

# Fire Brigade Intervention Model (FBIM) – Dangerous Goods Sites and Major Hazard Facilities

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## 1. PURPOSE

The purpose of this guideline is to provide advice in regard to the use of the Fire Brigade Intervention Model (FBIM) at dangerous goods (DG) sites and major hazard facilities (MHF). This guideline should be used in conjunction with FBIM Manual V2.2, as it is intended to highlight issues that are specific to DG sites and MHFs that are currently not comprehensively incorporated in the model.

## 2. SCOPE

In 1996, a performance based building code was introduced in Australia. To ensure that the fire brigades' functional role was maintained in the building code, a method of quantifying fire brigade roles was required. In response to this issue, the Australasian Fire and Emergency Services Authorities Council (AFAC) formed a **Performance Based Fire Engineering Committee**. This committee developed a model that determines the time taken by a fire brigade to undertake its activities at a fire scene.

There has also been a shift away from a prescriptive based approach with the introduction of a performance based design regime in the Dangerous Goods (Storage and Handling) Regulations 2000 and The Occupational Health and Safety Regulations 2007. As part of these regulations, there are a number of industry requirements relevant to emergency planning, which may require industry to estimate a fire brigade intervention time. This may be required during the development of emergency plans or as part of a demonstration of fire protection system adequacy.

### 2.1 SCOPE LIMITATION

It is not intended that FBIM, in its current state, be used to determine the time to control and extinguish a selected fire scenario. An FBIM for MHFs or DG sites should be used to calculate the time for the fire brigade to set up prior to initiating the actual fire attack. The FBIM result can then be used to validate industry assumptions.

As previously discussed, the intention of FBIM use was for application within the Building Code environment, with specific application for buildings. Consequently, the wide variety of dangerous goods related emergency/incidents that can potentially occur at MHFs and DG sites cannot be fully addressed using the model.

### 3. DEFINITIONS AND ISSUES

#### 3.1 WHAT IS FBIM

FBIM is an event-based methodology that quantifies fire brigade activities employed during a fire from time of notification through to commence extinguishment. It has primarily been developed for use in the engineering design in a performance based regulatory environment so that the functional role of a fire brigade can be effectively incorporated into the building design process. It establishes a structured framework necessary to both determine and measure fire brigade activities on a time line basis.

#### 3.2 HOW CAN FBIM BE USED AT MHF AND DG SITES?

In general terms, FBIM is designed to determine the time taken by a fire brigade to undertake its activities at a fire scene *involving a building fire*. However, in recognizing the potential application of FBIM at MHF or DG sites, a number of issues specific to emergency scenarios that may result at these sites have been compiled.

The Dangerous Goods department has reviewed the content and scope of each chart contained in FBIM. The review was completed to:

- determine the intention of the chart
- determine the general relevance of the Chart to MHF and DG sites fire and emergency scenarios
- identify those issues specific to MHF and DG sites fire and emergency scenarios that were appropriately addressed in the current FBIM
- identify those issues specific to MHF and DG sites fire and emergency scenarios that were not appropriately addressed in the current FBIM
- determine how such issues could be incorporated within the current format of FBIM through the development of a guideline.

It was important to recognise that the development of FBIM in its current state was based on extensive investigation and collation of relevant data. Information required to provide conclusive information and guidance of FBIM application at MHF and DG sites may not be available. This is an important limitation and has been used to ultimately determine whether each chart can be successfully applied.

### 4. RECOMMENDATIONS

The review comments for each chart are detailed below. These comments should be used in conjunction with FBIM when completing an FBIM for a MHF or a DG site.

#### 4.1 CHART 1: TIME TAKEN FOR INITIAL BRIGADE NOTIFICATION

- Selection of a fire or emergency scenario should be based on information contained in a site's emergency plans.
- Some MHF and DG sites emergency plans may indicate that site personnel are expected to undertake specific activities as part of their emergency response procedures, prior to notification of the fire brigade. This issue will be particularly important if brigade notification is reliant on manual activation. Through the review of emergency plans, an indication of 'time to fire brigade notification' should be discussed based on the timeline development of an emergency scenario. It may be valuable for industry to construct a timeline to identify the critical events that may contribute to the development of the scenario and to estimate the corresponding time for brigade notification.

- The Dangerous Goods department should ensure through the review of the emergency plans that the actions detailed in the site emergency response procedures are to be performed in a suitable order.
- The mechanisms incorporated in the calculation of intervention time associated with detection and alarm, either manual or automatic, must reflect the site specific infrastructure available at the MHF or DG site being analysed, this could include emergency shutdown systems or process control systems.

#### **4.2 CHART 2: TIME TAKEN TO DISPATCH RESOURCES**

- All decision boxes are relevant. The time allowances for these activities may have been incorporated in the Chart 1 calculations. Therefore it may be unnecessary to complete and include the time allowances outlined in this chart.

#### **4.3 CHART 3: TIME TAKEN FOR FIREFIGHTERS TO RESPOND TO DISPATCH CALL**

- All decision boxes are relevant.
- The calculations performed as part of this chart should be performed for scenarios where the fire fighters are/are not in the station.

#### **4.4 CHART 4: TIME TAKEN TO REACH FIRE SCENE**

- All decision boxes are relevant.
- In the context of dangerous goods incidents, “kerb side” is referred to the entry point to the site or where emergency information is located.
- Decision Box 2: to ensure that a conservative approach is used the time taken to reach the fire scene should be determined using both the percentile response statistics and the alternative calculation methods, and the greater time estimate should be used.
- Emergency Services Telecommunications Authority (ESTA) should be contacted to determine the assignment rule(s) (number/type of appliances to respond) for the relevant site (as per the example supplied with the FBIM).
- The calculations should be performed for cases where the emergency route is, and is not, defined.

#### **4.5 CHART 5: TIME TAKEN FOR INITIAL DETERMINATION OF FIRE LOCATION**

- Box 3 should allow time to access the site’s manifest (Emergency Information Book) and consult if present with an on-site staff member for specialist advice. The means for information transfer at an MHF or DG site will be critical in determining fire brigade response actions and time allowances.
- Due to the complexity and diversity of hazards found at MHF and DG sites, the availability or omission of the following emergency response provisions may delay or increase fire brigade response time. Issues which require specific consideration include:
  - provision of an Emergency Information Book
  - delegation of a representative to meet and brief the fire brigade on their arrival

- provision of specialist resources to offer technical information and facilitate emergency risk assessment, e.g. atmospheric monitoring.

Time taken to access the above information should be calculated at triple that indicated in Table L. “Building Floor Area” can also be substituted for total site area.

- In some instances the issues involved in the time taken for initial determination of the fire or emergency location may be more complex for MHF or DG sites than building sites. Specific design considerations include:
  - size and layout of the site. Any obstructions which may hinder fire brigade actions at the site (i.e. overhead piping, truck or tanker parking areas)
  - location of emergency scenario relevant to the position of roadways and access points surrounding the site.

When completing an FBIM, consideration should be given to the above issues. In addition the location of the emergency scenario should be selected to be the most remote point (or the most difficult location to access) on the site where an incident could be reasonably expected to occur. The scenario selected should be selected from those included in the site emergency plans.

- Decision Box 5: consideration should be given to whether the site is in operation 7 days a week, 24 hours a day. The nature of the occupancy (i.e. a security guard as opposed to a shift team) at various times should be understood. To ensure a conservative approach, the minimum number of personnel present at the site should be used when performing the FBIM.

#### **4.6 CHART 6: TIME TAKEN TO DON SAFETY EQUIPMENT AND GATHER NECESSARY TOOLS**

- All decision boxes are relevant.

#### **4.7 CHART 7: TIME TAKEN TO ASSESS FIRE**

- This chart specifically deals with the assessment of a building fire. However, the range of fire scenarios and emergency scenarios that can occur at MHFs or DG sites is not limited to building fires. Consequently this chart should be carefully applied.
- Decision Box 2: as discussed previously, the types of incidents that can occur may not always be immediately visible. If there is the potential for an incident of this type to occur at the site then the FBIM should consider this scenario in the model development.
- Decision Box 3: the emergency scenario may not involve a building fire. In this instance, the answer to Decision Box 3 should be ‘No’. This will allow progression to Decision Box 4. The remainder of the decision boxes can be applied to MHF and DG site emergency scenarios.

#### **4.8 CHART 8: TIME TAKEN TO TRAVEL TO SET-UP AREA**

- Decision Box 4: the nature of MHF and DG sites and/or the chemicals included may restrict fire brigade access. When determining the location and time taken to travel to the set-up area consideration should be given to:
  - the location of the fire or emergency scenario relative to internal and external roadways and control points

- the type of incident. For example, if the incident is a tank top fire and the bund arrangement does not allow for a clear and direct fire fighting attack, then the time taken to travel to set-up area and then set-up may be extended
- the weather conditions. In particular, the impact of wind speed and direction upon incidents involving toxic and explosive/flammable vapours
- the design of roadways to allow fire brigade appliance travel
- the provision of hard standing
- the provision necessary firefighting equipment and firefighting medium at the set-up area.

#### **4.9 CHART 9: TIME TAKEN FOR FIREFIGHTER TRAVEL**

- All decision boxes are relevant.

#### **4.10 CHART 10: TIME TAKEN TO SET UP WATER FOR INITIAL FIREFIGHTER PROTECTION**

- In general, this chart can be used for MHF or DG site application
- There is no allowance for any additional time taken when the firefighting attack involves firefighting medium other than water. For example, for a flammable liquid fire, the required firefighting medium would be foam. Sites may provide hydrants or monitors with equipment to allow the introduction of foam into the system. However, additional time requirements may exist due to the need to set up such a system, and this time delay may be in excess of the time required to set up a water-based firefighting attack. Consideration should be given to the:
  - location of the firefighting medium (i.e. on-site or mutual aid) and time to retrieve the medium
  - activities required by the fire brigade to interface with the facility fire protection equipment (i.e. access to and use of inductors, manual opening or closing of valves etc.).
- It is important to recognise that the search and rescue activities included in Chart 12 are based upon the building environment, however, the philosophy of ensuring a safe environment for fire fighters to undertake search and rescue remains. Consideration must be given to the availability of the necessary resources to perform search and rescue in parallel with other intervention activities.

#### **4.11 CHART 11: TIME TAKEN TO SET UP WATER SUPPLY REQUIREMENTS**

- Comments made as part of Chart 10 review also apply to Chart 11.
- Decision Box 14: at some sites, a mutual aid agreement may be in place to assist with the availability of additional resources. This information should be evident from the site emergency plans or pre-incident plans.

#### **4.12 CHART 12: TIME TAKEN FOR SEARCH AND RESCUE**

- It is important to recognise that the search and rescue activities described in Chart 12 are based upon the built environment. However, the philosophy of ensuring a safe environment for fire fighters to undertake search and rescue remains regardless of the enclosure/area concerned. Many MHF and DG sites may comprise of unique and extensive outdoor plant, process equipment and pipework.

- Consideration must be given to the availability of the necessary resources (e.g. fully encapsulated gas suits etc.) to perform search and rescue in parallel with other intervention activities.
- At Decision Box 4, when the answer is “Yes”, the flow chart should feed into the top of Decision Box 2. The question posed in Decision Box 2 is crucial to firefighter safety and must not be bypassed.

#### 4.13 CHARTS 13-16

- The activities described in Charts 13-16 can be applied to an MHF or DG site, however, as with Chart 12, the time taken to ensure safety of firefighters is crucial and must be considered. Due to the environment that firefighters will be working in, additional personal protective equipment (PPE) may be required such as fully encapsulated gas suits, splash suits, etc., plus the time taken to set up decontamination procedures.

### 5. DOCUMENTATION

When conducting FBIM verification for a MHF or DG site, the relevant dangerous goods personnel should document all charts used, and all decisions made with justification. A team approach should be utilised when performing the FBIM, including participation from Fire Officers and technical department personnel. Documentation should include appropriate records to demonstrate that the calculated intervention time has been determined for the final design.

In instances where the FBIM calculated by the Dangerous Goods department conflicts with the time allowed for Fire Brigade Intervention by industry, the team should ensure that a detailed explanation of the FBIM calculations is compiled. This information can be used to explain and justify the FBIM results to industry.

Where industry elects to conduct an FBIM for a MHF or DG site, all decisions (with justification), should be documented and included as part of the FBIM. Industry should consult with the fire brigade to ensure that the FBIM is being used correctly and within its performance scope.

### 6. CONCLUSION

FBIM may be applied to satisfy the objectives and performance requirements of the BCA and the AFAC model may be utilised. Further assistance and advice can be obtained from the FRV Fire Safety Technical Department.

Where FRV are requested to conduct an FBIM on behalf of a third party, an FRV Fire Protection Report application form should be forwarded to the FRV Fire Safety Technical Department as part of the submission.

### 7. REFERENCES

The Fire Brigade Intervention Model, Version 2.2, October 2004

FRV Fire Safety Guideline *GL-17 – Fire Brigade Intervention Model (FBIM) – General Provisions*

*Performance Based Designs Fire Brigade Requirements* – FRV (previously MFESB) Community Safety/Fire Safety Policy Group, Policy No. B 6000/14, 5 January 2004

**Note:** *this is a controlled document and may only be modified by authorised personnel after review by FRV Fire Safety Advisory Group.*