Environmental Contingency Program

1. Scope

The contingency program in The University of Queensland EMS is limited to disasters that impact upon the quality of:

- soil;
- water; and
- air.

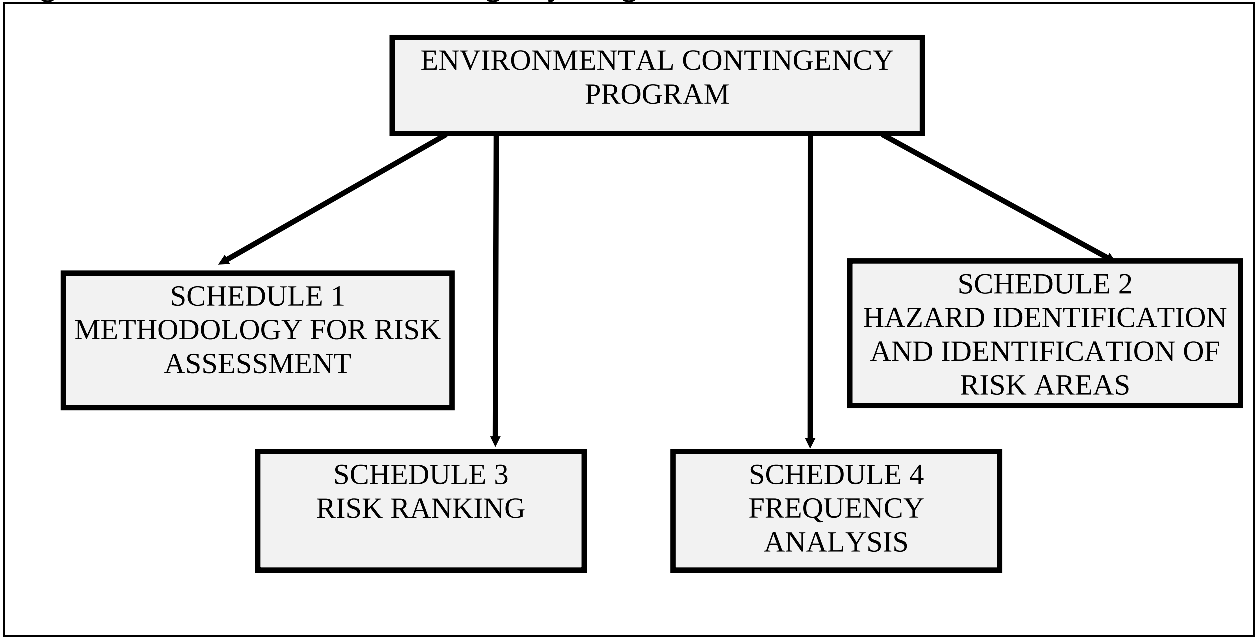
2. Objectives

- Ensure that environmental considerations are addressed in the handling of emergencies by The University of Queensland;
- Minimise the impact on the environment by any disaster; and
- Ensure quick and effective response to environmental disasters in the advent of an emergency.

3. Program structure

The Environmental Contingency Program structure is depicted in Figure 1.0. The program contains a strategic and systems approach to the environmental contingency management. It also contains schedules which deal with specific functions of the program. These include five schedules as shown in Figure 1.0.

Figure 1.0 - Environmental Contingency Program Structure.



4. Procedures

4.1 Risk Minimisation

Table 1 lists the various strategies that should be adopted within the University to minimise the risk of environmental disasters.

Table 1. Risk Minimisation Strategies

Area	Opportunity	Actions
Technology	Minimise risk by installing latest equipment for the prevention and containment of emergencies.	• Smoke detectors; • Fire alarms; • Fire retardant construction materials • Fire doors; • Smoke isolators for venting of enclosed areas; and • Bunding.
Education and Training	Risk management is improved by making people aware of the risks within the workplace.	• See training section in EMS Manual
Segregation	Segregation of incompatible materials and activities will reduce the risk of a disaster occurring.	• Segregate incompatible chemicals in stores and cabinets. • Remove flammables from possible ignition sources during use and storage. • Separate high-risk processes from expensive instrumentation and information technology.
House Keeping	Ensure that risks are minimised by properly and safely storing, housing and working with chemicals.	• Regular removal of process waste, packaging, etc. • Ensure all containers used for storing chemicals are designed for that particular purpose and chemical • All containers used for handling chemicals are in good condition with no flaws. • Storage of only volumes required for immediate use. Bulk storage is limited to specifically designed buildings. • Utilisation of University Chemical store for handling of large quantities of chemicals and chemical disposal. • Following correct disposal procedures (refer EMS Manual).

4.2 Emergency Procedure

Don't Panic! Keep calm in all situations.

In every situation

Contact Security

53333

and follow their instructions

Table 2 Emergency Procedures

Hazard	What to do	Contact	Number
Fire	• Contact security. • Alert people in the area/building/down wind, as appropriate • If safe to do so, use preventative measures (eg fire extinguishers to contain fire); • Obey all directions from security or emergency services in relation to the emergency (either over phone or on site).	Security	336 **53333**
Explosion	• Contact security - do not use a mobile phone • Alert all people in surrounding area • Alert relevant school or centre • Contain and control any spills, fires, etc with preventative measures if safe to do so. • Obey all directions from security or emergency services in relation to the emergency (either over phone or on site).	Security	336 **53333**
Spill	• Contact security - do not use a mobile phone; • Alert people in surrounding area/buildings/downwind from the affected area; • If safe to do so, contain the spill if possible. • Obey all directions from security or emergency services in relation to the emergency (either over phone or on site).	Security	336 **53333**

4.3 Contingency Plan

A general contingency plan has been developed to deal with the environmental aspects of spills, fires and explosions. These procedures are included in Property and Facilities Security Section's workbook.

4.4 Disaster Management Plan

The Disaster Management Plan has been set up as a response to potential accidents and emergency situations. The plan includes response procedures, emergency preparedness, communication lines and overall management procedures in respect to potential occurrences. A copy of the Disaster Management Plan is available on the Handbook of University Policy and Procedures (HUPP) web site under policy 7.60.1.

5. Responsibilities

Table 3 outlines the responsibilities of individuals across the University.

Table 3. Responsibilities

Responsibility	Action	Contact
Users and Employees	• To ensure that all work is carried out in a way as to minimise the probability of a disaster occurring. • Ensure all likely safety equipment is on hand or nearby when undertaking any activities that may present a risk. • Be aware of the location and operation of all containment and control equipment.	N/A
Heads of Schools, Centres and Executive Officers	• To ensure the safety of all staff who work within the school or centre; • Provide adequate training on environmental management and emergency preparedness. • Ensure there are designated fire/emergency wardens within the school or centre/building who are aware of the emergency contacts to security; • To be aware of all the potential risks of work within the school or centre may have on the environment and address these.	Consult internal phone directory as appropriate.
Security	• Provide technological support and equipment to minimise risk, and to contain and control any hazard. • Provide support for any event which has the potential to cause an environmental disaster.	51234 or email: security@pf.uq.edu.au
Sustainability Office	• Provide technical support for emergency situations. • Provide environmental management training to University staff	51587
Occupational Health and Safety Unit	• Provide technical support for emergency situations	52365

6. Contacts

Table 4. Contacts

Subject	Contact	Number
Fire Safety Issues	Senior Fire Safety Officer Property and Facilities Division	69723
Environmental Contingency Issues	Manager Sustainability Property and Facilities Division	51587
Operation Coordination	Manager Asset Services Property and Facilities Division	52233
Hazards, Risks and Emergency Issues Risk Management Advisory Committee	Associate Director Occupational Health and Safety Unit	52563
Emergency	Security Shift Supervisor Property and Facilities Division	53333

7. Definitions

7.1 Hazard

A hazard can be defined as being "a situation in which there is potential for human injury, damage to property, damage to the environment or ecosystem, or some combination of these".

7.2 Risk

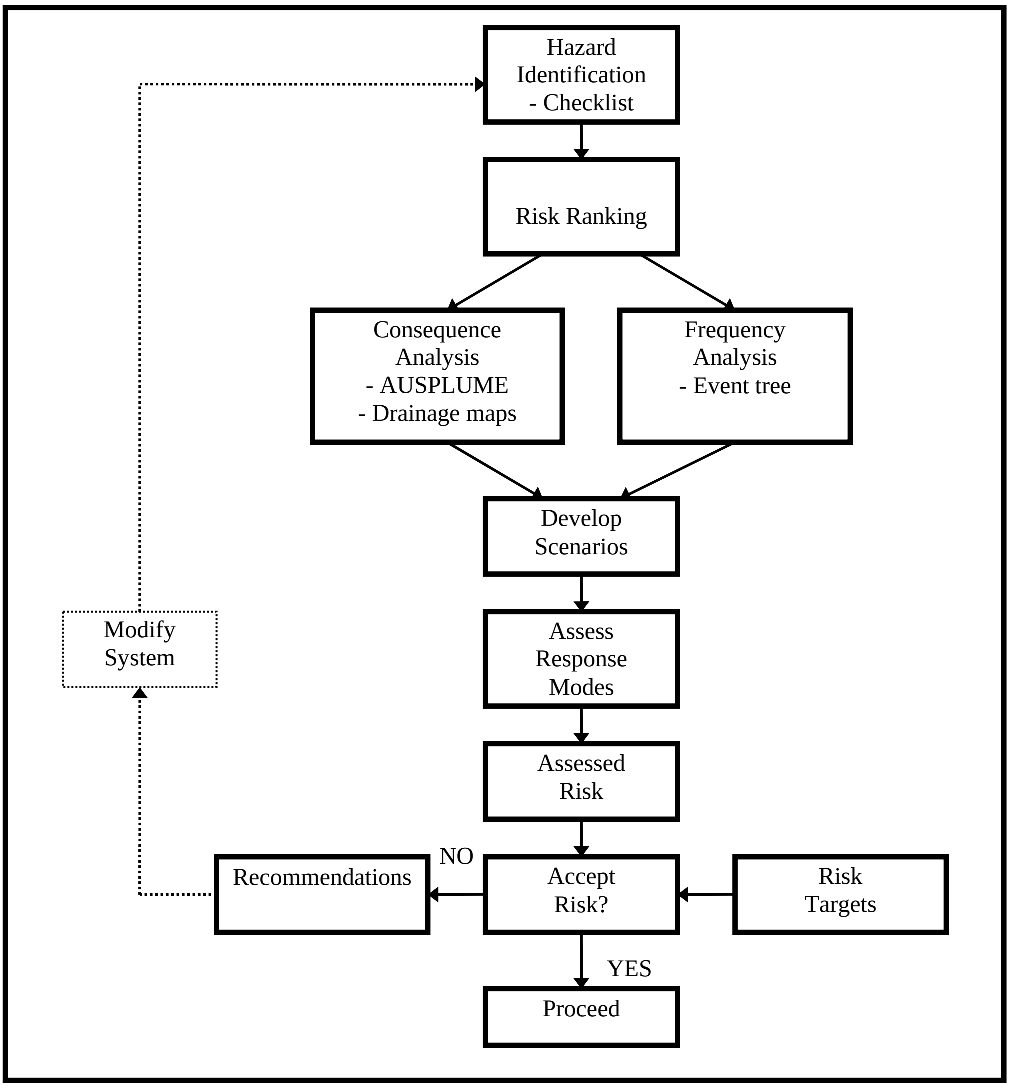
Risk is "the probability of a specified undesired event (ie a hazard), occurring within a specified period of time". Risk is expressed as a fractional probability per time period (eg 0.4/year).

SCHEDULE 1

METHODOLOGY FOR RISK ASSESSMENT

Quantified Risk Assessment (QRA) is the methodology used by The University of Queensland. QRA is one of many processes that can be used when developing risk management strategies for potentially hazardous facilities. Figure 1.0 outlines the QRA methodology.

Figure 1.0 - QRA methodology.



The basic elements of quantified risk assessment consists of the following eight steps:

- Identify potential hazards for the facility;
- Identify the specific potentially hazardous scenarios (dependant on the type of facility);
- For each scenario assess the likely severity of effects using appropriate models. The severity looks at the effects on people, property and the environment;
- For each scenario identify the likelihood (frequency) of the event and probabilities of different outcomes;
- Combine the consequences and the frequency to determine the risk for each scenario;
- Sum all the calculated risks to determine the total risk;
- Compare the assessed risk levels with established risk acceptance criteria; and
- Make recommendations for reduction, control and management.

SCHEDULE 2

HAZARD IDENTIFICATION

Hazard identification involves the systematic identification of hazardous events that could cause impacts outside the boundaries of The University of Queensland campuses. These might affect people, the environment, property or surrounding land use.

Chemical storage has been identified as the major activity which may give rise to environmental impacts. The potential hazardous events identified are:
- Spills;
- Fires;
- Exploding drums; and
- Flooding.

8. Spills

Spills could occur spontaneously due to badly corroded containers, or by accident during handling and or transport. The maximum allowable container size in any UQ chemical store is 200 L, therefore the size of any release could range from a few grams to the contents of a 200 L drum. Consequences of spills, depend on activity, quantity, location, barriers to propagation, clean-up action and whether ignition could occur.

A large spill could occur from leakage in underground fuel tanks. Undetectable small daily fuel losses may accumulate during a long period causing soil contamination and infiltrating ground water flows.

9. Fires

A fire could be initiated in the following ways:

- Static electricity discharge during decanting of flammable liquids;
- Sparks from electrical items such as lighters, power points and office equipment;
- Friction sparks (eg. during maintenance);
- Ignition of flammable vapour from uncapped containers or from spills;
- Human error; and
- Vandalism.

The heat radiated from major fires could cause property damage, injury, fatalities and could propagate to damage neighbouring buildings.

If a fire occurs where toxic substances are stored, the smoke may present a health and environmental hazard to anyone exposed. The following situations are generally the most hazardous in terms of fume production:

- slow burning, low intensity fires;
- partial combustion through lack of oxygen;
- stable or inverted weather conditions; and
- the fire is partially extinguished.

Firewater runoff has the potential for widespread contamination of the environment if not properly managed.

10. Exploding Drums

In the event of a fire, exploding 200 L metal drums could cause serious damage. When a drum is exposed to flames, its internal temperature and pressure rise until the drum ruptures. A fireball is produced as part of the liquid flashes off.

There are two possible consequences to consider:

- The radiated heat effects of the fireball; and
- The effects of the drum becoming a projectile.

Fireballs could result in significant damage and harm but this is considered to be relatively localised and therefore this is considered a safety issue.

In cases where the drum becomes a projectile, neighbouring properties could be affected and hence it is also an environmental problem.

11. Flooding

Due to the siting of The University of Queensland St Lucia campus next to the Brisbane river, certain chemical stores may be flooded. Partial inundation may result in release of packaging (glass or plastic containers) containing contaminants into the environment. If the store is open and fully submerged, then the containers are likely to float away with their contents.

12. Identification of Risk Areas

Accidents resulting in environmental impacts are mainly concentrated in chemical storage and petrol station areas. A register of risk areas is held by the Manager Sustainability, Property and Facilities Division.

SCHEDULE 3

RISK RANKING

13. RISK RANKING CRITERIA

Risk ranking incorporates the concept of qualitative risk assessment. It involves the development of criteria in which risks are given a rank from 1 (least hazardous) to 10 (most hazardous). Qualitative risk assessment is based on opinion and experience, therefore the assessment is subjective.

Some criteria are more significant than others in terms of analysing the risk. Therefore the criteria themselves are “weighted” - 1 for least hazardous, 4 for most hazardous. A summary of the risk ranking criteria is shown in Table 4.1.

Table #4.1 - Criteria used in risk ranking

Description	Weight	Scenario	Rank
FIRE PROTECTION SYSTEMS • Alarms • Suppression systems (CO_2) • Fire Hoses • Ignition Prevention • Fire extinguishers	4	Complete protection No protection	1 10
ENVIRONMENTAL PROTECTION • Bunding • Smoke control • Absorbents • Run off	4	High protection Low protection	1 10
FREQUENCY OF USE The risk is proportional to the frequency at which the store is used. In general, the more users there are, the lower the standard of training and the greater the likelihood of accidents.	3	Low Medium High	1 5 10
GENERAL HOUSE KEEPING The risk posed by a store can be greatly reduced through good organisation and management. This criteria takes into account tidiness, corrosion of containers, use of a database tracking system etc.	3	Good Fair Poor	1 5 10

Description	Weight	Scenario	Rank
<u>BUILDING CONSTRUCTION</u> • Construction materials (fire resistance); • Construction layout (holds, separate zones)	3	High standard Brick or cement, but no holds Timber plus no separation zones	1 5 10
<u>STORAGE VOLUME</u> The hazard is considered to be proportional to the quantity of chemicals stored.	2	<2000 L 2000 - 4000 L > 4000 L	1 5 10
<u>EMERGENCY ACCESS</u> This takes into account the speed at which the emergency response vehicles can get to the site. Ease of attacking the fire is also considered.	2	Easy Medium Difficult	1 5 10
<u>SENSITIVITY</u> This is a broad criteria which attempts to quantify the sensitivity of the surrounding environment.	1	Isolated Residential	1 10

14. <u>Risk Ranking Calculation</u>

Schedule # 3 shows the areas on campus that may give rise to environmental risks. Each area is graded according to the criteria set out on table one above. An overall score is obtained using the following equation:

RISK RANKING = Σ (Risk Criteria x Weight)

Schedule # 3 shows the areas on the St Lucia campus that may give rise to environmental risks. These are:

A. Riverside Store
B. Chemical Store
C Chemical Engineering
D. Molecular Biosciences

Table #4.2 - Risk Ranking

CRITERIA	A	B	C	D
fire protection systems	20	4	12	8
environmental protection	20	12	12	16
frequency of use	15	9	15	3
house keeping	15	3	9	3
building construction	3	3	3	3
storage volume	10	20	2	2
emergency access	2	2	20	2
sensitivity	1	5	5	5
RISK RANKING	**86**	**58**	**78**	**42**

15. RISK RANKING ACCEPTABILITY

Risk ranking may lead to biasing of criteria. Hence, coupled with the subjectiveness of assessment, there is a possibility of incorrectly weighting criteria. All of the risk areas are well within the same risk margin (ie risk ranking from 78 to 86).

SCHEDULE 4

FREQUENCY ANALYSIS

This schedule presents a frequency analysis tailored for **worst case scenarios**. The strategy is to ensure that the worst case scenarios are around or below the incidence levels for Australia.

16. Fire Initiation Frequencies

Six fire incidents were reported to have occurred at The University of Queensland between 1991 and 1996. No one was injured during these incidents but emergency personnel were called in. Assuming that a fire is just as likely to occur in any building on campus, the frequency of fires incidents can be calculated as follows:

$$F = N / (B * Y)$$

Where
F = Frequency
N = Number of fires (6)
B= Number of buildings (100)
Y = Years (5)

Therefore the likelihood of a fire occurring in any building at The University of Queensland's St Lucia campus is 0.012 chances per annum. This fire initiation frequency is in good agreement with the values quoted for warehouse fires in Australia as follows:

- Insurance Council of Australia 0.0083 pa
- Victorian Fire 0.011 pa

17. WORST CASE SCENARIO

The worst case scenario is built around fire events which may lead to emission of toxic gases.

18. Fire Event Tree Construction

Using a fire initiation frequency of 0.012 chances pa, it is then possible to develop event trees to assess the possible outcomes of different fire scenarios. The probability and consequences of the different outcomes will be dependent on several important "events" which may take place during course of the fire. These are explained below.

18.1 Extinguished Immediately

A fire may not be extinguished immediately for a number of reasons, for instance:

- if the fire occurs at night or when no one is in attendance;
- if the operator arrives at the fire too late and the fire is already out of control;
- if extinguishers are ineffective or unavailable.

Most fires would be brought under control at the incipient stage such that the frequency of major fires would be less than the fire initiation frequency of major fires, by about one order of magnitude.

18.2 Suppression System

The suppression system (if available) may not work due to the following reasons:

- mechanical failure; and
- store is well ventilated and the fire re-ignites after initial suffocation.

Generic failure rate of automatic valves on demand ranges from 0.37 to 0.001 pa.

18.3 Major Fires

Major fires may cause high level of emissions which may contain toxic substances. One major fire out of six occurred between 1991 and 1996. So the relative frequency for major fire is 0.167 (ie 1/6).

18.4 Wind Direction

A frequency breakdown of wind conditions at Brisbane City was obtained from the Bureau of Meteorology. From this file it was possible to obtain the frequency at which the wind will blow in the direction of the closest residents within 500 m.

18.5 Stability Class

Stability Class G is considered to give rise to the most dangerous situation. The frequency of occurrence of this stability class was obtained from the Brisbane Airport Meteorological file.

18.6 Evacuation Failure

A failure rate of 50 people not evacuated in a 1000 is estimated. This failure rate is very high and is very conservative. People who failed to evacuated, may be exposed to toxic fumes.

19. FIRE EVENT TREE ANALYSIS RESULT

Event tree analysis was performed for fires occurring in all chemical stores. Figure 4.0 shows the event tree generated for the South Precinct Store. The tree shows that the nearest residents will be exposed to toxic plumes at a worst case scenario at a frequency of 1.4×10^{-6} chances per annum.

Figure #4.0 - Fire event tree analysis.

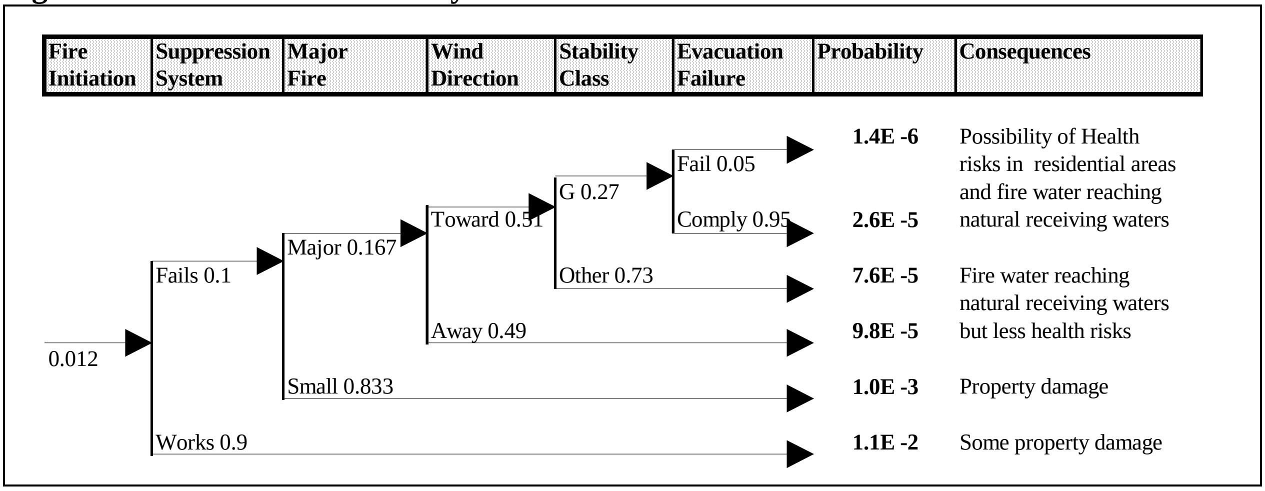


Table 4.0 summarises the worst case scenarios for each chemical store. For each store, failure probabilities have been listed and multiplied to obtain the worst case fire frequencies. The store were then ranked in order of decreasing frequency. Stores that were not equipped with a suppression system (ie. probability that suppression system fails = 1) displayed the highest frequencies.

20. RISK ACCEPTANCE CRITERIA

The New South Wales Department of Planning (NSWDOP) has adopted an individual fatality risk level of fifty in a million per annum (50E-6) for industrial sites, whilst residential sites are one in a million (1E-6).

The University of Queensland is neither an industrial site nor a residential area. However, the worst case scenario (Table 5.0) will be between and or below the recommended individual fatality risk levels. It must be borne in mind that some conservative figures have been used for the event tree analysis and some results could be lower by an order of magnitude.

Therefore, the results obtained in this schedule suggests that the environmental risks posed by fume exposure are within acceptable levels.

Table 5.0 - Worst case event tree branches for all chemical stores

Store	Initiating Freq (pa)	Suppression System	Major Fires	Wind Direction	Stability Class	Evacuation failure	Frequency (pa)
Riverside	0.012	1	0.167	0.41	0.27	0.05	1.1 E -5
Chem Eng	0.012	1	0.167	0.64	0.27	0.05	1.4 E -5
Microbiology	0.012	0.01	0.167	0.64	0.27	0.05	1.7 E -7
Chemical Store	0.012	0.01	0.167	0.57	0.27	0.05	1.5 E-7