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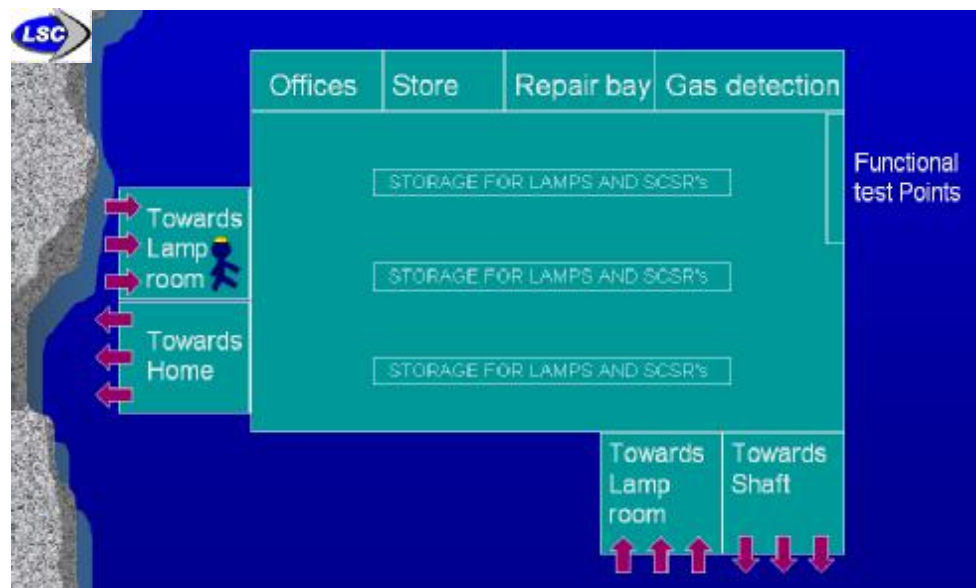
## Introduction

Lamp room management is a critical function in the mining environment, but not necessarily a core function. Therefore, mines in South Africa generally outsource this service. Examples of two such leading service providers with extensive experience are **Lamp room Solutions and Consulting (Pty) Ltd, (LSC)** and **Willard Batteries (Pty) Ltd**.

Their service includes, but is not limited to the;

- *Manage and maintain all portable mine lighting equipment i.e. Cap Lamps and Locolites,*
- *Manage and control of Self-Contained Self-Rescue packs (SCSRs),*
- *Manage and control of portable Gas Detection Instruments for miners (GDIs),*
- *Manage and control of special equipment i.e. First Aid bags,*
- *Maintenance of Lamp room infrastructure: i.e. Battery charger racks, access control (turnstiles etc), Time and attendance systems, gas calibration stations, workshops, management software etc.,*
- *Loss / theft prevention, of the SCSR packs, GDI's and the cap lamps,*
- *Training of lamp room personnel as well as user training and*
- *Compliance to the law and Code of Practices that is specific for each country/mine.*

A typical large mine in South Africa has between 3000 – 6000 employees per shift that use the above equipment to a greater or lesser extent.



**Typical Lamp room layout**

Source: Courtesy LSC



**Typical Lamp room with battery charger racks**

*Photo: Courtesy Willard: Paardekraal mine – Amplats*



**“Cap lamp for life” concept – each employee has own cap lamp**

*Photo: Courtesy Willard: Paardekraal mine – Amplats*



**Portable Loco lamps/batteries**

*Photo: Courtesy LSC: Kopanang Mine Anglo Gold Ashanti*



**Different types of GDI's being tested and calibrated**

*Photo: Courtesy LSC: Kopanang Mine Anglo Gold Ashanti*



**Typical SCSR pack in stainless steel housing**



**Time and Attendance access points to and from the Lamp rooms**

*Photo: Courtesy LSC: Kopanang Mine Anglo Gold Ashanti*

## The Need

Both the service provider (Lamp room manager) and the client (Mine) **need** to measure and evaluate certain **key performance indicators (KPI's)**.

Some **KPI's** are;

- **Compliance with Mine Health and Safety Act (MHSA), Act No. 29 of 1996**
- **Compliance with Department of Mineral and Energy's (DME) "Code of Practice for Lamp rooms"**
- **Equipment performance measures:** i.e. Availability, Reliability, Maintainability, process rate, Quality rate and equipment effectiveness.
- **Cost performance measures:** i.e. Maintenance cost and repair/replace justifications.
- **Process performance measures:** i.e. Shift clearance report accuracy, Response to emergencies, Planned vs. unplanned maintenance, Scheduled compliance, Preventive Maintenance scheduled compliance, Work orders generated, Urgent vs. normal purchases, Stores inventory turnover and stores stock-outs.
- **Trace-ability:** Equipment history and tracking throughout the product's life cycle.

## The Constraints

- The effects that **Labour / Health and Safety legislation** have on the mine management to justify additional human and technical resources needed to ensure that mine management does everything in their power to protect employees in case of accidents.
- All these items need to be calibrated, tested, issued and managed properly. Information about whom, what and when is captured. In most mines this **logging and reporting** still happens in **manual ways**, which jeopardises the **integrity** of the **management information**.
- MHSA requirements with regard to **radiation levels and intrinsic safety** of certain electronic equipment.
- Technology must withstand a **harsh environment**
- Equipment **theft and loss** is a huge problem, as the cost of a SCSR pack is between R2500.00 - R3000.00 and the GDI is typically R6000.00 per unit. Stolen cap lamp batteries are used to power radios and other electrical equipment. This **shrinkage** will be unmanageable for as long there are **manual asset management systems** in place.
- **Budget cuts.** Although it is compulsory for each employee to have a SCSR pack, it is not possible due to a lack of funds thus multi-shifting of these items take place (one unit shared by several people) according to a DME report (no:2004-0153). This increases the accountability and responsibility of the mine management in case of an accident, where a mine employee was not in possession of the correct safety equipment due to shortages/availability of equipment. (reference could)
- **Labour Unions:** Putting pressure on mine management to comply with safety issues. They also could be against automation of processes if there is not a benefit for the employee.

## The Problem

The problem was two fold;

- Firstly, managing and implementation of safety and compliance processes are a major issue as it could help **saving lives**. The use off SCSR's and GDIs is dependant on the areas where miners work. The **Environmental Control and Safety departments** off each mine identify these areas. Usually at least 2 people in a team to wear calibrated/certified GDI's (usually the team leader and any other person in the team) – the typical data that is required just for the SCSR pack for example are as follows:

According to the level of compliance with legislation (Regulation/Chapter 16.2, 16.3 and 16.4 of the Mine Health and Safety Act), section 16.4(2) states that;

The employer must keep the following information, on self-contained self-rescuers at the mine, covering the preceding 24 months:-

- (a) total number and makes of self-contained self-rescuers in service at the mine;
- (b) number and make of self-contained self-rescuers purchased by the mine in that period;
- (c) number and make of self-contained self-rescuers withdrawn from use by the mine in that period;
- (d) the number of shifts worked per day ( 1,2 or 3);
- (e) number of self contained self-rescuers in daily use (average for each month);
- (f) number of employees underground (average per shift);
- (g) number of spare self contained self rescuers available (average per month);
- (h) a tabulation of the type of defects found;
- (i) number of self contained self rescuers repaired/refurbished; and
- (j) number of self-contained self-rescuers tested in terms of regulation 16.4(1).

***How do you log this data with confidence and integrity especially when it is a manual system?***

- Secondly, for the outsourcing to be optimal, the Lamp room processes need automation. ***Accurate data needs to be available instantly in order to generate useful management information; how will one achieve this effectively and efficiently?***

**Important KPIs for service providers are:**

- The correct billing to the mine for asset utilisation per day,
- To make 100% sure each employee going down the mine has all the required safety equipment with him and
- To make sure they have 100% shift clearances.
- Fixed monthly cost,
- Comprehensive record keeping that is available all the time,
- To maintain the Lamp room to the standards required by the Mines and Department of Mineral and Energy's Code of Conduct,
- To effectively and efficiently control and maintain all the equipment 24h per day, 365 days a year,
- To optimise the service and repair cycles of equipment and
- To minimise equipment losses.



To achieve this both companies looked at ways of tracking the cap lamps, SCSR packs and the GDI's throughout the process. One way was to introduce RFID.

A real life example is at one of the Amplats mines - Paardekraal shaft, outside Rustenburg, with approximately 5000 cap lamps. About 3.5 years ago, after searching for the right technology, Willard contracted a local supplier to provide 4W EIRP UHF readers and passive tags, operating at 915.3MHz.

Cap lamp battery compartments were fitted with tags whilst readers were installed at issuing bays and in portal fashions at the turnstiles. A propriety management application, running on a central server connected to the reader network as well as the mine's Enterprise Resource Planning (ERP) system. The server received time and attendance data from the mine's HR module that was consolidated with the lamp room's asset issuing information in order to generate billing and management information.

Willard had various levels of success, up to a point where the data integrity of the system became unsatisfactory due to tag failures, corrosion of unprotected tags, incorrect reader deployment and limitations of passive UHF technology in an environment where people, wet goods and metal are involved.

A criterion for using the UHF tags was to increase the read range from proximity (100mm) to 600mm with a low cost passive tag, in order to realise a hands free environment where the mine employee enters or exits the turnstiles between the shaft and the lamp room.

Other options were to incorporate active tags on the batteries for the continuous tracking of these assets, but at a cost of up to 10 times a passive tag. To add complexity each tag need to be intrinsically safe and (Ex) certified. Justifying a cost associated with mounting an R200.00 active tag, on an R 150.00 - R450.00 battery/lamp is not so easy.

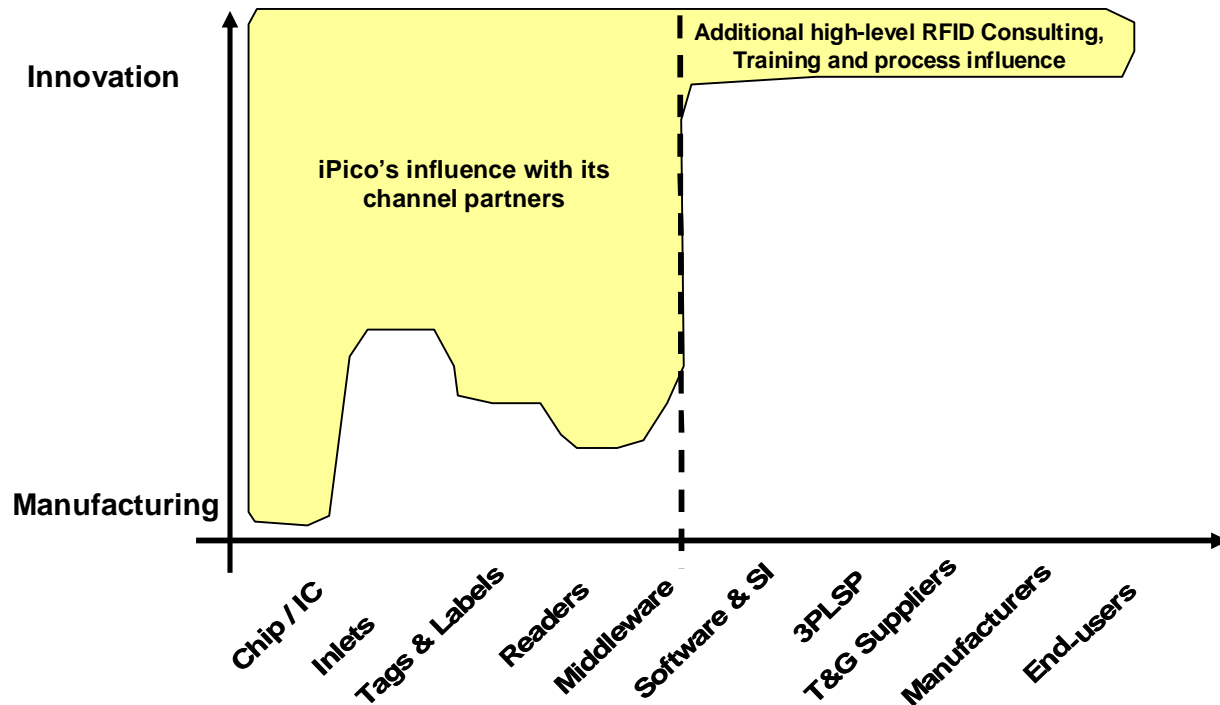
Other experimentation on SCSR packs and GDI's included microwave passive tags that did not fit the purpose at all, as well as standard 125 KHz or 13.56MHz proximity tags. Low frequency technology is highly susceptible to electromagnetic interference, which in the case of a mine is severe.

This multi assortment of tag and reader technology is a nightmare to maintain and interface successfully into a management system that needs to be reliable and accurate in terms of the reporting.

The **key question** remained - Is RFID justified for lamp room management?

## The Solution

The key to the solution is the uniqueness of iPico, as shown on the space map below regarding the level of influence iPico has over its own technology, from middleware right down to chip design level, beating other RFID providers' easily.



After the failures that Willard experienced, a proposal was made that they use iPico's new passive RFID technology, namely **Dual Frequency (DF) tags and readers**. Although iPico also manufactures UHF tags/readers, Willard quickly acknowledged the advantages of DF over UHF during a live pilot period of 4 weeks in October 2003 at Paardekraal.

One of iPico's system integrators, i-Chain, implemented 14 DF Short range master readers, 4 slave readers and 5000 DF Linear tags (read range +/- 600mm with Short range reader), in December 2003.

LSC was using RFID technology sourced from various suppliers with success for the past five years, but because of iPico's success with the DF tags and readers at Paardekraal, it made sense to partner with iPico to become the preferred supplier of RFID technology. LSC did this because of the "one stop shop" service rendered by iPico. LSC consolidated their RFID methodology by implementing only iPico's technology at one of Anglo Gold Ashanti's largest mines namely Kopanang in Orkney, South Africa. The deployment will include tags for about 5000+ cap-lamps, 200+ SCSR, 900+ GDI's and proximity readers for 76 issuing and registration points as well as 14 medium range portal readers.

To minimize the operational issues at Paardekraal such as re-training and user behaviour, the DF tags/readers had virtually the same form factor as the previously installed UHF tags and readers.

**Before**



**Unprotected UHF tag**

**After**



**iPico's Sealed DF tag**

*Photos: Courtesy Willard: Paardekraal mine – Amplats*

**Before**



**UHF readers**

**After**



**iPico's DF Short range readers**

*(Read Cap lamp tag @ 600mm)*

*Photos: Courtesy Willard: Paardekraal mine – Amplats*

The **DF technology** outperforms the traditional passive low frequency technologies as well as the UHF and microwave technologies in this specific environment. Due to the magnetic coupling between the readers and tags, human bodies, fluids, and even some kinds of metals pose no problem.



SCSR with over-moulded linear tag

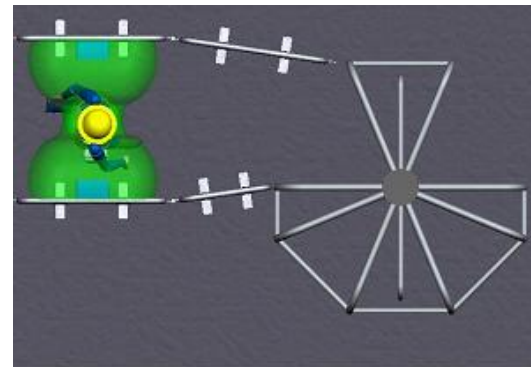
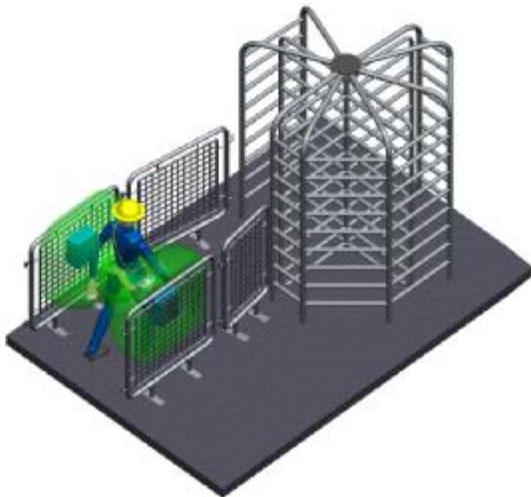


Cap-lamp battery with linear tag



Steel and Plastic GDI's with 26mm disk tag (external or internal mount)

### Various DF tags on equipment



Plan view

DF Short-range reader portal with single body access reading the tag in the Cap-lamp battery as well as the tag on the SCSR pack



### DF Short-range readers

*Photos: Courtesy Willard: Paardekraal mine – Amplats*



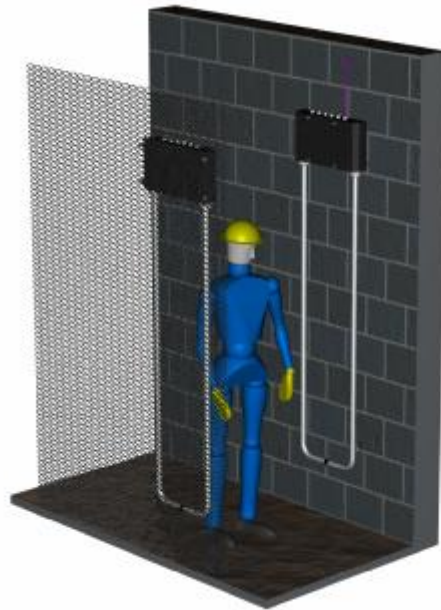
### Wall-mount DF proximity OEM readers and LMS Controllers at Issuing, Test and repair stations

*Photo: Courtesy LSC: Kopanang Mine Anglo Gold Ashanti*

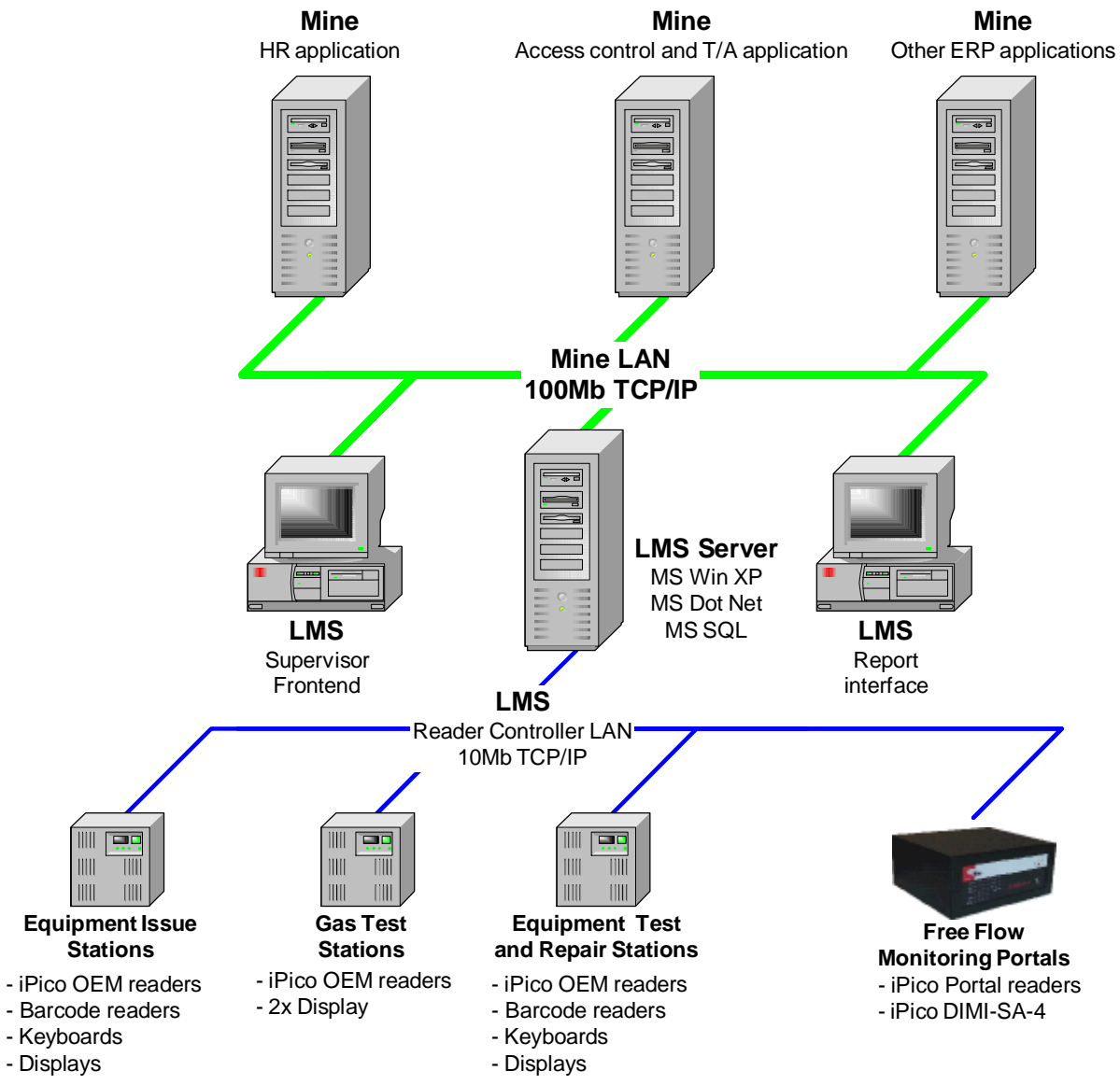


**Example of a Gas Test station with DF proximity OEM readers and LMS Controllers**

*Photo: Courtesy LSC: Kopanang Mine Anglo Gold Ashanti*



**DF Medium range reader portal for Free flow tracking at the turnstiles to cover a larger area – LSC to implement 14 portals at Kopanang in Feb 2005**



### Lamp room Management System (LMS) at Kopanang mine

Source: Courtesy Lamp room Solutions and Consulting (Pty) Ltd



## The Results

According to Mr. Theo Kleynhans, Senior Business Unit manager for Willard Batteries at Rustenburg, the status of their 23+ Lamp rooms and 30 000+ cap lamps, including the new installation at Paardekraal is as follows:

- Evaluation of iPico's equipment started in Sept 2003 for a period of a month using 150 tags and 4 readers. Orders were placed in November 2003, and system was commissioned in Jan 2004,
- 100% shift clearance reports at Paardekraal since installation – 24 hour operation all year,
- Cap lamp tags and Access Control cards must both be present before entry/exit are allowed at the turnstiles resulting in better access control and eliminating a buddy system – someone swiping his friends card as well as his own in order to fool the system,
- Seamless integration into their existing IT and Lamp room management system,
- Automated logging and issuing, increasing operational through-put,
- Trouble free access control speeds up shift entrance and clearance at the turnstiles,
- ***During the first 2 weeks after commissioning the RFID installation, accurate shift clearance information resulted in saving an employee's life. The management system flagged an incident of a person not entering the Lamp room on time. A proto-team was send down the mine were they found the disorientated employee just in time before the blasting session commenced,***
- Maintenance cycles on batteries can now be managed intelligently and cost effectively,
- Huge savings have already been achieved because battery theft and losses are under control,
- Billing of asset usage is more accurate,
- Data integrity of battery movement is 100%. No more manual logging of items are done,
- System now allows for a complete safety check at turnstile since adherence to rules is enforced. i.e. does the employee have a Battery, SCSR pack and or a GDI with him, before the system allows access through the turnstile to/from the shaft?

***Results continue...***



According to Mr. Giel Oberholster, Director of LSC, the status of the 15+ Lamp rooms they maintain 30 000+ cap-lamps, is as follows:

- Their complete service is bundled as an off-the-shelf solution that can be easily tailored to the customer's requirements,
- Complete integration into the mine's HR and Time/attendance modules,
- Service fully complies with the Department of Mineral and Energy's Code of conduct,
- This service can either be outsourced to LSC or the customer can take complete ownership,
- Savings up to 10% on the total monthly cost of ownership can be achieved
- Three important outputs of Lamp room automation service are
  - Electronic record keeping – allows instant equipment allocation information, controlling and reporting,
  - Equipment logistics – Equipment history, usage, service and repair information,
  - Timeously reporting and exception reporting which hugely reduces the risk of management.
- Additional information that is spin-offs from the automation process are;
  - Evaluating Medical fitness certificates by time/date,
  - Evaluating Blasting permits by date,
  - Conformation that calibrated GDI was handed to the employee,
  - Shift allocation of the employee is correct.
- RFID technology, as part of the Lamp room Management System has been successfully used since the turn of the millennium by LSC in several Lamp rooms.
- ***iPico's range of products seamlessly integrates in their product range, and allow for quick deployment and scalability, eliminating the difficult logistics of different/multiple RFID technologies on one network.***
- Standards in the Lamprooms are kept at a high level of competence by continuously training their personnel
- Regular updating of the Management System to conform to changing requirements from government and customers.

## Conclusion

From the successes that Willard is experiencing and LSC's business case whereby they fully integrate iPico's technology in their Lamp room management system, it is evident that there are huge benefits using RFID in this application.

***The biggest justification for iPico's RFID technology is the contribution directly and indirectly to improve the safety procedures that minimises/prevent accidents, resulting in saving lives.***

---- The End ----