JOIFF

THE INTERNATIONAL ORGANISATION FOR INDUSTRIAL EMERGENCY RESPONSE AND FIRE HAZARD MANAGEMENT

JOIFF GUIDELINE

ON

FOAM CONCENTRATE

Part of THE JOIFF STANDARD

JOIFF in Partnership with

FULCRUM CONSULTANTS

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JOIFF Guideline on Foam Concentrate

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First edition published September 2010.
First revision published October 2018

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INTRODUCTION

The first JOIFF Guideline on Foam was published in 2010. There have been major changes in the foam market since its publication due to increasing regulatory requirements and changes in the manufacture and use of foam concentrate and last year JOIFF decided to revise the 2010 Guideline to reflect current Good Industry Practice.

The purpose of this Guideline is to assist JOIFF Members in setting operating standards and resolving issues with regard to foam concentrate. It provides information and background detail which JOIFF hopes will enable Users of foam concentrate to make informed decisions as to the most suitable type(s) of foam concentrate to use for the protection of their facility, the persons working and contracted in it and the surrounding communities and environment. It also includes important information on how to manage stocks of foam concentrate.

JOIFF hopes that this Guideline will be of assistance to those with responsibility for foam concentrate in their organisations to ensure that stocks of foam concentrate are managed to Good Industry Practice.

Because of current changes impacting on foam concentrate due to innovation and regulations, to maintain a current position on foam concentrate, JOIFF will be carrying out a continual review of the detail in this Guideline and invites input from our members on issues relating to foam concentrate. Comments should be sent to the JOIFF Secretariat at joiff@fulcrum-consultants.com

PART 1: FOAM CONCENTRATE - THE PURCHASING PROCESS

1.1 Introduction

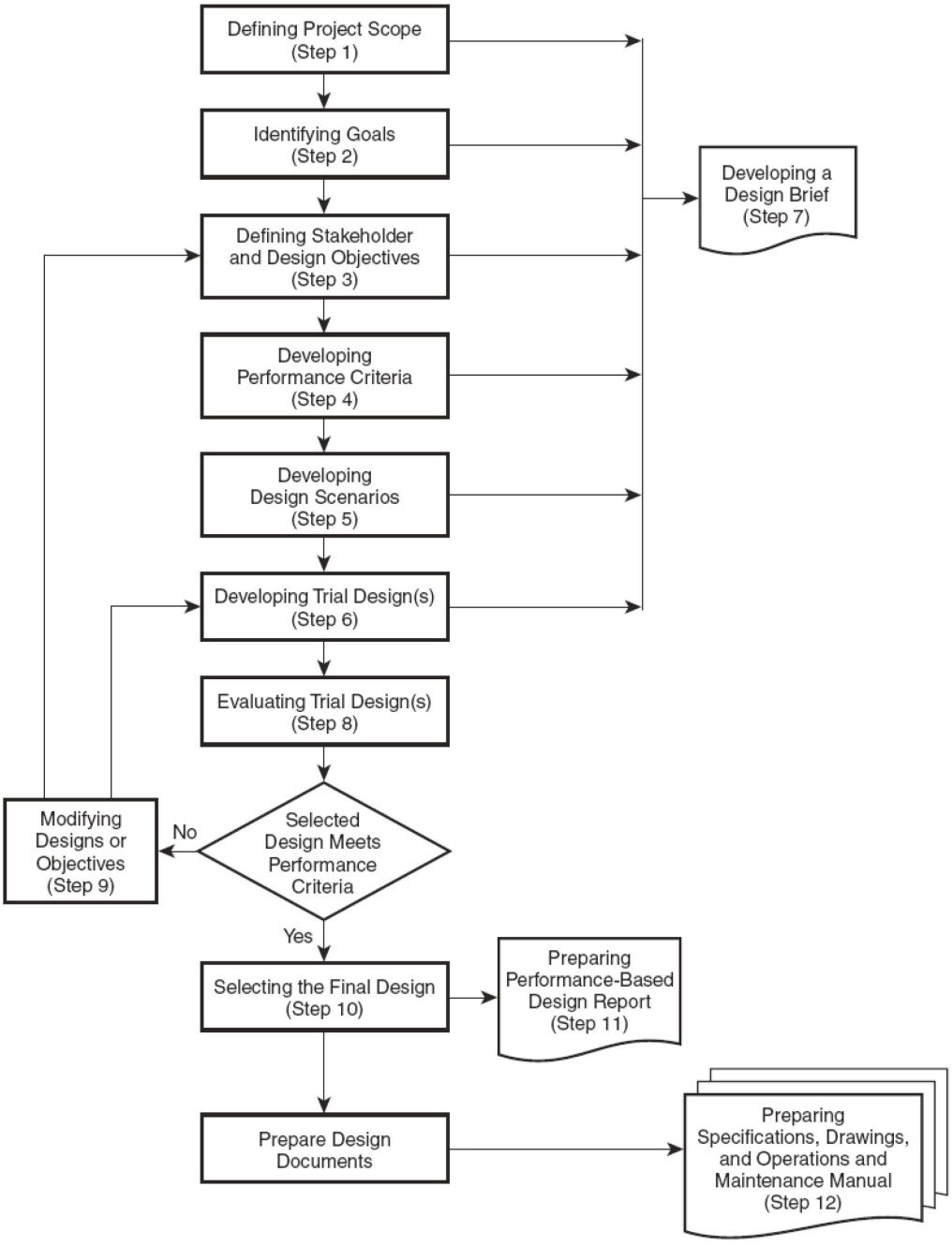
Foam is purchased as foam concentrate and is used for fire and vapour suppression of flammable liquids, gases and solids to reduce and/or prevent oxygen (air) coming in contact with the product which might result in a fire and/or an explosion.

The person(s) who makes the purchasing decision for foam concentrate is/are the person(s) who set(s) the Organisation's parameters for protection of the property, persons and environment for which it is purchased to protect. Therefore the decision-maker(s) should have knowledge of the performance criteria for identified incident scenarios of the foam concentrate in these scenarios as shown in the process flow diagram below. In addition, in order to ensure that an informed decision on purchase is reached, the decision maker(s) should also be knowledgeable about legal and other requirements both locally and Internationally, the impact on the environment and the properties of the foam concentrate, the method for storing and the storing conditions for the foam concentrate at the operator's site/facility and how the foam concentrate should be used and maintained.

Whilst the employer/employing entity has the ultimate legal responsibility for protection of the property, persons and environment, all stakeholders i.e. any party that can positively or negatively influence the performance of the system of protection by their actions, are joined in the responsibility of protecting the property, persons and environment.

This means that all stakeholders have a responsibility to ensure that the foam concentrate purchased and how it is stored, maintained and used is fit for purpose, balancing issues such as safety, suitability, environmental impact; cost and services expected from the manufacturer/supplier of the foam concentrate and all other relevant factors.

PROCESS FLOW DIAGRAM



Note:
ISO/IEC/IEEE 15288:2015 establishes a common framework of process descriptions for describing the life cycle of systems created by humans. In terms of Fire Safety this interpretation has resulted in it becoming increasingly accepted that fire protection provisions should be viewed as a system composed of construction, installation and organisational aspects. In these terms, a system can be fixed, mobile and a hybrid of the two e.g. a semi-fixed systems. The flow diagram above is a system to achieve the goals and objectives stated based on credible incidents where identified.

1.2 Pre-purchasing considerations

The tables below provide a non-exhaustive list of questions which the purchaser might consider before making a decision to purchase foam concentrate.

Purchasers should complement this list with site/facility specific questions based on local conditions and requirements. Purchasers are encouraged to ask manufacturers/suppliers any questions that they wish to ask in arriving at their final decision as to which foam concentrate to buy. The manufacturer's/supplier's ability to answer these questions may be influential in the final purchasing decision.

There are no universally correct or incorrect answers to the questions set out in the following pages. The relevant PASS/FAIL criteria for any answers given must be established by the Purchaser and they should have a very big influence on the purchasing decision.

TABLE 1.1 RISK ASSESSMENT and LEVEL OF PROTECTION REQUIRED		
QUESTIONS	**YES**	**NO**
1.1.1 Have you identified the risks for which foam concentrate is likely to be used within the site/facility emergency plan and the working environments in which it is likely to be used?		
1.1.2 Within the Risk Assessment have you calculated the theoretical quantities of foam concentrate – based on actual results with this foam concentrate on the products involved in the credible incidents at your site/facility - that will be required to successfully mitigate the expected incidents?		
1.1.3 Within the Risk Assessment, have you taken account of the type and volume of compatible foam concentrate that can be provided in support by partners in Mutual Aid?		
1.1.4 Have you identified desired performance criteria of selected foam concentrate considering anticipated risk derived from risk assessment of facilities?		
1.1.5 Have you considered how those who will have to handle and use the foam concentrate will be trained in its use?		
1.1.6 Have you considered pre-planning aspects affecting the logistics of firefighting such as transportation obstacles impacting the time needed to transport the required amount of foam concentrate, or groundwater protection areas which could cause making detours in foam delivery affecting the amount stored on site/facility?		
1.1.7 Have you reviewed by Risk Assessment the performance and environmental benefits and disadvantages of using different proportioning ratios?		
1.1.8 If considering using fluorine free foam concentrate have you included consideration of the possibility that application rates may or will go up depending on the present fuel types which again impacts the logistical planning?		

TABLE 1.2 INFORMATION ON AVAILABLE FOAM CONCENTRATE			
QUESTIONS		**YES**	**NO**
1.2.1 Have you carried out research to determine the types of foam concentrates available for the products on your site/facility?			
1.2.2 Have you carried out research to determine if there are any technical limitations regarding the types of foam concentrate that are compatible with the foam systems in use on/for your site/facility e.g. foam pumps, proportioners, ,discharge heads, storage system?			
1.2.3 Have you determined the number of potential suitable manufacturers/suppliers?			
1.2.4 Have you asked the potential manufacturers/suppliers what is the technical life of the foam concentrate at atmospheric conditions at your site/facility that they propose to supply?			
1.2.5 Have you established that the foam concentrate that you are considering is	1.2.5.1 approved by a third party agent and a specified test programme/procedure to be suitable for its intended purpose?		
	1.2.5.2 approved by a third party agent and a specified test programme/procedure to be appropriate to the risk involved?		
1.2.6 Have you assessed the limitations of the foam concentrate being considered with regard to test suitability, limiting factors such as minimum expansion, water quality etc.?			
1.2.7 Have you gathered information from comparable organisations using similar foam concentrate for similar tasks?			

TABLE 1.3 MANUFACTURER'S CERTIFICATION		
QUESTIONS	**YES**	**NO**
1.3.1 Are there any legal or procedural requirements in your Country and/or Organisation that foam concentrate must be certified to any particular standards?		
1.3.2 Have you established the particular standards to which the foam concentrate should be tested?		
1.3.3 Have you investigated which Test Houses are authorised and capable of testing to the standards that you require?		
1.3.4 Have you decided which certification will be acceptable to you?		
1.3.5 Have potential manufacturers/suppliers provided you with details from a recognised Test House on compliance with and certification to relevant standards of the products they propose to supply?		
1.3.6 Have you matched the performance properties achieved by the foam concentrate in testing with the types of hazard identified in your own Risk Assessment for which the purchase of foam concentrate is taking place?		
1.3 7 Have you obtained from the potential manufacturer/supplier written confirmation that the foam concentrate being purchased meets the Environmental Legislation of the Country where this will be discharged?		
1.3.8 Have you asked and received comprehensive toxicological and eco-toxicological information on the foam concentrate covering the foam's impact on bacteria, aquatic life, degradation behaviour and mammals?		
Note: For testing details please consider EN1568:2018. At present there is no such reference in ISO but it is likely that there will be in the new revision of ISO 7203 series. NFPA 1155/2010 gives some advice in Chapter 4.2.1 "Health, Safety and Environmental Considerations		

TABLE 1.4 PRACTICAL PERFORMANCE TESTS			
	QUESTIONS	**YES**	**NO**
1.4.1 For the foam concentrate being considered, have you reviewed	1.4.1.1 the compatibility with other types of foam concentrate e.g. from mutual aid partners that might be used during an incident?		
	1.4.1.2 the compatibility with other types of extinguishing media e.g. Dry Powder that might be used during an incident.		
	1.4.1.3 the suitability of foam concentrate you are considering to undertake all tasks that you expect the foam concentrate to be used on?		

TABLE 1.5 CARE AND MAINTENANCE OF FOAM CONCENTRATE			
	QUESTIONS	**YES**	**NO**
1.5.1 Have you been made aware of requirements for storage of the foam concentrate to be purchased?			
1.5.2 Have you been made aware of requirements for inspection of the foam concentrate to be purchased?			
1.5.3 Have you been made aware of requirements for testing of the foam concentrate to be purchased?			
1.5.4 Have you been made aware of the replacement requirements and costs for the foam concentrate to be purchased?			
1.5.5 With regard to the expected lifetime of the foam concentrate to be purchased, have you been made aware of	1.5.5.1 the parameters whereby the foam concentrate continues to be safe to use?		
	1.5.5.2 the expected lifetime period claimed by the potential manufacturer/supplier?		
	1.5.5.3 how the potential manufacturer/supplier has arrived at the time given for the expected lifetime period?		
	1.5.5.4 any testing programme that the manufacturer/supplier operates either by themselves or in conjunction with a testing laboratory, to help determine expected lifetime period of the foam concentrate they supply?		
	1.5.5.5 the cost of such testing?		
	1.5.5.6 any obligations that you will have if the claimed expected lifetime period is to be achieved?		
	1.5.5.7 what guarantees the potential manufacturer/supplier is giving if, having followed all obligations, the foam concentrate does not last for the stated expected lifetime period?		
1.5.6 Are you aware of procedures to correctly sample foam concentrates from stocks to make sure that the sample and its testing results are representative of the entirety of the stocked volume? Note: Sampling procedures should be in place and personnel should be trained to make sure that samples are representative. This is to avoid some issues that arise in testing e.g. before taking samples, proper circulation of stored foam should be carried out, sampling tubes should be flushed with sufficient amounts of foam agent prior to taking the sample; ensure that samples taken from a tank for testing are representative of the entire volume in the respective tank the sample is taken from etc.			
1.5.7 Have you been made aware of the requirements for disposal of the foam concentrate when it has outlived its use?			

TABLE 1.6 DELIVERY / GUARANTEE CONSIDERATIONS			
QUESTIONS		YES	NO
1.6.1 Are there any requirements from the proposed manufacturer/supplier for minimum quantities?			
1.6.2 Have you established	1.6.2.1 the proposed manufacturer's/supplier's delivery time for the complete order?		
	1.6.2.2 the type of container in which the foam concentrate will be delivered?		
	1.6.2.3 the proposed manufacturer's/supplier's delivery time for replacements when the foam concentrate is used?		
	1.6.2.4 what support the proposed manufacturer/supplier will provide if the agreed delivery times for part or all of the order are not met?		
	1.6.2.5 what is the time limit after which you can cancel the order without penalty if promised delivery times are not met?		
1.6.3 Are there any guarantees for replacement if there is a failure of foam during testing within the manufacturer's claimed life of the foam concentrate supplied?			
1.6.4 What costs do any guarantees offered cover?			

TABLE 1.7 THE COMPANY YOU ARE PROPOSING TO DEAL WITH		
QUESTIONS	YES	NO
1.7.1 Is the Company legally established and registered under the Laws of the Country in which it is operating?		
1.7.2 Has it the financial structure to operate its business and to fulfil its statutory requirements such as paying its taxes, paying its employees, its suppliers etc.?		
1.7.3 Does it carry an adequate level of Insurance cover e.g. product liability, public liability and employer's liability?		
1.7.4 Has it the technical support needed to carry out its activities, support that is based on scientific fact and modern practice?		
1.7.5 Are the products it sells approved by a Test House accredited to ISO/IEC 17025:2018 General requirements for the competence of testing and calibration laboratories; or ISO/IEC 17000:2004 Conformity assessment- Vocabulary and general principles and does it offer guarantees and proof of these approvals and guarantees be provided? Note: Good practice is that foam concentrate testing should only be executed by independent third parties which have their own capabilities and expertise to do so and which participate regularly in independent third party quality check programmes.		
1.7.6 Is it approved to the relevant ISO quality and environmental standards or equivalent?		
1.7.7 Can it provide you and those who will use the foam concentrate with adequate and relevant training in its use, storage, care, maintenance and eventual disposal?		
1.7.8 Have you seen a copy of the Safety Data Sheet and the Product Data Sheet that is provided with the foam concentrate?		
1.7.9 Is the Sales person you are dealing with competent to role and knowledgeable about the goods and services being offered?		
1.7.10 Are you comfortable in your dealings with this Company?		

PART 2: SELECTION AND TEST REQUIREMENTS FOR FOAM CONCENTRATE

2.1 Introduction

Extinguishment of fires of flammable liquids in high hazard industry requires a dedicated suitable foam concentrate which can only be selected after going through an expensive and elaborate process. Foam concentrate is part of the (semi) fixed and/or mobile fire fighting systems.
Note:
ISO/IEC/IEEE 15288:2015 defines a system as an interdisciplinary approach encompassing the entire technical effort to evolve and verify an integrated and total life-cycle balanced set of system, people, and process solutions that comply with the operator's needs.

Any change to that system can have far reaching consequences for the performance of the whole system and the control of incidents. Even the best quality foam concentrate won't do the job if applied in the wrong way or by the wrong equipment. If a change of foam concentrate is considered, this aspect could become of major importance yet still is often overlooked.

Therefore purchasers/operators should consider dealing only with manufacturers/suppliers who can guarantee that future supplies of foam concentrates will have the same quality and rating according to the relevant standards and regulations, when they reorder the foam concentrate for many years after they first purchased the foam concentrate.

Reputable producers of foam concentrates perform sampling of the onsite foam concentrates for the annual foam concentrate testing as required by the relevant standards and regulations e.g. as in National Fire Protection Association Code NFPA 11 *Standard for Low, Medium and High-Expansion Foam* or equivalent. These sampling and testing processes should be performed under controlled conditions to get reliable and reproducible test results.
Note:
NFPA 11: 12.1.1 At least annually, all foam systems shall be thoroughly inspected and checked for correct operation.

Laboratories that carry out testing should work to an internationally recognised standard that measures Good Industry Practice by laboratories and so allows fair comparison of the work of one certified laboratory with another. ISO 17025: *General requirements for the competence of testing and calibration laboratories* is widely used as the good practice reference for laboratories who carry out testing.

- Subject to National / Regional / Local regulations which may differ in different regions of the World, all foam concentrates should be sold with product information listed in the mandatory Safety Data Sheets to comply with Globally Harmonized System of Classification and Labelling of Chemicals. This information should include at least:

    1. Identification of substance/mixture
    2. Hazard(s) identification
    3. Composition/ information on ingredients
    4. First-aid measures
    5. Fire-fighting measures
    6. Accidental release measures
    7. Handling and storage
    8. Exposure control/ personal protection

9. Physical and chemical properties
10. chemical stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

- A client specific product information folder about the foam concentrate that lists information about the technical life of the foam concentrate and the sites dedicated foam concentrate sampling protocol, compatibility of the system materials with the foam concentrate, among other information.

This document contains examples of information which should be available to the operator before selecting fire fighting foam concentrate in the high hazard industry. The examples provided are for illustrative purposes only and are based on fixed fire fighting systems. Semi fixed systems and mobile systems can have additional information requirements.

2.2 Production Foam Concentrate

Foam concentrate can be a mixture of 20 or more materials/substances. These materials/substances are mixed in a specific sequence. How this is done is only known to the producer.

To ensure that future purchases of foam concentrate have the same quality and ratings as the foam concentrate which was purchased after the selection process of the foam concentrate, producers should use the quality control elements described in the ISO 17067: *Conformity assessment – Fundamentals of product certification and guidelines for product certification schemes* or equivalent.

PART 3: ENVIRONMENTAL ASPECTS AND FOAM DISCHARGE

- It is likely that the use of foam is controlled by National/Regional/Local Regulations whether it is used on a fire or not.

- All precautions that are reasonably practicable in the circumstances should be taken to minimise the impact of foam discharge on the environment.
  Note:
  The use of perfluoro-octane sulfonate (PFOS) and perfluoro-octanoic acid (PFOA) containing foam concentrates is highly regulated or prohibited in some Countries.

- Firefighting foam concentrates containing PFOS should not be used. PFOS is highly polluting. Foam concentrates containing PFOS should be disposed of by incineration. Some manufacturers believe that this ban should be extended to cover a wider range of chemicals contained in some foam concentrates. Irrespective of the foam concentrate that is used, the criteria to be followed is that when discharging foam, as much fire water run-off as is technically possible and feasible should be contained and disposed of in accordance with local environmental legislation. If this is not possible, foam concentrates containing environmentally critical ingredients i.e. fluorine- or silicon compounds, should be avoided and fully degradable foam concentrates should be used instead. If avoiding fluorine- or silicon compounds containing firefighting foam concentrates is not possible (e.g. the local risk can only be managed safely by AFFF or similar), all technical and organisational measures should be taken to reduce consumption.

- When purchasing an Aqueous Film-Forming Foam Concentrate (AFFF), film forming fluoro-protein foam concentrate (FFFP) or fluoro-protein foam concentrate (FP), short molecular chain fluorosurfactants of 6 hydrocarbons or less are considered to be less persistent and more environmentally acceptable than their longer chain variants like PFOA. Persistency of the perfluorinated chain is not any different to C8 (C8 is a longer perfluorinated carbon chain than C6).

- Every effort should be made in operational use to ensure that firewater is prevented from entering surface drains, running into nearby watercourses (rivers and streams), foul drainage systems, or land. During all other uses, National/Regional/Local Regulations should be followed.

- When flow testing systems, consideration should be given to testing them without releasing any foam concentrate to the environment. Recent developments have resulted in new products that provide an alternative non-foaming environmentally benign test liquid which is used in place of the foam concentrate stored in the system. Some of the manufacturers of these products claim that as the proportioned solution test is non-foaming and contains no environmentally harmful chemicals, it is usually acceptable for direct release to storm drains leading to municipal waste water treatment facilities. If using these products to flow test systems, it is very important that detailed information relative to the effluent released must be provided to local authorities having jurisdiction prior to the system test.

  Note:
  There are two types of test foam concentrates:
  1. "mimic foam concentrate" *with no foaming properties* (mimicking only the hydrodynamic properties of a real foam concentrate) for testing of the flow and correct operation of the proportioner only installations and systems.

2. "mimic foam concentrate" *with foaming properties* for testing foam concentrate with similar pseudo plastic and foaming properties and foaming as the foam concentrate that will be used in practice (mimicking hydrodynamic properties and foam performance of a real foam concentrate), but with reduced risk for environmental pollution.
   This foam concentrate is used after it is clear that the installation/system provides the right flow with the correct % of foam concentrate suppletion to test:

   - Expansion ratio of the foam concentrate – quarter drainage time;
   - Throw distance of monitors.

   The mimic foam concentrate under "2" can be used for the tests under "1", the mimic foam concentrate under "1" cannot be used for the tests under "2".

- Containment lagoons, tanks or systems to hold firewater should be constructed on waterproof surfaces.
  Note:
  "Waterproof" may not automatically mean "foam proof" as the lower surface tensions allows for penetration into micro-ruptures or pores which water would not go in.

- Containment systems from surface drains, watercourses, land or sewers should be isolated.

- Bund containment systems should be considered. This involves building a secondary barrier around the main containment system, to hold firewater if the main containment fails. The bund should be resistant to both heat, and the products being stored.
  Note:
  This is a link to a publication which is considered good practice: https://www.ciria.org/Resources/Free_publications/c736.aspx

- Some Countries have legal requirements with regard to foam concentrate and the Environment. It is strongly recommended that a policy/procedure be developed by each site/facility to satisfy current legal requirements for the containment of water/foam run-off from the discharge of foam in testing, accidental discharge and/or operational use.

PART 4: THE MANAGEMENT OF FOAM CONCENTRATE STOCKS

4.1 Management System:

All Users of foam concentrate should implement a system to manage their foam concentrate Stocks. Such a system should take account of at least the following:

4.1.1 Storage:

- Foam concentrate Stocks should be stored and used in accordance with the manufacturer's instructions which should accompany each delivery of foam concentrate. The respective documentation should be kept up to date.

- It is Good Practice to retain a sample of each batch of newly delivered foam concentrate under ideal storage conditions.
  Note:
  The reason for retaining such a sample is that it can be used as a reference to understand the impact of actual conditions of storage on stocks of foam concentrates over time. This could assist in an understanding of – for example why a certain stock deteriorated earlier than any other. It also may help in the event of a claim.

- Where different foam concentrate types are stored at a facility the storage containers should be clearly marked and visible for identification. Care must be taken to maintain these labels and markings.

- The Safety Data Sheet (SDS) for foam concentrate products should be readily and easily accessible to the storage location. (For further information on SDS see Appendix B of this Guideline).

- In addition account should be taken of any statutory, regulatory and/or legal requirements applicable to the site for the storage of foam concentrate.

- Consideration should be given to avoid prolonged or extreme storage conditions. If this is unavoidable, procedures should be in place to capture any accelerated degradation of the foam concentrate.

- Requirements for minimum stock levels should be established and regularly reviewed. Procedures should be implemented to ensure that minimum stock levels are maintained. These procedures should take into account delivery times from manufacturers/suppliers.

- Some manufacturers recommend that to ensure longevity of product shelf life foam concentrate should be removed from the original manufacturers packing and decanted into larger bulk storage tanks in accordance with the foam concentrate manufacturer's guidelines. Other manufacturers recommend that excluding bulk foam concentrate installations and dedicated vehicles, foam concentrates generally are best left in their original containers as supplied by the manufacturer and subject to their recommendations, because unnecessary decanting of foam concentrate increases the risk of contamination, dilution or evaporation. Before taking any action on this, Users should seek advice from their manufacturer/supplier.

- Free air exchange between atmosphere and storage container/tank should always be minimised to prevent seasonal evaporation loss, helping to prevent introduction of contaminates and to support extended product shelf life for the foam concentrates.

- When refilling or topping up fire vehicles or large bulk storage tanks, the foam concentrate products that are used should be of the same firefighting foam concentrate following the manufacturer's recommendation for this.
  Note 1:
  Tank base filling is preferable to reduce aeration of the foam concentrate which could occur when other types of filling are used.
  Note 2:
  It may be necessary to differentiate between refilling in case of an emergency and refilling for storage. Refilling for storage has higher requirements on the compatibility of the two agents - the old agent and the new agent. In case of an emergency backfill it may be necessary to use the same type of agent (i.e. AFFF or Synthetic) only and take care of a proper fill after the emergency (this excludes alcohol resistant/polymer containing foam concentrates in particular which should never be mixed unless it's the same product from the same manufacturer) whereas for long term storage the agents must be fully compatible.

  A premixing test on samples of the existing foam concentrate and new foam concentrate should first be carried out.
  Note:
  Under normal circumstances, it is possible to take a sample from the foam concentrate in the tank of the vehicle at any location. This sample can be used to carry out the test at any suitable location.

  Before carrying out these actions, it is important to consult with and obtain agreement from the manufacturer of the foam concentrate.
  Note:
  It is recommended that with each delivery from the manufacturer/supplier there should be an SDS ***plus*** a letter of conformity to batch. SDS do not hold any information on storage or mixing or handling but what is relevant in health and environmental safety. The technical information on compatibility with other foam concentrates is typically given in the product information sheet.

- Before changing a foam concentrate from one type to another in a fire vehicle or large bulk storage tank, to ensure that the tank is fit-for-purpose the manufacturer of the "new" product should be consulted on aspects such as storage container suitability, material compatibility, cleaning measures, filling requirements.

4.1.2 Inspection and Testing:

- Foam concentrate stocks should be subject to routine inspection and testing by suitably qualified personnel.

- It is good practice to test annually samples from each batch number held in stock.

- Intervals between inspection and testing should be based on the manufacturer's recommendations and any statutory and/or regulatory requirements applicable to the site.
  - Where no such inspection and testing guidance is available a minimum annual frequency is considered good practice.

- The programme of inspection and testing should include a sampling method that secures that the sample represents the foam concentrate in the reservoir and periodic test and inspection of foam producing equipment to the manufacturers' instructions.

- In testing foam pumps, some systems use a procedure that circulates the foam concentrate from the foam concentrate reservoir through the system and back to the reservoir without any water being added. This method may affect the quality of the foam particularly the foam concentrates containing polymer forming properties. Those using this test should be aware of this and include in their quality system a requirement to check the quality of the foam after the test.

- Stocks of foam concentrates held in bulk tanks or drums should be assessed for continued satisfactory performance by taking samples from each batch and having these analysed at regular intervals by a competent person to verify compliance with the requirements of the Authority.

- When in doubt about satisfactory testing procedures or results it is recommended to consult with a qualified or certified third party testing service.

4.1.3 Compatibility of Foam Concentrates:

Some types of foam concentrate are incompatible with others. Incompatible types of foam concentrate should be kept apart both in storage and in use. Mixing of incompatible foam concentrate is likely to result in cross contamination and spoiling of foam concentrate stocks. This may nullify the manufacturer's warranty, and the destruction of the foam concentrate is costly. In addition, incompatibility of foam concentrates could render equipment inoperable due to blockage as a result of reactions/interactions between foam concentrates.

4.1.4 Foam Concentrates used in vehicles/foam systems:

For foam concentrates used in vehicles/foam systems, it is essential that prior to new concentrate being used, all parts of the foam system in the vehicle/system are thoroughly cleaned. This is particularly important in regions where legal threshold limits are in place for particular chemical compounds such as PFOS or PFOA.

- After every foam system operation, prior to the vehicle being returned to its station, the proportioning system, associated pipe work and equipment should be flushed thoroughly with fresh water to remove any stratified foam or foam solution.

- Stratified foam in parts of the storage reservoir and proportioning system such as orifices and low point piping may present long term maintenance issues and therefore good house-keeping procedures are recommend to ensure proportioning systems and related equipment are correctly cleaned as per instructions.

- After cleaning, the last water from flowing from the system should be tested in a laboratory for presence of residue of foam.

4.1.5 Induction Accuracy:

Foam generating systems should be routinely inspected and checked for proportioning accuracy. The periods between inspections and checks should take into account the proportioning equipment used i.e. hydraulic, electronic etc.

As a guide, induction accuracy should be validated on an annual basis
Note: The viscosity of foam concentrates may vary with changing temperature hence this may have a big impact on the accuracy of induction:

For environmental reasons the testing of the proportioning systems may be carried out by using water only to simulate foam, providing the equipment can operate correctly by this method.

4.1.6 Record keeping:

Organisations using foam concentrates should maintain records relating to Stocks of foam concentrates. Such record keeping should include at least the following:

- Selection records i.e. how and why the foam concentrate was chosen.
- Product data sheet stating intended proportioning rates and application listings, ratings or approvals.
- Safety data sheet (SDS). (For further information on SDS see Appendix B of this Guideline).
- Manufacturers recommended storage information and life span warranty when stored as directed, shelf life conditions and materials for acceptable long-term storage.
- A record of the sample of the foam concentrate retained on delivery.
- Records showing that foam concentrate stocks are rotated in a manner that allows for the oldest dated product to be utilised first.
- Specification of each type of foam concentrate on site including date purchased and from whom, copy of any test certification, receipt of all necessary user information etc.
- Certificate(s) of Conformity with the standard to which the foam concentrate has been purchased should be provided by the manufacturer/supplier with each batch of foam concentrate delivered. Certificate(s) of Conformance should be retained in a suitable location for reference and inspection.
- Ongoing record of amount of foam concentrate held in stock including:
    - Dates of manufacture and packaging type;
    - Date of delivery;
    - Date of fire vehicle or bulk tank fill;
    - Manufacturer's product batch number(s);
    - Manufacturer's warranty policy and contact information;
    - Manufacturer's letters of conformity to delivery notes.
- Routine inspection and testing dates along with supporting test results.
- Method of controlling the use of foam concentrate stocks.
- List of extinguishing agents on site with which the foam concentrate is compatible and incompatible.
- List of fixed fire-fighting systems on site with which the foam concentrate is compatible and incompatible.
- Information on storage conditions/location.
- Method and any associated declaration stating disposal of out of date foam concentrate stock.

4.1.7 Risk Assessment:
As with many activities carried out by Emergency Responders in both training and in Incidents, handling and using foam concentrate can be a hazardous activity. A Risk Assessment should be carried out before using foam and at least the following should be taken into account:

- It is important that only personnel who have been given the correct training and can demonstrate on-going competence in the use of the foam concentrate and the equipment used on site are allowed to participate in activities where foam concentrate is used.

- Before any activities using foam concentrate, a risk assessment should be undertaken and actions taken to reduce or eliminate risk identified by the risk assessment.

- It is important that all personnel engaged in the use of foam concentrate, have been trained and can demonstrate competence in Manual Handling on an on-going basis.

- To minimise the potential for personnel exposure and/or environmental impact the foam concentrate product Safety Data Sheet (SDS) should be reviewed by experienced and qualified company representatives to ensure that all listed material compositions are acceptable for use on site.

- General basic personal protection equipment such as protective gloves and eyewear should be available for all personnel handling and using foam concentrate.

4.2 Foam Concentrate Properties:

Areas to be addressed when dealing with foam concentrate should take account of at least the following:

4.2.1 Expansion ratio:
The amount of air entrained into a foam stream governs its expansion, which in turn will affect the fluidity of the finished foam and therefore the rate of spread over the surface of burning fuels. In addition, the expansion ratio is a conditional factor for extinguishment of water soluble liquid fires.

4.2.2 Drainage time:
The rate at which foam solution drains from a foam blanket may be a partial consideration in the efficiency of the foam blanket in progressively controlling and extinguishing fires and subsequent post-fire security. Amongst other factors, the use of foam nozzles or branchpipes capable of producing aspirated foam of good consistency will be beneficial in prolonging foam drainage times.

- Fluid free flowing finished foam is a factor in control and extinguishment.

- Stable resilient long draining finished foam is a factor for post fire suppression and un-ignited fuel vapour suppression.

Some industries such as Aviation have a prescribed drainage rate of 25% in 3 minutes. In considering drainage time, it could be useful to take such figures into account.

Note:
Fluorine free foam concentrates typically require a certain minimum foam quality to actually work as they can only physically extinguish as a foam blanket, there is no help from any chemical ingredient such as fluoro compounds. Hence the quality (good consistency) of the foam is much more crucial for this foam concentrate type than for AFFFs.

4.2.3 Foam concentrates compatibility with equipment used:

With various foam concentrate types commercially available the selection of delivery systems such as monitors, nozzles, branchpipes and other equipment used with foam concentrate is critical to overall foam quality performance as intended by the foam concentrate manufacturer.

Care should be taken during the selection process to ensure that the optimum combination of foam concentrate and equipment is chosen.

4.2.4 Foam Concentrate Performance Levels, Specifications and Test Procedures:

Foam concentrate in use should be of consistent good quality, fit for purpose, stored and used in accordance with manufacturers' recommendations.

- Foam concentrate performance listings, in most cases vary, when foam concentrate is used with fresh water to that of seawater or in extreme changes of temperature. Certification and performance listings should be sought from the foam concentrate manufacturer to ensure suitable ratings are achieved specific to water grade used on site/facility.

- Foam concentrate users should consider using a test protocol relevant to the industry in which they participate. A non-exhaustive list below provides a general overview.
    - NFPA codes 11, 16 and 30, Handbooks and FM Global Data Sheets which provide guidance information, LASTFIRE for tank and pool fires in the Petro-chemical industry, ICAO for Aviation, UL for Engineering, IMO for Maritime, EN 1568 for fires in the process industry, warehouse, tank storage, fires in the public domain.

  It is recommended to reduce environmental pollution by fire tests for specific chemicals like organic acids, chemicals like Styrene, Propylenoxide, Tert-butylacohol, Epichlorohydrin, etc., by performing the following test first:

  Compare destructive properties of product on foam bubbles by lab-tests in fume cupboard.

  Prepare foam in large beaker using a primary foam concentrate by using the required % of foam concentrate used in the tests for qualifying as primary reference, in potable water to prepare premix. Aerate the foam solution using a hand operated mixer to give foam of a 6:1 expansion ratio.
  Note:
  Foam concentrate with highest rating according to EN1568-3 or EN1568-4 (depending on product being tested) for which the EN1568 fire test was successful for the product being tested.

  Mixer
  Use the measurements on the side of the beaker to confirm the expansion ratio.

  Place a petri-dish with tout and a diameter of at least 25 cm, on an elevated stand in the cupboard.

Petri-dish

Pour 5 cm of the product in the petri-dish.

Fill petri-dish completely with the foam concentrate (not premix liquid) of the primary reference.

Start immediately with filming the behaviour of the foam concentrate for a period of 15 minutes.

Repeat the test using the foam concentrate for which the performance is to be tested

Exclude this foam concentrate from further testing if the performance is less than that of the primary standard.

Note that the foam has to be freshly prepared for each individual test starting from the concentrate and plain water.

- If foam concentrate Users discover that there is no test that suits their particular requirements and they may need a test designed specifically for their requirements, they should discuss with their foam concentrate manufacturer/supplier the design of such a test.
  Examples of conditions where dedicated tests are required are:
  - Fuel pickup for fluorine free foam concentrate for direct application of the foam concentrate,
  - Dedicated tests for life extension of the foam concentrate after technical life of foam concentrate is exceeded.

4.2.5 Manufacturer's declaration:

The following information is the minimum that should be recorded for each batch delivered. This information is usually readily available from the websites of reputable manufacturers or on their Safety Data Sheets or from their technical support personnel. Where not available from these sources, the manufacturer should be requested to submit such information with each batch delivered.

- Any incompatibility with alternative foam concentrates and/or extinguishing agents in general use on the site, particularly with respect to simultaneous use on the same fire.
- Corrosive effects in storage and use in contact with materials normally used in the construction of fire extinguishing apparatus.

- Cleaning and removal of spilled extinguishing agents.
- Health hazards and side effects.
- Environmental consequences of use and/or disposal.
- Statement if foam concentrate can generate banned products over time.

4.2.6 Certification:

Manufacturers/suppliers of foam concentrates should provide a certificate of assurance with each batch of foam concentrate delivered, to the effect that the concentrate supplied meets all requirements of the Purchaser. The criteria used to determine compliance should be applied consistently.

4.3 Regular Assessment of Foam Concentrate:

A regular programme of inspection and test should be determined to assure continued conformance of each batch of foam concentrate with the manufacturer's declared original specification when measured according to relevant accepted national and international standards. This may include taking samples from each batch and having these analysed at regular intervals by a competent person. (Part 5 covers Sampling and Test Procedures.)

Issues to be taken into account with this testing include at least the following:

- pH value i.e. in the measurement used to express acidity or alkalinity on the scale 1 to 14, a reading 1 and 6 to 8.5 being the highest content of acidity and 14 being the highest content of alkalinity. In order to prevent the corrosion of component parts of fire fighting foam tanks and systems, the foam concentrate should be as neutral as possible i.e. in the range of 6 and 8.5.
  Note:
  Some of the pH for some foam concentrates may be out of the acceptable range, while the performance of the foam concentrate is still as anticipated for extinguishment of specific product ranges. The manufacturer should list this information in their product sheet.

- Viscosity: This gives an indication of the resistance to flow of the liquid through any pipework of a foam system. The viscosity of a foam concentrate at its lowest anticipated use temperature should not exceed 200 mm/s. Any higher viscosity will restrict flow and retard its adequate induction into the water stream unless special precautions are taken.

  There are also so-called non-Newtonian (thixotropic) foam concentrates having a high viscosity which declines when movement (mixing, pumping, shaking etc.) is applied (the effect is called shear thinning). Without any agitation, these foam concentrates in a cup filled with the material can be turned upside down and the product stays in the cup. If stirred, the material runs out.
  Note:
  This is similar to what is known as the "Ketchup-effect" - open a new bottle of ketchup and turn it upside down – nothing will come out no matter how long you hold it. Give it a tap on the upper end of the bottle and you will have Ketchup all over yourself…

- Sediment/Undissolved Solids: Sediment formed in a foam concentrate may affect the performance of a foam proportioning system or negate its fire fighting efficiency. The volume of any deposit in a foam concentrate should not exceed 0.5% of sediment by volume.

- Expansion ratio – see clause 4.2.1 above.
- Drainage time -see clause 4.2.2 above.
- Surface tension – refer to EN 1568 or to ISO 7203 or similar.
- Film formation (if applicable) – Provides confirmation that the concentrate lowers the surface tension of the water significantly enough to produce a positive spreading coefficient.
- Where essential to the function of the system e.g. outdoor storage in cold areas, pour point testing may be required. EN1568:2018 includes a method for this test which can be carried out by manufacturers and any accredited test laboratory.

PART 5: SAMPLING FOAM CONCENTRATE AND TEST PROCEDURES

1. The analysing of foam concentrate samples is a complex procedure that should only be attempted by competent personnel. In most cases it may be considered preferable to send samples to the manufacturer of the foam concentrate for such tests.

2. Most foam concentrate manufacturers guarantee their products and therefore have a vested interest in ensuring that they remain in good condition throughout their lifetime. Third party test facilities may not have the full specification of the foam concentrate in order to give a correct analysis of the foam concentrate. The foam concentrate manufacturer should be able to supply a Certificate of Analysis listing at least the following values:

- pH value.
- Viscosity.
- Sediment/Un-dissolved solids.
- Expansion ratio.
- Drainage time.
- Film formation (if applicable).

Dependant on the use and type of foam concentrate, dedicated parameters should be added to the testing requirements to secure the performance of the foam concentrate.

Records highlighting the important parameters should be maintained.

3. The testing of induction equipment can be a complex process and therefore may produce inaccurate results. It is crucial to ensure the accurate mixing of foam concentrate in use.

PART 6: COMPATABILITY OF DIFFERENT TYPES OF FOAM CONCENTRATE

Some types of foam concentrate are incompatible with others. It is the end Users responsibility to ensure that incompatible types of foam concentrate are kept apart both in storage and in use.

Note:
Readily expanded foam concentrate typically is not sensitive to co-application with other expanded foam concentrates as opposed to foam concentrates or solutions thereof, which are sensitive to co-application with other foam concentrates.

The end User should ensure that they develop and implement a policy to ensure the continuing separation of incompatible foam concentrates and other extinguishing media in storage and use.

Foam concentrate manufacturers warranties may become invalid if different types of foam concentrate are mixed.

If circumstances arise where there may be a practical reason to use foam concentrates from different manufacturers, manufacturers' guidance should be sought before such action is taken.

Care should be taken during fire pre-planning to ensure that only Mutual Aid Partners with compatible foam concentrate supplies are on the list of suitable responders.

APPENDIX A: Guideline on requirements for the production of foam concentrate

A non-exhaustive enumeration with management requirements for the production process is provided below. Non-exhaustive list of requirements for the foam concentrate quality control management process is shown below.

- Define specifications of raw materials in purchase order based on the recipe for the production of the foam concentrate.
- Have acceptance procedure for raw materials.
  Written instructions on the control of the quality of raw materials used for the production of the foam concentrate for:

    - Pre-acceptance control procedures of the materials on arrival.
      This includes sampling and testing of raw material batches delivered in bulk.
      Use one of the following standards or other reference to select suitable sampling method and associated equipment and setup and dedicated sampling procedure:

        - *DIN 51750-1: Sampling of petroleum products; general information*
        - *DIN 51750-2: Sampling of liquid petroleum products*
          Standard is suitable for non-viscous samples
        - *DIN 51750-3: Sampling of pasty and solid petroleum products*
          Standard is suitable for viscous and non-Newtonian foam concentrates
        - *ASTM D6759 – 16: Standard Practice for Sampling Liquids Using Grab and Discrete Depth Samplers*
        - *ASTM D6699 – 16: Standard Practice for Sampling Liquids Using Bailers*
        - *ASTM D5358 – 93: Standard Practice for Sampling with a Dipper or Pond Sampler*
        - *ASTM D4057 – 12: Standard Practice for Manual Sampling of Petroleum and Petroleum Products*
        - *ASTM D3925 – 02: Standard Practice for Sampling Liquid Paints and Related Pigmented Coatings*
          This standard is suitable for sampling thixotropic products
        - *ISO 1513: Paints and varnishes — Examination and preparation of test samples and*
        - *ISO 15528: Paints, varnishes and raw materials for paints and varnishes – Sampling. These two standards discuss sampling equipment for thixotropic materials*

- Management and storage conditions of original and opened packaging of raw materials.

- Procedure for cleaning and checking condition of all material and equipment in production process, prior to the start of the production.

- Quality control of measuring (temperature, speed, leaks, etc.), timing, dosing and equipment.

- Sampling and testing of finished batch, with criteria for acceptance and rejection.

- Packaging, labelling, including end of life date product, and storage of finished product.

- Written procedure on the production process of each specific type of foam concentrate including sheets which have to be filled with information to track each step of the production process.
- Verifiable training of production personnel to become competent or qualified to produce and store the foam concentrate.

- Instructions for sampling and testing quality of finished product. Protocols for the sampling and performance of these tests and reports with record keeping (including videos and photos) of these tests should be available to substantiate performance and rating of foam concentrate in tests.

- Procedure for investigating deviations in the production process and/or quality of the produced foam concentrate.
    - Records with findings of the investigations.
    - Follow-up actions to prevent the same problems occurring in the future.
    - Discuss lessons learnt during regular toolbox meetings with production personnel.

APPENDIX B Requirements for the Safety Data Sheet (SDS) and product information sheet

All foam concentrates need to be supported by a product information sheet which is issued by the manufacturer of the foam concentrate and which should have at a minimum, the following information:

- The Safety Data Sheet complies with legal requirements.

- The list of test standards used to determine values in the SDS.

- A note that special attention should be given to the biological and chemical demand of the foam concentrate, including the way this information was obtained.
  Note:
  All information listed in SDS and product information sheets shall be verifiable when requested by the operator who intends to buy the foam concentrate

- Disposal techniques of off-spec foam concentrate and runoff water containing foam ~~a~~re incorporated and discussed in the SDS – alternatively, the SDS can refer to the product information sheets for this information.

The product information sheet should also address:

- If the product is a viscous, (NON-) Newtonian liquid.
- If the product is sensitive for stratification based on a centrifuge test of the foam concentrate.
- Technical life of foam concentrate in years, with associated information to substantiate this information.
- Tests procedure required to test for life extension of the foam concentrate i.e. foam concentrate that is used longer than its technical life.
  Note:
  As is the case with any material in industry, this requires additional testing for the worst-case application, even if the foam concentrate passes its annual tests, as these test do not represent the worst case.

- Method for annual sampling of the foam concentrate during the “use” phase. A sampling protocol should be part of the documents that accompany the supplied foam concentrate. The sampling protocol should also address storage and transport of the sample to the location where the sample is submitted to tests.

- Required tests based on EN1568-1 EN1568-3 and/or EN 1568-4 and foam concentrate specific tests required in addition to the EN1568 tests, like fire test for foam pick-up properties, performance of foam under heavy duty conditions.
  Note:
  EN 1568:2018 provides an example for what should be contained in a comprehensive product data sheet

- Information on compatibility of materials/equipment and materials with foam concentrate and water containing foam.

APPENDIX C LASTFIRE Project

On behalf of a consortium of oil companies a project was initiated in the late 1990s to review the risks associated with large diameter (greater than 40m) open top floating roof storage tanks. The project was known as the LASTFIRE project. (Large Atmospheric Storage Tanks).

The project was initiated due to the oil and petrochemical industries recognition that the fire hazards associated with large diameter, open top floating roof tanks were insufficiently understood to be able to develop fully justified site-specific fire response and risk reduction policies

A Fire Hazard Management (FHM) approach to reducing the fire associated risk to “as low as is reasonably practicable” was adopted during the project. This is in line with current regulatory trends towards preparation of “Safety Cases" whereby all aspects of risk mitigation including incident prevention are reviewed.

Under the direction of a Project Coordinator, a Working Group including Shell and BP Research personnel worked closely with the project sponsors to investigate these risks and to disseminate the findings of the review in the form of a comprehensive document including:

- incident frequency survey
- review of incident escalation mechanisms
- risk reduction options
- review of foam properties
- risk workbook
- lightning issues review
- foam performance test for storage tank fires

The LASTFIRE Project provided an independent and comprehensive assessment of fire related risk in large, open-top floating roof storage tanks resulting in a methodology by which site specific Fire Hazard Management policies can be developed and implemented. It therefore represents a major advance in the knowledge of this risk.

Recent follow up work has included the development of the LASTFIRE Risk Workbook into a fully computerised analysis tool and the development of a foam performance test exclusively for storage tank application.

APPENDIX D USEFUL CONVERSION TABLES

LENGTH

LENGTH Centimetres (cm)	Cm or inches	Inches (in)
2.54	1	0.394
5.08	2	0.787
7.62	3	1.181
10.16	4	1.575
12.70	5	1.969
15.24	6	2.362
17.78	7	2.756
20.32	8	3.150
22.86	9	3.543
25.40	10	3.937
50.80	20	7.874
76.20	30	11.811
101.60	40	15.748
127.00	50	19.685
152.40	60	23.622
177.80	70	27.559
203.20	80	31.496
228.60	90	35.433
254.00	100	39.370

VOLUME

VOLUME litres	Litres or Imperial gallons	Imperial Gallons
4.546	1	0.220
9.092	2	0.440
13.638	3	0.660
18.184	4	0.880
22.730	5	1.100
27.276	6	1.320
31.822	7	1.540
36.368	8	1.760
40.914	9	1.980
45.460	10	2.200
90.919	20	4.399
136.379	30	6.599
181.839	40	8.799
227.298	50	10.998
272.758	60	13.198
318.217	70	15.398
363.677	80	17.598
409.137	90	19.797
454.596	100	21.997

VOLUME U.S. gallons	Imperial Gallons	Litres
1	0.83	3.79
2	1.67	7.57
3	2.50	11.36
4	3.33	15.14
5	4.16	18.93
6	5.00	22.71
7	5.83	26.50
8	6.66	30.28
9	7.49	34.07
10	8.33	37.85
20	16.65	75.71
30	24.98	113.56
40	33.31	151.42
50	41.63	189.27
60	49.96	227.12
70	58.29	264.98
80	66.61	302.83
90	74.94	340.69
100	83.27	378.54

CONVERSION FACTORS

To convert	Into	X = multiply / = divide		To convert	into	X = multiply / = divide
acres	sq. kilometres	x 0.247		acres	sq. miles	/ 640
acres	sq. Metres	x 4047		acres	hectares	x 0.4047
barrels oil	Imp. Gallons	x 34.97		barrels oil	US Gallons	x 42
barrels oil	Litres	x 159				
centimetres	Inches	/ 2.54		centimetres	feet	/ 30.48
centimetres	Millimetres	x 10		centimetres	metres	/ 100
cubic cm	cubic inches	x 0.06102		cubic cm	litres	/ 1000
cubic feet	cubic metres	x 0.0283				
feet	Centimetres	x 30.48		feet	metres	x 0.3048
fl ozs Imp	fl ozs USA.	x 0.961		fl ozs USA	fl ozs imp	x 1.041
inches	Centimetres	x 2.54				
kilograms	Pounds	x 2.2046		kilograms	Tons (Imp)	/ 1016
kilograms	tons USA	/ 907				
kilometres	Miles	x 0.6214				
litres	gallons Imp	x 0.2200		litres	gallons USA	x 0.2642
litres	pints Imp	x 1.760		litres	pints USA	x 2.113
metres	Yards	/ 0.9144				
miles	Kilometres	x 1.609				
millimetres	Inches	/ 25.4				
pounds	Kilograms	x 0.4536				

APPENDIX E ABOUT JOIFF

The International Organisation for Industrial Emergency Response and Fire Hazard Management

JOIFF is an organisation dedicated to developing the knowledge, skills and understanding of emergency response personnel who respond to incidents primarily in high hazard industry, with the aim of ensuring that personnel manage risks safely. Full members of JOIFF are organisation which are in high hazard industry and/or have nominated personnel as emergency responders who provide cover to industrial/commercial organisations. Corporate members of JOIFF are primarily organisations that supply goods and/or services to High Hazard Industry.

The 3 pillars of JOIFF are:

- **Shared Learning – exchange of information aimed at improving risk awareness**
  JOIFF's Shared Learning email network is aimed to improve the level of knowledge of its members' emergency responders and to work to ensure that members benefit from the misfortunes of some to educate against the same mistakes being repeated. This network is also used by members who are seeking guidance and advice on particular job related matters. Further information is disseminated through the JOIFF quarterly e-Magazine *The Catalyst* copies of which can be downloaded from the JOIFF website. An archive of all this information is updated and available to Members on the password protected Members' Area of the JOIFF website.

- **Accredited Training – a system of quality assurance of training that enhances operational preparedness in emergency response and crisis management**
  JOIFF accredited training is competency based, aimed at developing competence of emergency response personnel when dealing with potential accidents/incidents on and off the site/facility/response area to which the emergency responder will be required to respond within their Site/Facility/Response Area Emergency Plan.

  JOIFF accreditation of training includes an examination of courses and programmes, the standards of instruction including instructors and the location and facilities where the training will take place. All successful participants in JOIFF accredited training courses/programmes receive JOIFF accredited certificates of competence issued by the JOIFF accredited Training Provider.

- **Technical Advisory Group – raising the quality of safety standards in the working environment of High Hazard Industry**
  JOIFF develops guidelines, codes of practice and standard operating procedures (SOPs) to assist its Members in hazard management within their own sites. JOIFF also provides input to Regulatory Authorities and other policy making organisations at local, national and international level on the nature and control of safety and other relevant issues in the sectors of high hazard industry in which its members operate.

An application for JOIFF membership can be made through the JOIFF website www.joiff.com