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# IMPLEMENTATION OF S.H.E.Q. MANAGEMENT SYSTEMS AT COROMANDEL FERTILISERS LIMITED (a)

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The stakeholders of every organization are becoming more and more demanding. Customers demand better product, competitive price and on-time delivery. The community expects environment friendly and safe business operations. Employees seek safety, security and a healthy working environment.

To ensure that such demands are addressed, Coromandel Fertilisers Limited (CFL) at Visakhapatnam, implemented the Quality Management System (QMS), Environmental Management system (EMS), and Process Safety Management system (PSMS) to international standards. The QMS and EMS are based on ISO 9002: 1994 and ISO 14001: 1996 respectively and were certified by Det Norske Veritas.

Regardless of type(s) of management systems, the implementation involves, a) establishing needs and expectations of interested parties b) developing objectives and setting targets c) devising a set of processes to fulfill these objectives and d) measuring the performance for continually improving the organization's ability to adapt to the changing needs and expectations of interested parties. These three management systems were independently implemented. As there is some commonality amongst them, it was possible to integrate them wherever applicable.

It is also planned to implement OHSAS 18001, to reinforce the existing safety systems and to upgrade QMS to the 2000 version of ISO 9001. In this article, the authors share their experiences in conceiving, developing and implementing the above management systems.

## 1. Introduction

In today's era of globalization and rapid technological changes, the integration of safety, health, environment and quality (SHEQ) aspects into an organizations' business management system is critical for ensuring its sustainable competitiveness particularly in the context of the challenges arising out of WTO commitment. Organizations must reform the way, safety, health, environment and quality issues are managed and should adopt a holistic approach, that involves people, processes and performance. The key is to establish a common management system that is applicable to both an organization's business processes and management practices.

The last decade saw a global shift towards a systems approach for continual improvement in SHEQ areas. Starting with safety and later with quality, environment and health, management

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systems addressing these critical areas were developed and adopted by many organizations around the world. These systems included ISO 9000 standards for quality management system, IS0 14001 standards for environment management system, Process Safety Management System and OHSAS 18001 (Occupational Health and Safety Administration System) standards for safety and health.

## 1.1 Some important aspects of phosphatic fertilizer industry in India

Phosphatic fertiliser industry in India is almost entirely dependent on imported raw materials and intermediates, such as rock phosphate, sulfur, phosphoric acid and to a limited extent, sulfuric acid. Against 4.2 million metric tons of P205 consumed in the country in the year 2000-01, the P205 in the fertilisers manufactured in the country during above period was 3.7million metric tons. While most of the phosphate is in the form of concentrated phosphatic fertilisers, 11% of total 'P' content was from single super phosphate. About 2/3 capacity of the phosphatic industry is dependent on importation ammonia. These factors give raise to environmental and safety issues in importing, storage and usage of large quantities of these materials. As opposed to these, the nitrogen industry, mainly urea, has distinctly different characteristics calling for a different approach in tackling the safety and environment concerns. Thus, each unit manufacturing phosphatic fertilisers has to take into account these specific characteristics while designing its management systems.

## 1.2 Brief details of the company

Coromandel Fertilisers Ltd. (CFL) is one of the leading phosphatic fertilizer manufacturing units in India and is a part of the Rs. 4000 crore (US$ 800 million) Murugappa Group, a well known business house in South India. The company has, at Visakhapatnam Port City on the east coast of India, facilities for the manufacture of 400MTPD of phosphoric acid from rock phosphate by dihydrate route supported by a 1200MTPD sulfuric acid plant on DCDA process. The end products, granulated complex fertilizers, are produced in three streams (trains) using pipe reactor process and slurry granulation process with a combined capacity of 2050 MTPD. The infrastructure facilities include steam generation plant, 14MW-power generation on LSHS as fuel, 5MW turbo generator utilizing waste steam from sulfuric acid plant and facilities for import and storage of solid and liquid raw materials. The urea and ammonia manufacturing facilities have been closed down in 1997 and 1999 respectively due to economic reasons and these inputs are now imported. Part of the phosphate requirement also is met by imports in solid as well as liquid forms.

CFL proactively recognized the need to adopt systems approach and putting ownership and accountability for safety, health, environment and quality into the hands of every employee. Towards this end, CFL implemented the following SHEQ management systems:

## 1.3 Systems implemented

| | System | Year of implementation |
|---|---|---|
| i) Safety | Process Safety Management System. | 2000 |
| ii) Quality | ISO 9002:1994 | 2001 |
| iii) Environment | ISO 14001: 1996 | 2001 |

## 1.4 Systems under implementation

| | System | Target date |
|---|---|---|
| i) Safety (including health) | OHSAS 18001. | March, 2003 |
| ii) Quality | ISO 9001:2000 | March, 2003 |

For all the three systems, the key characteristics measuring the performance of the systems were included in the Organization's business plan.

Murugappa Group implemented ERP system based on SAP R3, 4-0B version for integrating the business operations covering CFL and EID Parry consisting of fertilisers, sugar, pesticides and ceramic divisions. The modules implemented under SAP are FICO, MM, PP, SD, PM and HR. The documentation required for the above SHEQ systems is aligned with ERP systems.

## 2. Process Safety Management System

Even before the introduction of the above system, CFL has been giving a thrust to improving safety and health of employees. CFL has a good safety record, achieving One Million Safe Man hours 33 times, 2 Million Safe Man hours 9 times, 3 Million Safe Man hours 4 times and 4 Million Safe Man Hours once, various National Safety Council Awards and Five Star rating by British Safety Council, and also their national safety award for 1999.

Process Safety Management System has been developed based on the standards of Occupational Safety and Health Administration (OSHA) of U.S.A. Even though adherence to the standard by a process industry handling hazardous chemicals is a statutory requirement in U.S.A., it has not so far become mandatory in India. The objective of this system is to proactively avoid any incident or accident in a chemical process plant that handles or processes hazardous chemicals. This system consists of thirteen elements, for which requirements are specified. These elements are listed below:

| | |
|---|---|
| 1. Process safety information | 8. Mechanical integrity |
| 2. Process hazards analysis | 9. Incident investigation |
| 3. Operating procedures | 10. Emergency response and planning |
| 4. Contractor control | 11. Management of change |
| 5. Training | 12. Compliance audit |
| 6. Pre-start up safety review | 13. Employee participation |
| 7. Safe work practices | |

CFL has adopted the Process Safety Management System as an addition to the existing safety policies and procedures. Though OSHA requires that PSMS is applicable only to certain hazardous chemicals such as Ammonia, CFL has decided to extend the system to sulfuric acid, and high-pressure (>3.5 Ata) steam system along with ammonia and plans to extend it later on to phosphoric acid also.

To derive full benefit of the PSM system, proper documentation procedures must be in place, and OSHA like for any other management system, stresses the same in the following few lines:

*"Write what you do,*
*Do what you write and,*
*If no records were made, it never happened."*

## 2.1 Implementation of the system

The Murugappa group has accorded top priority to the implementation of this system in all its fertilizer and pesticides facilities situated at different locations.

The corporate management appointed a person experienced in the PSM system at a senior level as deputy general manager (PSM), who guided the committee and element sponsors for understanding the system, developing the procedures and to ensure that the system is established and implemented as per the standard. A site PSMS co-ordinator (similar to Management Representative in ISO 14001 and ISO 9002) was identified for following up and co-ordination.

An in-house team carried out preliminary audit to identify the gap between existing safety practices and requirement as per PSMS.

To ensure that practically all the employees are aware of the system, a comprehensive training program was carried out.

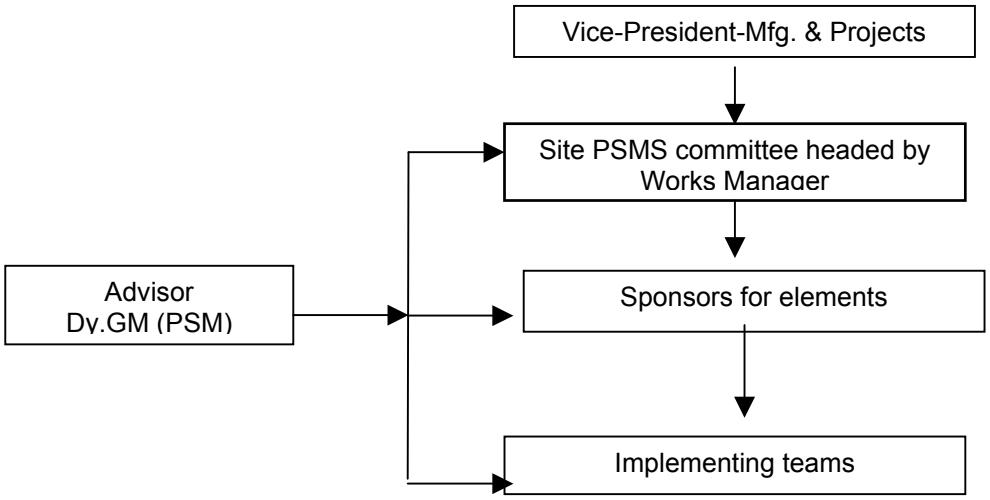
## 2.2 Formation of PSMS site committee

The vice-president for manufacturing and projects constituted a 14-member committee with the works manager as chairman, senior manager-S.H.E. as secretary, deputy manager-technical services as co-ordinator and other concerned departmental/sectional heads as the members for piloting the implementation of the system. The function of the committee was to review the procedures developed, approve the same and implement the procedures.

## 2.3 Selection of Element sponsors

The Chairman of the committee constituted 13 sub-groups one for each element consisting of members from various departments with a member in the Site committee as Element Sponsor (sub-group leader) to review the existing practices and develop procedures suitable to the requirement of the system.

A schematic diagram regarding mechanism of implementation is given below:




## 2.4 Time frame

During February 1999 it was decided to implement Process Safety Management System (PSMS) at CFL.
The milestones were:

| | |
|---|---|
| ▪ Preliminary audit of the existing Safety systems. | - February 1999 |
| ▪ Development of PSMS policy | - April 1999 |
| ▪ General awareness training on PSMS to all employees | - May-November 1999 |
| ▪ Development of procedures for each element and training | - May 1999-March 2000 |
| ▪ Pilot trial of all elements | - May 2000 |
| ▪ First compliance audit | - Oct 2000 |

The requirements of the PSMS elements and the status of implementation are given in Annexure 1.

## 2.5 Additional features of the system

Some of the MCCs at our plant are not provided with locking out devices for isolators, to be used at the time of maintenance. The earlier practice was usage of colored tags such as yellow for operations, blue for maintenance and red for electrical. People have been trained to treat it very sacrosanct. To further ensure safety, lock out system was prescribed by PSMS. For this, we had to modify the MCCs and there was a transitional period from tag to lock arrangement before the practice was accepted at floor level.

The awareness on safety was low among the contract workmen prior to the implementation of PSMS. As part of the contractor control element contractors and contractors' workmen were trained on the permit systems and actions during on-site emergency. Certificates were issued to all the contractors' workmen as evidence of having received training. Only those contractors' workmen who have the certificates are allowed to work in the plant premises.

## 3. Quality Management System

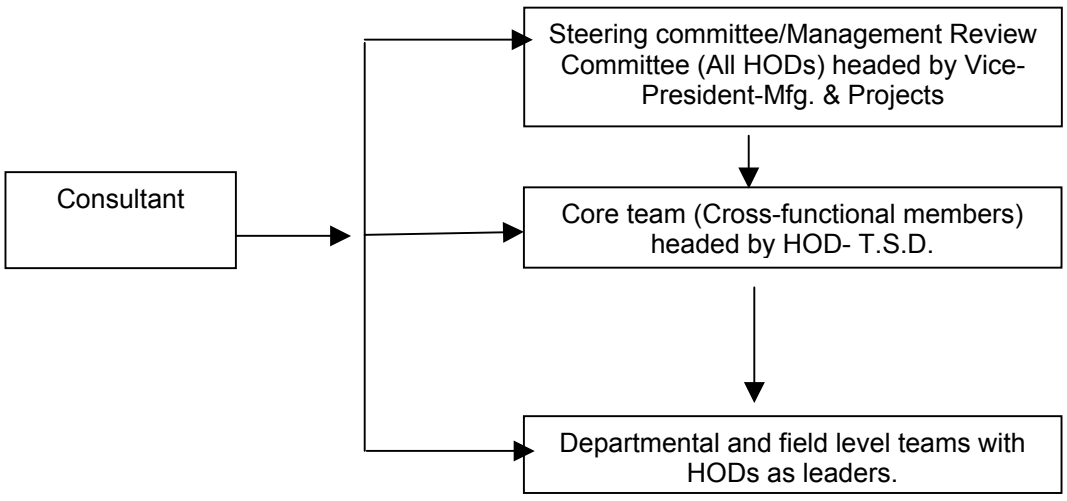
CFL implemented quality management system conforming to ISO 9002-1994 standard in 2000. It was decided to go in for this programme with a view to promote quality culture and create quality consciousness among the cross section of its employees for achieving company's mission of becoming a leading supplier of quality phosphatic complex fertilisers in the world.
Thus, the quality policy of the company was derived from the company's vision and mission statements.

The implementation of the QMS started in early 2000 and took about a year for fully becoming operational. The programme was started by engaging consultant initially for interpreting the standard and training of senior management staff responsible for carrying out manufacturing and business operations. But for the initial awareness, internal audit training including documentation review conducted by consultant of TQMI, the entire system was developed using in-house resources. The HOD - Technical Services Department was nominated as management representative to carryout and co-ordinate all activities involving senior executives and functional heads of various departments.

The scope of certification comprised manufacture and supply of phosphatic fertilisers, sulfuric acid, phosphoric acid, trading of by-product gypsum, imported fertilisers, hydrofluosilisic acid, rock phosphate, sulfur, sulfuric acid, phosphoric acid and ammonia including wharf facilities

The methodology adopted for implementation of the system is as under:

Schematic diagram showing mode of implementation of QMS




### 3.1 Function of core team and steering committee

The core team was mainly formed to draft policy, develop documentation and objectives and follow up the progress of implementation of the system.
The steering committee was constituted to oversee and review implementation of QMS based on ISO 9002:1994 and to execute the project in a time-bound manner. After implementation,

the same was renamed as Management Review Committee to review on periodical basis, the adequacy of the system as per the requirement of the standard.

After developing quality manual and procedures, CFL arranged for pre-audit by the consultants of TQMI. The review was particularly beneficial with respect to data and document control. Based on the remarks and suggestions given by auditors documentation of procedures was further streamlined to give a final shape to quality management system. Once the system was in place by September 2000, CFL approached certifying agency. DNV for conducting a pre assessment audit and all the non-conformities raised during the audit were addressed. Finally certification audit was carried by DNV in January 2001.

## 3.2 Implementation of ISO 9002

| S.n° | Requirement of the Standard | Action Taken |
|---|---|---|
| 1 | Updated process information | ▪ All operating manuals and P&I are updated in a comprehensive way<br>▪ Standard Operating Procedures (SOP) for all critical activities were documented.<br>▪ Developed process plans comprising critical steps and controls. |
| 2 | Maintenance systems | ▪ Adopted rigid schedules for periodic calibration and condition monitoring of instruments and equipment used in measurement and control of quality. |
| 3 | Quality Objectives / Performance monitoring | ▪ Defined Quality objectives and targets for all products, critical parameters, equipment breakdowns, revenue expenditure, stores and raw-material inventory. |
| 4 | Documentation | ▪ Developed procedures required for various functions including SOP, process plans, formats for data recording by the concerned Department and the same were reviewed by the consultant. |
| 5 | Training and awareness | ▪ Provided initial awareness training for Sr. Management Staff, by TQMI.<br>▪ Imparted training for the rest of the employees by trained Mentors on the Quality Policy, objectives and requirements of the standard. |
| 6 | Involvement of people | ▪ Conducted employee suggestion schemes and received no. of creative suggestions addressing problem areas and solutions for improvement in particular raw-material handling and storage, work environment, quality of finished product and reduction of material losses. |
| 7 | Customer focus / "Sense of purpose" programmes | ▪ Under corporate programme entitled " Sense of Purpose ", sent teams of production personnel directly to the marketing areas to educate farmers about our production facilities and the efforts made for improving quality of the product. |

CFL was awarded ISO 9002 certificate effective 17th January 2001 and since then two periodic audits were also completed by certification agency.

## 3.3 Change over to ISO 9001 : 2000 version

Having implemented the 1994 version of ISO 9002, CFL is now in the process of change over to 2000 version of the standard. The major differences are:

- Application of 8 Quality Management Principles. ( QMPs) form the basis of new version. The QMPs in essence are the guidelines for effective control and continuous implementation of the systems. This calls for a change in the way, quality is managed in the organisation. For example:"The Business Planning Process" as adopted by CFL, given at Annexure 2, illustrates the integration of business plan with quality management.

- While 1994 standard was based on 20 discrete functional elements, the 2000 version has process-oriented structure based on PDCA circle. It is a shift from procedure to process based approach.

## 4. Environmental Management System

### 4.1 Background

Over a period, CFL incorporated technological advancement in their manufacturing processes, adopting waste minimization/elimination, cleaner technologies, effluent recycle/reuse, green belt development and energy conservation techniques. The various measures implemented at CFL under the aforesaid, include:

- Switching over to DCDA process in sulfuric acid plant,
- Adopting total recycle of effluents for gypsum slurrying,
- Fluorine recovery unit enabling recovery of fluorine vapors as hydrofluosilicic acid ,which is the raw material for a neighboring Aluminum Fluoride Company.
- Installation of molten sulfur import facility at the wharf area, which is the only one of its kind in India, to avoid sulfur dust emissions and to make sulfur handling system more safe and environment friendly.

The total money spent on pollution control equipment amounts to approximately US $ 10 million. A system of monitoring the consumption of raw materials, energy efficiency and consumption of fuels against targets was existing, which is reviewed at the highest level.

Technical Services Department used to liaise with various statutory and legal bodies on environmental issues till 1996 and subsequently a dedicated department namely Safety, Health & Environment was formed to give thrust to environmental management in a more streamlined way. S.H.E department handles all statutory compliances, renewal of licenses and consents for operation and establishment. Environmental statements as required under law are being submitted to the concerned authorities, but detailed environmental audits were not carried out. Hence, it was decided to implement EMS conforming to ISO 14001.

As a first step towards achieving ISO 14001 certification, the management appointed Manager, Technical Services as Management Representative and TQMI again as the consultant for conducting awareness and internal auditors training.

The methodology of implementation was similar to the QMS model.

### 4.2 Road map to Certification

Along with the appointment of consultant, and Management representative, detailed activity schedule was developed and the expected time was projected between 12-15 months.

The major activities identified are:

### 4.2.1 Initial Environment review

Carried by the core team which identified environmental issues to be addressed and the potential scope of EMS to meet the requirement of ISO 14001:1996.

### 4.2.2 EMS Planning:

- Identification and evaluation of aspects of various departments
- Identification of legal requirement
- Formulation of Environment policy based on the significant aspects by the management
- Development of environmental objectives
- Development of environmental programs

The core team reviewed the aspects identified by the various departments and decided that all aspects having a score more than 300 in the case of normal/abnormal and more than 5 in the case of emergency conditions were considered as significant aspects along with other issues of interested parties.

Environmental policy and programs were developed based on significant aspects and the benefits derived from each program are as per Annexure 3.

### 4.2.3 EMS Documentation:

- Development of Environmental legislation manual: By S.H. & E department.
- Development of Environmental systems and procedures: By core teams and HODs
- Development of EMS manual: By Management Representative.
- Development of additional work instructions: By concerned Section Heads.

Since the QMS based on ISO 9002:1994 was being developed in parallel, the concerned departments had prepared/modified their procedures and work instructions to align with common clauses of ISO 14001:1996. All other documents relating to other clauses of ISO 14001:1996 were separately documented and controlled. The EMS Apex manual along with procedures was also put on Intranet for easy access by employees.

### 4.2.4 Training & Awareness:

- Half-day awareness program to top management
- One-day program to management staff

- 2 days detailed program to a group of 20 persons (Navigators)
- Aspect impact training to core team persons
- One-day program on documentation liaison to core team persons
- 3-day internal auditors liaison for 20 identified persons including one day practical training

Training system was designed in two basic categories namely centralized and decentralized.

Centralized training ensures coverage of all common EMS issues targeted for all officers, and supervisors of the organization. Several training modules have been designed for imparting training by well-trained trainers.

Centralized training is designed at the departmental level and focused for the shop floor people. Several training modules on department-wise specific EMS issues have been prepared and the trained departmental training mentors imparted training. These modules are on aspect – impact analysis, legal requirement, objectives and targets, various operational procedures and work instructions, emergency preparedness and response system etc., and put on Intranet for the access of field employees.

All the contractors at CFL have been given induction in EMS through well-defined documented training module indicating their role and responsibility. Environmental issues like spillages from dumpers, gypsum handling management house keeping at site affecting the environment and use of safety appliances are communicated to all the major contractors. All the contract personnel at site were given training by safety as well as by concerned departmental persons on safety and environmental issues. The training was spread over 4-5 months time.

### 4.2.5 Implementation Milestones

- Review of progress of implementation
- EMS audit by internal auditors
- 1st Management review meeting
- Appointment of Certification agency
- EMS audit by external consultant
- 2nd Management review meeting
- Internal audit by certification agency
- Certification audit by certification agency

A flow chart showing the steps in development of the system is as per Annexure 4

Vice-President along with Management Representative and concerned HOD made extensive rounds around the plant and areas of improvement such as housekeeping, material/oil spillage control and hazardous waste management were identified.

Considerable efforts were made for identification, segregation, storage and disposal of various types of wastes/scrap items, which not only brought better value for the scrap, but also gave good appearance to the area.

After the two internal audits and Management Review meetings, the certification body - DNV conducted initial audit, primarily going through the adequacy of all the documents. The auditor raised a few minor NCRs, which he advised could be closed at the time of certification audit. Looking at the organization's preparedness, he recommended that it could go for a certification audit in a month's time. The certification audit was conducted by the certification agency and the lead auditor announced in the concluding meeting scheduled on 31st May, 2001 that he was recommending the organization for certification as per ISO – 14001. Since then, one more surveillance audit by certification agency and few internal audits were conducted to check the adequacy of the system against the requirement of the standard and found in order.

## 5. Occupational Health and Safety Management System

The organization has already initiated development of OHSM system in line with the requirement of OHSAS-18001. At present, a study to identify the gap between the existing system and the requirement as per the specification of OHSAS 18001 is under progress. After implementation of the above system, the organization will initiate the process of integrating safety, health, environment and quality systems.

## 6. CFL's Experience in Implementing the Systems

### 6.1 Common Factors in implementation of the systems

There are a number of features common to implementing the three systems. The similarity of organisational arrangement required for implementation is obvious. Experience of CFL was that the simultaneous implementation was facilitated due to the following common aspects:

- Utilisation of the expertise of reputed consultants in the field for initiating the programme.
- Policy development and management commitment.
- Steering committee or management review committee.
- Nominating co-ordinator or management representative.
- Core teams involving sectional heads.
- Field level teams comprising of first line supervisors and workmen.
- Extensive and intensive training for all levels, including contract workmen – awareness programmes, practical training for understanding and implementing procedures and record keeping.

- Similarity of documentation, measurement, monitoring and control among the systems, as illustrated in Annexure 5. .
- Motivation through recognition and reward system.

## 6.2 Issues involved

During the period of implementing the systems, CFL paid special attention to the following aspects :

- The changes in the government policy towards the fertiliser industry with the objective of reducing dependence of subsidies.
- Increased competition forcing the company to focus on quality, cost reduction and bench marking with international standards.
- Changing the profile of the manpower – with most of the senior employees retiring in a span of 5 – 6 years, there is a need for continuation and preservation of expertise.
- Closure of ammonia and urea manufacturing plants for economic reasons.
- Addition of new facilities, such as molten sulphur and ammonia importation and storage in the middle of the port facilities.
- Geographic location of the plant – It is situated in a flat land surrounded by mountains forming bowl and atmospheric inversion conditions in winter season.
- Stringent ambient air quality standards (TSPM = 200 µg/M3 vs. 500 µg/M3 of National standard) imposed by local statutory authorities due to unloading of finer rocks at our fertiliser berth, located in a sensitive area of Defense installations.
- Increased the outsourcing of non-core operations and net working with outside organisations, requiring efforts to improve their standards to work performance.
- Introducing automation and revamping the plant facilities, while a part of the plant is in operation.

## 6.3 Benefits derived

## 6.4 Process Safety Management System

- Focused system approach towards process safety has proactively eliminated potential incidents in hazardous chemical (ammonia) handling and storage.
- Increased participation of employees and ownership of the system.
- Compliance to all safety regulations by contractors and contract employees.
- Changes to process involving hazardous chemicals carried out in a controlled and safe way.
- Increased preparedness for emergency response.
- Continual improvement in process safety by regular compliance audits & incident investigations.
- Maintaining safety critical equipment in proper condition, thus avoiding incidents.

- Improved technical awareness of process hazards and safety systems contributing to safe work behavior.

## 6.5 Quality Management System

- Focused attention on training and periodical internal audits, generated a sense of importance, which has particularly helped in improving effectiveness in product handling and bagging operations. The results were seen through reduction of off-spec generation and product losses.
- The practice of PDCA and preparation of CAPA documentation under QMS has resulted in improving quality of the product and operations.
- Documentation of procedures and maintaining of records though cumbersome and time consuming has given good clarity of job requirements and sense of direction to employees.
- The employee suggestion scheme as part of involvement of people brought solutions for chronic problems such as quality of finished products and reduction of losses.
- The sense of purpose programme under customer focus initiated by the organisation has given greater scope for understanding customer requirements by the plant personnel, thus resulted in delivering of improved quality of the product to the customer.
- Adhering to schedules for periodic calibration of instruments measuring the quality parameters and conditioning monitoring of the equipment affecting the quality helped the organisation supplying the consistent quality of the product to the customer on sustainable basis.

## 6.6 Environmental Management System

- Critical review of the existing systems as part of EMS helped in elimination of wasteful practices, identifying source of hazards and controlling inefficient operations resulting in energy and material conservation.
- Commitment towards statutory compliance and initiatives of better environment and energy management practices are the two major indicators of implementation of the system.
- The Aspect-Impact Analysis under EMS has thrown up the deficiencies in the system and by addressing the same statutory compliance could be ensured.
- Implementation of the systems has brought out cultural transformation amongst the work force including contract workmen, thus facilitating them carrying out the operations in a safe and environmental friendly manner.
- Implementation of EMS in line with ISO 14001 has lifted the organization to a new level of performance, winning many laurels particularly in housekeeping, sustained legal compliance with respect to liquid effluents, material and oil spillage control, hazard waste management and energy conservation.

## 7. Conclusion

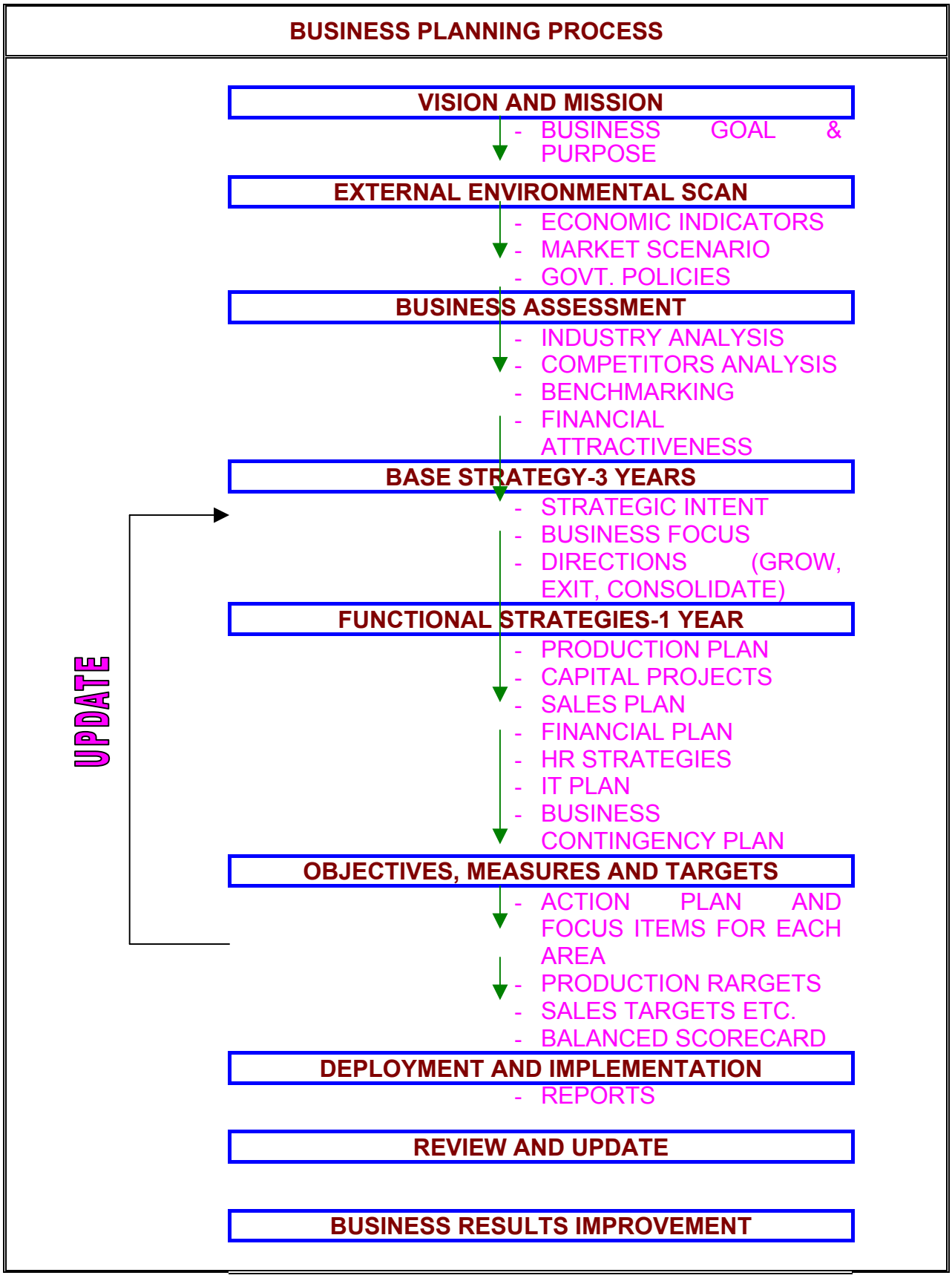
- For sustainability and to derive maximum benefit out of the systems, a holistic approach involving people and processes should be adopted.
- Like any initiative towards improvement, the implementation of the systems requires a cultural change amongst all concerned and the time schedule should allow for this.
- It is also important to explain and convince various operating personnel in the organization, the reasons to go for these systems.
- A team effort and commitment amongst employees including contract workmen, accepting their role in the process is highly desirable for the sustainability of the systems.
- The additional burden of documentation and regimented procedures is more than compensated by the benefits derived in form of organizational effectiveness.

**ANNEXURE1**

| No. | Element | Standard Requirement | Status of Implementation |
|---|---|---|---|
| 1 | Process Safety Information: | Process Safety Information defines the requirement for the documentation and availability of written process safety information, regarding hazards of chemical used, the technology and equipment covered in the process. This purpose of this standard is to ensure updated availability of process safety information. | The process safety information for all hazardous process is compiled and made available in the control room for the reference of the operating personnel. This has improved the confidence level of the operating personnel, controlling the hazard processes from preventing occurrence of any major incident/accident |
| 2 | Process hazard analysis (PHA): | The PHA element requires a structure for identifying, evaluating and controlling processes involving hazardous materials. To ensure safe operation of the plant on a sustainable bases, the standard calls for Hazop study for the whole plant once in five years, even if No changes have been done | In house training was imparted for the hazop team. This team has already carried out hazop studies that form part of MOC raised and modifications proposed and also originated from the recommendations of the final incident investigation team. |
| 3 | Operating Procedures: | The Element requires a format, structure and methodology for developing and revising specific procedures for operating processes which handles or process hazardous materials. | Developed 13 procedures for Atmospheric Ammonia storage handling facility and 18 procedures for Sulfuric Acid plant. For critical activities such as Ammonia ship unloading, rail/truck unloading of ammonia, startup and shutdown of sulfuric acid plant etc., the plant procedures are being followed in the form of checklist with records duly signed by the concern operating personnel to ensure compliance. |
| 4 | Contractor control: | Contractor control element ensures contractors who work in or around a hazardous process in the facility are given safety training. It includes specific record keeping requirements associated with contractors working in hazardous areas. | An administrative procedure was developed. Cards were issued to workmen as evidence of having undergone training on PSMS. It was made mandatory that all the employees of the contractors underwent this training before the take up any job in side the plant. |
| 5 | Training: | It establishes the process for initial, transfer and refresher training for all employees involved in operating or maintaining process which handle or process hazardous materials. Requirements also address verification of training and employee training documentation. | A training program including refresher training was drawn to provide training to all operating and maintenance personnel. Training modules relevant to each element have been developed and put on intranet for ready access to all field employees. |
| 6 | Pre-startup Safety Review: (PSSR) | This element establishes requirements for reviewing new or modified hazardous processes or facilities prior to startup. It requires a verification that the equipment is installed according to design specifications, confirms that process safety information is updated and accurate, operating procedures are in place and training is completed prior to startup. | An administrative procedure along with an exhaustive checklist was developed. No. of PSSRs have been undertaken for various modifications/new installations. |

| No. | Element | Standard Requirement | Status of Implementation |
|---|---|---|---|
| 7 | Safe Work practices: | This element ensures safe work practices for the hazardous materials including work permit systems used in hazardous processes and facilities | To fulfill the requirement of the standard, CFL refined existing procedures for the permits required under this standard. The effectiveness of the implementation of the above practices is ensured by the Safety dept during their routine plant visits. |
| 8 | Mechanical Integrity: | Procedures for maintenance, testing, quality assurance and inspection practices to maintain the on going integrity of process equipment are to be developed under this element. | Identified the safety critical equipment related to hazardous chemicals, developed inspection and preventive maintenance schedules and procedures for the above critical equipment, established acceptance criteria for the above equipment for safe operation. |
| 9 | Incident Investigation: | Root cause analysis of accident/ incident investigation procedures is to be established which includes follow up and closure of all recommendations. | The effectiveness of the implementation of this procedures has resulted in bringing up incidents of smaller magnitude including near misses and evaluating the same in a structured manner, thus eliminating recurrence of the above. |
| 10 | Emergency Planning and response: | This element ensures establishment of facility plans for responding to any emergencies involving hazardous materials. | As part of the requirement of the standard, procedures for chemical spillage recovery and table top drills were prepared Table top drills are conducted by the concerned for all identified scenarios on a schedule basis to strengthen the emergency preparedness of the organisation |
| 11 | Management of Change (MOC): | This requires written procedures for managing all changes to the layout, equipment, modifications and process. It includes requirements for ensuring that changes are correctly preformed, documented, training is conducted, and process safety information is updated. | An administrative procedure was developed for implementation, which specifies that a cross-functional team must review and approve any changes at the incipient stage to eliminate any potential risk consequent to the changes proposed. |
| 12 | Compliance Audit: | This element requires compliance audit of the PSM system to be organized and conducted, including written reports documenting any deficiencies and recommendations for any corrections. | The performance of the Process Safety Management System has been evaluated on a scale of (4.4), where the first figure denotes measurement against documentation and the second for activity (implementation). The system at CFL has acquired a score of (3,3). |
| 13 | Employee Participation: | This element requires employee participation in the development and continual improvement of the Process Safety Management System. | Small teams are formed in concerned areas, and they are reviewing the procedures of the PSMS for any improvement/awareness. |

**ANNEXURE-2**


BUSINESS PLANNING PROCESS
VISION AND MISSION
- BUSINESS GOAL & PURPOSE
EXTERNAL ENVIRONMENTAL SCAN
- ECONOMIC INDICATORS
- MARKET SCENARIO
- GOVT. POLICIES
BUSINESS ASSESSMENT
- INDUSTRY ANALYSIS
- COMPETITORS ANALYSIS
- BENCHMARKING
- FINANCIAL ATTRACTIVENESS
BASE STRATEGY-3 YEARS
- STRATEGIC INTENT
- BUSINESS FOCUS
- DIRECTIONS (GROW, EXIT, CONSOLIDATE)
FUNCTIONAL STRATEGIES-1 YEAR
- PRODUCTION PLAN
- CAPITAL PROJECTS
- SALES PLAN
- FINANCIAL PLAN
- HR STRATEGIES
- IT PLAN
- BUSINESS CONTINGENCY PLAN
OBJECTIVES, MEASURES AND TARGETS
- ACTION PLAN AND FOCUS ITEMS FOR EACH AREA
- PRODUCTION RARGETS
- SALES TARGETS ETC.
- BALANCED SCORECARD
DEPLOYMENT AND IMPLEMENTATION
- REPORTS
REVIEW AND UPDATE
BUSINESS RESULTS IMPROVEMENT
UPDATE

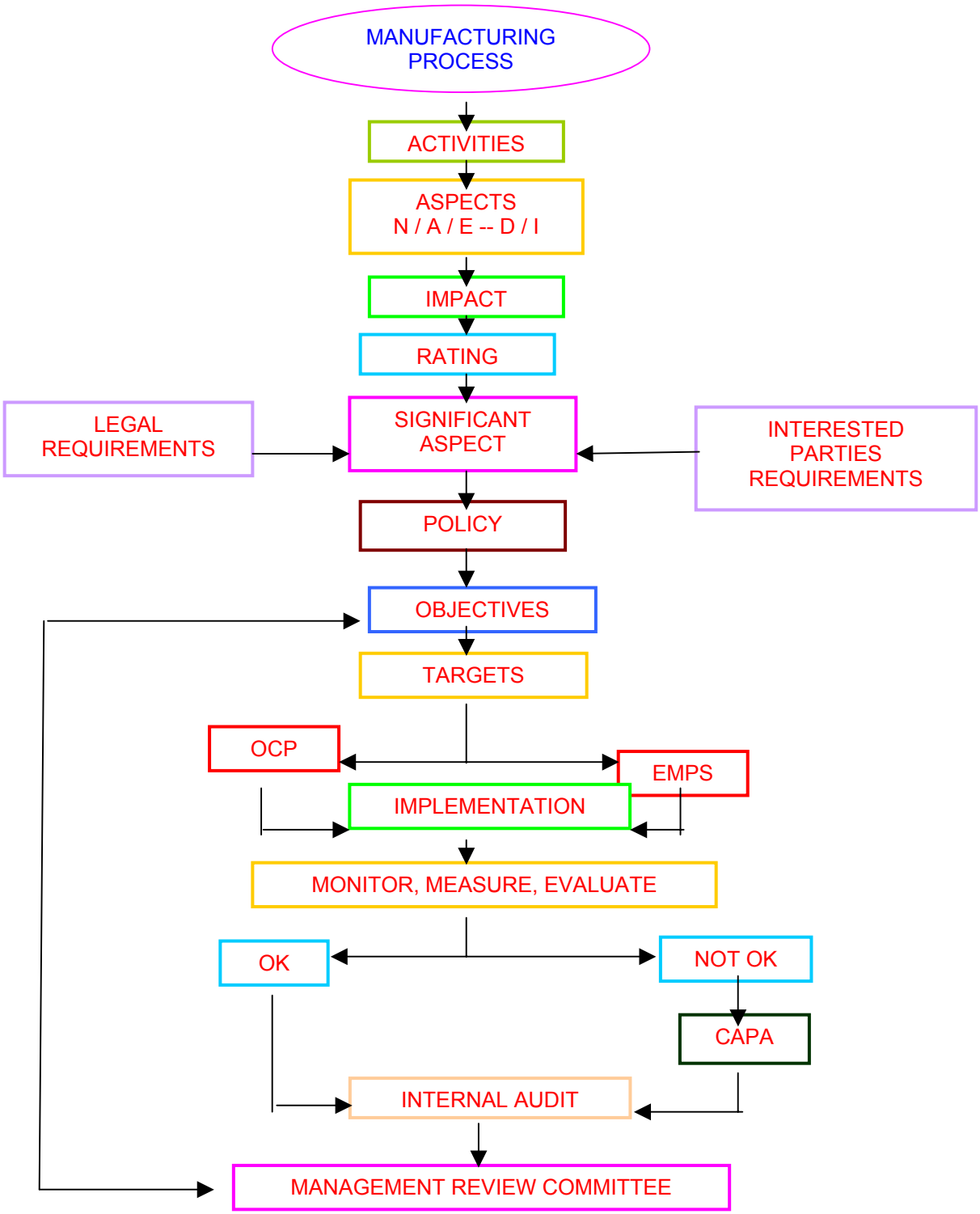
**ANNEXURE3**

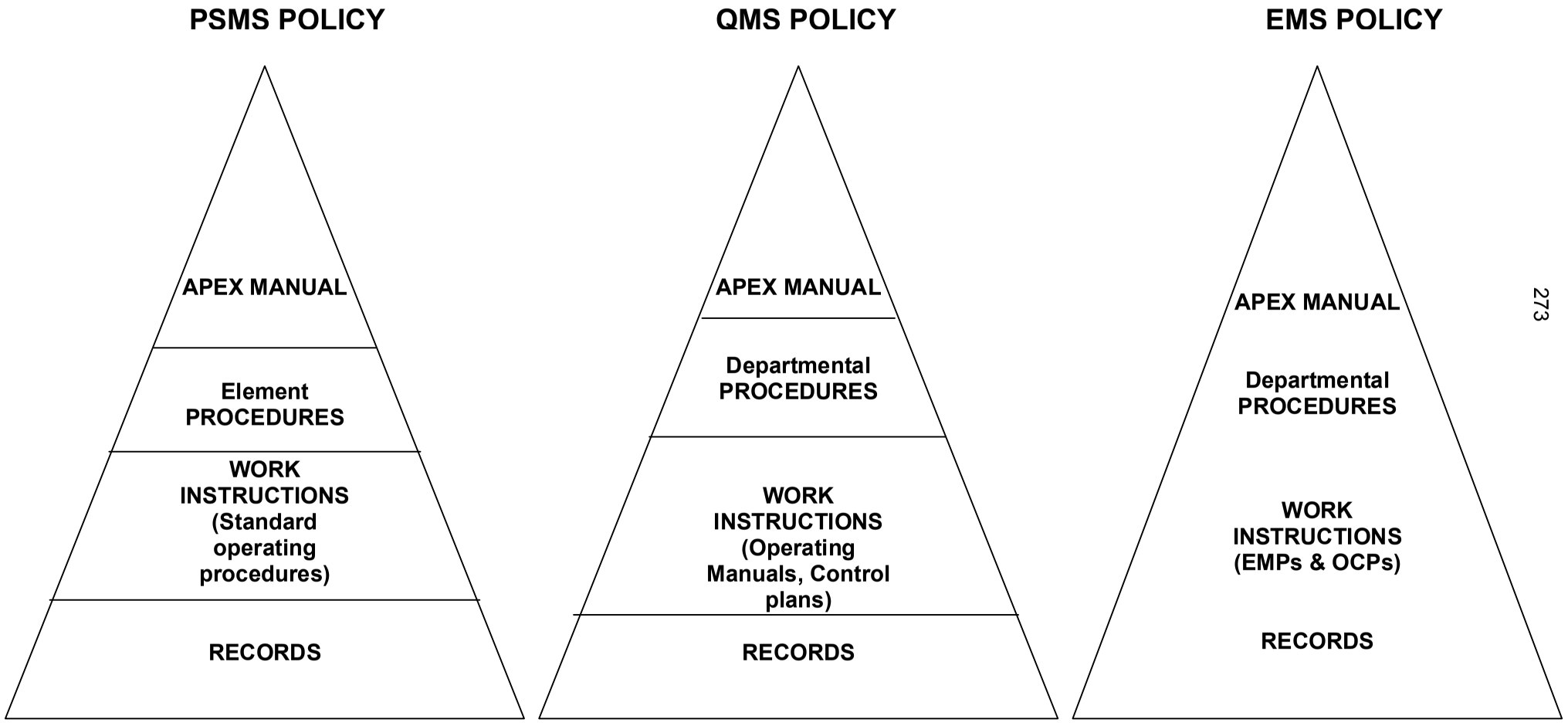
**Environmental Management Programs implemented at Coromandel Fertilisers Ltd.**

| No. | Environmental Management Program | Description of the program | Benefit from envisaged objective |
|---|---|---|---|
| 1 | Reducing water pollution at Gate-13. | Strengthened the gypsum pond bunds. Prevented overflows from effluent sump in complex plant. Installed online pH meter at the outlet of plant effluent canal. The above are carried out to eliminate potential risk of the final effluent of the plant deviating from meeting APPCB limits due to various reasons. | Facilitated sustained statutory compliance with respect to liquid effluents at the plant outlet. |
| 2 | Reuse of phosphoric acid plant effluent. | Constructed a sump followed by acid proof brick lining at the phosphoric acid storage tank to facilitate collection of the drained acid from the storage tank, while undertaking unplugging operation and reuse the same within the plant preventing joining the final effluent canal. | Realised recovery of 50 MT of $P_2O_5$ per annum along with reduced load on effluent treatment plant in terms of 'P' and 'F'. |
| 3 | Reducing Ammonia emission through stack in complex plant 'A' train. | Old scrubbers have been replaced with the modified and improved design of scrubbers. | Realised Annual savings of 200 MT of ammonia along with legal compliance beyond standards with respect to dust and fluorine. |
| 4 | Ground rock conveying system modification. | Installed pipe conveyor for transfer of ground rock from rock grinding unit to phosphoric acid plant, replacing the energy-intensive pneumatic conveying system. | Realized energy saving to a tune of 240 kW. |
| 5 | Low $NO_x$ modification in DG-I | Improved the compression ratio from 12 to 14 along with reduction in exhaust gas temperature by 30 degrees through replacement of conventional pistons. This facilitated improvement in engine efficiency and reduces the $NO_x$ emission and fuel oil consumption. | Realized annual saving of 30 MT of LSHS. Achieved reduction in NOx emission levels by 30%. |
| 7 | Dedusting system at wharf | At present, emulsifying nozzles and telescopic chutes are being used to control dust at unloading hopper and silo discharge, respectively. To control dust more effectively, a screw unloader is being procured and installed, replacing the conventional, age-old grab bucket gantry system. This is expected to come into operation by end December 2003. | Ambient air quality (TSPM & RSPM) around Naval premises is expected to be maintained within the limits of 200 and 100 $\mu g/M^3$ respectively. |
| 8 | Green-belt development | Planted 8000 saplings around plant and wharf facility. | Reduced the dust pollution in and around fertilizer complex significantly. |
| 9 | Rainwater harvesting | A trench was provided across Meghadrige river course connecting the infiltration belt and filled up with different grades of metal and sand. | Realized additional yield of 0.5 LIGPD of water. |

**ANNEXURE 4**

## EMS FLOW CHART




PSMS POLICY
APEX MANUAL
Element PROCEDURES
WORK INSTRUCTIONS (Standard operating procedures)
RECORDS
QMS POLICY
APEX MANUAL
Departmental PROCEDURES
WORK INSTRUCTIONS (Operating Manuals, Control plans)
RECORDS
EMS POLICY
APEX MANUAL
Departmental PROCEDURES
WORK INSTRUCTIONS (EMPs & OCPs)
RECORDS