In this event, a contingency plan exists for the vehicle with the malfunctioning unit, and replacement vehicle/for the agent to drive to the problematic vehicle, to meet each other half way respectively. This would result in a reduced time of a malfunctioning unit and therefore product exposure

### Skills

Since this is a hybrid model, skills lie with both Fast 'n Fresh and the service provider.

### 3.4 Star Bazaar - India

#### Overview

Star Bazaar, a TATA & TESCO ENTERPRISE, is a multi-format hypermarket chain present in Mumbai, Pune, Kolhapur, Aurangabad and Bengaluru. It is also present in an express format known as Star Daily in Pune.

Its 11 hypermarket stores are spread over a large area (40 000 to 80 000 sq. ft.) and offer the entire spectrum of product categories, ranging from fresh food, groceries, apparel, general merchandise and consumer durables. They provide a range of more than 30 000 items.

Interviews were undertaken with the management in order to ascertain the nature and extent of their cold chain maintenance activities.

Star Bazaar offers home deliveries so the cold chain equipment required extends all the way to the customer's home.

#### Equipment maintenance approach

Star Bazaar uses a hybrid system for its walk-in coolers and cold rooms; warehouse refrigeration systems; and the store display freezers. The normal maintenance work of checking, cleaning, temperature recording, minor repairs (door seal replacement, etc.) is undertaken by store specific and regional technical staff, with the outsourced (service provider) model employed to maintain CCE in the event of major breakdowns. The rationale behind this management decision was based on recommendations from CCE manufacturers and the availability of a service provider that had excellent references and good availability of spare parts, together with the required level of geographic coverage. However, due to the critical nature of CCE, Star Bazaar has internal staff who are responsible for managing the CCE operational performance, compliance and on-going adherence to internal procedures. They have been trained in the relevant aspects of CCE; they use monitoring equipment (temperature gauges), weekly performance checks and adherence to standard operating procedures to ensure CCE is running within the specifications.

The operational and regulatory responsibility sits with the central management. The rationale behind the move to outsourcing was a belief that it would minimize downtime, and that CCE requires specialist knowledge of electronics, automation, display modules, digital temperature indicators, defrost systems, compressor efficiency, customized hardware materials and thermal breaks.

The appointed service provider has signed a contract (service level agreement) to ensure that scheduled maintenance, emergency maintenance and spares are available to ensure the continued operation of the CCE. Response times are critical in the SLA as are backup CCE and power generation equipment. The service provider guarantees a response time of between three and five hours on a 24-hour service cover for 365 days a year.

Penalties are imposed on the service provider for non-performance and direct contact is maintained with regular meetings that are enforced as part of the SLA.



In developing the maintenance schedules for their staff the management based these on the manufacturers' guidelines and also experience; utilizing Mean Time Between Failure (MTBF) data and statistics.

Maintenance logs are maintained for each item of CCE together with records of failure that itemize the breakdown duration time for each item of CCE.

Cost records are maintained for the maintenance function by each item of CCE. The records reflect the total cost of the asset, including all direct and indirect costs.

Replacement of CCE is based on performance data and also new and more efficient technologies that are available at the time of selection.

#### 4. Randgold Resources Limited Mines - based in,

- Mali (Morila in the south; Loulo and Goukoto in the west)
- Ivory Coast (Tongon – north)
- DRC (Kibali – North West) respectively

It is interesting to note that across the Randgold organization multiple maintenance models are leveraged, depending on the business requirements/structure, location and skills base. These include:

1. **In-house maintenance model:** In this model, both the work of maintenance plus the provision of spares rests completely with Randgold. It therefore requires all the planning and associated activities related to the provision of staff and materials needed to complete maintenance activities – e.g. mill maintenance, crusher maintenance.
2. **Owner (Randgold) maintenance model together with vendor managed inventory:** In this model, the work of maintenance is performed by Randgold. However the materials/spares required for the work is held by the vendor on site and is drawn by Randgold as and when required. Payment for the materials only happens once these are used – e.g. Sandvik underground fleet maintenance.
3. **Outsourced maintenance model:** In this model, both the work and materials required to maintain a portion of plant is contracted out to an external body. Both the provision of manpower and the planning of other resources e.g. spares, etc. is the responsibility of that outside body – e.g. maintenance of Toyota vehicles at Kibali. Sometimes the total delivery of a product can also be associated with this model – e.g. the provision of air products by Air Liquide.

## 5. Local and multinational manufacturer/agent

### 5.1. Overview of capability and reach into Africa

South Africa is often the base for many multinational manufacturers wishing to reach into Africa, particularly, Sub-Saharan Africa. Additionally, some companies manufacture under license to these multinational suppliers, and the many that are not established in country, has agents who represent them.

Samsung and Zero Appliances are organizations that were explored for both their reach and the models of cold Chain equipment maintenance that they propose and/or execute.

#### 5.1.1 Samsung

##### Overview

The South African Samsung agency was contacted initially in order to understand Samsung's service offering in terms of cold chain equipment maintenance, as well as Samsung's presence in the DRC, Kenya and Malawi.

The service agent provided contact details for the Samsung regional manager responsible for DRC operations. This manager informed the consultant that Samsung has a presence in the DRC, in both Kinshasa and Lubumbashi. There are two agents in Lubumbashi and eight agents in Kinshasa. In addition, Samsung has a presence in Malawi, in Blantyre and Lilongwe. The head office and main brand store is located in Blantyre, while the IT-specific office is in Lilongwe. In addition, Samsung has a presence in Kenya, with the head office and certified resellers of its products based in Nairobi.

##### Capability and reach into three countries of interest: DRC, Malawi and Kenya

In **the DRC**, specifically, Samsung offers multiple agencies that are capable of installation, repair and maintenance of air-conditioning equipment. However, Samsung's technicians have broad background experience (having many years' experience in the refrigeration and electrical industries) and so are also capable of maintaining cold room and refrigerated vehicle equipment. Spare parts are ordered from local sources or South Africa and kept in the agency's head office. Service contracts may be entered into for the maintenance of equipment, however Samsung products are preferable.

In **Malawi**, Samsung offers a warranty service for all products. In addition, Samsung can repair and install air-conditioning equipment as part of its service rendering. Maintenance strategies are unclear from this point of contact. However, Samsung in Malawi has two points of contact for services, repairs and maintenance: Munir Issa (265-1 879 259) and Shafik (265-995 428 088).

In **Kenya**, Samsung has a head office and resellers in Nairobi, however no information was found on cold chain equipment maintenance.

### Equipment maintenance approach

Regarding specific information about Samsung's ability to repair, install, service and perform maintenance in the DRC, the Samsung regional manager responsible for DRC subsequently did not want to relay any further information and cut the conversation short. However, in order to gather country-specific information (and considering Samsung's presence in the DRC) a Samsung agency was visited during the in-country DRC investigation. Please refer to the Deliverable 3 technical report, which documents the findings from the Samsung DRC investigation in Kinshasa.

## 5.1.2 Zero Appliances

### Overview

Zero Appliances operates in tandem with Zero Medical and is a South African-based organization that provides WHO PQS approved front opening medical refrigerators. Gareth Samuel, the sales manager-Commercial Products division, was contacted initially in order to understand Zero Appliances' capacity for providing different refrigeration equipment technology into Africa, as well as assistance with cold chain equipment maintenance strategies, considering the group's involvement in supplying various refrigeration technologies into different African countries.

Zero Appliances provides the technology as well as repair, installation and maintenance services. This is done in two forms; either they have established an agency in-country that acts as a local point of contact, service and repair, or they can send technicians from a neighbouring country.

Zero's vaccine refrigerators utilize modified Sure Chill® technology, which is WHO pre-qualified and involves patented liquid water jackets that surround the interior. Insulation used is a form of polyurethane called "Ecomate" foam.

### Capability and reach

Zero Appliances operates in numerous African countries. These countries include: South Africa, Ethiopia, Zimbabwe, Kenya, Mozambique and Botswana. The organization is looking to invest in establishing agencies in the DRC and western African countries such as Nigeria, Mali and Algeria. Notably, Zero Appliances has already established a connection into Burkina Faso. A freight forwarding agency, Cargo Compass, will be utilized in the DRC by Zero Appliances, to leverage Cargo's equipment.

### Equipment maintenance approach:

Zero Appliances provides the following refrigeration technology:

- 1) AC (alternating current) technology (five fridge types);
- 2) Solar direct drive technology (three fridge types);
- 3) LPG (liquid petroleum gas) technology; and
- 4) Kerosene technology.

The above technologies have similar maintenance patterns and similar components for repair and replacement (i.e. motors, seals, compressors etc.). The exception being the solar direct drive technology, which uses a DC (direct current) technology whose power source is solar panels connected to the roof of the building. Furthermore, critical components for the direct solar drive technology may be mutually exclusive of each of the other technologies as the key which affixes the two solar panels to the roof mounting bracket per unit is engineered in this manner to prevent theft of the panels. Once fully charged and in operation, the solar direct drive technology has a 2 °C – 8 °C holdover period of 17 days until the first

excursion above 8 °C. Typically, component items, of the remaining technologies (such as LPG, kerosene and AC technologies) may be common - the exception being the unique power source.

In terms of maintenance, the solar direct drive technology needs potable water to fill the internal water jacket, as well as Danfoss compressor parts. It is understood that with proper preventative maintenance measures, the technology should function well for 20 + years.

#### Skills required:

Examples of insourced and easily trained maintenance may include:

- 1) Regular cleaning of dust.
- 2) Eye inspections for leaks.
- 3) General cleaning of the unit exterior and interior.

An example of maintenance that may typically be outsourced includes:

- 1) Servicing (however this should be limited if utilized correctly).

### **5.1.3 Thermo King/GEA (agents of Thermo King) - South Africa**

#### Overview

GEA are the agents of Thermo King in South Africa. They only service southern Africa (for vehicles). Countries further north are not well developed and there are not contracted agents for Thermo King. The exception is Zambia, which has a Thermo King branch not related to GEA. This branch is often called to other African countries where technicians and parts are needed. The parent company, GEA in Germany, deals with industrial refrigeration (including maintenance) for brewing and agriculture in countries such as Kenya.

#### Equipment maintenance approach

Maintenance schedule is calculated according to the number of hours the unit is used. Most clients (approximately 85%) take a maintenance package when they buy the vehicle. Many others pay for each service. A few service their own vehicles.

#### Skills

In terms of technicians, the company trains all of its own technicians. They generally come from a refrigerator, electrical or diesel mechanic background. Microchip and IT knowledge is essential to be able to service a vehicle. They do not deal with the automotive parts of vehicles.

#### Spare parts

Components are the same as for normal refrigeration but are not interchangeable. Most parts are brand specific. When dealing with customers outside of city centers, they recommend that clients keep all spares for repairs which can be performed by a mechanic. For instance belts and filters.

#### 5.1.4 Transicold/ Carrier

##### Overview:

Transicold are the agents for Carrier refrigerated vehicles in South Africa. They only operate in Southern Africa. Carrier has other agents in other parts of Africa such as Kenya.

##### Equipment maintenance approach

Most of their clients do not take service plans although they offer them. Many do servicing themselves.

##### Skills

They train all of their own technicians.

##### Spare parts

All of their parts are brand specific. Clients do not keep spares.

## Annexure 1: Acknowledgements and contact details

### Contacts Details

KENIEBA HEALTH CENTRE	: DR HALADOU MAHAMAN MANIROU: HALADOU.MANIROU@RANDGOLD.COM
MORILA MINE	: PIERRE FEA: PIERRE.FEA@RANDGOLD.COM
BIOVAC/ LITHA HEALTHCARE	: SUE WOOD, RESPONSIBLE PHARMACIST
SAMSUNG	: REGIONAL MANAGER SOUTH AFRICAN-BASED CUSTOMER SERVICE AGENT DRC
ZERO APPLIANCES	: GARETH SAMUELS
THERMO KING/ GEA	: ZARREN - HEAD OF TECHNICAL DIVISION
TRANSICOLD	: TECHNICAL MANAGER
ATS	: DAVE HUTCHINSON-CHIEF OPERATING OFFICER
IMPERIAL FAST 'N FRESH	: ANGELA D'AMATO, STRATEGIC CLIENT LEAD AND ANDRE BASSON, FLEET MANAGER
RANDGOLD RESOURCES LIMITED	: RIAAN GROBLER, GROUP COMMERCIAL MANAGER  KEN GREEN- SPECIAL PROJECTS SUPPLY CHAIN  MARTIN HEUNES- GROUP SUPPLY CHAIN MANAGER