

The management of

HEALTH AND HYGIENE AT QUEENSLAND FERTILIZER OPERATIONS

M D Wicking Occupational Hygienist WMC Fertilizers

Executive summary

Queensland Fertilizer Operation (QFO) is a world class high analysis fertiliser manufacturing plant in North-West Queensland operated by WMC Resources.

The complex processing plant poses occupational hazards as diverse as gaseous fluorides, sulphur dioxide, sulphuric acid mist, respirable dust, respirable quartz and noise.

To accurately determine the risk posed by these hazards QFO has collaborated with James Cook University (JCU) to develop a long term three phase program.

JCU began by undertaking an exercise that combined employee health assessments, an environmental contaminant sampling survey and employee focus groups.

This provided a baseline understanding of employee health and an indication of atmospheric conditions. Phase II and III will involve biological monitoring and will establish methods to reduce identified risks.

In addition QFO completed a baseline health survey according to the WMC Health Impact Standard.

This survey involved employee interviews and task observations to identify chemical, physical, biological and ergonomic workplace hazards.

This combined approach enabled QFO to confidently design a routine sampling program for all atmospheric contaminants.

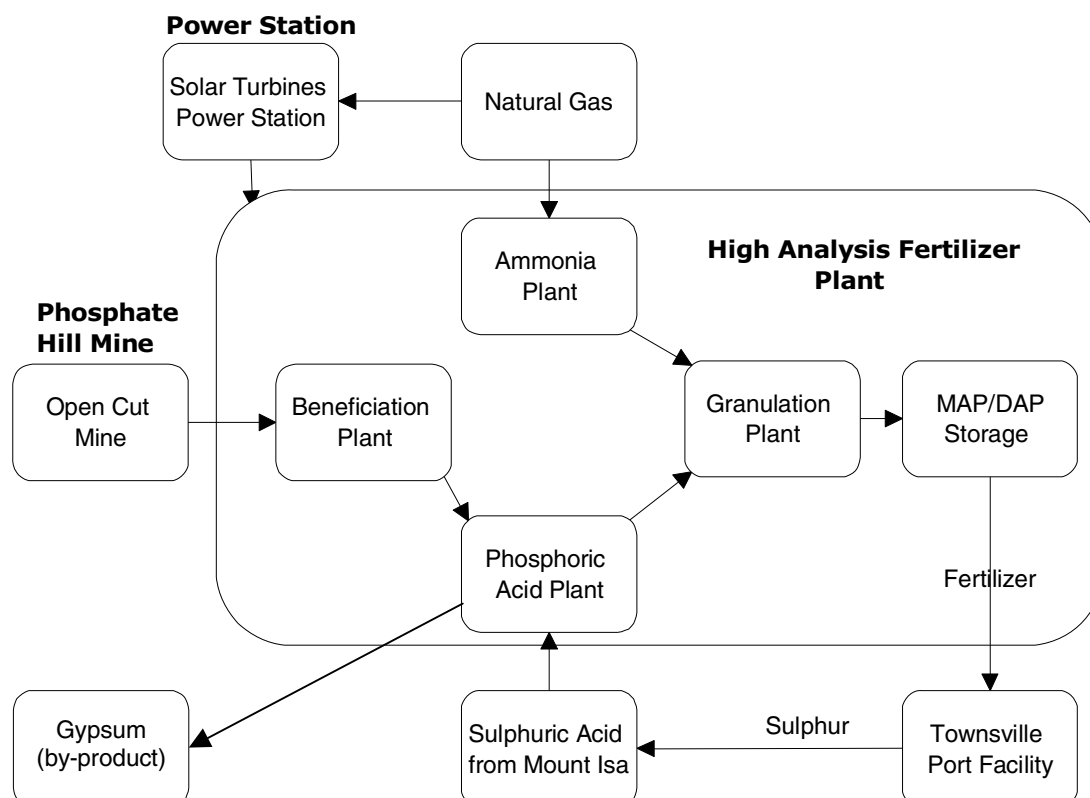
The results of this monitoring are compared to exposure standards documented by the National Occupational Safety and Health Commission (NOHSC) to determine risk for each identified work group.

Statistical tools are applied to the results to determine the potential for resultant health effects and the effectiveness of the program.

Introduction

Queensland Fertilizer Operations is a fully integrated operation owned and operated by WMC Resources encompassing three sites in North Queensland. WMC Resources also owns world class operations in Nickel

Figure 1 – Schematic of Queensland Fertilizer Operations



and Copper-Uranium. QFO is consists of Phosphate Hill, an open cut mine and fertiliser manufacturing facility, an Acid Plant in Mt Isa and a materials storage and handling facility in Townsville. The Operation is detailed in the schematic in Figure 1.

The very nature of these operations has the potential to cause harm to health. The most significant health issue at Phosphate Hill is the emission of gaseous fluorides. The primary sources of these emissions are the Phosphoric Acid Plant (PAP) and the Gypsum stack. Fluoride is released from the phosphate rock ore after the addition of sulphuric acid in the PAP. The fluoride is scrubbed during this process using a wet scrubbing system. A by-product of this is gypsum which is stacked on site in lined dams. Traces of fluoride remain in the impure gypsum.

The management of the more 'typical mining' health risks of respirable quartz and noise is also required at Phosphate Hill. Sulphur dioxide emissions in Mt Isa pose a potential health risk to employees at the Sulphuric acid Plant. These risks were being well managed by QFO but it was decided to go one step further to ensure the long term health and wellness of all employees. This holistic approach to health and hygiene will improve employees lifestyle as well as their occupational health.

Health and Hygiene at WMC

Recently WMC undertook a company-wide review of its health risk management processes.

Following the review, a structured risk management system specifically designed to guide the management of health risks at sites was developed.

The management system now incorporates the standard risk management principles of Australian Standard AS 4801 'Occupational health and safety management systems - Specification with guidance for use'.

The management system utilises risk management processes which constitute industry best practice. This ensures the application of due diligence in the day to day management of health risks, while at the same time providing the basis for sound corporate governance in relation to the management of health in WMC.

Fundamental to the effective management of risks is the identification and evaluation of those risks. This requires not only the identification of hazards but also:

- the definition and application of risk assessment strategies
- the development of acceptable risk criteria
- the application of decision logic based around those acceptable risk criteria
- the application of control measures to eliminate or mitigate risks
- the evaluation of the effectiveness of those control measures.

WMC recently implemented the initial phase of such a risk management process across all of its Australian operations with the application of a structured and comprehensive hazard identification and risk assessment process.

Health hazards at sites were identified through a team based health hazard identification and documentation process. This was facilitated by external and independent occupational hygiene consultants, in conjunction with key site personnel, including operators, and specialist health and hygiene personnel.

The consultants identified health hazards through task observation, then applied the WMC prescribed risk assessment process in order to prioritise risks for the application of control measures as appropriate.

The risk assessment process also identified those risks which had yet to be satisfactorily characterised, ultimately leading to the development of a health hazard monitoring strategy for sites which was aimed at providing valid data upon which to base subsequent risk management decisions.

Health and Hygiene Management at QFO

QFO recognised from the outset the requirements for a statistically valid routine monitoring program encompassing all potential health hazards.

The sampling program prior to the baseline survey was not considered statistically valid and was primarily based on employee concerns at the time. One reason for this was the unsteady state of the operation prior to mid 2001.

Now that QFO is approaching nameplate production levels it is an ideal time to undertake an assessment of baseline health that could be used to predict future sampling strategies.

The baseline health survey was carried out across all three QFO sites between April and May 2002. The work was completed by Southwest Occupational Health



The Phosphoric Acid Plant at Phosphate Hill

Services, with assistance from the site Occupational Hygienist.

The main objectives of the health hazard survey were to:

- Identify health hazards associated with jobs and tasks on site
- Review previous hygiene monitoring results
- Make recommendations in regards to controlling the identified health hazards
- Make recommendations on further monitoring requirements

The health hazard survey process involved:

- Collection of health hazard information for each job group and task by interviewing members of each occupational group
- Verification and validation of the information collected, by job and task observation
- Statistical review of historical exposure monitoring data
- Development of a monitoring schedule for Phosphate Hill Operations based on the statistical review of previous monitoring data and the information collected during the health hazard survey (Linto, 2002)

The sampling program will assess all the chemical hazards identified and will be statistically interpreted to develop future monitoring and management regimes.

The quota required is 850 samples over the next twelve months. The main samples are dust (inspirable and respirable including quartz), gaseous fluoride (as HF), acid gases, which includes HF, sulphuric acid and phosphoric acid mist, sulphur dioxide and ammonia.

In addition there are also samples for welding fume in the workshop. The samples will be collected by the site Occupational Hygienist with assistance from the Environmental/Health Technician.

The samples are collected in accordance with National Institute of Occupational Safety and Health (NIOSH) and Occupational Safety and Health Administration (OSHA) techniques and analysed in an off-site NATA accredited laboratory.

James Cook University Workplace and Environment Study

QFO first discussed the collaboration with JCU in 2000. Following the original meetings it was decided to approach the work in three phases.

Phase I was designed to establish a baseline of employee health and workplace conditions. Phase II was to introduce biological monitoring and investigate influencing factors while Phase III is expected to run parallel to Phase II and look at ways to work more healthily.

Phase I of this study was conducted between November 2001 and July 2002 and constitutes the baseline survey.

Phase I involved the following components:

Environmental Exposure Mapping

- Comprehensive Medical Check-up
- Health Questionnaires
- Focus Groups on the Perception of Occupational Risks

Environmental Exposure Mapping

The Environmental Exposure Mapping involved ambient air sampling of the following contaminants:

- Hydrogen fluoride
- Sulphuric acid mist
- Phosphoric acid mist
- Ammonia
- Carbon monoxide
- Sulphur dioxide (Mt Isa only)

The sampling was conducted by staff and students of the Department of Chemistry from James Cook University in December 2001. Measurements were taken to look at what's 'out there'.

The samples taken were positional only, no personal samples were taken during this activity. The data collection was undertaken to locate sources and identify general distributions of atmospheric contaminants as opposed to measure/monitor actual exposure.

The main findings of the exercise were that:

- there were significant variations in exposure to potential toxicants observed between groups of employees working in different plants
- hydrogen fluoride, sulphur dioxide and sulphuric acid mist need to be considered in assessing human health risk
- in general, concentrations of chemicals are well below current exposure standards
- The highest concentrations of HF were recorded on the gypsum stack and in the Phosphoric Acid Plant.



The Gypsum stack (as photographed from the Granulation Plant)

These are summarised in the tables .

Medical Check-up and Questionnaire

The Health assessment consisted of the following tests:

- Full blood count
- Liver function test
- Electrolytes and Albumin-Creatinine Ratio (ACR) urine test
- Basic physical examination
- Visual acuity
- Joint mobility
- Blood pressure
- Height and weight

At the same time as the physical assessment participants were asked to complete a comprehensive Health questionnaire which included questions on:

- Demographics
- Medical history
- Risk conditions/behaviours
- Current medications
- Smoking, alcohol and drug consumption
- Diet
- Other symptoms

A response rate of approximately 60% was achieved with 218 staff and contractors participating (Carter 2002). Initial indications are that employee health is more governed by lifestyle factors than occupational exposures at QFO.

This was considered a representative sample considering the availability of the workforce during the assessment period. Absences owing to Annual Leave, R & R, and variations in shift rosters meant that not all employees were on site to participate in the assessment.

The major findings of the survey were that, on average, the results from the workforce were higher than would be expected in the normal population in the following areas:

- Body mass

- Waist to hip ratio
- Blood pressure
- Dehydration

The key now is to improve employee wellness while at work without significantly interfering with their private lives. Dehydration will be investigated further in Phase II of the project with JCU to better understand what employee groups are most affected and how this issue can be better managed.

Employee perceptions

A qualitative research project comprising seven focus groups and one interview was conducted in December 2001 by two researchers from JCU.

The aims of the project were to:

- 1 Investigate employees perceptions of the types and sources of occupational health and safety hazards at Phosphate Hill;
- 2 Investigate employees perceptions of the current handling of identified occupational health and safety hazards in general and of the current response to employee concerns at Phosphate Hill;
- 3 Identify suggestions of employees on how WMC could respond to occupational health and safety hazards at Phosphate Hill and improve conditions/procedures (Devine 2002).

Common themes identified by the survey were:

- Chemical related issues
- Fatigue & general Fitness for Work
- Drug and alcohol issues
- Management and procedural issues

These issues are currently being addressed by QFO. The focus groups will be repeated regularly to determine how effectively these concerns are being handled. Many of the perceived issues can be addressed by communication and at low cost to the organisation.

Discussion

QFO has already addressed some of the issues

Table 1 – Results from the Gypsum Stack (Ridd, 2002)

	[HF] mg/m ³	[H ₂ SO ₄] mg/m ³	[H ₃ PO ₄] mg/m ³
Maximum value	2.60	0.12	0.06
Median	1.01	0.10	0.00
NOHSC Exposure Standard	2.6	1.0	1.0
Number of Samples	5	5	5
Detection Limit	0.03	0.10	0.03
Number < detection limit	0	3	4

Table 2 - Results from the Phosphoric Acid Plant (Ridd, 2002)

	[HF] mg/m ³	[H ₂ SO ₄] mg/m ³	[H ₃ PO ₄] mg/m ³
Maximum value	2.36	0.73	0.03
Median	0.20	0.07	0.00
NOHSC Exposure Standard	2.6	1.0	1.0
Number of Samples	30	30	30
Detection Limit	0.03	0.10	0.03
Number < detection limit	6	26	29

raised by the baseline health surveys. Trenchsportz, a fitness and lifestyle contractor has been appointed to improve the general health of employees at Phosphate Hill.

Two co-ordinators are responsible for developing fitness regimes for individuals and organising team activities. This combined with WMC's Fitness for Work Policy, (requiring 0.00 % Blood Alcohol Concentration) has improved employee lifestyles while on site.

A thorough sampling program has been designed and will be underway in August 2002. The program requires approximately six samples a day to be taken from a cross section of the workforce.

Over 12 months an accurate exposure profile across all operations and climatic conditions will be obtained.

Personal hydrogen fluoride monitors for Phosphate Hill and sulphur dioxide monitors for Mount Isa have been purchased and are currently being trialled at each site.

If successful more units will be purchased to assist with monitoring requirements. The units are data-logging and alarm when exposed to concentrations above the set limits.

Planning is currently underway for Phase II of the collaboration with JCU. The program will aim to address some of the concerns from Phase I as well as build on the knowledge already gained. Anticipated projects for Phase II include:

- Further Environmental Exposure Mapping
- Further Substance Specific Exposure Matrices
- Repeating the Personal Activity Questionnaire
- Repeating the Comprehensive Medical Check-up
- Focus Groups on the Perception of Occupational Risks
- Biological Monitoring
- Hydration Strategy development
- Fatigue Management Review
- Injury Data Analysis

Conclusion

The challenge of adopting two approaches to the management of health and hygiene at QFO was to not repeat or double the work involved. To date QFO has managed to do that successfully. Our challenge now is to maintain the focus and achieve the targets set by the program.

The successful implementation of the WMC baseline survey combined with the ongoing involvement of JCU will ensure the occupational health of all employees at QFO is maintained at a world class standard.

References

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Ridd, M, (2002) Initial Environmental Sampling of WMC Fertilizer Sites at Phosphate Hill and Mt Isa, James Cook University