APPENDIX A
(CFO/69/06

Report on Phase 3 of a Value for Money Simulation of a Balanced Strategy for Emergency Response Services for Merseyside Fire and Rescue Service

Peter Loader
Director
Process Evolution Limited

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Tel: 07782 170337 **Fax:** 08701 709887 **E-mail:** info@processevolution.co.uk **Web:** www.processevolution.co.uk
Process Evolution Limited, 6 Fordbank Court, 218 Henwick Road, Worcester. WR2 5PF
Registered in England No. 4983030, VAT 823-9689-84

Executive Summary

Merseyside Fire and Rescue Service (MFRS) commissioned Process Evolution to assess the impact of proposed changes to its staffing strategy and assess what if any impact this may have on emergency response. In the first two phases of the work, we focussed on identifying a range of potential means to increase efficiency through:

- Matching resource availability more closely to demand
- Meeting the performance challenges posed by the move to more demanding response standards.

This document reports on phase 3 of the project, which focussed on developing specific solutions within the framework established in phase 2. Phase 1 of the work created a predictive computer model that gave a very high degree of accuracy when tested against 5 years of data, and was the tool used to assess the ability of MFRS to meet higher and improved response standards. Phase 2 optimised the availability and location of appliances to directly meet risk levels at different times of day. The phase 3 solutions have been developed using the most recent data parameters, and using the nationally recognised FSEC incident coding system.

Extensive analysis of this more recent data that we have carried out, in conjunction with the use of advanced predictive technology has reaffirmed the conclusions drawn in phase 2, i.e. that it is possible to deliver an overall quicker response by using appliances differently in parallel with realising efficiency gains.

The specific solution recommended in this report is to:

- Use four pumps from two-pump stations as a Resilence Reserve between the hours of 2200-1000. The stations should be City Centre, Bootle / Netherton, St. Helens and Birkenhead.
- Up to four SFUs should be deployed between the hours of 1700-2300. A suggested grouping of station grounds is (with the SFU base in bold): (**Croxteth,** Kirkby, Old Swan, Huyton); (**Low Hill**,Toxteth,Speke); (**St. Helens,** Newton-Le-Willows, Whiston, Eccleston); (**Wallasey,** Birkenhead, Kirkdale).
- MFRS should crew the SFUs through overtime and the day crewed pumps through a separate pool of fire fighters whose core working pattern comprises day shifts only with retained fire fighters covering the night period.

By implementing the above recommendations, performance rises from 79.2% to 79.4%, a gain of 0.2%.

Under our proposed mobilising rules, we would expect a call out of an individual resilience reserve pump once every thirty days on average (once every 100 days for each individual pump); on over half of these occasions, the pumps would not actually attend an incident but would just be placed on standby at a station.

The proposed approach to crewing the SFUs and day pumps provides opportunities for those fire fighters who may wish to work overtime, and to those fire fighters who may find a days only working pattern more attractive. It also provides further opportunity for retained working by existing fire fighters and new employees from the community. Under this method, those fire fighters who prefer to work the existing shift patterns would be able to do so.

The main findings and conclusions upon which these recommendations are based are summarised in section 5 of this report.

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1. Introduction.

The National Framework Strategy that details Government strategy challenges fire services to review the deployment of their resources in order to provide targeted response in a more cost effective manner. Previous incident response standards and corresponding deployment strategies are based on historical guidelines and risks.

As part of its response to these challenges, Merseyside Fire and Rescue has commissioned Process Evolution to assess the impact of a number of proposed changes to its deployment strategy for emergency response, and help develop a balanced strategy for response.

During a successful pilot, we developed a simulation model which is proven to very accurately mimic MFRS's response to incidents. The model has been rigorously tested with data comprising real life incidents that have occurred in Merseyside since April 2000. Results have proved to be over 99% accurate, and the model has successfully predicted the outcome of changes that have occurred in this period, including the move to higher response standards, the introduction of AVLS (Automatic Vehicle Location System) and a reduced level of emergency calls.

In the second phase of work, we examined literally hundreds of options to increase value for money by:

- Matching resource availability more closely to demand.
- Meeting the performance challenges posed by the move to more demanding response standards.
- Deploying the appropriate level of response depending on risk.

At the conclusion of this work, a workshop was held with senior officers from MFRS in which alternative deployment options were discussed. **Through this workshop and a subsequent meeting with the Chief Fire Officer, it was agreed that only solutions that will deliver an improved quality of service to Merseyside should be considered.**

The workshop also concluded that the project should move into an implementation planning phase which would involve two main tasks:

- Updating the model to include the latest incident data, ensuring that decisions are based upon the most up to date and robust period of incident data.
- Detailed evaluation of scenarios around the preferred option; i.e. selecting which stations at precisely which times of day will have changed levels of cover.

This report contains the findings from this third phase of work. The report is structured as follows:

- Section 2 outlines our approach to the work.
- Section 3 contains analysis from the latest incident data, including the baseline results from the updated simulation model.
- Section 4 contains the findings from the simulation work.
- Section 5 contains the overall conclusions and recommendations from the work.

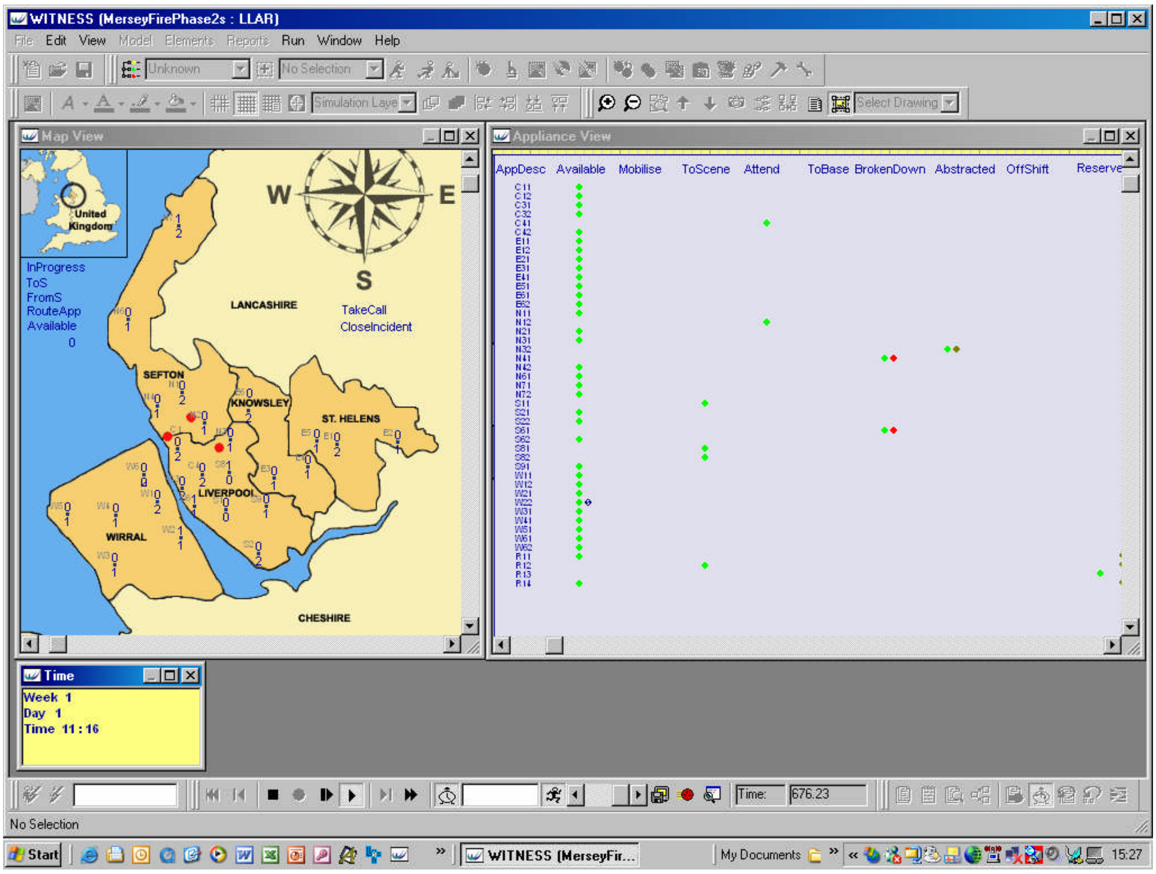
2. Approach Taken.

2.1 Background to Process Evolution.

Process Evolution specialises in the design, analysis and continuous improvement of business processes. A key feature of our work is our use of quantitative techniques. We combine our expertise in these areas with our clients' own business and professional knowledge to enable their management to implement change with confidence in the outcome, and at reduced risk. Techniques employed in this project include data mining / knowledge discovery, which can be used to transform operational data into meaningful management information, and process simulation. Simulation involves developing a computer model that can be used to enable management decisions to be tested prior to implementation and the effect on key performance measures quantified. These techniques are widely used across industry, commerce and the service sector, including within the emergency services sector.

2.2 The Merseyside Fire and Rescue Service Incident Response Model.

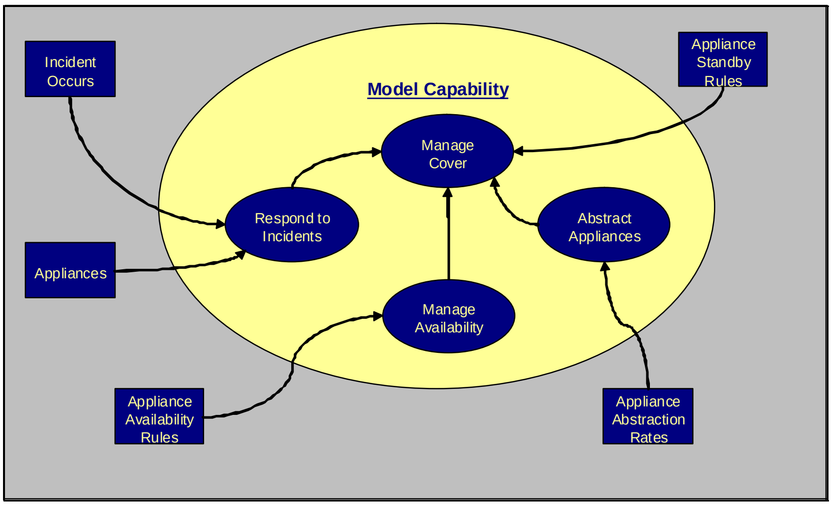
The diagram below is a screen capture from the incident response simulator which has been developed in internationally recognised simulation software.



This section details the process maps developed that form the basis of the logic included in the simulation model. Key assumptions built into the model are also listed.

2.2.1 Process Capability.

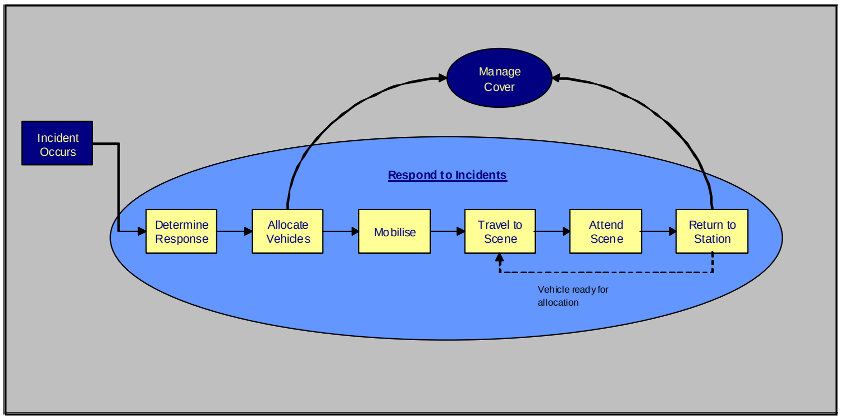
The diagram below shows the key capabilities that the model needs to have in order to mimic MFRS's response processes:



The boxes outside the main ellipse indicate some of the key data types that are required to drive the model. Note that by 'Manage Availability' we mean changing the level of cover provided at different times of the week in order to better meet demand. Abstractions cover any non-availability of appliances, such as for servicing of crew shortage. 'Manage Cover' means the use of standby moves in order to provide cover when appliances are at incidents.

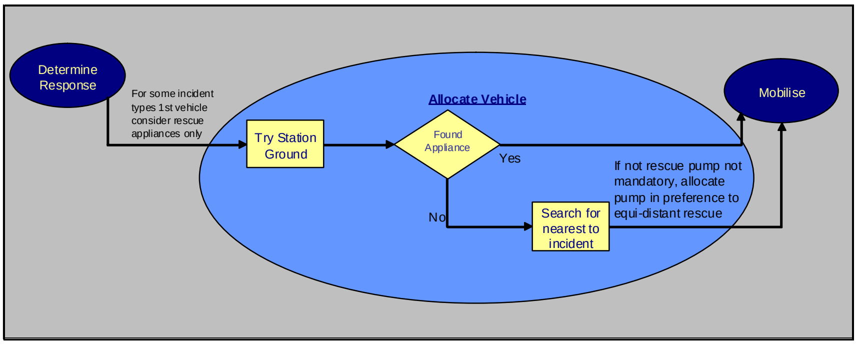
The diagrams below break this down into more detail for each of the high level model capabilities.

2.2.1.1 Respond to Incidents.



Note that appliances can become available to attend another incident once they have finished attending a scene. In the model, we have used the time at which they book available again from the historical incident data rather than allowing for the time to travel back to the station, as this accurately reflects mobilising practice.

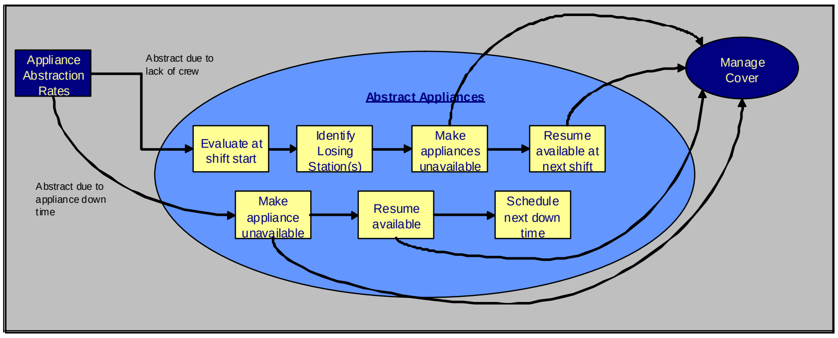
The next diagram shows the original allocation algorithm used by the model:



The model assumed initially that if an appliance was available within the station ground where the fire occurs, then this will be deployed as first choice. When AVLS (automatic vehicle location system) was deployed, this constraint was lifted and the nearest available and appropriate appliance is now deployed. The model was able to accurately quantify where and when this makes a difference, and to measure the benefit realised.

The model also reflects the fact that some incident types (*i.e.* primary fires) require attendance by the first appliance at a station (i.e. with officer of a certain rank / a rescue pump).

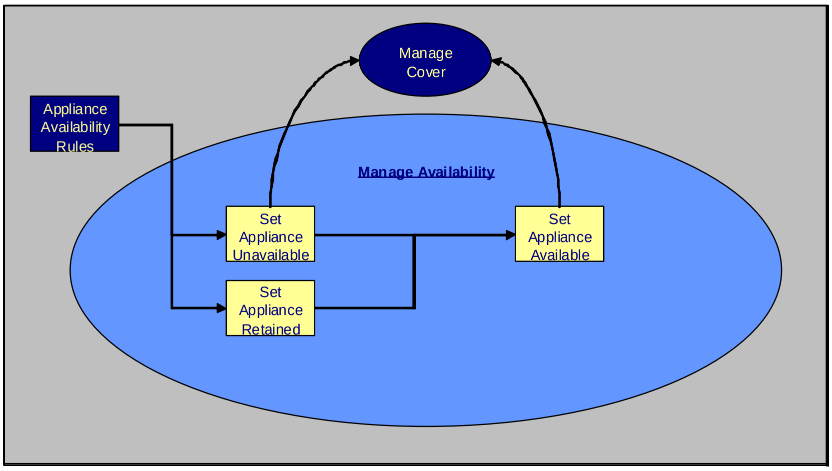
2.2.1.2 Abstract Appliances.



We have separated out abstraction into two types:

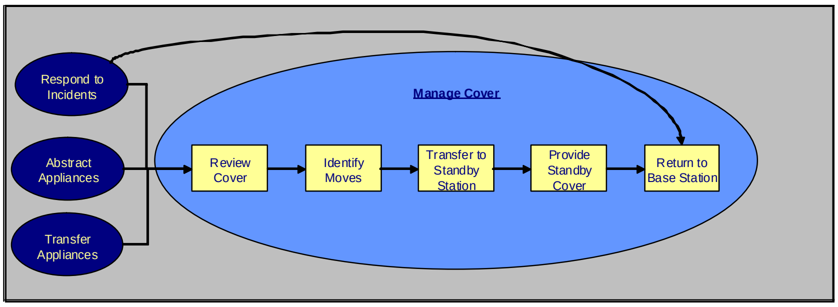
- Abstraction of an appliance where it is not available due to staff absence where the duration is for a whole shift.
- Any other abstraction, such as for changeover when an appliance is being serviced, or staff absence where the duration is less than a whole shift.

2.2.1.3 Manage Appliance Availability.



It is possible to specify that some appliances are only available to respond to incidents at certain times of the day, or to make pumps retained. For example, Small Fires Units (SFUs) can be made available at times of peak incidence of secondary fires.

2.2.1.4 Manage Cover.



Standby moves are triggered when the number of appliances available to attend incidents in a group of stations falls below a minimum level. The appliance providing the cover is selected in accordance with the Predetermined Attendance (PDA). The table below shows the standby groups, the station to which the appliance is moved and the list (in order of preference) from which stations are searched in order to find an available appliance:

Index	Description	Move To	Move From									
1	C3C4	C3	S6	C1	W1	N4	W6	S8	S1			
2	C1N4	C1	N1	N2	C3	N6	C4	N3	W6	S8	W1	
3	E1E2	E1	E5	E4	E3	E6						
4	E3N3	E3	E4	S9	E5	S8	N3	E6	N2	C4	E3	C1
5	E4S9	E4	E3	E5	E1	S8	S1	CO	S2	S6	C4	N3
6	E5E6	E5	E1	E4	E3	E2	N3	S9	S8			
7	N1N2	N1	N4	C1	N6	N3	E6					
8	N6N7	N6	LS	N1	N4	N2	E6					
9	S1S2	S1	S6	S8	S9	C4	C3	E3	E4	CO		
10	S6S8	S6	C3	C4	S1	C1	W1	N3	S9	E3		
11	W1W2	W1	W6	W4	C3	W3	W5					
12	W3W5	W3	W4	W2	W1	W6	C3	S6	C4			
13	W4W6	W4	W1	W5	W3	W2	C3	C1	S6	C4		
14	E2	E2	GM	E5	CO	E4	E3	E6				

The model takes into account that a standby move itself could trigger a further standby move.

2.3 A Phased Approach.

2.3.1 Phase 1 - Pilot.

This phase comprised developing the simulation model and populating it with historical incident data. The model was then tested and found to be over 99% accurate in replicating actual achieved performance against historical response standards.

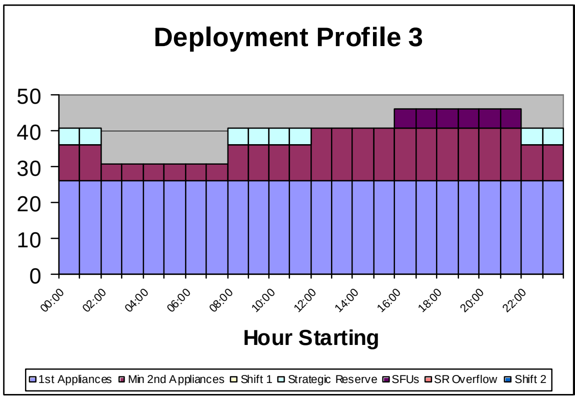
We then used the model to test some specific proposals relating to the cover provided at Low Level of Activity and Risk (LLAR) stations, and to quantify the extent of the challenge posed by the move to new higher response standards.

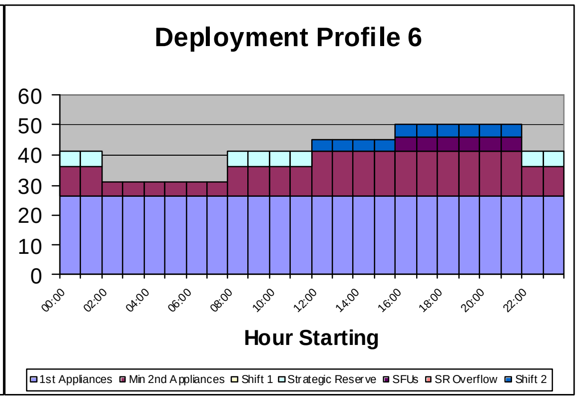
2.3.2 Phase 2 - Solutions Development.

Phase 2 of our work presented a set of options for delivering varying degrees of improved performance and efficiency that could be achieved by changing the level of cover provided at different times of day. These options contained features such as:

- Reducing cover at quieter times and increasing cover at busier times.
- Using Small Fires Units (SFUs) to deal with secondary and vehicle fires
- Placing appliances into a resilience reserve which could be called upon when required on a delayed response basis

The two graphs below provide examples of these solutions. These show varying levels of appliances at different times of the day.





Through the workshop at the conclusion of phase 2 and subsequent meeting with the Chief Fire Officer, it was agreed that only solutions that result in a better quality of service should be considered. These have been evaluated in phase 3 which is the subject of this report.

2.4 Phase 3.

This report contains the findings from the implementation planning phase of the work. The feasible solutions identified in phase 2 were narrowed down to solutions with four key characteristics:

2.4.1 LLAR Stations.

It is proposed to adopt new working patterns for LLAR stations. These working patterns would have no impact on the level of response provided by appliances based at these stations, and as a result, no further analysis of LLAR stations was required in this phase of work.

2.4.2 Resilience Reserve.

A number of two-pump stations would have their second pump placed in resilience reserve for 12 hours during the night shift. A key requirement of this work was to:

- Determine which stations should be selected.
- To evaluate alternative start and end times for the resilience reserve period.

2.4.3 Additional Resource at Peak Times.

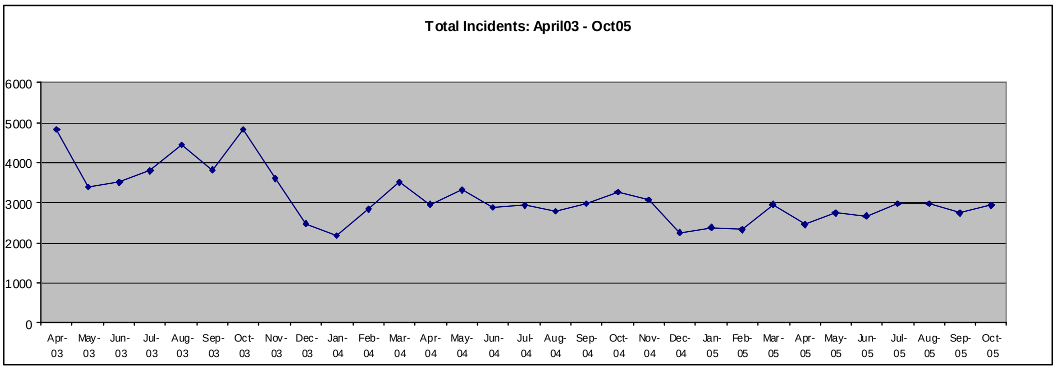
Up to four SFUs (covering the whole of Merseyside) and up to two additional pumps to be provided at peak times. The requirement of this work was to determine the locations where SFUs could provide greatest benefit, and to quantify the benefit of providing one or two additional pumps.

3. Analysis of Incident Data.

The first two phases of work used incident data based upon the period 1st April 2000 – 31st March 2003. MFRS has recently been able to provide data in the required format up to 8th November 2005 and it was decided to update the model to include this data.

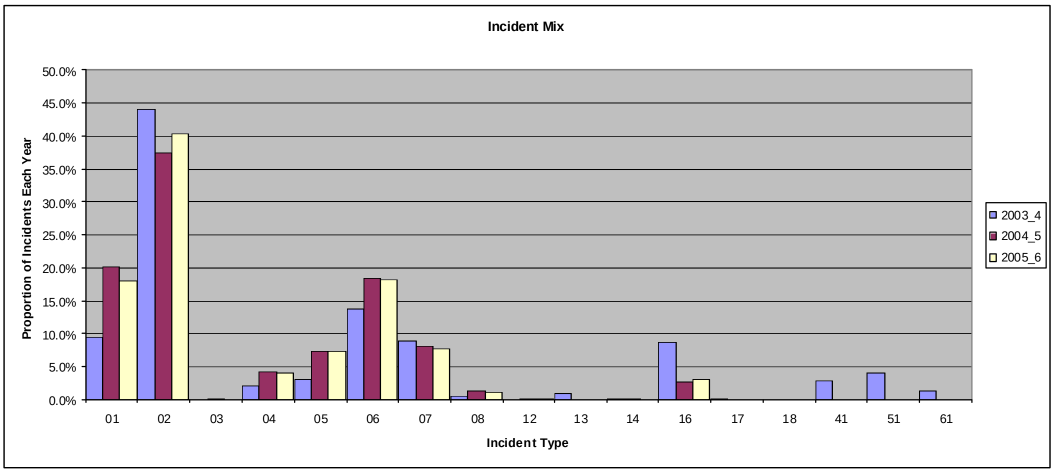
3.1 Incident Volumes.

The chart below shows the change in monthly incident volumes during the period April 2003 – October 2005.



Incident volumes fell from October 2003 (up to which incident levels were consistent with the previous period of data), settling again at a new lower level from around March / April. This is primarily the result of efforts by MFRS to reduce the number of emergency calls.

In April 2004, a new coding system for incidents was introduced in line with the FSEC coding system. The FSEC system means a change in the mix of incidents as shown below (using the original incident codes):

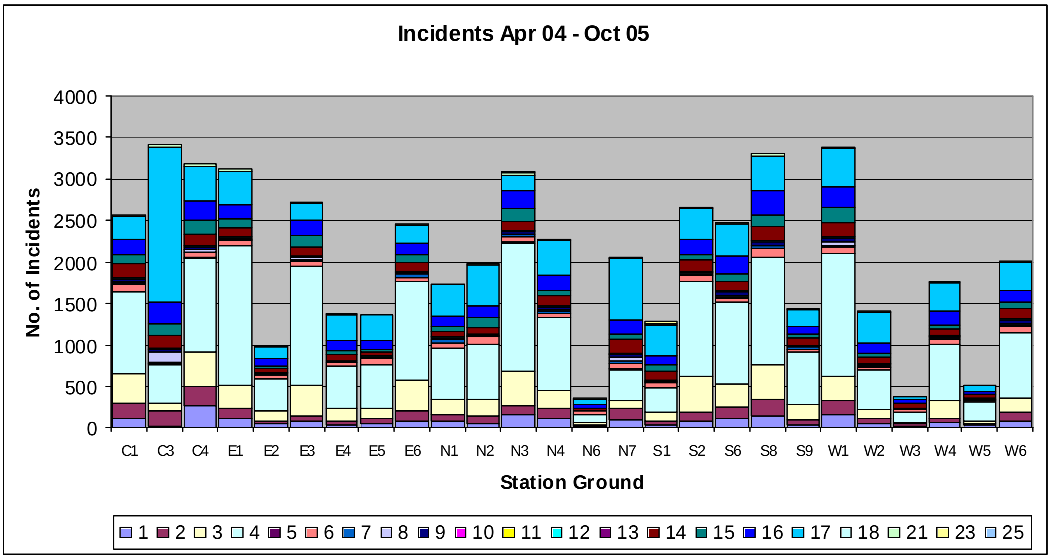


Thus a higher proportion of incidents are now counted as primary fires (01) due mainly to some vehicle fires (16) falling into this category.

Due to the significant changes in both incident mix and volume, it was decided that the modelling work for this phase should use incident data from 1st April 2004 until 31st October 2005. All remaining data in this report relates to this time period unless otherwise stated.

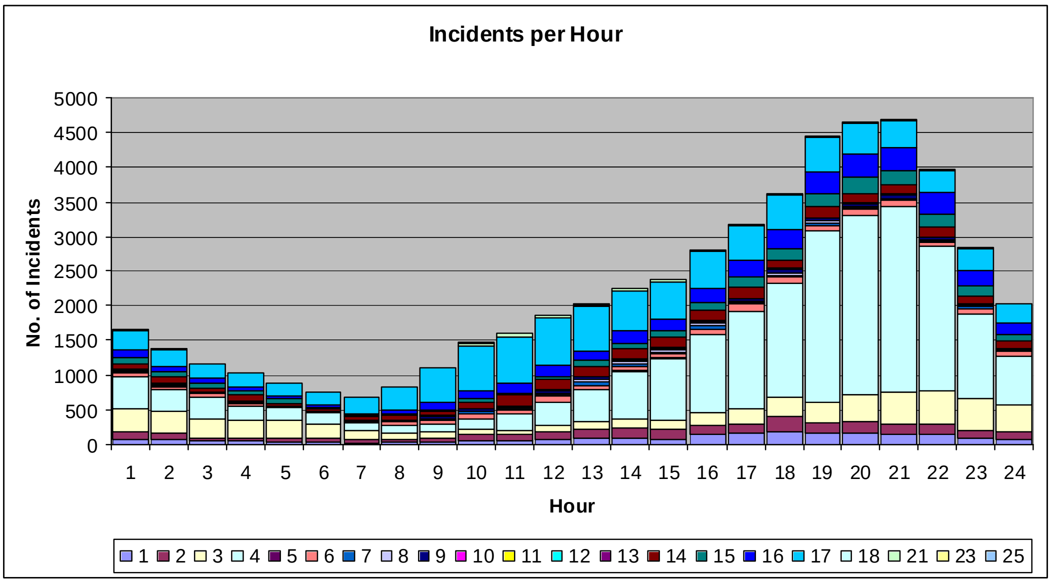
3.2 Further Analysis of Incident Data.

3.2.1 Overall Incidents Analysis.



This chart shows the number of incidents by station, colour coded by incident type. Of note is the high proportion of type '17' in C3 (City Centre) which is defective alarms. A campaign to reduce these and /or provide an alternative response would have significant impact in workload in C3, and could make it one of the quieter two-pump stations rather than the busiest.

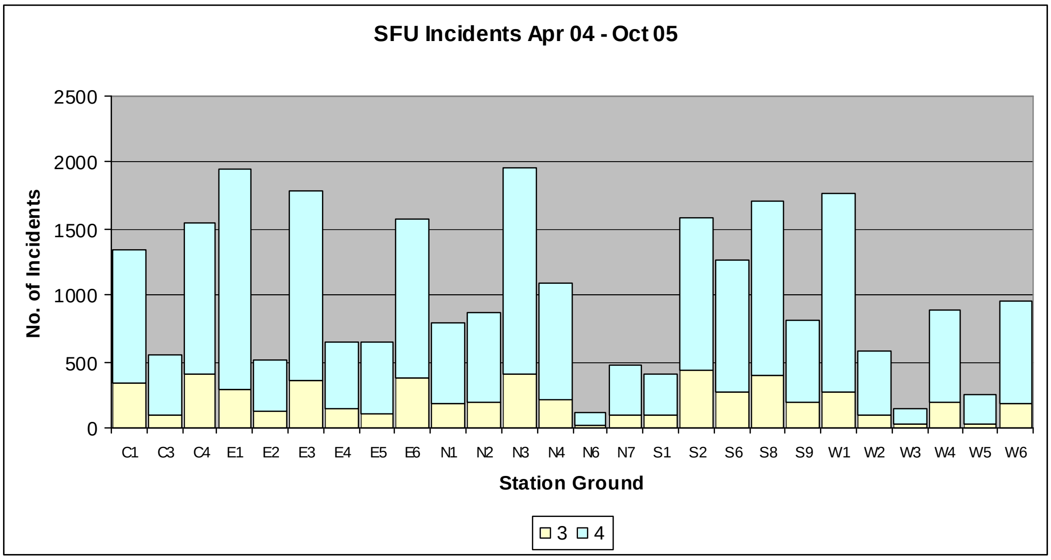
The next chart shows the hour of day in which incidents occur (note hour 1 is 0000-0100 *etc.*), again colour coded by incident type.



The busiest six hours overall are from 1600-2200; the busiest ten hours are from 1300-2300 and the busiest twelve hours are from 1200-2400.

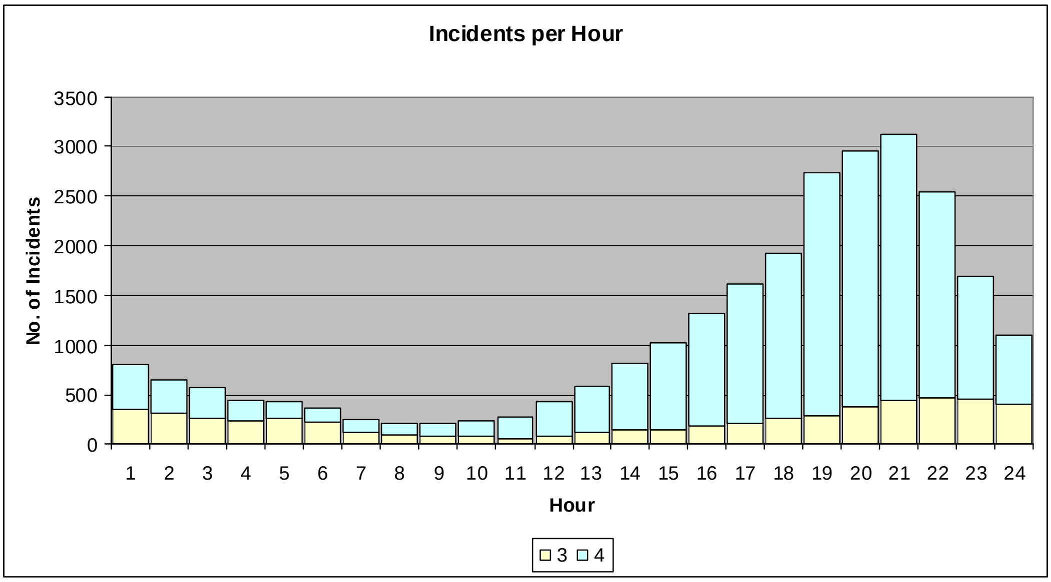
3.2.2 Vehicle and Secondary Fires.

These are the types of fires that SFUs can attend, and the number by station is shown below:



If a 'one per district' basis is used to select the stations at which to base SFUs, then E1 (or E3), N3, S8 (or S2) and W1 are the choices based upon volumes of incidents. The close proximity of some of the higher volumes also suggests that a cross district scenario may be worth considering which targets SFUs more effectively.

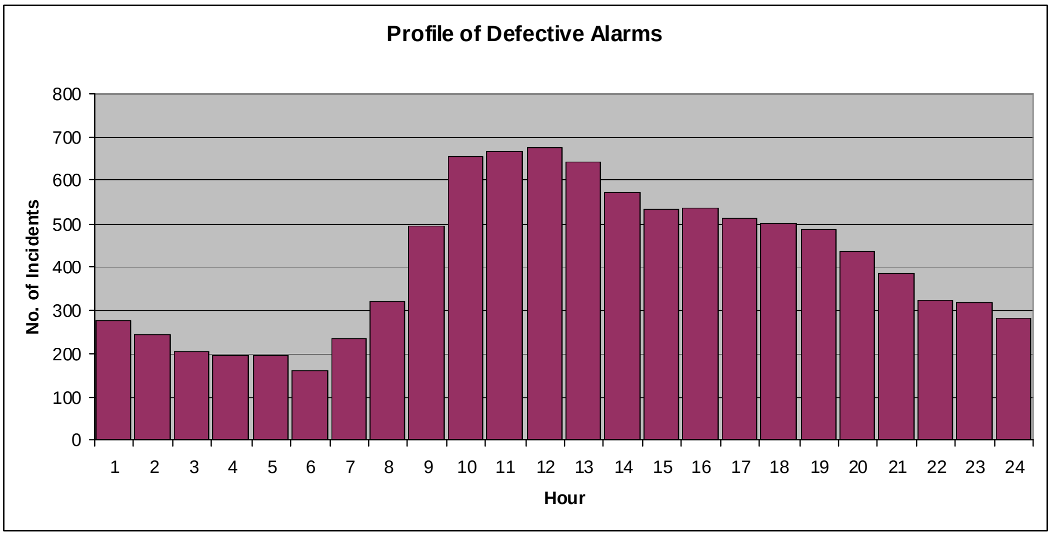
The next chart shows the time of day at which these incidents occur:



Thus the busiest six-hour period is from 1700-2300.

3.2.3 Defective Alarms.

The chart below shows the times of day at which defective alarms (code 17) occur:



It can be seen that demand peaks in from 0900 through until early afternoon. Better management of this type of incident demand would reinforce the policy of focussing resources from early afternoon through late evening.

3.3 Model Baseline.

The model was run with the new incident data and found to retain a high degree of accuracy. Using the best value performance indicator, the model returned 82.0% within target compared to 81.5% achieved in reality. Measuring performance for incident types 01,02,05,06, the model returned 79.2% compared to 78.0% in reality. The baseline of 79.2% was used for the purposes of comparing scenarios in the remainder of this report.

4. Simulation Model Results.

We carried out a large number of experiments with the simulation model to determine the optimal second pumps to place in resilience reserve and the locations of SFUs and additional pumps at busy times. We also tested the sensitivity of the results to different shift start and end times and durations within the overall framework detailed in sections 2.4.2 and 2.4.3.

4.1 Location Optimisation.

Initial runs focussed on selecting which second pumps to place in resilience reserve and which stations should house the SFUs. The table below shows the conclusions from these runs:

District	Resilience Reserve Pump	SFU Location
C	C3 (City Centre)	C4 (Low Hill)
N	N12 (Bootle/Netherton)	N3 (Croxteth)
E	E12 (St. Helens)	E1 (St. Helens)
S	-	S8 (Old Swan)
W	W12 (Birkenhead)	W1 (Birkenhead)

Note that in Wirral district, Bromborough has a much lower volume of incidents than Birkenhead and its second pump could therefore be considered for placing in resilience reserve. Whilst this will give a marginally better overall performance than by using the second Birkenhead pump, the nature of the risk in Bromborough is such that Birkenhead is a more suitable location.

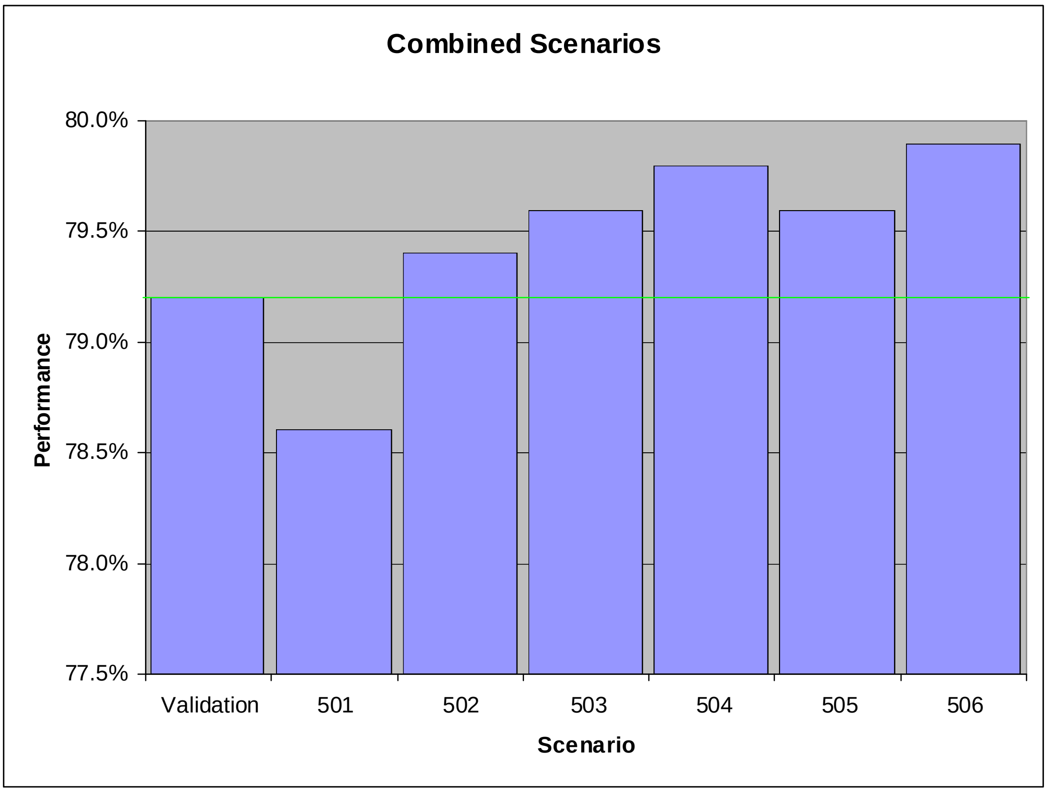
The following assumptions were made:

- Pumps in resilience reserve will be mobilised within 15 minutes from the hours of 2200-1000, and would be available as normal during other hours.
- Pumps in reserve would be mobilised to their station if the number of available pumps (i.e. not attending incidents) in their district fell below critical levels. These levels varied by district: C(3), E(4), N(5), S(4),W(5).
- SFUs were available from 1700-2300 and each district's SFU would be deployed to any incidents coded 03 or 04 within its respective district.
- 03 and 04 incidents were queued for a maximum of 15 minutes; if the SFU had not become available within this time then a normal appliance would be deployed instead.

We also examined the impact of adding a pump at each of the one pump stations during the hours of 1000-2200. This showed that the best two stations are E3 and N2 (see runs 504-506 in the table in section 4.2). However, the marginal nature of the benefit from adding these pumps was outweighed by the cost associated with their provision.

4.2 Combined Scenarios.

The chart below contains the results of scenarios to quantify the effect of combinations of resilience reserve, and the impact of adding SFUs and additional pumps. The two tables below the chart show the hours for which reserve, SFUs and additional pumps operated.



Run	Reserve	SFUs	Additional Pumps	Performance
Validation				79.2%
501	2200-1000			78.6%
502	2200-1000	1700-2300		79.4%
503	2200-1000	1300-2300		79.6%
504	2200-1000	1700-2300	Huyton	79.8%
505	2200-1000	1700-2300	Aintree	79.6%
506	2200-1000	1700-2300	Huyton & Aintree	79.9%

The resilience reserve and SFUs in these model runs were:

Reserve Pumps	SFUs
Bootle/Netherton	Low Hill
St. Helens	St. Helens
Birkenhead	Croxteth
City Centre	Old Swan
	Birkenhead

and the additional pumps at Aintree and Huyton were added between 1200-2200.

The key points here are that:

- It is possible to cover the loss in performance by placing five second pumps into resilience reserve for twelve hours by adding five SFUs for six hours.
- Huyton is a better location to add a second pump at busy times, and Aintree makes very little difference when added either on its own or in conjunction with Huyton. However, neither of these additional pumps are required in order to make a net performance gain once the SFUs are added.

4.3 Sensitivity Analysis.

Various runs were carried out to assess the sensitivity of the above results to changing timing and location of the resilience reserve, SFUs and additional pumps. The key results from this analysis are reported in this section.

Unless otherwise stated, the sensitivity analysis was carried out by comparing the results of run 502 in section 4.2. (Run 502 is based upon four pumps in resilience reserve from 2200-1000, five SFUs from 1700-2300 @ one per district, no additional pumps, using the locations detailed in section 4.1.)

4.3.1 Resilience Reserve Period.

We examined the impact of starting the resilience reserve period either earlier or later than 220, and also of increasing the resilience reserve period.

Resilience Reserve Period	Performance
2100-0900	79.3
2130-0930	79.4
2200-1000 (scenario 502)	79.4%
2300-1100	79.4%
2300-1300	79.3%

Thus there is negligible difference if resilience reserve starts from any time between 2130 and 2300. If the resilience reserve period is increased to 14 hours, or if it starts at 2100, then this also makes only a 0.1% difference in performance.

4.3.2 Number of SFUs.

We relaxed the constraint that SFUs would operate only in their own district, and instead allowed them to operate over a combination of station grounds that crossed district boundaries. Groups of adjacent station grounds were selected for each SFU to operate across.

The table below shows the results from running the model with 2,3,4 SFUs. The parenthesis indicate the station grounds served by the SFUs; the station at which the SFU was based is highlighted in bold. For example, in the 2-SFU run, one of the SFUs was based in the Croxteth station ground serving Croxteth**,** Kirkby, Old Swan, Huyton. The other was based in Low Hill *etc*.

Scenario	SFU Location and Coverage	Performance
502	One per district as above	79.4%
2 SFUs	**(Croxteth,** Kirkby, Old Swan, Huyton); (**Low Hill**,Kirkdale,Toxteth,Crosby)	79.0%
3 SFUs	**(Croxteth,** Kirkby, Old Swan, Huyton); (**Low Hill**,Kirkdale,Toxteth,Crosby); (**St. Helens,** Newton-Le-Willows,Whiston, Eccleston)	79.2%
4 SFUs	**Croxteth,** Kirkby, Old Swan, Huyton); (**Low Hill**,Toxteth,Speke); (**St. Helens,** Newton-Le-Willows,Whiston, Eccleston); (**Wallasey,** Birkenhead, Kirkdale)	79.4%

This shows that it is possible to achieve the same performance level with one fewer SFUs by allowing cross district working.

4.3.3 Frequency of Call Out of Resilience Reserve.

We tested the sensitivity of the changing the call out rules for resilience reserve to performance and frequency of call out.

The table below shows the trigger level within each district that would result in a pump in resilience reserve being called out and the corresponding performance. The penultimate column shows the number of call outs per night for each pump. Note that 'called out' means mobilised to a station in the district where the trigger level has been breached, and that the pump would not necessarily be called out to a fire. The final column therefore shows the number of incidents actually attended.

Scenario	Trigger Level per District				Performance	Call Outs per Pump per Night	Incidents Attended per Pump per Night
	C	N	E	W			
502	3	5	4	5	79.4	0.90	0.32
A	6	10	8	9	80.0	4.01	1.34
B	2	4	3	4	79.4	0.21	0.10
C	2	2	2	2	79.4	0.04	0.02
D	1	1	1	1	79.4	0.03	0.01
E	0	0	0	0	79.4	0.00	0.00

Scenario A means that pumps are called out as soon as any pumps are called to incidents, and is similar therefore to having the pumps available full time.

Scenario B shows the effect of reducing the trigger level by one compared to scenario 502.

Scenario C shows that a similar level of performance as scenario 502 can be achieved with a lower trigger level. However, each pump is called out once in every 25 days.

Scenario D shows that there is only 0.1% difference between having no ability to call upon the reserve and scenario C. Scenario E is giving equal performance to the validation scenario in section 4.2 above.

Given the use of standby moves that MFRS currently deploys, the conditions in scenario C would only be reached once the overall level of pumps available but not attending incidents falls below 8. This would result in any individual reserve pump being called out once in 25 days, with one call out per 6 days on average overall. Note that appliances would only attend incidents once in roughly 50 days.

5. Summary of Main Findings and Conclusions.

5.1 Analysis of Most Recent Incident Data.

Finding 1

The steps taken by MFRS to reduce emergency calls in 2003/04 has reduced the overall level of incidents requiring a response significantly.

Finding 2

The reclassification of incidents for FSEC in April 2004 has led to a higher proportion of incidents being classified as 'primary fires' due to the inclusion of vehicle fires.

Finding 3

City Centre station in particular has a high proportion of defective equipment alarms (type 17 incidents). Unlike the overall incident profile, these are weighted towards the hours from 0900-1300.

Finding 4

The busiest six hours overall are from 1600-2200, and the busiest ten hours are from 1300-2300. For incidents attended by SFUs, the busiest six hours are 1700-2300.

Finding 5

The response model validates to within 0.5% when measured against the best value performance indicator and to within 1.2% against a wider range of incident types.

Conclusion 1

The use of most recent incident data (from April 04) provides the most realistic platform for basing decisions.

Conclusion 2

There is opportunity to reduce demand placed upon appliances further by focussing on defective alarm incidents.

Conclusion 3

The response model still retains a high degree of accuracy even when using revised incident data with a different mix of incident types and a lower level of incidents.

5.2 Resilience Reserve and SFU Deployment.

Finding 6

If the principle of spreading resilience reserve across districts is retained, then the impact on overall performance is minimised by selecting stations City Centre, Bootle Netherton, St. Helens and Birkenhad for resilience reserve.

Finding 7

The optimal SFU locations at one per district are Low Hill, Croxteth, St. Helens, Old Swan, Birkenhead.

Finding 8

Equivalent performance to that achieved in finding 7 can be achieved with four SFUs rather than five by operating across district boundaries as indicated in the table in 4.3.2.

Finding 9

There is little difference in performance if the start time of resilience reserve is anywhere between 2130 or 2300. Indeed, increasing its duration to 14 hours from 2300 only impacts performance by 0.1%

Finding 11

The resilience reserve call out rules can be set such that the likelihood of call out to an incident of an individual pump is 1 in 50 on any given night shift (2200-1000), with one call out to a station every 25 nights on average.

Conclusion 4

The analysis reinforces the conclusion from previous work that it is safe to remove pumps during the quieter hours with minimal impact on performance.

Conclusion 5

Four SFUs can achieve the same performance level if cross district groups of station grounds are selected, as can be achieved by five SFUs operating one per district.

Conclusion 6

A net performance gain can be achieved by combining the resilience reserve and SFU solutions above.

Conclusion 7

Provided that the cost of crewing a single pump for twelve hours (plus retained element) and an SFU for 6 hours can be met for less than the cost of crewing a single pump for 24 hours, the net performance gain can be delivered at lower cost.

6. Recommendations.

Recommendation 1

The second pumps selected for Resilience Reserve should be City Centre, Bootle/Netherton, St. Helens and Birkenhead.

Recommendation 2

Resilience reserve should be operated for 12 hours starting between 2130 and 2300.

Recommendation 3

A procedure is developed for mobilising resilience reserve pumps in the event of extreme demand.

Recommendation 4.

Four SFUs should be deployed. A suggested grouping of station grounds is (with the SFU base in bold): **(N3**,E6,S8,E3); (**C4**,S6,S2); (**E1**,E2,E5,E4); (**W6**,W1,C1).

Recommendation 5

SFUs should be operated from 1700-2300.

Recommendation 6

Subject to analysis of relevant costings, MFRS should crew the SFUs through overtime and the day crewed pumps through a separate pool of fire fighters whose core working pattern comprises day shifts only.

By implementing the above recommendations, performance rises from 79.2% to 79.4%, a gain of 0.2%.

Two alternative solutions that could be considered are:

- A performance neutral solution can be achieved by modifying Recommendation 4 to the three SFU solution detailed in section 4.3.2.
- A 0.1% performance gain can be achieved by modifying the resilience reserve hours to 2300-1300 with 4 SFUs.

7. Conclusion.

The analysis reaffirms the opportunity for MFRS to safely deliver an improved quality of service whilst increasing the efficiency of its emergency response capability.

In order to achieve these goals, changes to emergency cover in order to meet peaks and troughs in demand are required.

We anticipate that the approach of creating a separate pool of resource for day crewed appliances and increasing the level of overtime available will provide new opportunities to fire fighters without disrupting those fire fighters who prefer to work the existing rosters.

We have enjoyed working with MFRS on this project and would like to thank all those who have contributed to it. In particular we would like to thank Allan Harris for his responsiveness and Sandra Robinson for timely provision of the incident data.