2001, Issue 3

The Catalyst

The Official Newsletter of JOIFF September 2001

From the Editors

We welcome readers to the third edition of "The Catalyst" which in its production, has taken a step forward from previous editions. This has been made possible by the support of Orion Safety Industries Pty. Ltd. Australia and Solberg Scandinavian AS, Norway, who jointly share the historic honour of having the very first adverts published in The Catalyst. We thank Orion and Solberg for their patronage of JOIFF and also thank them for their contribution of an article on Foam. Foam is the most important tool available to the Firefighter for controlling large flammable liquid fires, yet often, little or no detailed performance specification is prepared when purchases are made. Members of JOIFF will have received a notice inviting a debate on Foam a debate that we feel it is important to have due to the importance of foam in the overall protection of High Risk Industry - indeed the recent withdrawal from the market of one of the world's major foam producers has meant that many end Users have had to review their foam concentrate purchasing practices. Dr. Niall Ramsden, an eminent specialist in Fire Hazard Management and a staunch supporter of JOIFF, agreed to act as Technical Editor for this debate which is introduced in this issue of The Catalyst with an article by Dr. Ramsden on the background to the LASTFIRE foam study.

The notice about our intention to commence a debate on Foam, including an invitation to submit an article, was sent to 19 of the major Companies Worldwide involved with Foam, with a list of the Member Companies in JOIFF, so that they would know the main target audience. Only three Companies of the 19 replied and just two of them, Orion and Solberg, took the time and expense to provide constructive input - and an advert, which was optional, not a requirement, for the publication of an article. The excuse for the lack of response suggested by some colleagues was "….holidays…." but another colleague wondered how many of the Companies would respond and how quickly they would do so if we had sent out an enquiry to purchase 10,000 litres of foam! In fairness to two other Companies of the 19, we should point out that since the deadline for going to print, we have received one other submission and one apology for delayed response. We will be pleased to make available to members of JOIFF the list of the Companies contacted who did not respond.

Thanks again to Dr. Genny Laverty of Du Pont Geneva, who in this issue, has provided further explanation to her excellent and most interesting series of articles on protection against exposure to electric arc published in the first two issues of The Catalyst. In the PPE Corner of this issue, we include a list of the most important Eurpoean Standards relating to Firefighters PPE and some detail on them.

Once again, we are pleased to welcome new Members to JOIFF and hope that those from non Member High Risk Industries reading this will give serious consideration to applying for Membership. Detail on the forthcoming JOIFF Seminar is also included and we urge Members and friends to support this most important event.

As you can see, JOIFF is growing from strength to strength and we look forward to your continued support.

About JOIFF

JOIFF, the Joint Oil and Industry Fire Forum, is a grouping of Companies in High Risk Industry represented by their Emergency Services Manager or equivalent position, and nominated Deputies. A JOIFF High Risk Industry is any Organisation that is engaged in processing, storage, handling or transport of high risk materials and that has nominated personnel as Emergency Responders. JOIFF offers to its members a forum for discussion amongst peers, accredited training, information dissemination and technical advice.

JOIFF welcomes application for Membership from suitable Organisations - contact the JOIFF Secretariat, details on the back page.

Disclaimer:

The views and opinions expressed in The Catalyst are not necessarily the views of JOIFF or of its Secretariat, Fulcrum Consultants neither of which are in any way responsible or legally liable for any statements, reports or technical anomalies made by authors in The Catalyst.

The Catalyst — The Official Newsletter of JOIFF

MEMBERS SECTION

Report from the JOIFF Secretary, Kevin Westwood C.Eng., M.I.Fire E

Dear Members,
Here is the report of the JOIFF Secretariat for the previous nine months. A great deal of work and effort has been committed to ensure that JOIFF is known worldwide as a centre of expert knowledge in all aspects of fire relating to high hazard industry. Much of this is as a direct result of the JOIFF secretariat (Fulcrum Consultants) who have worked tirelessly in the promotion of our organisation. As secretary of JOIFF I wish to thank Fulcrum Consultants on behalf of the JOIFF Executive and all JOIFF members for "raising the bar" - setting new standards and professionalism for and on behalf of JOIFF.
Kevin Westwood.
Enron Asset Protection & Logistics.

Fulcrum Consultants were appointed Secretariat of JOIFF in December 2000. Below is a brief summary of their activities since then:

1. Presentation of JOIFF:

A standard of design for JOIFF has been established.

- JOIFF Notepaper has been printed and is in use.
- JOIFF email notepaper has been designed and is in use.
- JOIFF Website has been designed and is now on-line and updated as relevant. (www.joiff.com).
- A quarterly Newsletter for JOIFF was started in March and is now in its third issue. This has been and is at no cost to JOIFF, the costs being met by
- The Secretariat and by income from advertising /sponsorship.
- JOIFF Membership Certificates have been designed and are being distributed at present.
- JOIFF Training Site Accreditation Certificates have been designed and issued to Serco International Fire Training Centre, Teesside and Lancashire Fire and Rescue - Washington Hall Training and Development Centre.

2. Membership:

- The Membership Directory is updated and distributed to Members regularly.
- A Membership Drive was commenced. As a result a number of new Members have joined.

Please advise the Secretariat of the names of any Organisations that you think would be interested in becoming a Member of JOIFF.

3. Contact with other Organisations:

Contacts have been made and are being developed with a number of Regulatory Authorities and Organisations involved in Trades associated with High Risk Industry in Countries where JOIFF has Members.

4. Finance:

- In conjunction with the Treasurer, Membership records have been set up and Membership Fees collected.
- The only cost to JOIFF for the operation of The Secretariat is direct expenditure in the execution of the business. No fees are charged at present by Fulcrum Consultants for the operation of The Secretariat.

5. Constitution.

Fulcrum Consultants drew up a Constitution for JOIFF which, through the Secretary, was presented to the Members Meeting in March and passed with minor amendments.

6. Seminar

In conjunction with the JOIFF Executive, Fulcrum Consultants have organised all detail for the forthcoming JOIFF Seminar. This includes arranging venue, speakers, design, printing and circulation of promotional detail etc.
It is YOUR Seminar - please SUPPORT it !!

7. Meetings:

- Fulcrum Consultants have attended three meetings with Members of the JOIFF Executive and the JOIFF Members meeting in March.
- Fulcrum Consultants have attended a meeting of the European Oil Refinery Fire Chiefs in Hungary where great interest in JOIFF activities was shown.

JOIFF
in association with
Lancashire Fire and Rescue
Washington Hall
Training and Development Centre
presents a 1 day Seminar on

CorpOrate ManslAugHter

This Seminar will examine the implications, responsibilities,and potential liabilities of Senior Management in High Risk Industry as a result of an Emergency Incident occuring.

Tuesday, October 23rd, 2001

Speakers include:
Mark Scoggins - Solicitor
John Sparke - Phillips Petroleum
Tim Beals - Health and Safety Executive
Ron Edmond - SHE/Emergency Planning Consultant
Niall Ramsden - Resource Protection International

Further details and booking from the JOIFF Secretariat and on the JOIFF website www.joiff.com

FOAM FOR STORAGE TANK APPLICATION - THE LASTFIRE PROJECT

Dr Niall Ramsden
Resource Protection International Ltd. U.K.

For some time there has been a great debate about the most appropriate method of fighting full surface fires in large open top floating roof storage tanks. Unfortunately, much of the debate has been based on incomplete information from incidents or from parties with a large vested interest. Consequently, the Oil Industry decided that an unbiased detailed review should be carried out to assess the true levels of associated risk and develop a better understanding of risk reduction options. 16 Oil Companies ranging from major International Organisations to Companies with a single Refinery sponsored the project. It is estimated that the overall direct and indirect costs totalled more than US $1m. Resource Protection International (RPI), an independent Consultancy specialising in Fire Hazard Management of Oil and Petrochemical facilities, was selected by the Consortium of 16 companies as Project Coordinators. RPI has worked with many Oil Companies on a Worldwide basis and they were therefore ideally suited to coordinate this major International exercise.

The LASTFIRE project looked at every aspect of Fire Hazard Management of floating roof tanks and over a 2 year period, the Project Coordinators collected and analysed data from the 16 Oil companies and elsewhere and held brainstorming meetings with all interested parties on a Worldwide basis. The LASTFIRE Project resulted in a report which detailed the findings under several headings:-

- Statistical incident data
- Incident Consequence Analysis
- Risk Reduction Options Review with special section on Foam
- Risk Workbook (which allows an end-user to develop cost effective site specific risk reduction policies)

Once this initial phase of the project was completed and the results published, further work was carried out on those aspects considered to be most important and where knowledge was not considered sufficient as follows:-

- Production of a video, by Industry firefighters, to provide improved information and guidance on handling fire incidents.
- A review of lightning related issues, as lightning is by far the most common ignition source for such incidents.
- Development of Tank Firefighting Workshops incorporating both classroom and site specific practical sessions.
- Development of a hazard specific fire test for foam concentrate - the LASTFIRE test.
  Computerisation of the Risk Workbook.

The LASTFIRE Test

One conclusion from the LASTFIRE study was that there was a need for a fire test to critically assess the capability of a firefighting foam for the particular performance attributes required for storage tank incidents. Most performance tests currently available were aimed at rapid rescue situations such as aircraft crash incidents. Using work previously carried out by Mobil as the basis for development, RPI worked with a group of LASTFIRE members to define the critical aspects of the test which were identified as:-

- Critical application rates of foam solution
- Application techniques that reflect "real life"
- Long preburn times to develop high temperatures
- Obstructions in the travel path of the foam
- Flexibility to allow use of different fuels to suit site conditions
- Build up of hot surfaces

Unlike many of the standard fire tests, end users thus had the opportunity to influence the specification for the test. The overall intention was to produce a Standard that could be used for comparison between different foam types, a Quality Control test for purchases and a test for checking ongoing performance of a foam over time. The result was a test with the following characteristics:-

Three types of application nozzle:-

1. System nozzle to simulate "gentle" application by fixed foam pourers
2. Aspirating nozzle to simulate "plunging" application
3. Semi-aspirating nozzle to simulate "plunging" application by non-aspirating monitors. (In practice non-aspirating monitors give some foam expansion due to impinging jets and/or travel through the air.)

These 3 nozzles were designed to give the same foam characteristics (expansion and drainage time) as that from actual typical application equipment.

- Critical application rates in the order of 50% of those recommended by standards such as NFPA 11.
- Baffles to give restricted areas for foam flow and create hot spots.
- A 3 minute preburn to allow much greater heat build up. (This compares with one minute or less on most tests.)
- 0.5m high freeboard of the test pan above the fuel to allow build up of hot surfaces for the foam to have to seal against.
  Foam application for 7 minutes after the preburn time. The fire should be extinguished within this time.

"Torch" tests around the complete circumference of the pan 2 minutes and 13 minutes after foam application has ceased to check vapour sealing.

A burnback test started 15 minutes after foam application has ceased to check the foam's ability to prevent reignition of a significant amount of fuel surface.

- Although heptane was used during the development work for reproducibility, the test can

be adapted to suit other fuels. Already some foams have been tested with polar solvents such as alcohols.

As part of the test development work, several LASTFIRE members provided samples of the foam concentrate being used at their site. The test clearly demonstrated differences in performance from different foams. In one particular case the results of one foam from one facility was very poor, but the same foam from a different facility performed reasonably well. On further investigation it became clear that the poor performance was actually due to contamination on site. Thus the test helped to identify a potentially dangerous problem and the need for continuous ongoing checks on foam concentrate was highlighted.

Test results showed different performance characteristics within the same generic family of foams. This demonstrated that it is very important to develop a detailed purchase specification incorporating fire performance in a relevant test - it is not enough to simply specify a concentrate by physical properties or generic name.

One of the main findings of the test development was the confirmation of one of the conclusions from the LASTFIRE study - the best foams currently available for this application are either a high quality fluoroprotein foam or a high quality multi-purpose foam. It is important to emphasise that simply specifying the generic type of foam is not sufficient to guarantee acceptable performance. There are good and bad quality foams on the market of each generic type.

Another observation during the tests was the clear difference between aspirated and semi-aspirated performance using the same type of concentrate and application rate. Semi-aspirated foams (which reproduced the properties of non-aspirating nozzles) undoubtedly had greater difficulty in extinguishing the fire at the point of foam impact with the fuel. This was thought to be due to the greater force of impact causing greater disruption of the fuel surface and causing greater fuel pick up by the foam and greater vapour emission. This bears out the findings of firefighters who have used non-aspirated foam in incidents to gain greater throw and have found that a certain application technique to establish a "footprint" is more effective and that generally higher application rates are needed.

Concluding comments

Through the LASTFIRE test a method to assess a foam's capability and performance on storage tank fires is now available. The test has been successfully used as an integral part of a detailed purchasing specification and to compare different foam application techniques. Witnessing the tests is valuable training to end Users as capabilities and limitations of different techniques of foam application can clearly be seen. Coupled with other specification conditions, the LASTFIRE test can help guarantee that a Firefighter has the best tools for the job on an ongoing basis. This is particularly important at a time when many foam Users are considering their long term foam purchasing policies due to the withdrawal from the maket of one major manufacturer. Details of the LASTFIRE study and the follow up work can be obtained through the JOIFF Secretariat.

Personal Protection against Electric Arc Events

Dr. Genevieve Laverty, DuPont de Nemours International SA

There have been very many occasions that deaths from electric arc accidents have been due to second and third degree burn injuries sustained by the high concentration of radiant/convective heat energy of the blast. Other consequences of an electric arc can be cardiac arrest, electrocution, damage to ears or being physically blown back and then injury upon falling. The purpose of Nomex(R) PPE is to address specifically the thermal effects, i.e. the burn injury hazard. It does so by minimising the burn injury level and thus increasing a person's chance of survival by its inherent Flame Resisting (FR) characteristic, thereby not propagating any flames, and also by its absorption of the bulk of the radiant heat energy caused by an electric arc event.

A risk assessment based on what is known about the working environment electrical conditions will help the enduser to decide on the appropriate level of personal protective equipment that the workers should have to provide the best chance of escape and survival in the undesirable event of an electric arc accident. This Paper summarises a way to make such a risk assessment when considering the hazard of electric arc events in a particular working environment.

The Table below was prepared by Du Pont after more than 8000 arc tests and shows that for different ranges of incident energy, different clothing systems can be suggested. These are not mandatory, nor enshrined in any legislation or norms, but can be a good guideline to endusers in choosing single or multilayer PPE systems to match their own particular 'worst case scenario'.

The calculated incident energy comes from the enduser's risk assessment, based on the following inputs:

- arc current (kA) ;
- arc voltage (V);
- arc duration (seconds);
- distance from worker to arc in cm (typically 30cm from elbow to fingertip if no extension rods being used);
- electrode spacing in cm (the airgap between the two conducting pieces which ionises and passes the arc);
- whether single or triple phase;
- whether in an open or a closed ('box') environment.

The protection factor of the clothing system, "measured protection level vs second degree burns" is as measured on the Du Pont Arc-Man(TM) test equipment. This is most usually equivalent to the Arc Thermal Performance Value, ATPV. Both incident energy and protection factor (ATPV) are measured in units of energy, shown in the Table as cal/cm2.

Let us take an example which may help to put all this in context. Imagine a working environment where the worst case scenario is deemed to be:

- 10kA arc current
- 300V arc voltage
- 0.5 sec maximum arc duration (after which circuit breakers come into effect)
- 30cm distance from worker to arc (elbow to fingertip if no extension rods are being used)
- 4cm electrode spacing - single phase - open environment.

With commercially available software (or by manual means) it is possible to calculate from this input data that the expected incident energy in the case of an electric arc accident under these conditions would be 6.65cal/cm2. Comparing this energy value to that shown on the Table, one sees that it falls into the category 2A (incident energy 5-8 cal/cm2). From this, based on the guideline proposed by Du Pont, an enduser may decide that a two-layer PPE system, which could be a single layer FR system such as Nomex(R) coverall (or shirt/trousers), with normal untreated cotton underwear, is appropriate for the working environment concerned.

Calculated Incident energy cal/cm²	Clothing class number	Clothing description (no. of layers)	Total weight g/m²	Measured protection level vs. 2nd degree burns, cal/cm²
0-2	0	Non-FR (1 layer)	150-240	N/A
2-5	1	FR shirt & pants (1)	150-270	5-7
5-8	2A	Non-FR underwear plus FR shirt & pants (2)	300-400	8-18
5-16	2B	FR underwear plus FR shirt & pants	340-480	16-22
8-25	3	Non-FR underwear plus FR shirt and pants plus FR coverall (3)	540-680	25-50
25-40	4	Non-FR underwear plus FR shirt and pants plus Double layer coat (4)	800-1000	40->60

PROTECTIVE CLOTHING GUIDELINES FOR ELECTRIC ARC HAZARD

"ARCTIC FIRE FIGHTING FOAM & SYSTEMS"

Solberg Scandinavian AS is a fire technical company manufacturing and marketing fire fighting foam liquids and supplying equipment, system designs and risk analyses in the areas of fire protection, fire consulting and fire technical services.

The company is located close to Bergen on the western coast of Norway. A sister company, Solberg UK, Ltd., located in Newcastle, was established in 1999.

Solberg Scandinavian was founded in 1967. Upon completion of the present factory in 1982, the production of foam liquids started up and is the main activity of today. Since 1990 the production has been based on 3M Light Water™ foam liquids.

The company's highly skilled experts use advanced technology on fire protection. Quality, service and safety have top priority. The company's fire fighting foam liquids have a significant market share on the offshore installations in the North Sea, in the British as well as the Norwegian sector.

When 3M announced that they were withdrawing from the foam market last summer, professional fire fighters from all over Europe began to ask, "What Now?" 3M Light Water was the worlds most popular and successfully used synthetic AFFF fire fighting foam. In close co-operation with 3M in the USA and Europe; as well as a new, well established supplier of the highest quality of surfactants; Solberg Scandinavian started a reformulation program with the following main objectives: To be based on 3M's high formulation and high performance and reduce the amount of fluorochemicals by up to 50%. Today this work has been blessed with success. The new brand name 'Arctic Fire Fighting Foams' have " drop in certificates" from 3M and the products are being tested and approved for the first time according to the CEN 1568 standard. The products will be sold through most of 3M's previous distributors.

The new 'Arctic Fire Fighting Foam' is approved according to CEN 1568 standard, but Solberg Scandinavian will continue to supply 3M Light Water Fire Fighting Foams for some time.

Products

Solberg Scandinavian's activities are split in two areas: i) Sales of fire fighting foam liquids and ii) complete fire fighting systems and Arctic Foam Fog System for engine rooms onboard ships.

The foam liquids include these products: AFFF concentrates extinguishing non-polar liquids or hydrocarbons, at 1%, 3% or 6%; and AFFF/ATC

concentrates that, in addition to extinguishing hydrocarbon fires, also extinguish fire in polar liquids as alcohols etc. They are supplied as 3x6% and 3x3% for both non-polar and polar liquids.
The second area includes complete fixed water based extinguishing systems for engine rooms; category A, according to IMO circular 913; as well as extinguishers on car decks and ferries. Arctic Foam Fog System's market share in Norway is 75 % for new constructions and reconstructions.
A comprehensive study and research that has lasted for 5 years resulted in newly applied for patents along with innovative equipment and fog foam systems design. Up until now, the application has been for the marine market, but customers world wide are requesting information for other industrial uses as well

Emergency stock

Solberg Scandinavian holds an emergency stock of AFFF and AFFF/ATC fire fighting foams and offers 24-hour emergency services. Deliveries can take place in acid-proof steel transport tanks, certified under DNV 2.7-1 standards and approved for use in the North Sea. They may be transported by helicopter, boat or truck.

Quality Testing and Training

The company has its own laboratory with indoor and outdoor fire test facilities that assures quality according to U.S. MIL-F-24385F specifications, UL, U.S. Coast Guard, ICAO, SP, and others. Solberg Scandinavian also holds the HOCNF (Harmonized Offshore Chemical Notification Format) data sheet, which follows the "Oslo and Paris Convention for the prevention of marine pollution"
Solberg Scandinavian can arrange seminars for international key safety officers and other target groups all around Europe, together with their distributors, and runs evaluating tests on different foam types upon request from oil companies etc.

Research and development

Solberg Scandinavian has invested in a research facility where new products and equipment are being tested continuously. The company's objective is to become a world leader in certain segments of the fire protection business within two years.

* * *

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Arctic Foams

Introducing the First and Only FIre Fighting Foam tested and endorsed by the 3M Company to be compatible with 3M Light Water

- AFFF & ATC
- Fast Extinguishment
- Built-in Safety
- CEN/EN 1568

For more information about our foam and distribution, visit us at: www.arcticfoam.com

Arctic Fire Fighting Foam

Solberg Scandinavian AS
fire fighting equipment/foam

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PPE Corner

Below are listed Standards for Personal Protective Equipment (PPE) relevant primarily to Fire-fighters. "EN" followed by numbers denotes an actual European Standard. "prEN" followed by numbers denotes a European Standard in the process of being developed and/or revised, currently in a phase of voting. Where relevant, corresponding International (ISO) Standards are referred to.

Head Protection:

EN 443:1997. Helmets for Firefighters, specifies design requirements and minimum performance requirements of helmets when tested for flame, heat transfer by radiation, electrical resistance, shock absorption and resistance to sharp objects at high and low temperatures. It also includes requirements for the marking and manufacturer's information that must be provided with the helmet. This Standard is currently being revised. There is no equivalent ISO Standard.

Body Protection:

EN 469:1995 Protective Clothing for Firefighters specifies minimum performance requirements of materials and material assemblies used in the clothing when tested for flame spread, heat transfer by flame and radiation, tensile and tear strength, penetration by liquid chemicals etc. It specifies that each material in the test clothing assembly must pass a heat resistance test in an oven at 180°C and must not melt, drip or ignite. It also includes requirements for general clothing design and specifies the marking and manufacturer's information that must be provided with the clothing. The ISO Standard that corresponds to EN 469 is ISO 11613.

EN 531:1995 Protective Clothing for Workers exposed to Heat, specifies minimum performance requirements of materials and material assemblies used in the clothing when tested for flame spread, heat transfer by convective heat and radiation, splashes by molten metal and molten iron - where these may be hazards to which clothing covered by this Standard may be exposed. Includes requirements for general clothing design and specifies the marking and manufacturer's information that must be provided with the clothing. Currently undergoing revision. The ISO Standard that corresponds to EN 531 is ISO 11612, currently undergoing revision under the same procedures as EN 531.

EN 1486:1996 Protective Reflective Clothing for Specialised Firefighting relates primarily to clothing with an aluminised outer surface and specifies minimum performance requirements of materials and material assemblies used in the clothing when tested for flame spread, heat transfer by radiant heat, convective heat, contact heat, tensile and tear strength. It includes requirements for general clothing design and specifies the marking and manufacturer's information that must be provided with the clothing. This Standard will be replaced by the ISO Standard, ISO 15538 which has just been approved as an International Standard.

prEN/ISO15384:1998. Protective Clothing for Wildland Firefighting is being developed for clothing that is usually worn for extended periods of fighting fires in forests, crops, grass etc.

Hand Protection:

EN 659:1996. Protective gloves for Firefighters specifies minimum performance requirements of materials and material assemblies used in the gloves when tested for abrasion, cut and tear resistance, burning behaviour, resistance to radiant and convective heat, dexterity, penetration by liquid chemicals etc. It also specifies the marking and manufacturer's information that must be provided with the gloves. Currently under revision.

ISO 15383:2001. This ISO Standard entitled Protective Gloves for Firefighters has just recently been approved and specifies three different levels of performance requirements - except for flame resistance and ergonomic requirements, which are the same for each level. The requirements for Level 1 gloves are based partly on EN 659 but use some of the criteria from EN 469. Level 2 has been adopted from NFPA 1973, the USA Standard for Firefighters gloves. Level 3 offers requirements consistent with prEN/ISO 15384 clothing for Wildland Firefighting.

Foot Protection:

Currently, work is being done to produce an EN/ISO Standard on Fire-fighters footwear. This draft is numbered **prEN 17250**. When this Standard is agreed, it will replace the following Standards that are currently being used for Fire-fighters footwear:

EN344 safety, protective and occupational footwear for professional use.

EN345 specification for safety footwear for professional use.

Respiratory Protection:

EN 136:1989. Full face masks. Currently under revision in prEN 136:1996.

EN137:1993 Self contained open-circuit compressed air breathing apparatus. Currently being revised. Will include a new flame engulfment test for B.A. sets.

Chemical Protection:

prEN 466	Part 2. Protective Clothing - Protection against liquid chemicals.
prEN 943	Part 2 Protective Clothing for use against liquid and gaseous chemicals.

Other Standards of interest:

ENV 342	Ensembles for protection against cold.
ENV 343	Protection against foul weather.
EN 388	Protective gloves against mechanical risks.
EN 399	Lifejackets and personal buoyancy aids.
EN 471	High Visibility Warning Clothing.

If you require any further detail, please contact the JOIFF Secretariat.

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Fire Protection of Large Storage Tanks Using Mobile Equipment

David Meyer, Orion Safety Industries Pty Limited, Email: djmeyer@orionsafety.com.au

The fire protection of large storage tanks is a complex issue. This article is intended to look at one aspect of the problem and I hope it will stimulate some constructive discussion on the topic. I would like readers to take the following as a basis for discussion and would welcome any comments.

Overview

One point of view regarding the fire protection of large tanks is that the most cost effective solution is to let them burn. Were it not for environmental, social and political considerations this might be the simplest choice.

Once the decision is made that a tank fire must be extinguished there are the options of equipping the tank with fixed systems or using portable equipment.

In both these instances we do not have a large body of experience with large tank fires to draw on that will enable us to define the correct solution. There is little practical experience to draw on and currently the techniques used and/or proposed are not fully evaluated. Even if they do work we do not have enough information to determine the 'best' method.

The design of fixed systems for large cone roof tanks, for instance, will be made more difficult due to the large distances to be traversed by the foam in order for the fire to be extinguished. These distances are much greater than experienced in smaller tanks. The impact on fire fighting performance will need to be considered. Fixed systems will have advantages in terms of operational manpower and may be cost effective because of this. These systems should require the smallest amount of foam concentrate for fire fighting operations.

The use of large capacity mobile equipment will be less efficient in terms of manpower and foam concentrate used. Considerable analysis of the costs involved, in terms of equipment, manpower and resources (such as water supplies and foam concentrate) needs to be done to determine whether this is an economic option.

It may be that a combination of fixed systems and portable equipment offers the most suitable protection.

Large Capacity Monitor Overview

Some important points need to be considered when designing or selecting large capacity trailer monitors.

1. From a fire fighting point of view there is no reason to have a trailer with 360 degrees travel. When the trailer is in use it will be dealing with a fire up to 80 meters away and no more than 80M wide. The maximum apparent width of such a fire is 53 degrees. The working travel needed for the trailer would be about 60 degrees if a margin for flexibility were included. It might be worth considering that if you ever need to turn the monitor through 180 degrees when fighting a fire you could be in serious trouble.
2. For fire fighting there is no reason to have the nozzle depressed below 30 degrees elevation. Maximum throw will occur at an elevation of about 35 degrees. If less throw is required the nozzle can be elevated further or adjusted to a wider spray pattern. It is important to note that foam should be applied gently, if the nozzle is depressed below 35 degrees the foam stream will have a high horizontal velocity when it hits the fuel and will be much less effective.
3. When fighting large tank fires (or any other fire) will one large fire stream be more effective than two moderate sized streams? The answer to this is simple. In many fire fighting situations two fire streams are necessary to extinguish a fire. When dealing with large capacity monitor trailers other considerations such as the management of the hoses and other resources also makes two smaller trailers easier to use.
4. Is putting all your eggs in one basket good strategy?
5. Having smaller equipment that is quick and easy to deploy makes training easier, and the equipment can be deployed for smaller incidents. For the fire services smaller, more versatile equipment can be used on a wider range of incidents making it a better investment.

Light weight 30,000 lpm trailer

The first three points are very important in the design of large capacity monitor trailers. If the nozzle is depressed below 30 degrees it will be more difficult to stabilise the trailer. Since there are no good fire fighting reasons for depressing the nozzle below 30 degrees why not restrict travel to a minimum of 30 degrees?

Similarly, if horizontal travel is restricted the trailer can also be simplified. A trailer that has more movement than is necessary becomes large, cumbersome and more difficult to use. Ballast tanks are then needed for

stabilisation and in the long run the tanks will also be the biggest maintenance problem. The ballast tanks also make the trailer less manoeuvrable, so that it may not be possible to locate it in the best location, and then you need wider travel. If the ballast tanks can be eliminated the trailer will be lighter, easier to tow and manoeuvre and require less maintenance. It will also be easier to set up the trailer when and where it is needed and easier to pack up after.

Handling and management of the hoses supplying the monitors is also a significant issue. Smaller hoses are easier for personnel to deploy and smaller monitors need fewer hoses.

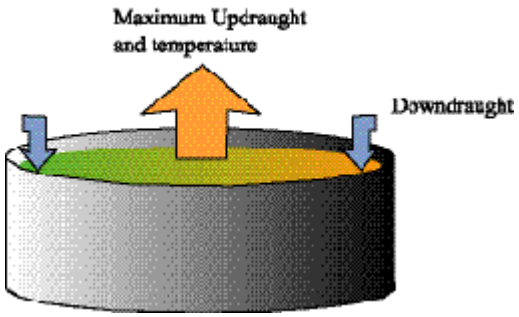
By using these design principals a well balanced trailer that can be moved by two or three people is possible. No ballast tank is required and a reasonable sized sedan can tow the trailer. They are simple, reliable and can be set up quickly by a very small crew. Two men can set up a 200mm trailer in only a few minutes. The most time consuming job is connecting the hoses. Training is also simplified.

The main argument for big trailers is that higher flows give longer throws. With good nozzle design it is possible achieve throws at 25,000 litres per minute that are superior to other nozzles at 50,000 litres per minute. Two trailers can fight the same fire just as effectively as one; in fact they can do it better if they are designed correctly.

Fire Fighting Techniques

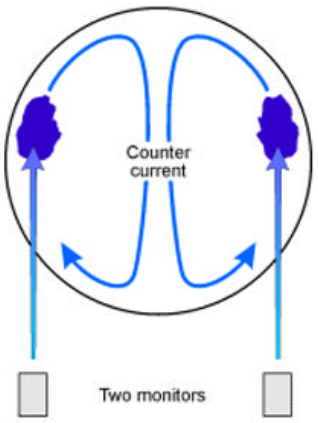
It has been recommended by some that one fire stream aimed at the centre of a tank fire is the most efficient method for using monitors. In our opinion there are two fundamental problems with this fire fighting technique. The centre of the tank fire has the strongest updraught and the hottest temperatures. These conditions will be very destructive of any foam stream that passes through this part of the fire.

A far better fire fighting technique is to apply foam at the edge on each side of the tank. Here the foam is actually drawn down into the tank by the airflow and has the least exposure to high temperatures. Basically, this way we will get the most foam onto the fuel and thereby extinguish the fire most efficiently.



Tank Fire Air Flow

Secondly, two fire streams will also set up efficient counter currents within the tank (assuming no obstructions) to bring foam to the front face of the tank, thus extinguishing the fire at the front edge quicker.



Two monitor fire fighting method

There are other advantages with the use of two monitors, such as:-

1. If a hose bursts only one monitor will be out of action or at reduced performance, basically it is bad practice to put all your eggs in one basket,
2. One monitor can be shut down and moved without completely stopping fire fighting operations, and
3. When a monitor needs to be moved it can be carried out more easily and faster if the monitor is smaller.
4. In the worst case scenario of a floating roof tank with a partially submerged roof two monitors will be far more effective than one.

Nozzle Selection

There are two schools of thought on the right selection of nozzle for fighting large tank fires. One school insists that non-aspirated foam is best while the other school insists that only aspirated foam will work.

Test data on aspirated Vv non-aspirated foam is strongly in favour of aspirated foam as being the most effective for tank or pool fires. If this were the only issue to consider aspirated foam would be the only choice. Unfortunately aspirated foam will not throw long distances so that for large tank fires it may not be possible to apply it. Non-aspirated foam nozzles may be needed to gain control of large tank fires.

Aspirated foam will be far more efficient when securing a tank after a fire.

Consequently, large capacity trailers should be able to use both aspirated and non-aspirated nozzles.

Conclusion

This analysis of the requirements for mobile fire fighting equipment concludes that smaller versatile equipment can perform the job and do it more efficiently. The basic design principal used is the KISS principal.

From our experience fire services will be better able to justify expenditure on more versatile equipment.

If equipment is kept simple and easy to use training will be more effective and less costly.

* * *

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New Members

We are very pleased to welcome the following new Members to JOIFF:

BASF plc., Seal Sands, England, represented by its Emergency Services Co-Ordinator, Phil Almond and Don Harrison, the Responsible Care Process Owner. The Emergency Services Team in BASF supply 24 hour cover by full time firefighters with additional support from Production Technicians. BASF have a number of emergency response appliances and an Ambulance.

Corus Aluminium, Belgium, represented by its Manager EHSS, Joris Vangeel and Ivo De Kegel, Prevention Advisor, Safety. The types of Risk in Corus include Fire, solvents, dust explosion and molten aluminium. Corus have an Emergency Services Response Team comprising a large number of Fire Brigade volunteers and they also have contingency planning and organise fire and evacuation exercises on a regular basis with their response team and with the Authorities.

There have been a number of changes of personnel in JOIFF Member Companies and Members can read about them in their current Membership Directory.

We look forward to the involvement of our new Members in the development of JOIFF.

Amish Virus

A message received on my Computer:
"You have just received the Amish virus. Because we don't have any computers or programming experience, this virus works on the honour system. Please delete all the files from your hard drive and manually forward this virus to everyone on your mailing list and ask them to do the same. Thank you for your cooperation.
From: The Amish Computer Engineering Department"

"THE REACTOR COLUMN."

Write to The Reactor, Mr. R., with comments, problems, ideas or anything at all that you would like to be heard. The Editors may decide not to print a letter or part of a letter and letters may be edited. No letter will be published unless the name and address of the Writer is given to the Editors, but names and addresses will not be published without the writer specifically requesting it.

The Reactor Column in this issue was devoted to comment on the statistics and detail published in the July/August 2001 issue of the N.F.P.A. Journal relating to U.S. Firefighter fatalities.

As a mark of respect to the families and friends of those Emergency Services Personnel injured and killed during the recent tragic events in the United States, this column has been withdrawn from this edition of The Catalyst.

We are sure that all Readers will join us in extending our deepest sympathy to all those who have been injured and killed and to their families and our gratitude to those Emergency Services Personnel whose bravery and selflessness have helped save many lives and mitigate the effects of the Outrages.

JOIFF TRAINING NOTES

All Members of JOIFF have been sent details of the Training Courses organised for the remainder of this year and those planned as the foundation of the JOIFF Training Programme for 2002.

From 1st - 5th October a JOIFF accredited 5 day Crew Leader Course will be held in IFTC Teesside. This 5 day Course is aimed at providing technical and practical Training in Command and Control of Firefighting Teams in High Risk Industry. The Course includes sessions and exercises on Team Building, Motivational Skills, Management of Emergency Procedures as well as Crisis Management. Other subjects covered include Leadership, Communications, review of Breathing Apparatus procedures and there are numerous practical exercises on the Fireground involving valve fires, plus ignited gas release fires, fires on multi rigs, bulk storage and road tanker incident, etc.

This will be followed on 8th-10th October, by a JOIFF Accredited Auxiliary Firefighter Course, also in IFTC Teesside. This 3 day Course is aimed at providing part time Members of Occupational Fire Brigades with basic practical skills and understanding of the equipment and procedures used. The Course includes sessions on the Chemistry and Physics of Fire, Fire Extinguishers, Foam, Basic Firemanship and Basic Breathing Apparatus and exercises in Fire techniques, working in smoke - search and rescue - plus tackling major Fire scenarios such as a Fire Screen and valve isolation rig.

Following the Auxiliary Course, on 11th -12th October, there will be a 2 day JOIFF accredited Course on Practical Firefighting which includes Students tackling seven different fire scenarios burning large amounts of fuel.

As with all JOIFF Courses, assessment of Students is ongoing and at the end of each Course, successful students receive a JOIFF Certificate of Competence.

The first JOIFF accredited Fire Extinguisher Instructor Course will be held in Humberside Fire Brigade Industrial Training Centre starting on November 7th and December 10th.

Places are available on all these Courses.

Dates	Detail	Venue
October 1st - 5th	5 day Crew Leader Course	IFTC Teesside
October 8th - 10th	3 day Auxiliary Firefighter Course	IFTC Teesside
October 11th and 12th	2 day Practical Firefighting Course.	IFTC Teesside
November 7th	2.5 day Fire Extinguisher Instructor Course	Humberside Fire Brigade
December 10th	2.5 day Fire Extinguisher Instructor Course	Humberside Fire Brigade

FIRE EXTINGUISHER

Under European Law - in the United Kingdom, under the Fire Regulations and the Management of Health and Safety at Work Regulations - Employers are required to provide instruction and training to Employees about fire precautions in the Work Place. If a Fire can be controlled during the first few minutes, the likelihood of it developing into a destructive event is limited, so a most important aspect of instruction and training is the correct use of portable fire extinguishers, the First Line of Defence in the event of a Fire.

Many persons offer Fire Extinguisher Training to Companies. How do you check their competence to provide such Training - a person with an attractive business card, driving a van and carrying a tool box, does not necessarily make them a competent Instructor ?

We have requested Humberside Fire Brigade Industrial Training Centre to develop a Course for Fire Extinguisher Instructors which JOIFF will accredit. They have prepared a 2½ day Course, the first of which is scheduled to start on 7th November. The Course includes detail on the chemistry of Fire, the principals of Fire Extinguishers, Health, Safety and Environmental considerations for extinguisher training, and gives guidance to Students on how to draw up and present suitable Training sessions including the actual fire demonstrations.

As with all JOIFF accredited Courses, student assessment is ongoing throughout the Course and successful Students will receive a JOIFF Certificate of Competence.

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