FIRE AND RESCUE INTERNATIONAL

Integrated fire, rescue, EMS and incident command technology

Volume 7 No 2

Airport Rescue and Firefighting Services

The Solution for Africa

RM RURAL METRO
EMERGENCY MANAGEMENT SERVICES (PTY) LTD

ADVANCED
GROUP OF COMPANIES

From my heart!

I wish you could know what it is like to search for a burnt out wreck,
With families clinging to a straw of hope,
And you knowing instinctively what you will find,
Tiny, broken little bodies,
Only identifiable by DNA,
And all you can offer is some sort of closure.

I wish you could comprehend
A wife's/husband's/parent's/brother's/sister's/child's horror
When a loved one's wreck is found,
To check a pulse and none is found.
And you pray to the Lord
To give you the strength
To break the news
That will change lives forever!

I wish you could read my mind
as I respond to a SAR call,
Is this a real accident?
is it just a non-cancelation of SAR?
What was the weather like?
How many people on board
How many families
How many friends and loved ones
Will I be able to get there soon enough to find survivors?
And give them back to their families alive!

I wish you could be in the ARCC when a wreck is found,
With the broken little body of a baby girl, who will never
Go on a first date or say the words "I love you Mommy"!

I wish you could know the frustration I feel when I
Know where to find the downed aircraft, but the bad weather
And terrain, just does not allow for the quickest means of getting to it.

I wish you could feel the apprehension,
When you have precious volunteers –
Who responds every time without fail
Leaving behind families and loved ones.
Walking side by side, in dark and misty places
Hanging off endless ropes, in monstrous mountains.
Flying endless patterns, up and down,
They never ask anything – they just give!
And without them, my world is empty.
And every time they return back safely, I whisper a silent prayer.

I wish you could feel the hurt as people verbally abuse you,
Or belittle what you do – or as they express
Their attitudes of "It will never happen to me"

I wish you could realize the physical, emotional and mental drain,
Of missed meals, lost sleep, and forgone social activities, in addition
To all the tragedy my eyes have seen and my heart has felt.

I wish you could know the brotherhood and self-satisfaction of
Having saved a life, or being able to be there in time of crisis,
Or handing a downed Aviator safely back into the arms of loved ones!

I wish you could understand what it feels like to have a loved
One asking "Is he/she OK" not being able to hold back the tears,
And not knowing what to say.

Unless you have lived with this kind of life, you will never truly
Understand or appreciate who I am, or what my job really
Means to me....

I wish you could though!
Before you make that fatal mistake!

Written by Santjie White, South Africa

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(click a headline to view the article)

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Comment

Lee Raath-Brownie

We proudly share our 61st edition of **Fire and Rescue International (FRI)**. We remain dedicated to serve the emergency services and first responders and share technical and research articles, motivational leadership guidance as well as practical hands-on advice. Enjoy the read!

Cover profile
Our cover profile features Rural Metro Emergency Management Services' Airport rescue firefighting services (ARFF): The Solution for Africa, which meet the approval of the South African Civil Aviation Authority (SACAA) and employ International Civil Aviation Organisation (ICAO) standards.

News
Congratulations to Mr Moshema Petrus Mosia on his appointment as the chief of Emergency Services for the City of Tshwane Emergency Services on a permanent basis.

Firefighting foams
Dr Niall Ramsden of LASTFire discusses the transition to fluorine free foams, which is one of the biggest issues facing firefighting foam users currently. Dosetech Fire's Mike Feldon and FireDos shares the importance of accurate proportioning when fighting fires with foam.

Wildfires
We feature Industrial Fire and Hazard Control's recently launched CAFS Wildland Interface Pumper, Chief Tim Murphy's Command Corner focusses on the transfer of command and we share Chapter IX, working towards a detailed five-year fire prevention plan from the late Dr Neels de Ronde's book, The Garden Route in flames.

Major fire incidents
Colin Deiner's article in this edition is Walking the dog – preparing for the 'Big One': Firefighting considerations when responding to major fire incidents. Deiner discusses the common denominators, scale and intensity, resource intensity, potential for fire spread, structural stability hazards, safety and evacuation considerations, incident command, logistics, media and social media, mutual aid, incident duration, fire cause investigation, impact on surrounding community, environmental impact, recovery and rehabilitation and debriefings. He also unpacks planning and response to major incidents.

Training
ETS Emergency Training Solutions, the first South African training entity to gain IFSAC accreditation, discusses industrial firefighting for on-site responders.

Technology
Jo Nieman shares urban air mobility and eVTOLs: A game-changing solution for South African emergency services and we take a look at a machine learning-based solution could help firefighters circumvent deadly backdrafts.

JOIFF Guideline
We will be sharing the JOIFF Guideline on emergency response to incidents involving vehicles powered by alternative fuels, including hybrid vehicles in three separate issues with special permission from JOIFF to assist our responders with the challenges faced during these incidents.

Fire safety and prevention
Deon Esau writes about igniting the future: embracing cutting-edge strategies for fire prevention. Esau looks at the potential of innovative strategies in fire and injury prevention.

Thank you to our local and international contributors, our advertisers and readers for their continued support! Fire and Rescue International is your magazine.

Read it, use it and share it!

Lee Raath-Brownie
Publisher

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Congratulations

To Aldus Smith for his photograph 'Bonfire' taken with an Iphone 12, f/2.4, exposure: 1/4sec, ISO 2500, exposure bias +0.6 step, focal length 2mm with no flash.

Well done!

Aldus Smith wins this months prize money of R2 000!

Photo description:
Rocket HEMS airlifting a trauma patient from Potchefstroom Hospital to Johannesburg for further emergency care.

This month's FRI Images winner!

Best rescue, fire or EMS photo wins R2 000!

WIN R2 000

Fire and Rescue International's (FRI) bi monthly photographic competition is open to all its readers and offers you the opportunity of submitting your digital images of fires, fire fighters, disasters, incidents, emergencies and rescues.

Rules
- All photographs submitted must be high resolution (minimum 1meg) in jpeg format
- Allowed: cropping, curves, levels, colour saturation, contrast, brightness, sharpening but the faithful representation of a natural form, behaviour or phenomenon must be maintained
- Not allowed: cloning, merging/photo stitching, layering of two photos into one final frame, special effects digital filters
- Fire and Rescue International (FRI) reserves the right to publish (printed or digitally) submitted photographs with acknowledgement to the photographer
- Winners will be chosen on the merit of their photograph
- The judge's decision is final and no correspondence will be entered into afterwards

Entries must include:
Name of photographer
Contact details (not for publishing)
Email (not for publishing)
Name of photograph
Brief description of photograph including type of incident
Camera, lens and settings used

All entries must be emailed to:
lee@fireandrescue.co

>> ENTER NOW!

Airport rescue firefighting services (ARFF): The Solution for Africa

Since 2000 Rural Metro Emergency Management Services (Pty) Ltd has specialised in the provision of firefighting solutions for a range of industries, protecting a variety of risk profiles.

Rural Metro recently embarked on expanding its airport rescue firefighting capacity by adding fully equipped and functional airport crash tenders to their arsenal.

"Our solutions meet the approval of the South African Civil Aviation Authority (SACAA) and we employ International Civil Aviation

Organisation (ICAO) standards. Our staff are well trained with approved personal Protective equipment (PPE) and the most modern equipment for ARFF", said Chris Gilbert, chief executive officer of Rural Metro Emergency Management Services.

Rural Metro's emergency response teams are ready and equipped to service airport protection requirements from Categories 3 to 9.

"Our clients demand uncompromised levels of ARFF protection. Rural Metro is the only private company capable of mobilising ARFF units with equipment, principal and complimentary extinguishing agents as well as providing trained personnel within our approved operational models. We provide compliant response expertise that will rescue life in the event of an aviation incident" said Gilbert.

Services offered

- ARFF fleet meeting airport category demands
- Firefighting equipment as per airport category
- Trained, physically and medically fit personnel
- Protective clothing
- Fleet performance as per ICAO standards
- Principal and complimentary extinguishing agents
- Airport emergency plans and procedures
- Emergency medical response services.

Rural Metro is a firefighting company with the expertise and experience that understands the demands of airport rescue and firefighting.

"Our recent deployments to both state and private airports serve as evidence of our functional aviation solutions, ranging from for CAT 3 to 9 airports", concluded Gilbert.

Rural Metro: airport rescue firefighting in good hands.

City of Tshwane appoints Moshema Petrus Mosia as Chief of Emergency Services

Chief Moshema Petrus Mosia was appointed as the chief of City of Tshwane Emergency Services

On 28 September 2023, the City of Tshwane Council approved the report that approved the appointment of senior Section 56 managers. Mr Moshema Petrus Mosia was appointed as the Chief of Emergency Services on a permanent basis and reports directly to the City Manager.

In his media statement dated 29 September 2023, the Executive Mayor of Tshwane, Councillor Cilliers Brink, said that the selected candidates are fit for purpose and will be instrumental in turning the City of Tshwane around.

Chief Mosia's career in the emergency services fraternity started in 1987, when he was recruited by the then Qwaqwa Development Corporation as a learner firefighter at the time when the corporation was establishing a fire service for the homeland. He was one of the founding members of the Qwaqwa Fire Services. He went on to receive formal firefighter training at the City of Johannesburg Emergency Management Services Brixton and Rietfontein Training Centres in 1988. This is where his teeth were cut. This was to be a learnership in the true sense of the word. South Africa went through a volatile period at that time and the country was literally on fire. He was stationed at the Jabulani Fire Station in Soweto, which was the epicentre of violence and burning of facilities, infrastructure, transport and buildings.

Upon the successful completion of his firefighter training, he went on his career development path by enrolling for further studies with the South African Fire Services Institute (SAFSI), now called the Southern African Emergency Services Institute (SAESI). There were only two institutions where a firefighter could improve his career at that time, namely SAFSI and the Institute of Fire Engineers (IFE), which was based in the United Kingdom. He decided to pick SAFSI because of its proximity and the benefit of contact sessions with students.

He obtained his first certificate with SAFSI, a Junior Fireman's Certificate in the same year, 1988. It was not long before Chief Mosia was appointed as a leading firefighter (shift manager). In 1989, he obtained his Fireman Certificate. The latter saw him promoted to station officer. He continued with his studies until he received the Senior Fireman Certificate, Graduate Diploma in Fire Technology and the highest qualification at SAFSI, the Associate Diploma in Fire Technology.

Thereafter, he enrolled for further studies with the University of South Africa where he obtained his BAdmin Degree. He further proceeded to the University of the Free State where he obtained his Advanced University Diploma in Disaster Management (Postgraduate Diploma). He further studied with the University of Cumbria in the United Kingdom where he obtained his Postgraduate Certificate in Management Studies.

Throughout his career spanning 36 years, he continued to improve his skills through a significant number of short career-related courses.

In 1998, he successfully applied for the assistant chief fire officer position at the then City Council of Greater Germiston, which was a very good decision as this saw his career really taking off for the better. In 2000, the City Council of Greater Germiston was merged with 11 other municipalities and administrations to form what was called the East Rand Metropolitan Municipality, which later became the City of Ekurhuleni. The other ten municipalities and administrations were Alberton, Boksburg, Edenvale, Kempton Park, Benoni, Brakpan, Springs, Nigel and the then Eastern Gauteng Services Council. New organisational structures and change management strategies had to be implemented. Chief Mosia became the deputy interim coordinator of the Emergency Services Task Team and later became the

first chief fire officer of the City of Ekurhuleni in 2003 after the conclusion of the institutional review process. Not only did he become the first chief fire officer of Ekurhuleni but also became the first African chief fire officer in what was called East Rand towns.

During his stay in the Ekurhuleni area from 1988 to 2017, he served in various senior positions. From 2006 to 2011, he served as executive director of the Community Safety Department (departmental head), which was responsible for fire brigade, disaster management, metropolitan police and motor vehicle and driving licencing services. He also acted as the Deputy City Manager of operations for two years and was responsible for the Health and Social Development Department, Community Safety Department, Electricity and Energy Department, Sports, Recreation, Arts and Culture Department, Human Settlements Department, Transport Department, Water and Sanitation Department and Customer Care Centres Department.

His last senior manager position held in Ekurhuleni was the Head of the Department: Disaster and Emergency Management Services from 2012 to 2017. He later joined the Fire Protection Association of Southern Africa (FPASA) briefly from August 2017 to April 2018 as a technical specialist/facilitator. In May 2018, he joined the City of Tshwane as divisional chief: Fire and Rescue Operations, which is the position he held until September 2023 when he was appointed as the chief of Emergency Services in the City of Tshwane.

During his stay in Ekurhuleni, Chief Mosia pioneered the introduction of fire services in the former townships across Ekurhuleni. He changed the landscape in this area in the sense that he established the following fire stations in the townships: Thembisa, Daveyton, Etwatwa, Tsakane, Duduza, Kwa Thema, Zonkisizwe, Thokozani and Albertina Sisulu Corridor. The Olifantsfontein, Elandsfontein, Vosloorus and Katlehong Fire Stations were on his Integrated Development Plan when he left in 2017.

While he was in the service of Qwaqwa, he specialised in mountain rescue and successfully led a significant number of mountain rescues on the snowy Maluti and Drakensberg mountain ranges and sometimes in conjunction with the South African Air Force. His success in this area saw him climbing Mount Kilimanjaro in Tanzania to the highest peak, Uhuru Peak, reaching the highest point in Africa.

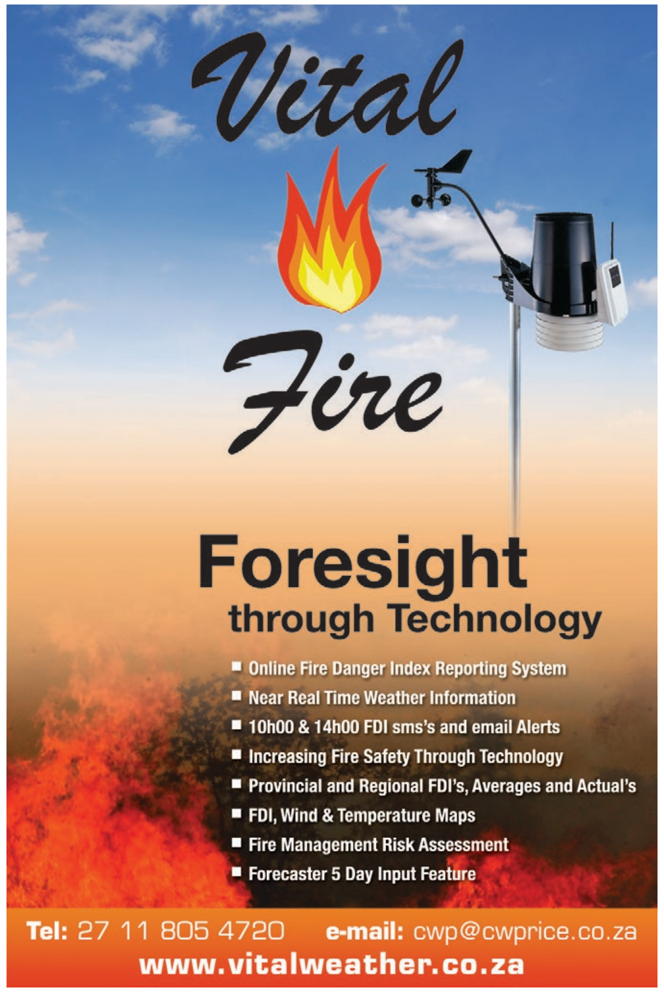
As a member of the SAESI, he became the first African president at its 59th biannual conference. He was anonymously re-elected at the end his term for a second term, which made him the first SAESI president to serve two consecutive terms. Following some of his plans, SAESI is today recognised by the South African Qualifications Authority (SAQA) as the professional body for firefighters in South Africa and is also registered as a non-profit company in terms of the Companies Act, 2008 (Act 71 of 2008).

Throughout his career, Chief Mosia was involved in standardisation development in fire services and disaster management under the South Africa Bureau of Standard (SABS)/South African National Standards (SANS). He represented the SABS in one of the International Organisation for Standardisation (ISO) Committees: ISO TC 223 - Societal Security Standards for a period exceeding 10 years. It was in this committee that he was exposed to operations at international level.

He became the chairperson of the Developing Contact Group of this committee, which was constituted by over 20 developing countries in the world.

He also became deeply involved in the development of urban search and rescue skills and he was a member of the South African Urban Search and Rescue (USAR) Team that went to Gujarat Province Bhuj in India with the earthquake disaster in 2000.

In his media statement dated 5 October 2023, the City Manager of the City of Tshwane, Johann Metter, reiterated, "Mr Moshema Mosia emerged as the top candidate based on his performance during the interview and the competency assessment stages, his qualifications and his 36 years of experience in an emergency services environment."



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The Dräger Nano, Type 4 full composite cylinder is specifically engineered to minimize the weight you carry during hazardous firefighting operations. Thus, it reduces fatigue and increases your ability. It is currently one of the lightest gas cylinders in the market with a shell weight of 2,8kg (6,8 litres of air/300 bar including impact-resistant caps).

Technology for life

Quality servicing is the only guarantee of safety in the event of an emergency.

Functional care

Help with the basics: Functional Care ensures that your equipment is inspected properly on a regular basis thus confirming that everything is operating correctly. During this process, our technicians take both regulatory requirements and product specific information from the manufacturer into account. At the same time, Functional Care helps you with the administration and documentation of your maintenance obligations. Quality servicing is the only guarantee of safety in the event of an emergency.

Preventive care

Maintain the value of your safety equipment through preventive care according to the manufacturer's specifications: Preventive Care guards against wear and extends the service life of your equipment. All functions are tested according to the manufacturer's specifications and wear parts are replaced preventatively on a regular basis through a comprehensive inspection and testing program. Moreover, your device is also calibrated at your request when necessary. Furthermore, ongoing documentation provides detailed information on the condition of your service shop-maintained equipment at all times.

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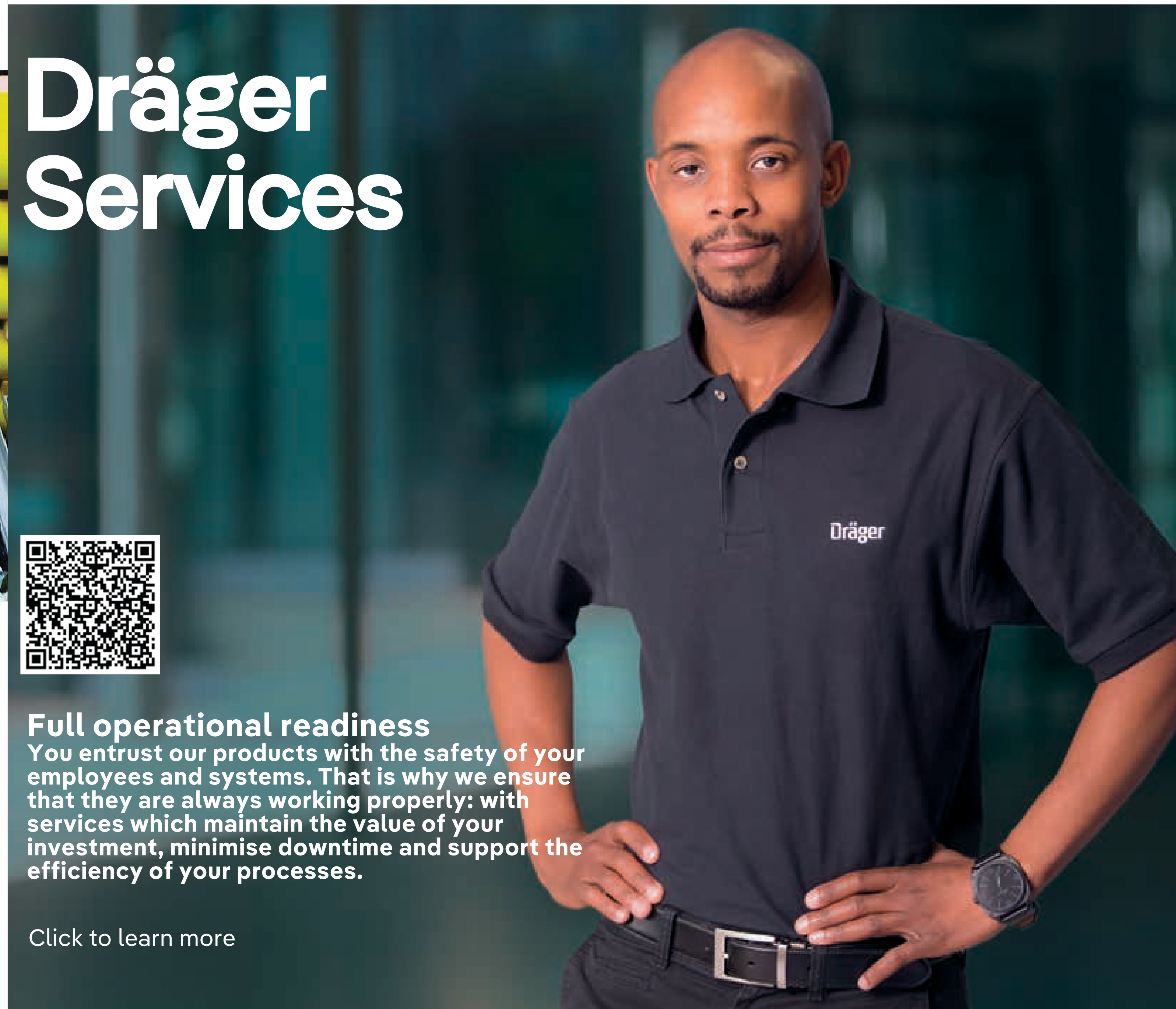
Although we recommend you to choose contracts for efficiency, nonetheless we also offer repair and maintenance on demand services. Our services at a glance:

- Inspection, maintenance and repair
- Installation and commissioning
- Spare parts service
- Regular software maintenance and updates
- Provisioning of rental equipment

Are you servicing your cylinders at an approved testing station? All Dräger South-Africa workshops are approved to the following standards: ISO 17020, SANS 1825 and SANS 10019 ensuring that all cylinders are tested in accordance with the above relevant safety standards.

Dräger



The Dräger NANO,
Type 4 full composite cylinder is specifically engineered to minimize the weight you carry during hazardous firefighting operations. Thus, it reduces fatigue and increases your agility. It is currently one of the lightest gas cylinders in the market with a shell weight of 2.8 kg (6.8 l of air/300 bar including impact-resistant caps).

Click here to learn more

Technology for Life

Dräger

Protecting you every step of the way

Fighting cancer in the line of duty

Practical ways to reduce health risk caused
by contamination in the Fire Service

WHICH SOPS ARE COMPULSORY AND SHOULD BE LEARNT BY EVERY FIREFIGHTER?

- Identifying and understanding hazards
- Selecting and using protective equipment
- Using PPE wisely and according to the donning doffing routines
- Applying personal hygiene routines after incidents

HOW CAN YOU MINIMIZE THE RISK OF DIRECT CONTAMINATION?

- Avoid exposure to hazardous substances wherever possible for teams as well as equipment
- Wear PPE and breathing protection at incident site
- Avoid direct contact with contaminated equipment during pre-decontamination – use PPE
- Clean skin during doffing of PPEs to remove contaminants
- Pack and stow contaminated PPE and equipment in sealed bags / containers; document the type of incident for further handling

HOW CAN YOU MINIMIZE THE RISK OF INDIRECT CONTAMINATION?

- Clean PPE routinely after use at any incident
- Treat returned PPE as contaminated equipment and protect service technicians accordingly
- Consult your PPE supplier for guidance on cleaning processes

Technology for Life®

LASTFire: Transition to fluorine free foams

The transition to fluorine free foams is perhaps currently one of the biggest issues facing firefighting foam users. The issue is not only limited to industrial firefighters but applies across all users of foam. Large Atmospheric Storage Tank Fires (LASTFire), the industry group developing best practices in storage tank fire hazard management, has taken a pragmatic approach to the issue of a transition to fluorine free foam. It is recognised that it is inevitable, so work has focussed on making the process as cost effective and practicable as possible.

The opportunity has been taken to develop a much better database and understanding of critical foam performance criteria in order to optimise a foam's performance through equipment design and application method as well as foam concentrate formulation.

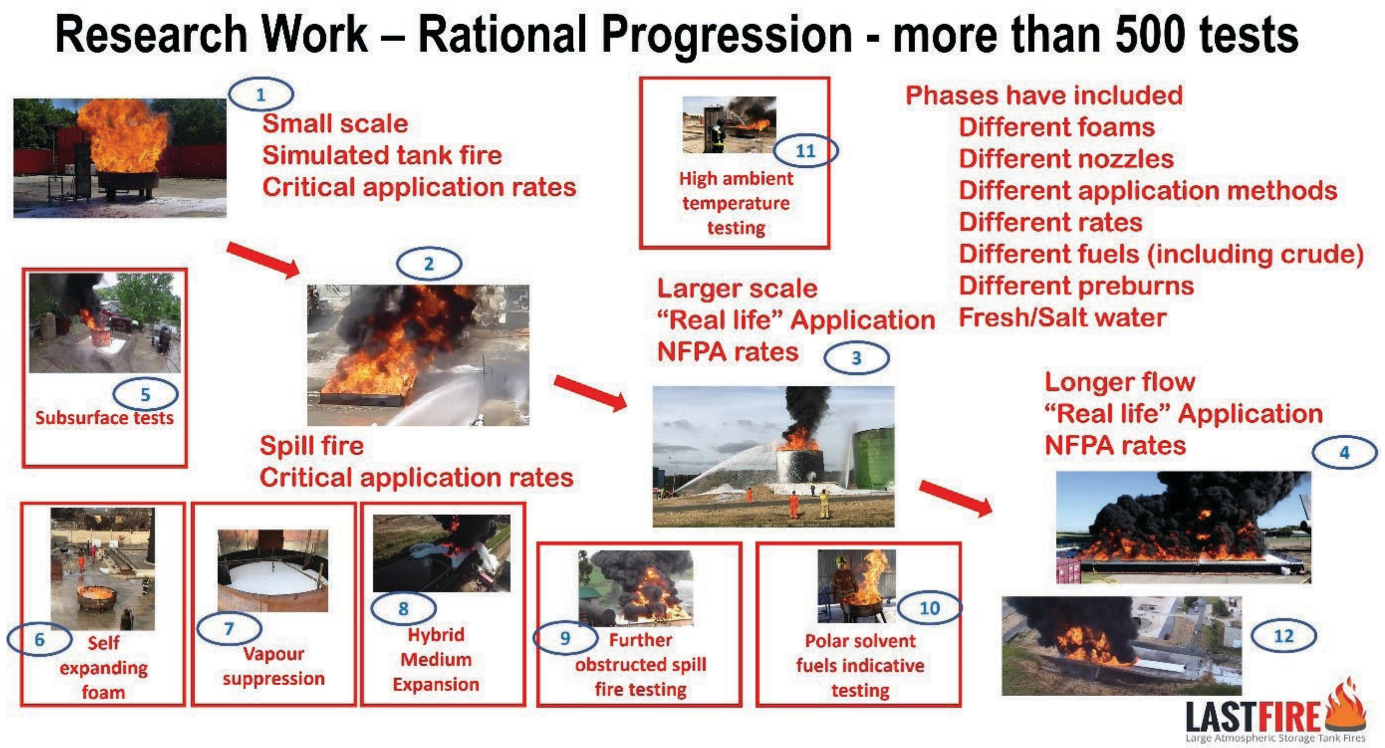
It is recognised that there are many aspects to getting the transition right and ensuring sustainable system assurance, such as achieving correct proportioning rate and assessing environmental issues of replacement foams. LASTFire is developing guidance on all of them.

The most critical issue, though, is fire performance and LASTFire has carried out the most comprehensive set of industrial end-user driven, independently managed, tests to date.

LASTFire work is directed and reviewed by members and thus is truly relevant to ends user needs.

Background note

It should be noted that, for many years, LASTFire has been testing foam firefighting performance using the standard LASTFire test protocol. This is a test procedure designed specifically for assessing a foam's performance for the critical conditions of a storage tank fire. This test was first developed by Mobil Research and Development Corporation (MRDC), recognising that most tests available were designed more for spill fire situations that did not reproduce these conditions. MRDC handed it over to LASTFire to complete its development and validate it against incident experience. Since then it has been used by a number of oil companies as part of their performance based procurement specification and factory acceptance testing protocols. Consequently, LASTFire has an extensive database of test results of per- and polyfluorinated substances (PFAS) based foams using this protocol which can also be used as comparison with the results obtained with fluorine free types. It is noted that the first fluorine



free foams marketed struggled to perform well in this test but with developments by suppliers there are now several commercially available products that perform well against this protocol.

There has been correlation noted between the performance and issues noted in the standard LASTFire test with some foams, such as flames 'ghosting' over the fuel surface and that seen in the larger scale testing described here.

ENRg Consultants, as LASTFire coordinator, has spent several years working on the issue. Initially concentrating on foam performance, with small scale research understanding how these new formulations work compared to older C8 or C6-based formulations; working up through elevated tank testing (10m height, 11m diameter tank) to larger scale (50m flow length), developing an understanding of how to maximise efficiency and effectiveness of the foams through different application types and methods.

Recent LASTFire work in December 2022 moved away from fixed application devices (monitor and system pourer application) and focused on hands-on application carried out by arguably some of the most experienced industrial firefighting experts from around the world from LASTFire member organisations. The aim of this work was to assist with developing real-world guidance on how to optimise the use of fluorine free foam.

The tests involved gasoline (180m2; ~21 000l fuel with water base), E15 (15 percent Ethanol and gasoline mix) (200m2; ~21 000l fuel) and Ethanol (45m2; 6 000l fuel). Different hand held application equipment types including non-aspirated, low expansion and medium expansion were used at application rates typically less than NFPA standard rates and in some cases down to approximately 35 percent of NFPA rates, well below rates used in practice. Some tests involved direct comparisons of the different foams using the same application techniques, others involved simultaneous application of different foams from different handlines.

Application techniques included forceful application, 'roll-on' pushing foam on from the ground on to the front of the fire, 'banking' where foam is applied to hot objects that were located within the fire, additionally served the purpose of creating obstacles for the foam to flow around and 'rain down' where the foam nozzle was directed vertically to allow a gentle application of foam on to the surface. Four different foams were used and full extinguishment was achieved in all cases. The intention is that the data from these tests will be used to develop guidance on what application practices are effective and most suitable under different conditions/stages of a fire.

Other issues

Whilst firefighting effectiveness is the most important issue for a firefighting foam there are many other aspects that must be considered when selecting the most appropriate agent and ensuring that it is applied as efficiently as possible. Consequently, LASTFire is also carrying out work in other areas including:

- Identification and analysis of critical foam parameters: expansion, stability, viscosity, flowability, fuel pick-up etc.
- Proportioning rate accuracy. LASTFire has carried out checks with a number of foams and different proportioner types including venturi line proportioners and water driven positive displacement pump types. This can be an issue and should be checked as part of the transition process on a case by case basis. However, it has been noted that developments by some suppliers have resulted in reduction in concentrate viscosity in some cases.
- Simultaneous application of different fluorine free foams on to the same fire. No issues of destruction of foam blanket due to interaction have identified with the combinations tested to date.
- Whilst not carrying out any work in their own right, LASTFire is constantly monitoring the situation regarding clean-up and disposal of PFAS in order to keep members up to date with best practices and latest developments.

Future work

LASTFire recognises that it is always useful to carry out more work and is in discussions with other industry sector groups with similar objectives to share information. It is undoubtedly the case that more test work is being requested for fluorine free foams than was done on previous foam generations, including 'C6' formulations. These 'C6' foams introduced after the implementation of the USA Environmental Protection Agency (EPA) PFAS Stewardship programme which introduced the concept of C6 PFAS formulations aimed at working towards zero C8 contents. LASTFire has seen definite reductions in performance in some cases with the introduction of these without it always being highlighted by the manufacturer.

The current plans of LASTFire include:

- Assessment of fluorine free foam for crude oil that has been burning for sufficient time to build up a hot zone
- Effectiveness of fluorine free foam on water soluble fuels at a larger scale
- Ongoing identification and optimisation of critical aspects of the foam/equipment combination

Summary

LASTFire has carried out a very comprehensive set of tests at both large and small scale. It is important to review these as a complete programme rather than take points from them piecemeal. To date nothing has been identified to suggest that fluorine free foams cannot be made to work for all required scenarios that have been conventionally managed by PFAS containing foams but there is still work to be done to optimise their performance and so minimise transition costs.

LASTFire is committed to filling any gaps in knowledge and to ongoing testing, working with other sectors to maximise the benefits from shared learning.

For more information on LASTFire work and copies of previous test reports, please contact: info@lastfire.org.

Fire fighting with foam and the importance of accurate proportioning

High expansion class A foam being used as a wildfire barrier

Fire fighting foam is seen as a complicated fire fighting method. Even though flammable liquid fires make up approximately one in five fires when they occur, they are particularly hazardous, so using foam correctly for extinguishing is critical. Mike Feldon, managing director of DoseTech Fire, shares current foam proportioning technology.

The fire fighting foam is the most critical component of a fire fighter's tool for class B fires. FireDos motto is 'Proportioning in excellence'. This fact binds everything we do in manufacturing precise foam proportioners and monitors designed to dispense foam accurately, regardless of the flow or pressure. This article helps to understand how it works, the equipment needed to proportion accurately and the latest developments in foam fire fighting equipment.

High Viscosity foam

Using foam to fight class B fires has led to it being used for class A fires as a wetting agent, where water droplets' natural surface tension is reduced, making the same quantity of water more effective at extinguishing. As a class A foam, it is also used as a barrier to prevent the spread of wildfires. As foam becomes more common in usage, fire fighters need to understand and use foam for a wider field of applications.

Using fire fighting foam means proportioning, admixing or dispensing it at the manufacturers and regulatory bodies (NFPA 11, BS EN13565, FM global, ICAO, UL162, IMO, MIL-F-24385) recommended proportioning rates. A common misconception is to increase the proportioning rate because a thicker mixture extinguishes the fire more rapidly.

Fire fighting with foam and the associated extinguishing or suppression devices have developed substantially over the past few years. The advantages of foam-based fire fighting are the ability to quickly smother a potential hazard and effectively knock down an oil/chemical-based fire.

Foam successfully operates by:

1. Forming a blanket, smothering and preventing oxygen from fuelling the fire,
2. Eliminating the flammable vapours released from the fuel surface
3. Separating the flames from the fuel
4. Cooling the fuel surface and surrounding area, such as adjacent tanks.

Equipment manufacturers have successfully automated foam proportioning systems to reduce the stress on fire fighters having to make mental calculations for eduction rates, application rates and required foam concentrate volumes. However, this has disadvantages in that the systems can be inadvertently abused, thus sometimes making the foam solution ineffective, for example, cycling handline hoses on/off with electronically controlled proportioning systems, as the foam quality is difficult to reach.

Many new and existing foam concentrates exhibit varying characteristics, such as high-viscosity, pseudoplastic and non-Newtonian, with differing viscosities at different temperatures and shear-thinning, as the foam viscosity reduces the more it is agitated. Other considerations are air entrainment and sedimentation and the introduction of environmentally friendly, fluorine-free foams, technically known as Synthetic Fluorine Free Foams (SFFF). Foam type and selection should naturally affect the selection of foam proportioning equipment, as the flow range, system pressure and mechanical mixing method all impact the foam quality.

Foam proportioning rates and their importance

Typical foam proportioning rates for class B fires are in the 1% to 6% range. However, recent years have seen a steady migration to move from 6% (using Fluoro-Protein foams (FP)) to 3% (Alcohol Resistant and Aqueous Film Forming Foams (AR-AFFF/AFFF) with some 1% in use.

However, as many existing fire fighting foams in use are known to be hazardous to health and the environment, the newer replacement Synthetic Fluorine Free Foams (SFFF) are generally proportioned at 3% until the foam concentrate technologists develop them further to reduce the proportioning rate. The PFAS (per- and poly-fluoroalky substances family) debate and development of suitable tested biodegradable fire ighting foams is ongoing but has an important impact on the use of fire fighting foams in legacy and new equipment.

High Viscosity foam

Accuracy

The purpose of a specific proportioning rate and why regulatory bodies insist on strict nominal proportioning rates of 3% or a minimum of 3,0%, maximum of 3,9%, a tolerance of -0% to +30% or 1% above the rated concentration (whichever is less) to maintain the effectiveness of the foam.

With lower proportioning rates, there may not be enough active foam ingredients for extinguishment and the discharged foam solution cannot form an effective blanket to both extinguish a fire and prevent re-ignition. If the proportioning rate is too high, the foam blanket is too thick and cannot travel fast enough across the surface of a liquid to extinguish. With some foam concentrates, the foam may also be too thick to dissolve effectively.

Extinguishing time

For an end-user or fire brigade, the obvious advantage of a lower proportioning rate is the ability to make the available stored foam last longer.

A foam proportioning rate at 1% lasts three times longer than a 3% proportioning rate and six times that of a 6% rate at a given flow rate. For example, a typical fire truck in the UAE with 8 000 litres of water ▸

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FireDos foam dosing proportioners and skids • Monitors and water cannons • Mobile dosing and monitor trailers • Bund, tank top and rim pourers

Too rich proportioning, meaning the foam solution cannot flow effectively to seal on a tank rim seal test (image courtesy of LaStFire)

and 2 000 litres of foam equates to 16 minutes of 3% foam solution at a flow of 4 000lpm, assuming a backup supply/hydrant is available for water (otherwise, it is two minutes). For a proportioning rate of 1% foam solution, 48 minutes is available.

Air entrainment can also be a problem when mixed with foam concentrate as the air volume at a system pressure of 10 bar is ten times less than at atmospheric pressure. What does this mean in practice: A foam concentrate containing 5% air due to being trapped in a high viscosity fluid. When the foam concentrate is mixed under a system pressure of 10 bar, the foam solution has 0,15% of air under pressure. When this expands upon reaching atmospheric pressure, the air expands by the same factor of the pressure it was under, ie 10 bar, therefore 10 times. This 5% air of the foam concentrate, made up 0,15% of the foam solution, expands ten-fold to 1,5% of the foam solution. We now have a proportioning rate of less than the optimum as 1,5% of the solution is air, not foam. The pumping of foam trapped with air is more complex than the example due to several factors such aspump speed, vacuum filling, thermal conductivity and vapour pressures. Air trapped in the foam means the system is under-dosed with a corresponding reduction in proportioning rate. Typically, we see lower than acceptable proportioning rates with higher air volume in the foam concentrate, meaning a failed foam test.

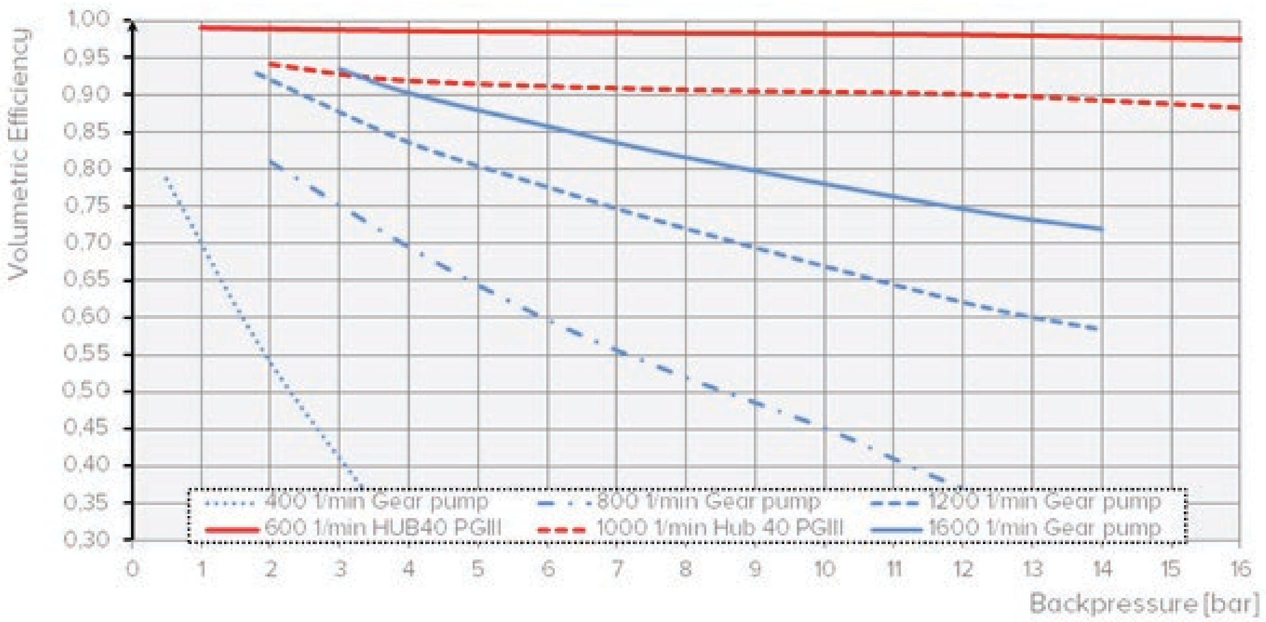
Many of these issues are stated as new problems. History tells us these are the same problems foam concentrate manufacturers, equipment manufacturers and end-users were faced with, when many new formulations were released dating back to the widespread introduction of AFFF in the 1970s and 1980s.

Equipment considerations

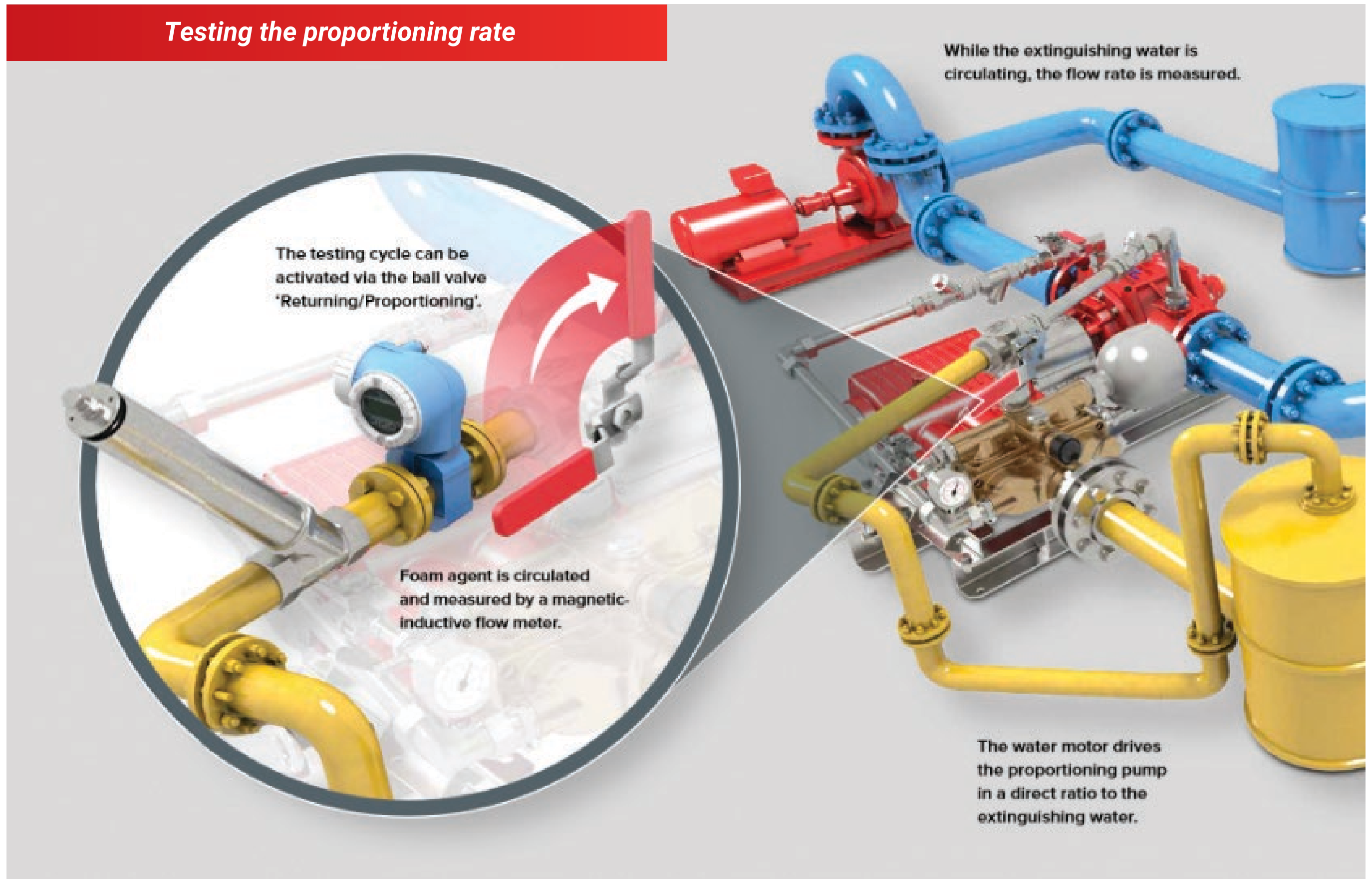
Different proportioning methods have different characteristics regarding the proportioning rate. In addition, sometimes their operation is affected by the foam type.

Bladder and Eductor proportioning

A bladder tank is pumped via the firewater pressure on a bladder and squeezed into the pipework and eventually to the Eductor before the discharge device (pourer, monitor, sprinklers). A system is designed to suit a constant viscosity, flow ranges are reduced when the fluid being pumped has a higher viscosity. The pressure loss also increases due to the effort required to educt or suck the foam concentrate into the water stream. This fact applies to any system using an eductor method of proportioning, such as a jet ratio controller, balanced pressure proportioner or wide range proportioner.



Curves show the difference between the FM-approved plunger pump technology used by FireDos in comparison to gear pumps



Gear pumps for foam pumping

Balanced pressure proportioners rely on the eductor principle with a pressurised flow of foam concentrate by a gear pump requiring an external drive (electric, diesel-driven or water-driven motor). However, with varying flow rates for differing fire scenarios and low viscosities, gear pumps have poor efficiencies, which translates into varying proportioning rates.

Water-driven variable flow proportioning pumps

FireDos, with their latest Gen III model, was designed after many years of real-life experience and using CFD techniques to optimise the pump head for high viscosity foam concentrates. Traditional thinking that piston pumps are for low viscosity and gear pumps are for high viscosity has been turned on its head. For accurate proportioning, high-efficiency pumps are required, which gear pumps cannot meet due to their susceptibility to different system pressures, flow ranges and varying viscosities. FireDos flow rate range has a ratio of 1:15 times (an FD8000 at 3% proportioning rate has an FM-approved flow rate range of 520 to 8 000lpm). An equivalent gear pump might have a flow rate range of two or three times, as shown in image 5.

The testament to this is the approval by the leading global fire protection authority, FM approvals. These approvals have been designed with water motor-driven foam pump proportioners specifically for variable viscosity foam proportioners with standardised conditions for approval.

The new pump design offers many advantages, not least:

- Low-pressure loss at specific system pressures. For a fire protection system designer, this offers the advantage of minimising the effect of the proportioning system on final discharge flows.
- A minimum flow threshold to achieve the proportioning rate
- A low NPSH requirement (in comparison to traditional off-the-shelf piston pumps).

The FM testing also includes many worst-case scenarios to simulate real-life applications, such as:

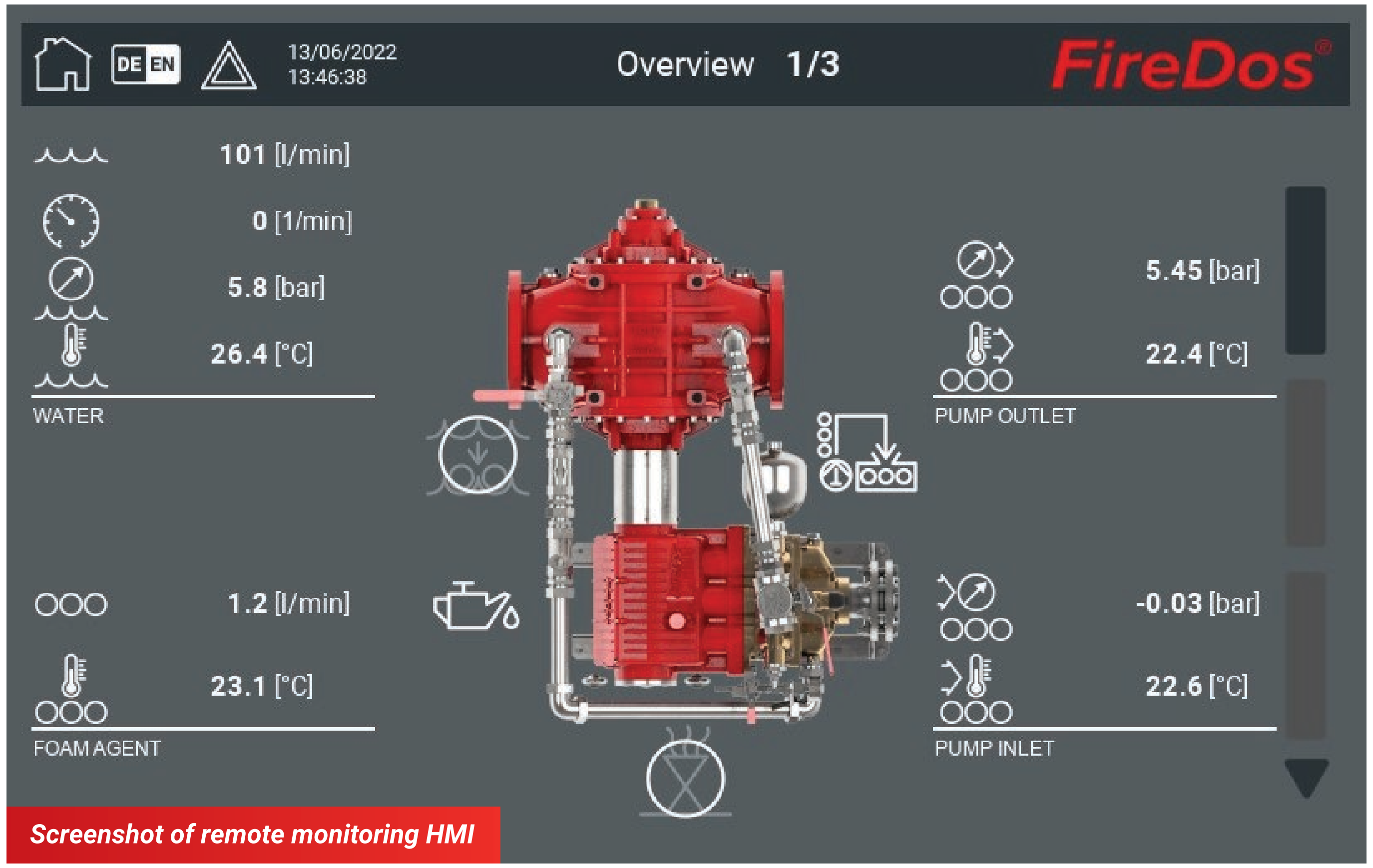
- Test points through the entire working range for testing viscous fluids, not only one point on a dynamic viscosity curve.
- Overload tests for pressure, flow and dry running
- Material compatibility tests, especially in saline environments

Testing the proportioning rate

An advantage of the FireDos proportion system is the ability to test the foam proportioning rate. As fire fighting foam concentrate becomes more complex, especially with SFFF, the cost rises. The NFPA and FM recommend annual foam proportioning rate testing. FireDos achieves this by measuring the flow rate of a foam concentrate return line to the foam storage tank and the water motor flow to calculate the precise proportioning rate.

The future is now: remote monitoring

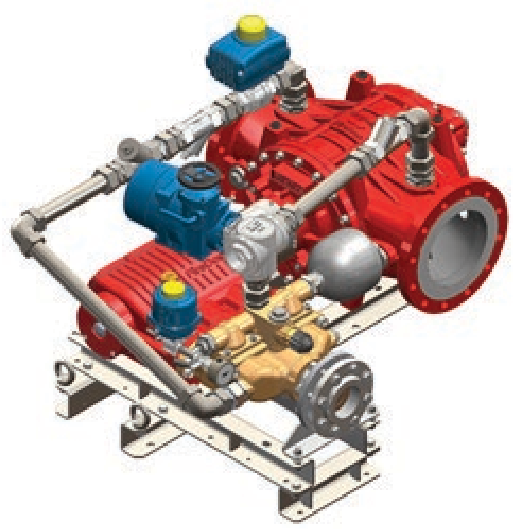
Monitoring fire protection systems in testing and readiness mode provides instant feedback without needing many remote and semi-skilled or qualified fire protection engineers. The system can be operated on-site with instructions provided remotely, providing



Screenshot of remote monitoring HMI

instant feedback and the creation of electronically created schedule maintenance logs. In addition, various data points are captured, such as flow rate, proportioning rate, oil fill level and temperature, ensuring at any time during service the FireDos proportioning system is always in a state of readiness.

A natural development of remote measurement, which relies on an operator to be present to turn the valves for testing and return to operational readiness, is the ability to perform an unmanned test. As the FireDos proportioner needs no external energy, adding actuators to the water


FireDos fitted with remotely operated valve actuators for operation and testing

motor doesn't require the start-up of any additional equipment, such as the fire pumps. Additional actuators are added to the two-way ball valve for proportioning/return.

All this information can be managed and viewed from a remote terminal or signals embedded into the end-users computerised maintenance management system.

A low-cost system
Considering fire protection systems are often legally required, the cost is considered an expense. However, the simplicity of a FireDos system, with very few system components, means the capital expenditure cost within an overall fire protection system is less expensive than many systems where redundancy must be designed in (electric motor-driven foam pumps, plus additional backup diesel engines).

The operational cost is also low, considering ongoing annual foam testing costs are one of the highest ongoing expenses. The FireDos' proportioning system's ability to test the foam and recirculate the concentrate back to the foam tank without discharging means the payback versus a lower-cost system which must discharge foam is regularly within two years.

What does this mean in practice: For the avoidance of doubt when specifying a precise foam proportioning system combined with almost any foam concentrate, the future of foam fire fighting systems, independently type-tested and approved, are available now from FireDos.

For more information please contact DoseTech Fire's Mike Feldon at email: mgf@dosetech.co.za or visit their website www.dosetech.co.za

Industrial Fire's compressed air foam system (CAFS) wildland interface pumper

As we have recently witnessed, the wildland fires are growing in veracity and in number, year-on-year. These wildland fires are proving to be a high-level risk and threat in the wildland/rural; wildland/mining; wildland/suburban interface. The mitigation of these interface fires requires specialised and effective firefighting vehicles.

In this regard, Industrial Fire and Hazard Control has recently launched the CAFS Wildland Interface Pumper that is highly mobile and versatile to mitigate the most extreme interface fires.

The CAFS Wildland Interface Pumper is based on a 4x4 chassis offering exceptional off-road capability to ensure that the unit arrives at the incident safely and in the least possible time. Firefighting is all about time management and the design of the CAFS Wildland Interface Pumper takes this factor into consideration for all aspects of the operational application.

The inclusion of CAFS offers the following advantages:

Increased fire suppression efficiency
CAFS produces foam that has better heat-absorbing and penetrating properties compared to water alone. This results in more efficient fire suppression, as the foam can quickly smother flames and cool down hot surfaces, leading to faster extinguishment.

Enhanced firefighter safety
The foam produced by CAFS creates a barrier between firefighters and the fire, reducing the heat and radiant energy they are exposed to. This enhanced safety margin allows firefighters to get closer to the fire for more effective firefighting without compromising their safety.

Reduced water usage
CAFS uses less water than traditional firefighting methods. The foam's expansion properties allow it to cover a larger surface area with less water, making it especially valuable in situations where water supply might be limited.

Improved penetration
Foam generated by CAFS has better penetration capabilities, enabling it to reach hidden fire sources within materials like wood, fabrics and insulation. This helps ensure that fires are fully extinguished and reduces the risk of rekindling.

Ember and heat control
CAFS is effective in suppressing embers and controlling heat, making it useful in mitigating spot fires, preventing flare-ups and reducing the potential for fires to spread.

Versatility
CAFS can be used for various types

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of fires, including structural, wildland and vehicle fires.

Effective for Class A and Class B fires
CAFS is suitable for both Class A (ordinary combustibles) and Class B (flammable liquids and gasses) fires. This versatility allows firefighters to address different fire types with the same system.

Reduced water damage
The foam produced by CAFS clings to surfaces and creates a barrier that prevents excessive water runoff. This helps reduce water damage to structures and contents, which is especially important in situations where property preservation is a concern.

Increased knockdown power
CAFS provides quicker knockdown of fires due to its expanded foam's ability to encapsulate and smother flames. This can lead to faster control of fire situations, minimising property damage.

Supports eco-friendly practices
The reduced water usage of CAFS can help conserve water resources.

The CAFS Wildland Interface Pumper features the following firefighting capabilities:

- Electric operated Elkhart SideWinder EXM2 deck gun operated by means of a joystick from the cab as well as a handheld remote control for operation up to 30m away from the vehicle
- Electric operated Elkhart BrushHawk bumper turret operated from a joystick in the cab
- Darley HM500 PTO driven pump
- Darley Hornet CAFS system
- Front mounted electric winch
- HyperSight thermal camera mounted on the bumper turret with monitor in cab
- Front spray bar, cab spray bar and undertruck nozzles
- Side pump control panel
- Trident Foamate #1.5 around-the-pump foam system
- Dual electric rewind hose reels
- 38mm CAFS crosslay
- 5 000 litre all polypropylene water tank
- 250 litres Class A foam tank (Silvex Class A)
- 250 litres Class B foam tank (Hydral 3C AFFF)
- Heavy duty aluminium extruded body
- Three compartments each side
- Slide-out and drop-down steps for access to the compartments
- Electric foam transfer pump for rapid refilling of the foam tanks

For more information on Industrial Fire's CAFS Wildland Interface Pumper, please do not hesitate to reach out to:
Abrie Dempers: cell 078 159 4845 or email: abrie@industrialfire.co.za
Lee Marques: cell: 061 225 2710 or email: lee@industrialfire.co.za
Zarto Williams: cell: 061 158 6941 or email: zarto@industrialfire.co.za
Trevor Fiford: cell: 082 651 2580 or email: trevor@industrialfire.co.za

CAFS Wildland Interface Pumper

The CAFS Wildland Interface Pumper is a highly effective pumper for the mitigation of a range of fires over varied industries.

The CAFS WIP is engineered and manufactured to assist firefighters in extinguishing Class A and Class B fires in everyday or remote locations.

The versatility of the CAFS WIP is founded in the application of Compressed Air Foam Systems as well as a traditional PTO driven side mounted pump.

These two pumping methodologies can be applied simultaneously in a fire attack or individually selected depending on the incident.

The 4x4 capability of the chassis cab allows the CAFS WIP to navigate extreme conditions.

For further information please reach out to:
Trevor Fiford Cell: 082 651 2580 or email: trevor@industrialfire.co.za
Abrie Dempers Cell: 078 159 4845 or email: abrie@industrialfire.co.za
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Zarto Williams Cell: 061 158 6941 or email: zarto@industrialfire.co.za

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Walking the dog – preparing for the 'Big One': Firefighting considerations when responding to major fire incidents

By Colin Deiner, chief director, disaster management and fire brigade services, Western Cape Government

Managing large-scale incidents requires effective incident command systems and clear communication among responding units, agencies and jurisdictions

"Make pumps many." This term from a previous era of our fire services conjures up vivid memories among older firefighters and officers of the radio call, usually the first arriving unit on a major incident that required a larger-than-normal response. Every firefighter who has spent more than a few years in this job will recall 'the big one'.

Major structural fires have become more prevalent in recent years and the need to effectively plan for such incidents and focus on the specifics of escalating resources has become an integral part of any fire department.

So, what would the 'Big One' be? Major incidents involving structural fires are typically categorised based on their scale, impact and complexity. Let's also appreciate that what could be regarded as a major fire in one jurisdiction might not be the same for a larger service. Much depends on the availability of resources, specialist skills, water supply and various other factors.

The general types of structural fires that could be classified as major incidents should include:

Multiple-alarm fires
These are fires that require the response of multiple firefighting units and resources due to their size, spread and potential for causing significant damage.

High-rise fires
Fires in high-rise buildings present unique challenges due to the height of the building, the potential for rapid fire spread and the need for effective evacuation and rescue operations.

Industrial fires
Fires in industrial complexes, factories, warehouses or chemical plants can be major incidents due to the hazardous materials involved, the potential for explosions and the complexities of managing such incidents.

Wildland-urban interface fires
These are fires that occur at the interface between wildland areas and urban or suburban developments. They can quickly escalate due to the proximity to flammable vegetation and the challenge of protecting both natural and built environments.

Tunnel or underground structure fires
Fires in tunnels, subway systems or underground facilities can be major incidents due to limited access, the potential for smoke spread and difficulties in evacuating and accessing the fire.

Structural collapse incidents
When a structural fire leads to the collapse of a building or part of a building, it becomes a major incident due to the potential for multiple casualties, the need for search and rescue operations and the complex logistics of managing the scene.

Historic or iconic buildings
Fires in historic or iconic structures often require special attention due to their cultural and historical significance, as well as the challenges posed by their construction materials and layouts.

Hospital or healthcare facility fires
Fires in hospitals or other healthcare facilities can be major incidents due to the vulnerability of patients, the need for safe evacuation and the importance of maintaining critical medical services.

Residential fires in dense urban areas
Fires in densely populated urban areas can become major incidents due to the potential for rapid fire spread, evacuation challenges and the need for coordinated response from multiple agencies.

Multi-structure fires
Fires that involve multiple buildings or structures, such as apartment complexes, townhouses or connected commercial buildings, can be major incidents due to the difficulties in containing the fire and protecting nearby structures.

School or educational institution fires
Fires in schools or other educational institutions can be major incidents when they threaten the safety of students, staff and surrounding neighbourhoods.

The common denominators
Each of the above examples will have its own unique planning priorities and challenges. Wildland-urban interface fires will require the deployment of units over a large area and have multiple command zones, while hospital or healthcare facility fires might require complex evacuation procedures.

Each of these incidents must, therefore, be planned for individually, taking these priorities into account. However, there are a number of elements that most major incidents will share among responding services. These elements often play a significant role in shaping the challenges and response strategies during such incidents:

Major fires and incidents can have a profound impact on the affected community

Scale and intensity
Major fire incidents are characterised by their size and intensity. These fires tend to cover a significant area and involve substantial fuel loads, leading to rapid and expansive fire growth.

Resource intensity
The magnitude of major fires often requires a large number of firefighting resources, including personnel, equipment, apparatus and specialised teams. Mutual aid and coordination with neighbouring agencies may be necessary to meet the resource demands.

Potential for fire spread
Major fires have the potential to spread quickly due to factors such as wind, building construction and available fuels. This rapid spread can challenge firefighting efforts and evacuation operations.

Structural stability hazards
The involvement of structures in major fire incidents presents added complexities. High-rise buildings, industrial facilities and other complex structures require specialised tactics for firefighting, search and rescue and evacuation.

Safety and evacuation considerations
Protecting the safety of occupants and emergency responders is a top priority in major fire incidents. Evacuation plans, traffic management and crowd control become crucial elements of the response.

Incident command
Managing large-scale incidents requires effective incident command systems and clear communication among responding units, agencies and jurisdictions. Coordination is essential to avoid confusion and ensure efficient resource deployment.

Logistics
Major fire incidents demand logistical support to ensure that responders have access to food, water, rest areas and equipment maintenance. Establishing staging areas and rehabilitation stations is important for sustaining firefighting efforts.

Media and social media
Major fires often attract significant media coverage and public attention. Fire departments must provide accurate and timely information to the media and public to manage expectations and prevent misinformation. They must also have the capacity to post updated information on identified social media platforms to ensure that they stay ahead of the potentially damaging and hazardous fake news that will be posted by sensation-seeking individuals.

Mutual aid
Collaboration with neighbouring fire ▸


Wildland urban interface fires can quickly escalate due to the proximity to flammable vegetation

departments, emergency services, law enforcement and other agencies becomes essential in major incidents to pool resources, share expertise and manage the incident effectively.

Incident duration
Major fire incidents can extend over extended periods due to the complexities of fire suppression, overhaul, investigation and recovery efforts. Maintaining operational readiness and personnel well-being throughout the incident is critical.

Fire cause investigation
Determining the cause and origin of major fires is important for insurance claims, legal purposes and prevention efforts. Fire investigators may be involved in gathering evidence.

Impact on surrounding community
Major fires can have a profound impact on the affected community, including the displacement of residents, economic losses and emotional distress.

Environmental impact
Depending on the location and materials involved, major fires can result in environmental contamination, air quality issues and ecological damage.

Recovery and rehabilitation
After the fire is contained, recovery efforts include supporting affected individuals and businesses, facilitating insurance claims and rebuilding damaged areas.

Debriefings
Major incidents provide opportunities for learning and improvement. After the incident, fire departments should conduct thorough debriefings and incorporate lessons learned into future training and pre-planning.

Planning for the 'Big One'
As mentioned earlier, all incidents will have their specific risks and will, therefore, require specific planning. The common denominators, however, will form the basis of your department's standard operating procedures (SOPs) and each one should be considered individually. Pre-planning is essential for fire services to effectively respond to major incidents, including large-scale structural fires. By establishing comprehensive plans and strategies in advance, fire services can improve their readiness, coordination and response capabilities.

Start by conducting a thorough assessment of your response area to identify potential hazards, including high-risk buildings, industrial facilities, hazardous material storage sites and areas prone to wildfires and the wildland/urban interface. Understand the unique challenges these hazards present and develop strategies to address them.

In a recent previous article, I have spoken at length about mutual aid agreements. Mutual aid agreements with neighbouring fire services and other emergency response agencies must define protocols for requesting and providing assistance during major incidents that overwhelm local resources. It is important that such an agreement includes the types and number of resources available at each participating service and what the requesting service can expect when it calls for assistance.

Typing of resources is a very effective system that we have used in the Western Cape Province for many years now. If you are calling for pumpers to provide a certain volume of pumping capacity, that's what you want to see turning up.

I recall being involved in the pre-planning team for a major international airport emergency response plan. We presented our plan to the fire chiefs in the region and stressed the importance of identifying the vehicles and equipment that would be pertinent to a wide-body aircraft incident and ensuring that only those units responded. One of the chiefs in the group wasn't so enamoured with the idea and said that "everybody should send everything they have". I suppose the feeling was that we shouldn't hold back on help and that we should do all we can to save as many lives as possible. If you are dealing with an air crash, you need an air crash tender. The incident commander will have a specific plan and that plan requires specific resources.

This brings me to incident command. Ensure that personnel are trained in the Incident Command System (ICS) used by the departments within your mutual aid system and understand their roles and responsibilities within the system. Your ICS will provide a standardised framework for managing incidents of all sizes and complexities and must be scalable to allow the first-in incident commander to escalate command when necessary. Reliable communication systems and protocols to ensure effective communication among responding units, incident command, mutual aid partners and other relevant agencies must also be agreed upon and implemented throughout all potential responding services. This includes both radio and digital communication systems.

In the event that you do have special risks, such as petrochemical tank farms that will require an automatic activation of your mutual aid agreement, ensure that the assisting service has sufficient information about the risk and copies of the pre-plans. This should include command post locations, the availability of water sources for firefighting operations in different areas, hydrant locations, water storage tanks and the need for alternative water supply methods.

Responding to the 'Big One'
Your Pre-determined Attendance (PDA) section of your SOP will dictate which resources must respond as part of the initial turnout. Depending on the risk, it should also determine the support services (police, EMS, environmental) that must respond.

As fire services, we tend to be rather good at training and exercising among ourselves but seldom do we include our local law enforcement and other services in our planning. Law enforcement agencies working directly with the fire service of a particular jurisdiction must have an 'Emergency Services Support Plan', which should outline their roles and responsibilities during major incidents. These responsibilities will include:
Incident security: Establishing a perimeter to secure the incident scene and protect responders.
Crowd and traffic control: Managing crowd movement, traffic flow and access to the incident area.
Evacuation assistance: Assisting with evacuations, particularly in law enforcement-sensitive situations.
Scene preservation: Preventing tampering, looting and unauthorised access to the incident scene.
Public information: Providing updates to the public and media regarding safety and security measures (road closures, alternative routes, etc).

Evacuation will always be a difficult task and you must appreciate that most people needing to be evacuated (especially members of the public) will have no prior experience of evacuation and there will probably be a great deal of confusion as to where to go and what to do. Evacuation can't be an afterthought and should be part of your initial actions. Obviously, it will be a lot easier and better organised if the incident occurs in a commercial or industrial complex where people are required to practice evacuation procedures periodically. Develop evacuation plans for different types of incidents, considering factors such as safe evacuation routes, transportation needs and coordination with law enforcement and other agencies.

Staging resources at a major fire is a critical aspect of firefighting operations. Staging involves strategically positioning firefighting personnel, equipment and other resources in a designated area near the incident site. This helps to efficiently manage and coordinate the firefighting efforts while ensuring the safety of responders.

High-rise fires present unique challenges due to the height of the building, the potential for rapid fire spread and the need for effective evacuation and rescue operations


Industrial fires can be major incidents due to the hazardous materials involved, the potential for explosions and the complexities of managing such incidents

Staging is divided into specific types: primary staging and secondary staging.

Primary staging is the initial phase of deployment during an incident. It involves positioning resources in a designated staging area that is strategically located relative to the incident site. The primary staging area is typically closer to the incident than the secondary staging area. Resources staged in the primary staging area are ready for immediate deployment to address the initial needs of the incident. This phase focuses on quickly containing the incident and preventing further escalation. The resources staged in the primary area often include first responders, initial attack firefighting crews and other essential personnel. These resources can engage in initial firefighting efforts, evacuation and other critical tasks. Because the situation is rapidly evolving in the early stages of an incident, primary staging resources need to be adaptable and capable of responding to changing conditions.

Secondary staging is the subsequent phase of resource management that occurs as the incident progresses and requires a more sustained and organised approach. It involves establishing a larger, more comprehensive staging area farther from the incident site. Secondary staging allows for better organisation of resources, personnel and equipment. It's a more controlled environment where resources can be assigned specific tasks, rotated and provided with necessary support. Resources in secondary staging might include specialised teams, additional equipment and personnel for long-term operations. These resources can support tasks like building containment lines, providing medical support or managing logistics.

Before staging resources, establish a command post where incident commanders and other key personnel can gather to manage the firefighting operation. This post serves as the central hub for communication, decision-making and resource coordination.

Initial actions must include evaluating the fire's size, behaviour, potential for spread and the required resources based on these factors. Develop an incident action plan that outlines the overall strategy and objectives for the firefighting operation and identifying suitable staging areas that are strategically located in relation to the incident site. These areas should have good access to the fireground, provide a safe distance from the fire and allow for the efficient deployment of resources.

Having a pre-determined resource grouping policy written into your mutual aid agreement will allow you to divide resources into specific groups based on their functions. Common groupings include engines, water tenders, hand crews, aircraft, medical teams and specialised equipment. This grouping ensures that resources are readily available for deployment as needed.

Safety will always be paramount. Ensure that staging areas are located upwind and uphill from the incident to minimise the risk of rapid fire spread and smoke inhalation. Personnel should also be briefed on safety protocols and specific risks they should look out for in their specific zone before being deployed. To help maintain an accurate account of available resources and ensure that personnel are not unaccounted for during firefighting operations, a system for tracking resources entering and leaving the staging areas must be implemented. Not only will this provide an account of available resources but it could also ensure that all personnel are accounted for.

Logistics management during a major incident is crucial. Consider implementing a rotation and rehabilitation schedule for personnel. Firefighters need rest, hydration and medical evaluation during extended operations. If operations are going to continue over an extended period of time, ensure that sufficient lighting is made available, which will support safe activities during hours of darkness.

Finally, we must always appreciate that firefighting operations are dynamic and can change rapidly. Plans may need to be adjusted based on shifts in fire behaviour, resource availability or changing weather conditions.

In closing

Despite the many challenges and risks that will present, the single most important factor for an incident commander to consider during a major incident is safety, both the safety of responders and the safety of the public.

The ultimate goal of any incident response is to mitigate the impact of the incident while ensuring the well-being of everyone involved. This includes firefighters, emergency personnel, affected communities and even the incident commander themselves.

Be safe.

Industrial firefighting for on-site responders

Industrial firefighting refers to the reactive measures and actions taken to contain, control and extinguish fires within the premises of manufacturing, engineering and fabrication, collecting, processing, storing, refining and mining organisations. Industry includes any organisation where a group of people come together and utilise machines and equipment to do work, for example at port terminals, airports, freight rail facilities, warehouses and printing presses. Furthermore, premises may include occupancies within industrial parks, factories, collection points, plants which generate electricity or process minerals or chemicals.

The variety, types and size of fire incidents that occur within industry are as varied and complex as the array of industries in existence. Fire suppression actions, especially first line immediate responses, are more often than not performed by employees who volunteer to be trained to an appropriate level and are appointed by the employer to fulfil certain expectations in terms of responding to those fires.

Firefighting in workplaces is part and parcel of managing fire risk. The risk of fire and explosions is common to all industries. There are few incidents which pose a risk to life and the workplace and impact on business continuity as profoundly as fires and explosions do. The risk of fire demands both pro-active and re-active measures to be planned and conducted by trained personnel.

So where does one begin when putting firefighting response strategy together within an industrial setting? It is important to understand that emergency response and more specifically firefighting, fits into a larger strategy of emergency management namely:

1. Risk assessment and vulnerability studies
2. Prevention measures
3. Emergency planning and preparedness
4. Emergency response
5. Recovery and business continuity

It is incumbent on employers to assess risk and put control measures in place to prevent and mitigate the effects of those risks. Fire risk assessment is crucial in high hazard industries and where there is extensive risk of fires, flash fires and explosions. Based upon these risk assessments, a process of prevention measures and activities must be established. Emergency planning and preparedness is key and the size of the organisation as well as the hazards found within the organisation, will determine the complexity of the emergency planning and preparedness strategies.

SANS 1514:2018 Ed 1, Major hazard installation: emergency response planning addresses emergency planning for major hazard installations but may also be seen as a useful guideline for ordinary installations. Response strategies contained in the emergency plan should provide guidance on how fires are tackled safely by containing fire response plans. Response plans may be as uncomplicated as equipping trained and appointed fire fighters to extinguish small fires when it is safe to do so. An EP organogram is used to identify the role players in emergency preparedness and response and would, for example, indicate the number of employees trained and appointed as basic firefighters (incipient stage firefighters).

Typically, the capabilities of personnel trained in basic firefighting, extend to extinguishing small fires with portable fire extinguishers and small water hand lines (hose reels) without the need to wear special personal protective equipment other than workplace PPE. Firefighters trained to a basic level, would not be expected to venture into smoke filled areas or to crawl in the process of approaching or extinguishing fires.

More advanced, and more formalised firefighting teams are sometimes created to fight larger fires with larger amounts of water, large diameter hose lines and possibly firefighting foam. It is important for risk managers to impose limitations on what on-site firefighters will respond to and how they will respond. The limits to the response of some firefighting teams may be confined to defensive firefighting and the cooling of exposed structures or exterior-only attacks. Specialised PPE may be required to perform these firefighting duties safely.

An organisation that is largely independent of the services of municipal fire brigades is most likely to follow a path of advanced training and providing specialised equipment for its firefighting teams to perform interventions, including interior interventions with recognised firefighting PPE and self-contained breathing apparatus (SCBAs). Such advanced levels of response require well established and well-planned methods of incident management, including incident action plans, procedures and operational guidelines.

Multi-disciplined on-site responders referred to as Emergency Response Teams (ERT's) may be developed as a specialist part of the EP structure to provide the organisation not only with firefighting capabilities, but also rescue, hazardous materials and medical capabilities, at least until off-site responders such as municipal services or specialised hazmat clean up teams are able to assist.

In large organisations, with highly developed strategies, fire risk management standards and directives are often written to form a comprehensive administrative system. These seek to provide more organisation specific policies, structures, procedures and other administrative controls. These standards and directives help to ensure the safety of firefighting personnel and efficiency and effectiveness of emergency response management. In larger, higher risk industries, response plans may become far more complex, involving more stringent selection of firefighting personnel, more specialised training regimes, greater numbers of specialised equipment and a documented administration system holding all of these components together.

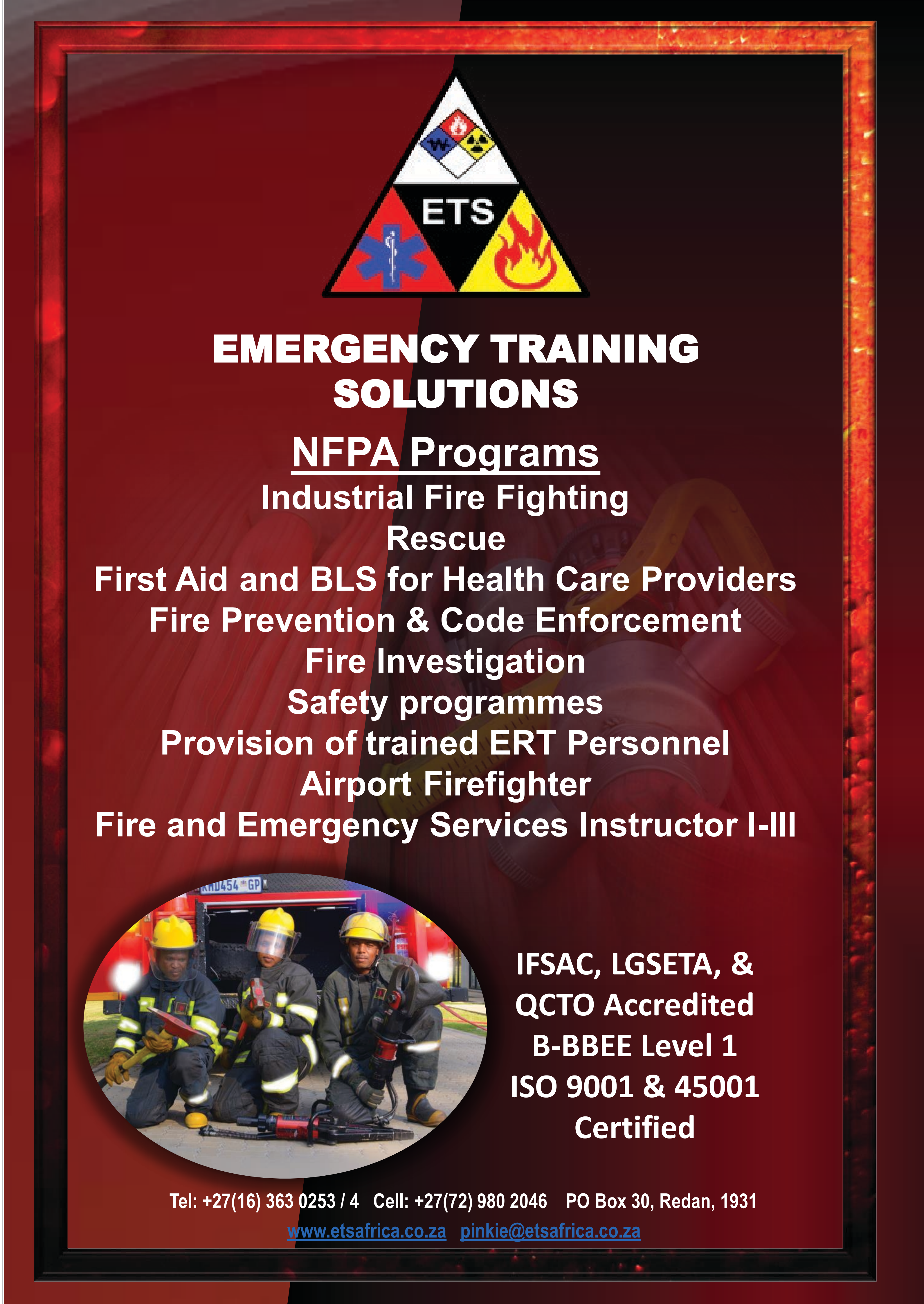
The response to emergencies outside the boundaries of the organisation may also be addressed in company standards and procedures. Such documented preparations are crucial when neighbouring communities are a factor. More examples of elements of a good administration system include; a written commitment by management in the form of policies or a firefighting organisational statement. The identification of high-risk fire 'hot spots' as identified in fire risk assessments, pre-incident plans containing strategies and tactics, identification of special hazards, action plans, standard operating procedures (SOPs), suggested operating guidelines (SOGs) and site maps, serve both on-site and off-site responders well, both in terms of preparation and in the course of firefighting operations.

NFPA 600 Standard for Facility Fire Brigades and NFPA 1600 Standard for Crisis and Emergency Management, are valuable guidelines.

Training and education

It is advisable that a training program for fire team members be developed and maintained as part of the organisations administrative systems. Fire team members should receive training to establish minimum levels of proficiency as well as to safely deal with site hazards specifically encountered during firefighting operations.

Most volunteer or outsourced industrial fire teams are well equipped, possess very good plant and premises knowledge, and very often have access to abundant water supplies. These aspects count towards successful responses. Challenges experienced by on-site industrial fire teams may result because they seldom respond to any emergencies, let alone fires. The potential thus for inefficiency and hazardous conditions arising at an incident due to a lack of experience is real, and therefore realistic training and drills, repeated periodically, is essential.



In terms of international recognition, ETS is proud to be the first South African training entity to gain International Fire Services Accreditation Congress (IFSAC) accreditation for multiple programmes.

"The certification and accreditation of ETS is a validation of our commitment to provide quality services to our clients that will meet and exceed their expectation. We are able to provide services consistently and reliably to national and international standards", said ETS director John Akal.

The IFSAC Quality assurance standards allow ETS to fill a long outstanding gap in the certification of South African fire fighters, who will be able to be certified for the National SAQA registered qualification as well as the associated and aligned NFPA standards.

Pictured in this article is Jurassic Park at the premises of ETS Emergency Training Solutions. Jurassic Park, affectionately so named because of the firefighting props (Dinosaurs) within its walls, is a simulated industrial environment which realistically represents various parts of an industrial plant. These include transformer fires, bulk fuel storage fires and boilers and pressure vessels involved in fire. The principles of "surround and drown" fire attack, flame bending and valve isolation attack groups and firefighting with foam can all be addressed in Jurassic Park.

The training is intense and realistic and seeks to maximise the exposure that students get while wearing full PPE in a simulated industrial firefighting interior attack. At the same time, the training aims to minimise the period of time that students are away from their workplace. Jurassic Park drills form part of the outcomes of the one-week Industrial Firefighting Advanced Level where students must work in teams to suppress various fires. We utilise Jurassic Park to meet the outcomes in NFPA 1001 Fire Fighter 1 and 2 successfully.

Drills

The test of an organisation's efficient response to incidents, including firefighting response, is its ability to protect its patrons and employees, its assets, the environment and in some cases, the ever-encroaching surrounding communities. Full and rapid recovery in terms of business continuity is directly related to the organisation's effectiveness of response. Naturally, an organisation cannot wait for a fire incident to take place in order to test the effectiveness of its response and therefore realistic, simulated incident scenarios are posed in order to assess an organisations emergency preparedness. Fire team drills should be conducted periodically to measure the teams' abilities against performance standards. These drill simulations should be representative of the conditions encountered at an actual fire. NFPA 600 recommends that drills be reviewed at least annually in order to establish training needs, equipment needs and the general effectiveness of the firefighting team.

ETS Emergency Training Solutions: The first South African training entity to gain IFSAC accreditation

ETS Emergency Training Solutions is located in the South of Gauteng between Meyerton and Vereeniging in a suburb called Redan. ETS has grown to over 90 personnel and offers at least 74 courses nationally and internationally. The six main offerings at ETS cover various qualifications and short programmes in fire fighting, rescue, hazardous materials, fire safety, first aid and occupational health and safety. These are managed from initial customer contact to certification by a proficient management team.

Commitment to quality and safety

ETS hold ISO 9001:2015 and ISO 45001:2018 certifications which demonstrates its commitment to the company's conduct in quality and safety administration.

The training centre has its origins way back in the 1980s when a portion of the old Klip Power Station's grounds were set aside for firefighting training and after extensive modernisation the training centre was officially inaugurated in 1990 by Eskom, the original owner.

The training centre was designed by forward-thinking individuals primarily to serve the interests of Eskom and satisfy the organisation's need to provide purpose-built facilities with realistic simulation areas to train its firefighters and rescue personnel. The design emphasis was on high-risk industrial occupancies, which included power plant hazards. This laid the foundation for expansion and the addition of improved simulation structures that apply not only to industrial fire fighters, but also to municipal and aircraft fire fighters. The early NFPA 1402 and 1403 influences can clearly be seen in the design of the training centre.

ETS is a registered Skills Development Provider and has a number of local accreditations, being registered with:

1. Primary Sector Education and Training Authority (SETA): Local Government SETA (LG SETA) LGRSv-EMsSR101117
   a. Qualification ID 57803: Further Education and Training Certificate: Fire and Rescue Operations
   b. Qualification ID 64390: National Certificate: Emergency Services Supervision: Fire and Rescue Operations
2. Quality Council for Trades and Occupation (QCTO) Assessment Centre QCTO/OQAC/17/00070 Occupational Certificate:
   a. Fire fighter SAQA ID 98991 NQF Level 4; Credits 149
3. Safety Health and Quality Practitioner SAQA ID 99714; Level 5; Credits 256
4. Department of Labour CI 663 for first aid
5. Resuscitation Council of South Africa
   a. Cardiopulmonary Resuscitation (CPR) for family and friends
   b. AHA courses
   c. Basic Life Support for Healthcare Providers

Conducting courses in the abovementioned fields is achieved by a team of experienced instructors, assessors and moderators ensuring quality training and assessment to the point of certification, not only in South Africa but throughout the continent of Africa and the Middle East.

The typical profile of the trainees ranges between:

- Employees seeking to fulfil their legal appointment obligations in the pursuit of compliance
- Private students seeking to make themselves more appealing in the job market
- On-site responders assisting organisations in emergency and crisis management
- Professional full time emergency services personnel in the municipal and metropolitan environment.

ETS commitment to B-BBEE

ETS is a Level 1 B-BBEE contributor and they assist many black individuals and businesses each year to overcome the legacies of the past. Being a Level 1 contributor means that client companies can claim 135 percent of their spend towards their own BEE scorecard.

Proud history

Thousands of students have received training not only at the training centre in Redan when it was affectionately known as KLIP but more recently in the past 18 years while under private ownership.

"Students do not only learn valuable life skills but they are also enabled to meet job performance requirements either as volunteers, on-site responders or full-time emergency services personnel. At ETS we provide an experience over and above the training component that results in team building, self-discovery, mind-broadening and healthy doses of adrenalin in many cases. At the turn of the century the training centre was the biggest facility of its kind in South Africa. (Mooivaal Media Pg 18 1999/2000 edition)", said ETS director, Dirk Moller.

Learnerships

"ETS is committed to facilitating learnerships and subsequent assistance to successful graduates in obtaining employment. We believe in the principle of newly qualified individuals having a reasonable expectation of finding employment when their studies are complete and so we constantly consult with employers. The learnerships are fully accredited with the Quality Council for Trades and Occupations and the LG SETA. ETS can assist organisations who are committed to supporting learnerships financially and we invite such organisations to discuss the various learnership opportunities and workplace experience exposure", added Moller.

ETS is staying relevant by continuously introducing self-study programmes, supported by instructors and an online preparation system. The online/self-study option is aimed at employed emergency response practitioners with workplace experience. Candidates have the opportunity to prepare and study at their own pace and select a date for assessment. IFSAC certification follows a process of in-person theoretical and skills assessments thereafter.

Provision of trained and managed emergency response teams

ETS also provides the services of qualified and experienced on-site emergency responders. "Our emergency response teams have worked at various sites in KZN, Mpumalanga and Gauteng, into Africa as far as Mauritania." said John Akal, "Clients should contact us if they require assistance integrating training programmes into their emergency planning and preparedness strategy."

Urban air mobility and eVTOLs: A game-changing solution for South African emergency services

By Jo Nieman

In the realm of emergency medical services (EMS), a ground-breaking transformation is on the horizon—one that could revolutionise how South African first responders mobilise and respond to emergencies. The key lies in the electric vertical takeoff and landing (eVTOL) industry and its constantly evolving technology, which holds immense promise for EMS operations.

While eVTOL technology might seem cutting-edge, its roots trace back centuries. Visionaries like Leonardo DaVinci, the Wright brothers, Sikorsky and many others paved the way for vertical lift aircraft. The concept gained momentum when Stanley Hiller, inspired by Charles H Zimmerman's work, pushed the boundaries in the 1950s with his VZ-1 Pawnee, a direct-lift rotor aircraft.

Today, advancements in lightweight materials, electric engines (as seen in Elon Musk's Tesla vehicles), and the proliferation of drones have set the stage for the development of manned eVTOLs.

eVTOLs, also known as personal aerial vehicles (PAV), play a crucial role in the larger urban air mobility (UAM) plan. The goals of this concept are clear: reduce traffic congestion, cut travel time, and provide an environmentally friendly and efficient mode of transportation. Unlike traditional aircraft, eVTOLs combine electric propulsion with vertical takeoff and landing capabilities, making them ideal for short-distance, point-to-point travel within cities.

South African emergency medical services face unique challenges due to the country's vast geography, remote locations, and limited resources. Integrating eVTOL technology could bring several benefits to the table. Faster response times, especially in challenging terrains, mean prompt medical care for those in need. The ability to navigate congested roads and reach emergency locations quickly could potentially save more lives.

Compared to traditional helicopters, eVTOLs are anticipated to be safer and more cost effective for emergency medical transportation. With reduced maintenance and fuel expenses, eVTOLs offer a sustainable option for EMS operations. Furthermore, their quiet operation and lower emissions contribute to a healthier environment for patients and medical professionals.

While eVTOLs show great promise, some limitations, like limited weight and patient capacity, need to be addressed. Until technology improves further, a hybrid system combining ground ambulances with eVTOLs will likely be the way forward.

To drive progress in the field, ongoing research and development in eVTOL technology and infrastructure are crucial. Collaborating with avionics suppliers, advancing battery technology, and integrating new propulsion systems can enhance eVTOL capabilities in emergency medical response.

Around the world, regions have already explored eVTOL integration in their EMS systems, providing valuable insights for South African emergency services. One notable collaboration between ADAC Luftrettung and Volocopter has shown significant advantages from technical, sustainable, and operational perspectives.

In South Africa, startups like Welkin Aero and Verti-Go Solutions are actively involved in applying eVTOL technology. Collaboration with organisations like ARFF South Africa supports the safety operations of eVTOL craft at airports and future vertiports, contributing to a comprehensive urban air mobility plan that has been well underway since early 2019.

Safety and value creation are top priorities in this endeavour. Thorough engineering designs and site selection processes, including adherence to NFPA and ARFF standards, ensure a robust and efficient eVTOL infrastructure.

Past consultation with the South African Civil Aviation Authority has demonstrated their excitement about the prospects of urban air mobility. Working closely with authorities ensures regulatory compliance and maximises the benefits of eVTOL technology in South Africa.

The integration of eVTOL technology holds immense potential for transforming emergency services in South Africa. With faster response times, cost efficiency and reduced emissions, eVTOLs offer a promising solution to overcome the challenges faced by the South African EMS system.

To move forward the technology will first have to advance whilst also jumping through obstacles such as safety and regulatory compliance to remain essential. Strategic partnerships and ongoing collaborations drive progress and foster growth in the region. Companies like Welkin Aero, Verti-Go in conjunction with organisations like ARFF South Africa play a vital role in shaping the future of urban air mobility, making emergency medical transportation more efficient, sustainable, and accessible.

Ultimately, the integration of eVTOL technology into South African emergency services represents a significant opportunity for progress in the future. Through careful planning, collaboration, and adherence to safety standards, South Africa could even lead the way in leveraging eVTOL technology for emergency medical services. By doing so, the nation can save lives, improve patient outcomes and build a safer and more resilient future.

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A machine learning-based solution could help firefighters circumvent deadly backdrafts

To learn how firefighters could anticipate deadly backdraft events in the field, NIST researchers conducted hundreds of fire experiments while taking a plethora of measurements. Many of these tests resulted in a backdraft, which caused fireballs to burst from the opening of a metal chamber. Credit: D Stewart/NIST

> *"The model offers a viable solution to make predictions based on particular measurements"*

A lack of oxygen can reduce even the most furious flame to smouldering ash. But when fresh air rushes in, say after a firefighter opens a window or door to a room, the blaze may be suddenly and violently resurrected. This explosive phenomenon, called backdraft, can be lethal and has been challenging for firefighters to anticipate.

Now, researchers at the National Institute of Standards and Technology (NIST) have hatched a plan for informing firefighters of what dangers lie behind closed doors. The team obtained data from hundreds of backdrafts in the lab to use as a basis for a model that can predict backdrafts. The results of a new study, described at the 2022 Suppression, Detection and Signaling Research and Applications Conference, suggest that the model offers a viable solution to make predictions based on particular measurements. In the future, the team seeks to implement the technology into small-scale devices that firefighters could deploy in the field to avoid or adapt to dangerous conditions.

Currently, firefighters look for visual indicators of a potential backdraft, including soot-stained windows, smoke puffing through small openings and the absence of flames. If the cues are present, they may vent the room by creating holes in its ceiling to reduce their risk. If not, they may charge right in. Ultimately, first responders must rely on their eyes in a hazy environment to guess the correct action. And guessing wrong could come at a steep cost.

"If you can take measurements at the scene and reliably know the likelihood of a backdraft, you can open a door without taking as much of a risk. Or you can be more confident that you need to cool down the compartment before entering, either by venting or hosing down the space through small openings," said NIST engineer Ryan Falkenstein-Smith.

At NIST's National Fire Research Laboratory, Falkenstein-Smith and colleagues conducted experiments where they lit a stream of gaseous fuel that poured into a small chamber and then sealed its door shut. In each case, the door remained closed for several minutes as the researchers continued to pump gas into the chamber and the fire burnt itself out by depleting its available oxygen.

Then, from a safe distance, they remotely sprung open the door. Some experiments were rather uneventful, with no hint of reignition. In others, fireballs, accompanied by pressure waves, erupted in the doorway, Falkenstein-Smith said.

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NIST researchers conducted hundreds of fire experiments to find out what conditions make a room ripe for backdraft and fed the data to a machine learning algorithm. The result was a backdraft-predicting computer model. The NIST's team plans to incorporate the model into handheld devices that firefighters could use to take simple measurements through small openings in a room.

Throughout nearly 500 experiments, in which the researchers altered factors such as the type and amount of gas injected into the chamber, they took measurements that ran the gamut. They recorded temperatures, pressures, the dimensions of the fireballs and more. To determine the abundance of the fuel in particular, they improved upon an instrument developed at NIST decades prior called a phi meter.

The meter sampled fuel and air gas mixtures from the chamber, added a known amount of oxygen and then combusted the sample internally, measuring the difference in oxygen before and after. The less oxygen consumed in the reaction, the greater the relative abundance of fuel in the mixture.

"We aimed to capture all these different components that create the conducive conditions for a backdraft," Falkenstein-Smith said.

The team analysed the measurements and picked up on certain trends. Fuel pouring into the chamber at higher rates coincided with a higher likelihood of backdrafts, for instance. To get more out of the data, the researchers also used a machine learning algorithm to establish a predictive backdraft model from their treasure trove of information.

As an initial trial for the model, they fed it readings of gas concentrations, fuel richness and temperature taken at a single location in the chamber before the door opened during their experiments. Based on that information alone, the model had to estimate the chance of a backdraft occurring.

Taking an estimate of above 50 percent as an affirmative prediction and below 50 percent as a negative, the model was correct in 70.8 percent of the experiments it was tested on. And the accuracy increased to 82.4 percent with the addition of measurements taken at a second location in the chamber.

The team is confident in its technique and aims to keep the ball rolling, improving the performance and practicality of the technology, Falkenstein-Smith said.

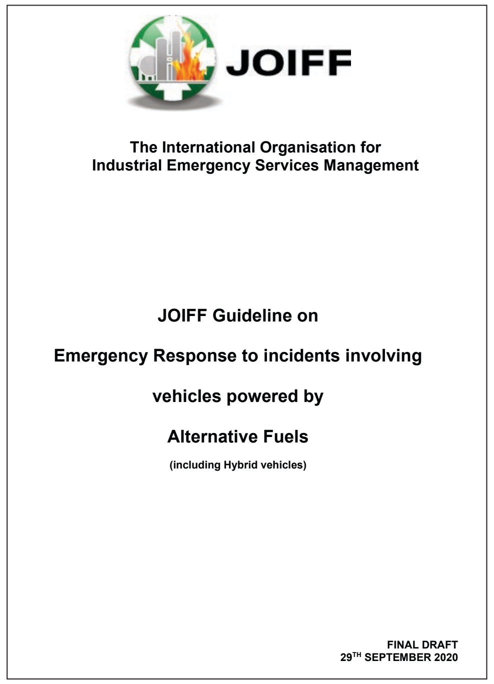
The next steps are to develop a portable device that houses the measurement technology they used in the lab as well as their computer model and then battle-test the technology in a more realistic building fire scenario.

The team envisions that firefighters using the handheld device would either probe the air of a room through existing openings, such as cracks around a door or create small openings.

With further development, the new approach could keep firefighters safe and make saving lives less of a risky business.

Published with special permission from the United States National Institute of Standards and Technology (NIST).

JOIFF Guideline on emergency response to incidents involving vehicles powered by alternative fuels, including hybrid vehicles


JOIFF

The International Organisation for Industrial Emergency Services Management

JOIFF Guideline on

Emergency Response to incidents involving

vehicles powered by

Alternative Fuels

(including Hybrid vehicles)

FINAL DRAFT
29TH SEPTEMBER 2020

JOIFF, the International Organisation for Industrial Emergency Services Management, through their shared learning committee, compiled this Guideline to assist emergency services in responding to incidents involving vehicles powered by alternative fuels including hybrid vehicles. JOIFF gave special permission to Fire and Rescue International to publish the Guideline in order to assist our emergency services in dealing with the challenges they face during these incidents.

Due to the length of the Guideline, it will be published in three sections, with this section including its first four sections.

Section 1: Foreword

JOIFF, the International Organisation for Industrial Emergency Services Management, is a not-for-profit organisation dedicated to developing the knowledge, skills and understanding of emergency services personnel by working to improve standards of safety and of the working environment in those sectors in which its members operate.

JOIFF's prime activity is Shared Learning aimed at driving inherent safety, continuous risk reduction and safe management of residual risk in industry. JOIFF Guidelines are an important part of JOIFF's Shared Learning philosophy, to increase the JOIFF Shared Learning knowledge base in line with new developments requiring different approaches to emergency response to assist its members to work to current levels of Good Industry Practice within their own sites and to ensure that emergency responders are well informed, competent and correctly equipped to deal with potential accidents/incidents to which they may be required to respond within their Area Emergency Response Plan.

This JOIFF Guideline has been developed to support those whose responsibility in their Area Emergency Response Plan includes dealing with incidents involving vehicles powered by alternative fuels. The number and types of vehicles using alternative fuels is growing rapidly leading to growth in the number of incidents, including fire, involving these vehicles. Good Industry Practice requires emergency services management which might be faced with having to provide emergency response to these incidents, to have a full understanding of the hazards and risks so that they can develop suitable standard operating procedures (sops)/standard operating guidelines (SOGs) and training materials and provide effective training for responders.

> *"Emergency responders dealing with incidents in alternative fuel vehicles need to carry out their own Hazard Identification and Risk Assessment exercises before they begin operations at each incident"*

JOIFF hopes that this Guideline will provide information and background detail necessary to enable emergency services management to identify the hazards, assess the risks and decide the action necessary to take in dealing with such incidents in their Response Area.

JOIFF recommends that those who may be required to respond to incidents involving vehicles powered by alternative fuels should ascertain if any local/national rules/regulations pertaining to vehicles powered by alternative fuels are in place in the country/region in which they operate. These may take precedence over any comments/recommendations in this Guideline.

The directors of JOIFF extend their thanks to the JOIFF Working Group of experts who developed this Guideline.

Section 2: Introduction

One of the major targets towards helping combat climate change today is the reduction or elimination

of the use of vehicles powered by petrol and diesel products and replacing them with vehicles referred to as "alternative fuel vehicles". Alternative fuel vehicles currently include vehicles powered by batteries (high voltage fuel cells), compressed natural gas (CNG), liquid natural gas (LNG), biofuels and hydrogen fuel cells, cylinders/tanks.

The use of alternative fuel vehicles of all types is a growing exponentially and includes not only passenger cars but also light and heavy commercial vehicles, busses, coaches, fire and rescue appliances, specialist vehicles etc. The increasing number and type of these vehicles will require emergency responders to be competent in dealing with vastly different hazards than those encountered at incidents involving petrol and diesel-powered vehicles.

This Guideline provides information on some of the hazards that responders may have to identify when they have to respond to an incident involving these vehicles and discusses some important response issues and techniques. Emergency responders dealing with incidents in alternative fuel vehicles need to carry out their own Hazard Identification and Risk Assessment exercises before they begin operations at each incident and act in accordance with their own standard operating procedures (sops)/standard operating guidelines (SOGs).

Section 3: Terms and definitions

For the purposes of this Guideline, the following terms and definitions apply.

3.1 Alternative fuels

Alternative fuels are fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. They include electricity, hydrogen, biofuels, natural gas compressed and liquefied and liquefied petroleum gas (LPG) and their possible simultaneous and combined use by means of, for instance, dual-fuel technology systems. (From EU Directive 2014/94/EU).

3.2 Battery

A primary battery is one that is not rechargeable, a secondary battery is one that can be re-charged. A battery is a combination of electrochemical cells which convert chemical energy into electrical energy to provide electricity to items such as electric motors. Secondary battery cells can be as small as the standard cell used to power torches etc. but unlike this type of cell, which is usually a primary battery and cannot be recharged; secondary cells used in vehicle batteries can be re-charged many times according to manufacturer's instructions.

A battery module is a battery assembly comprising a fixed number of cells put into a frame to protect the cells from external shocks, heat and vibration. A battery pack, which is the final shape of a battery system, is composed of modules and various control/protection systems including a battery management system, a cooling system etc.

One of the most popular electric cars internationally uses a battery pack encased in protective steel comprising four modules containing 1 000 cells each.

3.3 Electrolyte

An electrolyte is a compound which in a solution conducts electricity and is decomposed by it.

- The electrolytes of all batteries, primary, secondary and whether they are alkaline, lead acid or lithium ion etc. present the hazard of being corrosive and/or toxic.

3.4 Exothermic reaction

An exothermic reaction is a chemical reaction that releases energy through light or heat.

3.5 Hybrid vehicle

A hybrid vehicle is a vehicle with more than one method of propulsion. Each method can be powered or charged by another method or can be totally independent of the other method.

If one of the methods of propulsion in a hybrid vehicle is a battery system, a similar hazard is present as in a vehicle fully propelled by batteries. Subject to a risk assessment, recommended emergency response actions where a hybrid is involved may be as set out in this Guideline, primarily in Section 5: Operational response for fires/incidents involving electrically powered vehicles.

3.6 Stranded energy

Stranded energy is energy remaining in lithium ion (li-ion) cells after efforts to safely discharge the stored energy in damaged cells. Significant fire and shock hazards are presented by stranded energy as it is difficult to know when and how the batteries can be safely removed from their installation and then transported and disposed.

3.7 Thermal runaway

Thermal Runaway is an exothermic reaction that can occur in any battery. For the purposes of this Guideline, thermal runaway relates specifically to lithium ion (li-ion) batteries.

The anode breaks down to liberate methane and ethane gas, the electrolyte expands and evaporates, creating a vapour of flammable gases and as the temperature continues to rise, the energy stored in the battery is released, the cathode breaks down releasing oxygen and therefore provides all elements necessary for a fire.

The risk of thermal runaway begins at a temperature of around 60°C (140°F) and eventually temperatures can exceed 600°C (1112°F) as the battery becomes gaseous and a fire erupts. The time taken for a li-ion battery to go into thermal runaway is entirely dependent on the rate of heat absorption into the cell. When the increasing temperature nears 120°C (248°F), batteries may emit gas and/or rupture. If the threshold temperature near 120°C (248°F) is not crossed, the battery may smoulder and gas but may not ignite unless an external spark ignites the flammable gasses emitted from it.

The exothermic reaction in a cell can drag adjacent cells into a thermal runaway and may cause li-ion cells to ignite within a battery, hours or even days after an initial fire, crash or technical failure/production fault. The spread of thermal runaway to adjacent cells depends on a number of factors amongst which are the distance between cells, the presence of heat insulating material that may prevent spreading or the presence of means of active cooling, eg with a coolant etc. The amount of energy remaining in the battery when it is damaged can greatly affect the severity and duration of this reaction.

Thermal runaway can be stopped by deep cooling the battery pack or by immersing it in water – salt water is recommended (see clause 5.5.3). It can also be stopped by draining the battery of the energy causing the reaction but this is a very specialist task.

Section 4: Lithium batteries

The difference between primary lithium batteries - "non-rechargeable" or "disposable" - and secondary lithium batteries - "rechargeable" - is the form of the lithium that they contain. A primary lithium battery is a battery that has lithium metal or lithium compounds as the anode. Primary lithium batteries are also known as lithium metal batteries or "Li-Metal batteries."

A secondary lithium battery is a battery that contains lithium ions that move from the negative electrode to the positive electrode during discharge and back again when charging. Secondary lithium batteries are also known as lithium ion batteries or "li-ion" batteries.

Li-ion batteries offer excellent power and energy density; they have a large operating temperature range and are lightweight. Low voltage li-ion batteries are widely used in portable devices such as watches, mobile phones, computers etc.

High voltage li-ion batteries are used to power electric vehicles as they are much more flexible for use than the more traditional batteries like lead acid. It is usual that all of the constituent component battery cells in an electric vehicle are sealed within a pack as inter-connected subgroups in what are called pods/modules. The exterior of each pod/module is isolated from internal components and the pod/module is then installed in a rigid metal enclosure called a battery pack. A battery pack, even in a normally discharged condition is likely to contain substantial electrical charge and can cause injury or death if mishandled. This risk increases if the outer enclosure, pod/module enclosures and/or safety circuits have been compromised or have been significantly damaged.

Li-ion batteries require a good battery management system to protect circuits to prevent thermal runaway if stressed.

The next edition will feature Section 5: Operational response for fires/incidents involving electrically powered vehicles.

Visit the JOIFF web site for information on membership: www.joiff.com or watch their introductory video: https://www.youtube.com/watch?v=lkzpYzrSHf4.

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Ignite the future: embracing cutting-edge strategies for fire prevention

By Deon F Esau, community risk reduction specialist

A follow-up on Public Fire Safety Education into the 21st Century

In this article, I would like to express my heartfelt gratitude to my esteemed mentors, Ed Kirtley, head of Oklahoma State University Fire Services Training and Dr Rodney Eksteen of Charles Darwin University USA previous divisional chief of Johannesburg EMS and creator of all PIER divisions in South Africa his vision inspired a nation.

Their unwavering dedication to fire and life safety education has inspired me on my own journey to proactively intervene and save lives.

I am deeply grateful to Dr Rodney Eksteen for his guidance and support in embracing the realm of fire and life safety education. His dedication to advancing fire safety practices and his commitment to creating safer communities have propelled me forward in my journey. Dr Eksteen's insights into innovative approaches and cutting-edge technologies have broadened my perspective on the potential for pro-active intervention.

Introduction

In the realm of fire and injury prevention, we stand at a pivotal moment of opportunity and innovation. For the past 20 years, dedicated individuals like you, have tirelessly worked to enhance fire safety, saving lives and safeguarding communities.

As we embark on this journey of progress, we invite you to envision a future where fire safety education transcends conventional boundaries and reaches new heights. Together, let us explore the transformative power of embracing cutting-edge strategies that ignite the flames of change. Within our grasp lies the potential to revolutionize fire safety through the ever-expanding realm of social media.

Imagine connecting with a vast, diverse audience like never before, sharing fire safety messages that resonate deeply within their hearts. Through captivating content, we can captivate their attention and instil a profound sense of responsibility.

Together, we can forge a digital community united by a common purpose, to protect and empower, fuelling the collective commitment to fire safety. Yet, the realm of innovation does not stop there.

Visualise a world where fire safety education transcends the confines of traditional training. Step into a realm of virtual reality, where the boundaries between imagination and reality blur. With immersive simulations, we can transport individuals into the heart of fire incidents, empowering them to make life-saving decisions and practice emergency response techniques.

By engaging both their minds and their senses, we foster an emotional connection to fire safety, ensuring they are equipped to face any challenge with confidence and resilience. Picture a future where every home becomes a sanctuary, an intelligent fortress against the ravages of fire. Through the Internet of Things, smart homes become vigilant protectors, armed with smoke detectors, fire alarms and sprinkler systems that seamlessly communicate and respond. Our homes, once mere structures, become living entities that anticipate danger, alerting us in real-time to potential threats.

Together, we forge a partnership between technology and humanity, nurturing a sense of security that transcends bricks and mortar. Now, let us delve deeper into the heart of fire safety education, where learning becomes an adventure and knowledge is gamified.

Imagine the joy on a child's face as they embark on a quest to protect their virtual world from the flames of destruction. By transforming fire safety education into an immersive game, we ignite their curiosity, kindling a passion for learning that transcends the confines of traditional methods. Their journey becomes a personal crusade, as they carry the flames of knowledge back into their homes, enlightening their families and fostering a culture of safety.

Our mission extends beyond the realm of innovation alone. It is through partnerships and collaborations that we create a symphony of change.

Let us join hands with social media influencers, local celebrities and organisations deeply rooted in our communities. Together, we amplify our collective voice, resonating with hearts and minds far and wide. By standing united, we awaken a sense of collective responsibility, a call to action that reverberates within each person we touch. As we look ahead, we recognise the transformative potential of data analytics and predictive modelling.

The power to anticipate fire risks lies within our grasp, enabling us to allocate resources strategically and intervene before disaster strikes. By harnessing the insights gleaned from the vast ocean of data, we empower ourselves to be at the forefront of prevention, leaving no stone unturned in our pursuit of safety.

Finally, our journey is one of continuous learning, of seeking growth and knowledge. It is through the relentless pursuit of profession al development that we ignite the fires of change within ourselves. Let us embrace the thrill of discovery, never settling for complacency but instead embracing the cutting edge.

By expanding our horizons, we become beacons of inspiration, guiding others on the path to excellence. So, my fellow trailblazers, as we embark on this exhilarating journey, let us embrace the winds of change that carry us toward a brighter future. Together, we will inspire, educate and protect. The time is now and the possibilities are boundless. Are you ready to unleash the power of innovation and ignite a revolution in fire safety?

The power of social media: reaching a wider audience

In today's digital age, social media has emerged as a powerful tool in disseminating fire safety messages. By leveraging platforms like Facebook, Instagram and Twitter, we can extend our reach and engage with a broader audience. Sharing captivating content, such as interactive quizzes, infographics and educational videos, allows us to raise awareness and instil a sense of responsibility for fire safety.

Let us harness the potential of social media to amplify our impact and create a more fire-conscious society.

Immersive technologies: virtual reality and augmented reality

Virtual Reality (VR) and Augmented Reality (AR) have paved the way for innovative training methods in fire safety. By immersing individuals in realistic simulations, we can provide hands-on experiences of fire incidents and emergency response scenarios. This technology allows users to practice decision-making, evacuation procedures and the proper use of fire extinguishers. With VR and AR, we can enhance preparedness and equip individuals with life-saving skills in a safe and controlled environment.

Smart homes and Internet of Things (IoT): creating intelligent fire safety systems

Advancements in IoT and smart home integration offer tremendous potential for fire prevention. By connecting smoke detectors, fire alarms and sprinkler systems to the internet, we can achieve real-time notifications and alerts. Furthermore, IoT-enabled appliances and home automation systems can be programmed to mitigate fire risks, such as automatically shutting off stoves or electrical devices. Let us harness the power of smart technology to safeguard homes and prevent fire incidents.

Gamification: making fire safety engaging and fun

Gamifying fire safety education presents an exciting opportunity to educate and engage people, especially the younger generation. Through mobile apps and online games, we can create interactive experiences that educate users on fire prevention, safety measures and emergency response. By incorporating elements of competition, rewards and achievements, we can motivate individuals to actively participate in learning fire safety practices. Let us transform education into an enjoyable experience that leaves a lasting impact.

Collaborations and partnerships: amplifying our efforts

Strong collaborations with influencers, community partners, and local organisations can amplify our fire safety initiatives. By engaging social media influencers, celebrities and content creators, we can leverage their reach to spread fire safety awareness to a wider audience. Partnering with schools, businesses and community organizations allows us to conduct joint awareness campaigns, workshops and events. Together, we can build a network of support and foster a fire-safe environment.

Data analytics and predictive modelling: anticipating fire risks

Harnessing the power of data analytics and predictive modelling enables us to identify high-risk areas and predict potential fire incidents. By analysing historical data, fire incident patterns and demographic information, we can proactively target our fire prevention efforts. Let us develop early warning systems and pre-emptive measures in areas prone to fires, ensuring that our resources are efficiently allocated.

Continuous learning and professional development: staying ahead

To be at the forefront of fire and injury prevention, continuous training and professional development are paramount. It is essential to stay updated on the latest firefighting techniques, emerging technologies and best practices. Specialised courses, workshops, conferences and certifications provide opportunities for growth and knowledge sharing. Let us embrace a culture of continuous learning to adapt to the evolving challenges and drive innovation in fire safety.

Conclusion

As we reflect on the accomplishments of the past two decades, we must also look forward and embrace the potential of innovative strategies in fire and injury prevention. By harnessing the power of social media, immersive technologies, smart homes, gamification, collaborations, data analytics and continuous learning, we can ignite a new era of fire safety. Together, let us pioneer these advancements, enlighten others and pave the way for a safer future.

The Garden Route in flames: Chapter IX

Working towards a detailed five-year fire prevention plan

A book by Dr Neels de Ronde

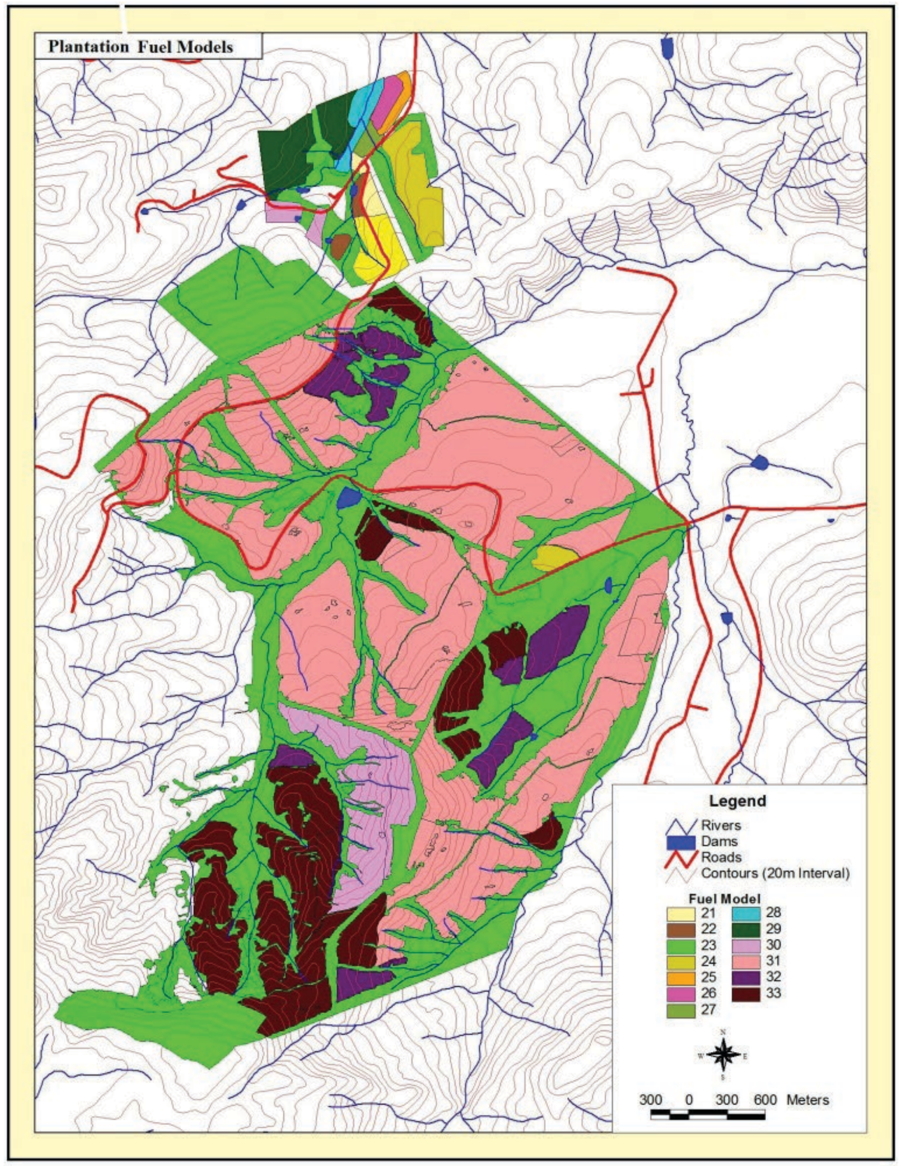
The following article is the ninth chapter in the series of excerpts from a book written by Dr Neels de Ronde, The Garden Route in flames. This is the last in the series of articles. We have also made these articles available on our web site, www.frimedia.org or www.fireandrescue.co for ease of reference.

Dr De Ronde lived in the Southern Cape in South Africa and had done extensive research in the field of land management and wildfire prevention. Dr De Ronde gave permission to Fire and Rescue International to publish his book in the magazine in separate sections for the benefit of all forestry and wildfire managers, fire protection associations and land owners in order to gain insight and an understanding of the intricacies that form the basis of such extreme fires and how it can be prevented, highlighting effective fuel management and fire prevention measures.

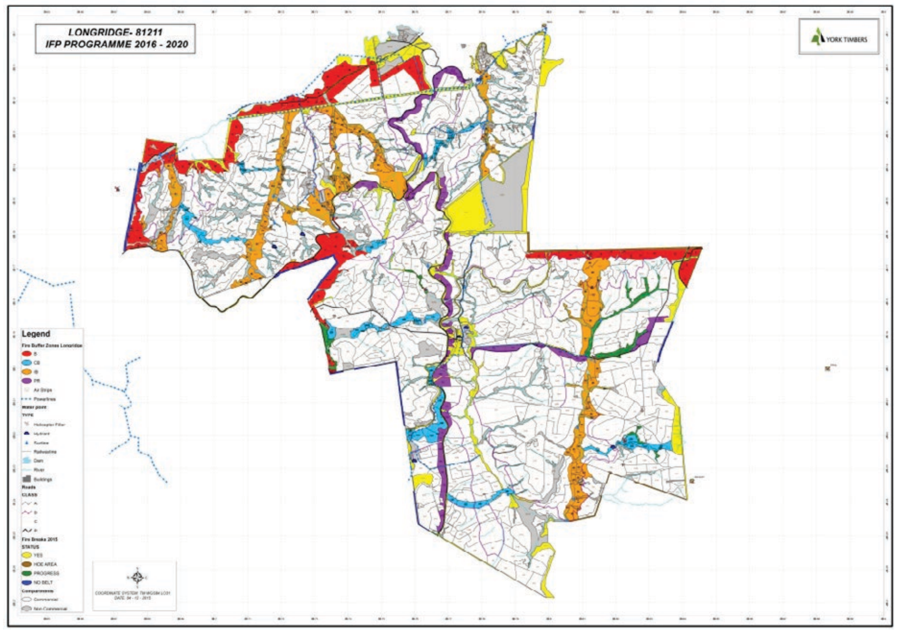
Working towards a detailed five-year fire prevention plan

It is only once the regional fire prevention plan has been drawn up as set out in Chapter III and considering all aspects required for further development work on fire prevention (as set out in Chapters IV to VIII) that a detailed five-year fire prevention working plan can be drawn out for pre-determined sub-regions.

Firstly, each sub-region's fire hazard status has to be classified, calculated and mapped, using pre-determined procedures as set out in Chapter V. These fire hazard rating classifications when mapped, will form the basis for the detailed five-year plan to be developed for each sub-region and the results will then be mapped on fire prevention maps by sub-region (Calvin et al., 2004).



Map 3. Fuel model map of plantation Unit (WPU), which could have been a sub-region fuel model map. Note illustration of contrasts between Pine plantation stand areas and natural montane grassland and wetland. A similar colour and unit contrast map can be developed/used for fire danger rating mapping at sub-regional level (unknown mapping source)



Map 4. Plantation Unit with surrounding external land and within-plantation montane grassland and wetlands used as mapping base. With integrated fire prevention information overlay (including sub-regional buffer zones). Courtesy York Timbers (Pty) Ltd

Map 3 (shown below) provides an example of what a sub-regional fire hazard rating (FHR) map for a Garden Route sub-region can look like for a five-year period (say 2021 to 2025). This can then be used as a basis for the development of IFP units used, from regional (main) buffer zones (B) through internal buffer zones (IB), to public road protection (PR) and conservation burning (CB).

An example was provided below of a sub-regional IFP unit with dominant Industrial Pine Plantation Forestry as land use, within a montane/wetland Grassland natural vegetation base. An example of such a sub-regional IFP plan is provided below (Map 4). Detail of such a year-plan-section has been provided below to illustrate how such a plan can be developed for practical use:

Example of section of a sub-regional IFP plan (Not related to Maps 3 or 4)

External buffer zones

B6: Yearly controlled burning of the external firebreak, as well as all available grassland on both sides of the common property boundary. Also under canopy burning as indicated on the mal as follows: Compartments M16 (pt) approximately 8.0ha, M11D 2.1ha, M11C 1.0ha, M11B (pt) 20.7ha, M11A 6.3ha, N06 2.4ha and N05A (pt) 8.0ha Total = 48.5ha. Compartment. M12 (pt) to be incorporated in B6 external buffer zone after 2021/22.

Internal buffer zones

All riparian zones (within the IBs as set out below (IB4 – IB7) should be prescribed-burned according to the original FP plan but in two ways:

- Narrow wetlands PB on two-yearly rotation as a whole. If similar narrow wetland close-by, burn these two wetlands alternatively yearly in tandem.
- Wider wetlands PB of approximately 50 percent of wetland on one side of watershed and remaining 50 percent of wetland on alternative side of the watershed.

Compartments with the IBs should be prescribed burned as follows:

IB8: Riparian zone areas should be controlled burned according to the above procedures.

Protection along public roads

PR7: Yearly burning of all burnable material within road shoulders to be prescribed burned. Burn approximately 50m east of road shoulder as indicated on the map. North of road reserve, in Compartments M18, M19, M25A and Q18 under canopy burning should be applied in strips as indicated on the IFP map. Compartments M16, M17A, M23, M24B, Q19, SM02, SM05, MB08A and MB01 to be incorporated into this PR after 2021/22.

PR8: Yearly burning of all burnable material within road shoulders to be prescribed burned. Burn approximately 50m along road shoulders as indicated on the map. South, east and north of the road reserve (as indicted on the map) the following Compartment strips should also be added and prescribed burned: Compartments G17, G18A, G18B, F01, G06 and G07B.

PR9: Yearly burning of all burnable material within road shoulders to be prescribed burned. Burn approximately 50m along road shoulders as indicated on the map. North of the road reserve (as indicated on the map) the following compartments should be added and prescribed burned: H12B and H07. Compartments H11A, H06B, H06A and H01 should be added to PR9 after 2021/22.

PR10: All burnable material within road shoulders to be prescribed burned. Burn approximately 50m along road shoulders as indicated on the map. As indicated on the map the strip of this PR should be added to the following compartments: X16B, U05A, U07, U15, T08, T06, T7A, T07B, T03, T19 and T18A (estimated total area can be added to this years' programme). Compartment U07 only after 2021/22.

PR11: Yearly burning of all burnable material within road shoulders to be prescribed burned. Burn approximately 50m along road shoulders as indicated on the map. North of the road reserve (as indicated on the map) the following compartments should be added and prescribed burned E and N as indicated on the map): S05A*, S09*, S08*, S07*, P30B, P28A*, P20*, P19*, P13, P12, P9A, P08, P05, P04, V16, M23*, M26, Q04A, Q05D, Q05B, Q05A, N01B, N02* and N01A.
*=Only after 2021/22.

Conservation burning

CB2A - D: Prescribed burning of all available grassland yearly, with exception of wetlands which should be prescribed burned as explained below on a two-year rotation.

All wetlands according to original FP plan but in two ways:

- Narrow wetlands PB on two-yearly rotation as a whole. If similar narrow wetland close-by, burn these two wetlands alternatively yearly in tandem.
- Wider wetlands PB of approximately 50 percent of wetland on one side of watershed and remaining 50 percent of wetland on alternative side of the watershed.

PL2: To be burned yearly as prescribed.

Summary of total areas to be under tree crown canopies during 2017/18

(Priorities of burning provided in brackets)

B (I)	IB (II)	PR (I)	CB (I)	Total
48.5ha	0.00 ha	0.00*	0.00ha	48.5ha

*=Still to be estimated after burning.

References

Andrews, P.L., 1986. BEHAVE: Fire Behaviour Prediction and Fuel Modelling System - BURN Subsystem, Part 1. USDA For. Serv. Intermountain Research Station. General Technical Report INT-194, 130 p.

Andrews, P.L. and Chase, C.H., 1986. BEHAVE: Fire Behaviour Prediction and Fuel Modelling System – BURN Subsystem, Part 2. USDA For. Serv. Intermountain Research Station. General Technical Report INT-260, 93 p.

Bond, W.J., 2004, Geldenhuys, C.J., Everson, T.M., Everson, C. S. And Calvin, M.C., 2004. Fire Ecology: Characteristics of some important Biomes of Sub-Sahara Africa. In: Wildland Fire Management for Sub-Sahara Africa: Johann G. Goldammer and Cornelis de Ronde ed.. 11 – 26.

Booysen P.V. and Tainton, N.M., 1984. Ecological effects of fire in South Africa ecosystems. Rcological Studies 48, Springer, Berlin, 426 p.

Burgan, R.E. and Rothermel, R.C., 1984. BEHAVE: Fire Behaviour Prediction and Fuel Modelling System – FUEL Subsystem. USDA For. Serv. Intermountain Forest and Range Experiment Station, Ogden, USA. General Technical Report INT-167, 126 p.

Byram, G.M., 1959. Combustion of forest fuels. In: Forest Fire Control and Use (K.P. Davis ed.). McGraw Hill, New York.

Calvin, M.F., van der Sijde, J.H.R., de Ronde, C., Engelbrecht, M.D., Everson, T.M. and Everson, C.S., 2004. Fire Protection Planning, Regional Integration and Fire Hazard Rating. In: Wildland Fire Management for Sub-Sahara Africa: Johann G. Goldammer and Cornelis de Ronde ed. 212 – 246.

De Ronde, C., 1988. Preliminary investigations into the use of fire as a management technique in plantation ecosystems of the Southern Cape Province. Unpublished M Sc. Thesis, Univ. of Natal 179 pp.

De Ronde, C., Trollope, W.S.W., Bayley, A.B., Brockett, B.H., Everson, T.M. and Everson, C.S., 2004. Application of Prescribed Burning. In: Wildland Fire Management for Sub-Sahara Africa: Johann G. Goldammer and Cornelis de Ronde ed. 285 – 323..

De Ronde, C. and J.G. Goldammer, 2016. Wildfire Investigation. Guidelines for Practitioners. A Publication of the Global Fire Monitoring Centre (GFMC): 131 pp.

Trollope, W.S.W., 1983. Control of bush encroachment with fire in the dry savannas of southeast Africa. Ph. D. Thesis, University of Natal, Pietermaritzburg.

Trollope, W.S.W., de Ronde, C. and Geldenhuys, C.J., 2004. Fire Behaviour. In: Wildland Fire Management for Sub-Sahara Africa: Johann G. Goldammer and Cornelis de Ronde ed.: 27 – 59.

Command Corner: Transfer of command

By Chief Tim Murphy, US Forest Service Africa Disaster Management Technical Advisor

Chief Tim Murphy

Risks to personnel increase significantly during transfer of command periods regardless of the size or complexity of the incident. There is a high potential for fatalities, serious injuries or incidents with incident potential during transfer of command periods (some have occurred in the past).

Be proactive in mitigating the risks by proper implementation of LACES ie lookout, awareness, communications, escape routes and safety zones.

Factors for increased risks to personnel during transition periods include:

- No or poor briefing of incoming personnel Lack of weather and behaviour information, both forecast and observed.

- Communications: face-to-face briefings may not be possible and radio frequencies may be overextended and/or changing due to the increased demands on the system.
- Initial attack resources may not have checked-in and the incident commander may not be aware of the number, type and location of all resources.
- Location of safety zones and escape routes may not be known and communicated to all resources.
- Not all resources know who is in command.

Mitigation actions to take:

- Lookouts: Post and maintain your own lookouts.
- Communications: Maintain existing communications with your own and adjacent resources, as well as your original supervisor, while you are developing communications with incoming adjacent resources and your new supervisor.
- Escape routes and safety zones: Identify escape routes and assure incoming resources are aware of their locations; be aware that your original escape routes and safety zones may no longer be accessible due to changing fire behaviour or your increased distance from them.
- Transition at the morning
- Utilise the Incident Response and Fireline Safety Pocket Guide Briefing checklist for transition of command (Inside of back cover).

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The life net or Browder Life Safety Net

A life net, also known as a Browder Life Safety Net or jumping sheet, is a type of rescue equipment formerly used by firefighters. When used in the proper conditions, it allowed people on upper floors of burning buildings an opportunity to jump to safety, usually to ground level. Invented in 1887, the device was used with varying degrees of success during several notable fires in the 20th Century.

Due to advances in firefighting technology, it became obsolete by the 1980s. Owing to their former prevalence, life nets often feature in popular culture as a running gag, especially in cartoons where they often appear in use during scenes where a fire is taking place.

A Browder life net on display at the Napa Firefighters Museum, in Napa, California, US. Photo by Jim Heaphy

Inventor

The device was invented by Thomas F Browder, born in Greene County, Ohio, in the US in 1847. During the American Civil War, Browder enlisted in the Company C, 60th Ohio Infantry of the Union Army at the age of 17 and was wounded at the Battle of Spotsylvania Court House on 9 May 1864. He was shot through the hip, sent home the following month and later discharged from the service. He became a school teacher, and later moved to Greenfield, Ohio, where he invented and patented the life net in 1887. Browder later opened a laundry business. He obtained additional patents for improvements to the life net in 1900 and later also patents in Europe.

Design

Browder's device was similar to a modern recreational trampoline, which was developed later in 1936. Among its advantages were that the life net was always taut when open, never slackened, and had a setup time of only two to three seconds. It used hinges to fold for storage and an automatic locking mechanism when unfolded. Its opaque cover helped reduce panic and increase the confidence of people who had to jump into it. The device helped save many lives. Some models had a red bullseye in the centre.

Limitations

Firefighters believed that the practical height limit for successful use of life nets was about six stories, although in a 1930 Chicago fire, three people survived jumps from an eighth story into a life net. One suffered a skull fracture and the other two had minor injuries.

Successful rescues

On 19 August 1902, the New York City Fire Department conducted its first real-life rescue with the Browder life net. During rescue operations at ▸

The life net used at Ringtheater fire in Vienna, 8 December 1881

a tenement fire that killed five people, a baby was dropped from a fourth-floor fire escape into a life net, and survived uninjured. On 10 November 1904, three people were saved when they jumped into a life net during a fire in New York City. Three other people died on the top floor of the building. In Anchorage, Alaska, in January 1957, a woman dropped her three-year-old daughter into a life net and the girl was uninjured; the mother suffered a broken back after jumping into the net.

The most intensive use of life nets was conducted in a large scale operation by the Berlin Fire Brigade during and right after construction of the Berlin Wall in 1961, when a large number of people jumped from houses in the Soviet sector onto the life nets of the West Berlin Fire Brigade on the pavement that was part of the western sector of Berlin.

Failures and problems

Life nets often failed to save people, and sometimes firefighters themselves were injured or killed by falling bodies. According to researcher and writer Cecil Adams, "Leapers sometimes struck something on the way down, landed on a fireman, or missed entirely." In November 1910, a fire swept through a factory in Newark, New Jersey, killing 25 people. Among them were four girls who held onto each other when they jumped into a life net. They tore the net apart and were killed.

In the Triangle Shirtwaist Factory fire on 25 March 1911, girls jumped into life nets from the ninth floor with their arms intertwined and the impact ripped the canvas and tore the springs from the frame, resulting in their deaths. In all, 146 garment workers were killed in that fire. During the Hotel Polen fire in Amsterdam on 9 May 1977, firefighters could not successfully deploy a life net in a narrow, congested alley. When a life net was deployed in a more open area, some hotel guests threw their luggage into the net and were then injured when they jumped. Others were injured when they hit the rim of the net. In all, 33 people died in that fire.

Phase out

In 1958, a fire department official in Eugene, Oregon expressed reservations, saying that the term "life net" was misleading, and that they should be used only as a last resort. As late as 1961, though, the Chicago Fire Department still emphasised the life net in its training programmes. However, the modern aerial apparatus often known as a ladder truck, has made the life net obsolete, as this ladder equipment makes it possible for firefighters to carry out rescues more safely, at greater heights and with smaller crews.

Another piece of equipment, which started to phase out the life net, especially in European countries such as Austria and Germany, are inflatable jumping cushions, which absorb the energy of a person due to the air inside the cushion being forced out by the impact. Adams has concluded that the life net was no longer mentioned after 1983 and writes that they are not discussed in current training manuals for firefighters. Many examples of life nets are on display in firefighting historical museums.

Sources: Wikipedia, British Library

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HERITAGE

Vancouver fireman jumping into life net (1910). William J Carpenter. This file has been provided by the British Library from its digital collections. It is also made available on a British Library website

What's On?

2024

January

16 to 18 January 2024
Intersec, Dubai
https://intersec.ae.messefrankfurt.com

March

26 – 28 March 2024
Wildland-Urban Interface Conference 2024
Nevada, US
https://wui2024.eventscribe.net/

April

April 15 – 19 April 2024
Fire Behaviour and Fuels Conference
USA, Ireland, Australia
https://firebehaviorandfuelsconference.com/

15 – 20 April 2024
FDIC International
Indianapolis, US
www.fdic.com

24-25 April 2024
Fire Sprinkler International 2024
Dublin, Ireland
https://firesprinklerinternational.com/

May

4 May 2024
International Fire Fighters Day

6 - 8 May 2024
World Fire Congress
Washington, DC, US

25 May 2024
Midvaal Fit to Fight Fire Challenge
Contact Tertius Engelbrecht on
Cell: 072 197 2700
Email: Midfiresubs@midvaal.gov.za

28 – 30 May 2024
A-OSH and Firexpo South Africa 2024
www.firexpo.co.za

June

5 - 9 June 2024
International Hazardous Materials Response Teams Conference 2024
Baltimore, Maryland, US
www.eventscribe.net/2023/HazmatConf/

8, 9 June 2024
Toughest Firefighter Alive Germany 2024
Mönchengladbach
www.tfa-germany.de

July

24, 25 July 2024
Dräger South Africa Fire Combat and Rescue Challenge
Wimpie.van-Onselen@draeger.com

27, 28 July 2024
British Firefighter Challenge
Liverpool, UK
www.britishfirefighterchallenge.co.uk

September

7 - 14 September 2024
15th World Firefighters Games 2024
Aalborg, Denmark
www.wfg2020.dk

18 and 19 September 2024
The Emergency Services Show UK
Birmingham, UK
www.emergencyuk.com

18 – 20 September 2024
Third Annual Women in EMS Leadership Conference 2024
Cape Town
Contact: Thulani Dube
Tel: +27 10 023 3985
Email: thulani@ec-s.co.za

24 - 28 September 2024
World Rescue Challenge 2024
Azores
www.wrescue.org

25 - 28 September 2024
Toughest Firefighter Alive South Africa
De Bakke Beach, Mossel Bay
www.frimedia/TFA