Guide for the Selection and Use of Flame Resistant Workwear

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Overview

This document is intended to provide guidance for the selection, use and care of flame resistant workwear (FRW) for protection against exposure of individuals to a hydrocarbon flash fire. Each organization must make its own decisions about the degree of protection they require and type of FRW that meets their needs. The guidance provided in this document will help CAPP member companies and other users to make these decisions. The actual period for which protective workwear can offer protection against the flame, varies with the intensity of the flash fire, the fit of the garment, other properties of the garment (e.g. insulation, water resistance) and the capabilities of the wearer. For a particular garment this period of protection may vary considerably from one wearer to another. For purposes of this guide, the recommendations included within are for worker protection against a hydrocarbon flash fire of duration of three seconds or less. It is important for users of FRW to acquire a basic knowledge of flash fire hazards and the clothing offering levels of worker protection. Flame resistant workwear comes in many forms with different material components, weights and styles. Depending on these factors, as well as the potential flash fire hazard and capabilities of wearer, each brand of FRW provides different levels of protection.
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Appendix A Flame Resistant Clothing Requirements by Work Discipline
1 Project Scope

This guide provides practical advice for the selection, use and care of flame resistant workwear for protection against hydrocarbon flash fires. It is divided into two main sections: Section 3 (Selection, Use and Care of Flame Resistant Workwear) offering practical advice for the day to day use of FRW and Section 4 (Background Information on Flame Resistant Workwear) which provides basic background information on the design and construction of FRW.

Section 3 is based almost entirely on NFPA 2113, Standard on the Selection, Care, Use and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire - 2007 Edition. This standard provides information for selecting, using and caring for FRW. It was developed originally based on work done in both Canada and the United States to develop FRW standards. The current edition of this standard was released earlier this year and represents the most current information on this topic. The guidance provided in this standard has been modified to suite the purposes of Canadian users of FRW. It is intended to be a practical guide for selecting and using FRW on a day to day basis. The Canadian General Standards Board (CGSB) has a parallel set of standards consistent with the NFPA.

Section 4 provides background information on FRW. It is a compendium of information about FRW intended to raise general understanding of the design, construction and performance of FRW. Most of the material in this section has been drawn from the original CAPP document on FRW released in 1999. It has been updated using more current information on this topic.

In combination, these sections will provide a practical guide for day to day use of FRW as well as a better understanding of the technology used in developing FRW.
2 Background

Flash fires in the petroleum industry result from the accidental release and ignition of flammable materials either in liquid or gaseous form. For purposes of this guide the duration of the flash-fire is three seconds or less. In that period of time, a flash fire can generate temperatures between 538 and 1038 degrees Celsius. The amount of heat generated is calculated as heat flux, which are calories per square centimeter per second (cal/cm²/sec). Flash fires can generate between 1.0 and 5.0 cal/cm²/sec, dependent on the fuel and burn rate.

The severity of a burn to a worker is determined by the amount of heat absorbed by the skin and how quickly it is absorbed. Technical data uses a temperature of 44 C as the temperature at which skin damage begins. Burn severity is determined by the amount, (Body Surface Area) and depth of skin burned, (first, second, and third degree).

In a flash fire without the protection of flame resistant workwear, the worker is exposed initially to the heat of the fireball and then secondly to the heat of the burning fabric of the worker’s clothes. The heat generated by a burning fabric depends on the composition of material, treated or non-treated, weight and weave of the garment and if the material was clean or soiled with hydrocarbons.

Flame resistant workwear provides protection against flash fires in two ways. In the first case, FRW is designed so that it does not burn when exposed to flame. This in itself provides protection for the wearer by eliminating or reducing injury when clothing burns after exposure to flash fire. In addition, FRW is designed to reduce the amount of heat that penetrates the skin during a flash fire. The fabric essentially provides a barrier between the flash fire and the wearer's skin reducing the amount of energy transmitted to the skin thus providing additional protection to the wearer. In this case, the thicker the fabric used in construction of the FRW, the greater the degree of protection to the wearer.

It is very important to consider the type of garments needed for working on site with flash fire potential as the workwear has the potential to increase or decrease the hazard tremendously!
3 Selection, Use and Care of Flame Resistant Workwear

This section provides detailed guidance on the selection, use and care of flame resistant workwear. It is based extensively on current information provided in NFPA 2113, Standard on Selection, Care Use and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire, 2007 Edition.

3.1 Selection of Flame Resistant Workwear

Ensure that your company’s selection of flame resistant workwear is based on the following principles:

- The use of hazard assessments to identify the need for flame resistant workwear.
- An evaluation of available flame resistant workwear to determine those suitable for the hazards identified on your site.
- The development of specifications for purchasing flame resistant workwear.
- The use of a hazard assessment to determine other hazards that the worker’s clothing needs to protect against (e.g. hot fluids, electrical arc flash).

3.1.1 Conduct Hazard Assessments

The wearing of fire resistant workwear should be considered as the basic standard for work in and near all oil and gas facilities. Any facilities or locations where oil or gas could be present can have an associated risk of flash fires.

Take the following steps to identify the specific hazards that may require the use of flame resistant workwear for all other situations:

- Determine the type and magnitude of hazards on your worksites.
- Decide whether other control measures (e.g., engineering controls, administrative controls) can reduce hazards to an acceptable level.
- Determine the level of protection needed to protect workers against the identified hazards.
- Determine if there is a need for garment decontamination.
- Determine if there are any ergonomic (e.g., restricted movement) or environmental constraints (e.g., temperature extremes) to using flame resistant workwear on your sites.
- Compare the risks and costs of each option (e.g., engineering controls, administrative controls, flame retardant workwear).
- Select and implement the best option or options.

Note: The materials used in FR clothing can protect against other workplace hazards as well and should be considered even when the risk of a flash fire is low. These other hazards may include minor scrapes and abrasions, hot surfaces, some chemicals, sun, and cold.
3.1.2 Evaluate the Need for Flame Resistant Workwear

Consider the following factors in deciding the requirement for flame resistant workwear:

- Proximity of work to flash-fire hazards.
- The potential for the work being done to increase the hazard of a flash-fire.
- The presence of engineering or administrative controls designed to reduce worker contact with a flash-fire.
- Incident history at the worksite.
- Potential for avoiding contact with a flash fire.
- Potential for workers clothing to ignite from work activity (e.g., welding, cutting with oxy acet torch, electrical switching, etc.).

3.1.3 Select Flame Resistant Workwear

- Select only workwear that meets the requirements of NFPA 2112 Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire or C.G.S.B. 155.
- In addition, ensure that you select garments based on the following:
  - thermal protective characteristics of the fabric
  - physical characteristics of the fabric
  - garment construction and components
  - avoidance of static charge build-up
  - design of garment
  - requirements for labels, logos and high visibility striping
  - conditions under which workwear will be worn
  - comfort of fabric and garment
  - cleaning and maintenance
  - identification of other hazards that the workers may be exposed to (i.e. hot water and steam exposure, electrical arc flash protection, welding, chemical exposure protection) Note: Although welders cannot wear typical flame resistant workwear, there are now welding garments that meet the standards of NFPA 2112 and CGSB 155.
- Ensure selected workwear will cover both the upper and lower body and any flammable under layers
- Ensure primary closure systems (e.g., zippers, snaps) will continue to function after a flash fire.
- Ensure workwear is not tight-fitting; a layer of air between the fabric and the skin will provide additional insulation against heat.
- Ensure that non–flame resistant logos and other decorative symbols and non-flame resistant reflective striping are eliminated or kept to a minimum. (The best approach is to ensure logos and reflective striping is made of flame resistant material). Use flame resistant materials where possible.

3.1.4 Specify Criteria for Purchase of FRW

Include the following criteria in purchase specifications for flame resistant workwear:
• Ensure clothing conforms to NFPA 2112 Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire (ensure this requirement is stipulated in the purchase specifications) or CAN/CGSB-155.20 & 21 standards.
• Ensure manufacturer’s bids include substantiation of certification for the protective clothing presented in the bid.
• Compare each bid against the purchase specifications.
• Include additional specifications regarding design and performance.
• Inspect purchased garments to ensure they meet purchase specifications.
• Return garments that do not meet purchase specifications to manufacturer.
• Examine written documentation received with the garments (e.g., instructions, warranties, technical data)

3.2 Use of Flame Resistant Workwear*

Ensure that your company’s use of flame resistant workwear is based on the following principles:
• Define locations in the workplace that requires the use of flame resistant workwear.
• Provide users of flame resistant workwear with information on care, use, and maintenance of the garments as well as any written instructions or warnings provided by the manufacturer.
• Provide information on any limitations related to the use of the garment.
• Provide information on laundering of FRW.
• Provide guidance on the use of undergarments or over garments that may be used with the work wear. (over- garments should not be flammable and under garments should not be subject to melting or shrinking) Note: The Alberta OHS Code mandates that each worker must ensure that clothing worn beneath fire resistant outer wear and against the skin is made of flame resistant fabrics or natural fibers that will not melt when exposed to heat.
• Provide guidance on the use of auxiliary FRW clothing that may be worn for insulating purposes, specifically hard hat liners and hoodies.
• Ensure collars are worn closed.
• Ensure sleeves are rolled down and cuffs are closed.

*For further guidance on use of Flame Resistant Workwear, consult the table in Appendix A.

3.3 Care of Flame Resistant Work Wear

Ensure that your company’s care of flame resistant workwear is based on the following principles:
3.3.1 Clean Soiled FRW

- Ensure flame resistant workwear is kept clean (Tip: be especially careful that garments do not become soiled with hydrocarbon or other flammable products).
- Wash new flame resistant workwear at least once before use.
- Clean flame resistant workwear according to manufacturer’s instructions, or in accordance with ASTM 1449, Standard Guide for Care, and Maintenance of Flame-Resistant and Thermal Protective Clothing or CAN/CGSB-155.21
- Clean frequently enough to prevent build-up of contaminants that reduce flame resistance.

3.3.2 Decontaminate FRW

Some tasks may result in extremely heavy contamination (beyond soiling and staining) that will require special cleaning.

- Clean flame resistant workwear contaminated with flammable, hazardous or biological agents according to the manufacturer’s instructions.
- Dispose of contaminated flame resistant workwear if no instructions for decontamination are provided.
- Handle contaminated flame resistant workwear to prevent cross contamination of clean garments.
- Do not launder or dry clean contaminated flame resistant workwear at home.
- Do not launder or dry clean heavily contaminated flame resistant workwear in public facilities or in other facilities where release of the vapours could cause a health and fire hazard.

3.3.3 Store FRW Properly

- Store flame resistant workwear in accordance with manufacturer’s instructions.
- Do not store flame resistant workwear in direct sun light.
- Ensure flame resistant workwear is clean and dry before long-term storage.
- Ensure storage areas are clean, dry and well ventilated.
- Do not store soiled flame resistant workwear with personal belongings.

3.4 Maintenance of Flame Resistant Workwear

Ensure that your company’s maintenance of flame resistant workwear is based on the following principles:

3.4.1 Inspect FRW

Develop a systematic inspection program for flame resistant workwear to that includes the following:

- Inspection by end user for damage, soiling or contamination after each use.
- Inspection by the end user or your organization after each cleaning and after each use where damage or contamination may have occurred.
• Inspection of flame resistant workwear for fabric damage (including: examination of outer shell, lining, interlining, wind/moisture barrier, hardware, wristlets, and reinforcements).
• Inspection by the end user or your organization for damage to threads or seams (Tip: this includes – skipped, broken of missing stitches).
• Inspection by the end user or your organization for damage to and functionality of all hardware (Tip: hardware includes – zippers, buttons, snaps, and other fasteners)
• Remove damaged flame resistant workwear from service immediately.
• Decide whether the damaged flame resistant workwear should be repaired or retired (Tip: your organization should establish criteria for deciding if damaged flame resistant workwear should be removes from service, repaired or disposed of).

3.4.2 Repair Damaged FRW
• Repair flame resistant workwear according to manufacturer’s instructions.
• Clean flame resistant workwear before doing repairs.
• Do all repairs and alterations to flame resistant workwear in the same manner and using the same materials as the manufacturer.
• Consider keeping records of repairs made to flame resistant workwear.

3.4.3 Retire Damaged or Deteriorated FRW
• Retire damaged or deteriorated flame resistant workwear when they can no longer be repaired.
• Retire flame resistant workwear when it exceeds the service life indicated by the manufacturer (Tip: manufacturers do not always state a service life).

3.4.4 Dispose of FRW
• Destroy or dispose of retired flame resistant workwear in a way that will ensure that it cannot continue to be used for protection of individuals against flash fire.
4 Background Information on Flame Resistant Workwear

This section is intended to provide background information on the technology related to flame resistant workwear.

4.1 FLAME RESISTANT WORKWEAR (FRW) - CHARACTERISTICS

Workwear that is appropriate to wear as protection against flash fires should have the following characteristics. The best method of ensuring the workwear meets all these criteria is to look for the following Canadian General Standards Board label of approval.

This ensures the workwear will meet the following standards:

- A high level of flame resistance - should not ignite easily when exposed to a flame or continue to burn after the flame is removed;
- A high degree of insulation - should provide a barrier or insulating layer against exposure to heat
- Excellent fabric integrity - it should not melt or shrink; and
- Contain anti-static properties - the fabric should not act as an ignition source, i.e. static electricity. (Tip: Inappropriate clothing around fire and explosion hazards includes untreated or light cottons, polyester, nylon and polycotton blends, (nylon is particularly bad!)

- Clothing worn underneath an outer layer of FRW should be made from fabrics that will not shrink or melt under exposure to heat. This applies to any article of clothing including pants, shirts and underwear. These fabrics include:

  Flame resistant fabrics
  - leather
  - wool
  - rayon
  - linen
  - cotton
Fabrics that will melt:
- nylon
- polyester
- acrylic

The clothing worn underneath FRW provides part of the thermal insulation from the heat generated by a flash fire and keeps the outer garment from making direct contact with the skin which also reduces the amount of heat transfer. When no clothing is worn underneath the garment, the FRW may need to meet higher thermal insulation standards (e.g., thicker FRW, TPP>4 as per section 4.3B).

4.2 Types of FRW Material

4.2.1 Inherently Flame Resistant Fibers

Manufactured fibers such as aramid and pbi fibers whose generic material makes them naturally flame resistant without a chemical treatment. Such fibers have slower flaming combustion and self-extinguish when exposed to a flame of short duration during testing. An advantage of inherently flame resistant fibers is that flame resistance is not altered by cleaning and they are generally strong, abrasion resistant fibers. Many are limited by a low moisture absorption; hence lack of comfort in a hot environment and the material has a greater tendency to build up static electricity. The blending of fibers with greater moisture absorption has been attempted in order to overcome this drawback.

4.2.2 Flame Retardant Finishes

A chemical process or treatment is applied, where flame resistance is imparted to a material such as cotton or rayon. Rayon can also have flame resistant properties imparted to the fibers and then would be inherently flame resistant. If the material was untreated it would burn and/or melt when exposed to a flame. An advantage of fabrics given flame retardant finishes is that the fibers used, (cotton, rayon, wool) are generally more comfortable to wear due to higher moisture absorption. Limitations may include lack of finish durability due to the cleaning process, and lowered abrasion resistance and tearing strength.

4.3 FRW Performance Requirements

Selection of appropriate flame retardant workwear should be determined by specific criteria related to individual job requirements. The choice of protective workwear is a compromise between protection or safety factors, (flame resistance, thermal protection) and other important criteria such as durability, (abrasion resistance, tearing and breaking strength), comfort, (thermal comfort, functional fit), hot water and steam resistance, appearance and cost. Purchasers must determine the relative importance of each of these criteria before the optimum combination of fabric/garment properties can be determined for a specific job.
4.3.1 Flame Resistance

When attempting to narrow the selection from a large number of possible candidate fabrics, the flame resistance test results from the manufacturer on original (unlaundered) fabrics, is the first information to request. Each single layer of protective fabric should be tested for flame resistance according the Canadian General Standards Board Test Criteria #27.10.

4.3.2 Heat Transfer

The thermal stability of the fiber components of a garment are essential for adequate protection in most cases. The fabric must have sufficient weight and thickness to provide a thermal barrier, with the requirements increasing with the intensity of the heat assault.

4.3.3 Thermal Shrinkage Resistance

Because thermal shrinkage can cause intense burns, there are tests that examine the effects of materials exposed to high temperatures. Thermal shrinkage of fabric greater than 3 per cent can contribute to burn injury severity due to increased heat transfer, restriction of body movement, or the breaking open of the fabric.

4.3.4 Static Electricity

The definition of static electricity is an accumulation of negative or positive charge on the surface of a garment induced by the body movement of the worker. Workwear can generate static electricity of sufficient energy to ignite combustible atmospheres. It is important to minimize the build up of static electricity on workwear to reduce the hazard of the workwear becoming an ignition source. Workers should ground themselves before entering high risk areas by making contact with bare skin to a wall and must avoid removing clothes in high risk areas. At low humidity, garments made from either natural fibers (i.e. cotton or wool) or synthetic fibers (i.e. aramids, rayon) are not anti-static. One solution is to use an anti-static treatment during laundering according to manufacturer’s directions. However not all static can be eliminated during very cold weather when relative humidity is low, especially indoors. Consumers can also purchase garments made of anti-static fibers or anti-static finished fabrics, but manufacturers should be questioned to determine if these materials eliminate the problem entirely.

4.4 Limitations of FRW

The fire retardant workwear addressed in this document are limited to protection against unplanned exposure to intense heat transfer for three seconds or less. Protection against a higher heat flux over a longer time period would require flame resistant garments with higher thermal integrity, heavier mass and/or a layering of flame resistant fabrics in order to achieve adequate thermal insulation. For example, the Firefighters’ Protective Clothing for Protection against heat and...
flame requires a TPP rating of 35 as compared to the value of 4 recommended in this guide. Similarly, protection against an electrical arc flash will require a higher TPP value in the FRW depending on the type of installation and voltage.

Rain gear and slickers used for chemical resistance are available in flame resistant fabrics, but are not fire resistant by themselves. They can be used safely if a layer of FRW is worn underneath. The protective clothing must be kept clean. Soiling will reduce the protective qualities and increase the risk of second and third degree burns. Standard FRW will not protect a worker from steam or hot water burns. Exposure to these burn hazards will require additional protection. Research has been initiated at the University of Alberta to determine the best ways of protecting workers against these hazards and to determine the best materials for providing both flash fire protection and protection against steam and hot water exposure. Periodically, a selection of garments should be removed from use and tested for flame resistance and thermal insulation.

Protective clothing should be replaced when it is no longer serviceable. Any tear in FRW decreases the level of protection offered by the garment. Repairs to the garment should follow manufacturer’s instructions. Laundering has an effect on the flame resistant properties of garments; ask the manufacturer regarding laundering instructions. Finally, FRW must be worn properly (i.e., with closed collars and wrists and rolled down sleeves) to be effective.

4.5 Additional Comments

Users of flame retardant workwear should be aware there is much discussion in the FRW community regarding the need for all layers in a multi-layer garment being flame resistant and the TPP values of the different tests. Is the testing of flame resistant properties of a garment in a laboratory an accurate reflection of what would happen with FRW in the field with a hydrocarbon flash fire? Some members believe garments with a flame resistant shell offer adequate protection against a flash fire and others believe all layers of workwear should be flame resistant. The discussion revolves around worker safety and the comfort level and functionality of the garment. A multi-layer garment consists of an outer shell fabric plus an inner lining fabric and/or insulating material. Examples of multi-layer garments are parkas and insulated coveralls. While all parkas create a potential for a chimney effect when a flame is applied, the results in particular indicate that parkas with a non flame resistant lining are inclined to create an increased chimney effect, which increases the hazard and may not offer adequate protection against flash fires. The tests in the lab with the insulated coveralls with a non flame resistant lining and insulation offered protection to the worker if the outer layer is flame resistant, when a flame was applied. However, from this experiment it was not concluded that the lining and insulation must also be flame resistant. Users must determine what is appropriate for them and evaluate the specifications for FRW from the FRW manufacturers and distributors. Awareness of the issues regarding the different levels of protection for FRW provides the worker with the information to make an informed choice.
4.6 Definitions

**Aramid** - a manufactured fiber in which the fiber-forming material is a long chain synthetic polyamide having at least 85% of its amide linkages (-NH-CO-) attached directly to two aromatic rings. Aramid fibers exhibit low flammability, high strength and high modulus. Fabrics made from aramid fibers maintain their integrity at high temperatures, but may shrink.

**Fabric** - a planar textile structure produced by interlacing yarns, fibers or filaments.

**Fabric Blend** - a fabric consisting of a combination of two or more textile fibres. The fabric blend has special performance qualities.

**Fiber** - a unit of matter, either natural or manufactured, that forms the basic element of fabrics and other textile structures. The term refers to units that can be spun into a yarn or made into a fabric by various methods including weaving, knitting, braiding, felting, and twisting.

**Flame Resistant** - a term used to describe a material that burns slowly or is self-extinguishing after removal of an external source of ignition. A fabric or yarn can be flame resistant because of the innate properties of the fiber, the twist level of the yarn, the fabric construction, or the presence of flame retardants, or because of a combination of these factors.

**Flame Retardant** - a chemical compound that can be incorporated into a textile fiber during manufacture or applied to a fiber, fabric or other textile item during processing or use to reduce its flammability. Listed below are examples of flame retardant finishes. Please note this is not an inclusive list and no product is endorsed by this guide.

Flame Retardant Treatments for Fabrics:

a. Dale Antiflame ® - a Dale Antiflame trademark

b. Indura * - a Westex Inc. trademark

c. Proban ® - an Albright and Wilson trademark

d. Zirpro ® - a Wool Foundation, Nominee Company Ltd. Trademark

e. Pyrovatex ® - a Ciba-Geigy Corporation Trademark

**Fusible** - these garments are likely to melt or form molten plastic under exposure to heat. Common fusible fabrics are acrylic, polyester, nylon and acetate.
**Inherently Flame Resistant** - manufactured fibres whose generic material makes them naturally flame resistant without a chemical treatment. Some examples of inherently flame resistant fibres are:

a. Kevlar® - a Dupont trademark

b. Kermal® - a Rhone-Poulenc trademark

c. Nomex® - a Dupont trademark

d. PBI® - a Hoechst-Celanese trademark

(This list is not inclusive of all products and does not endorse any one product)

**Knit Fabric** - a structure produced by interlooping one or more ends of yarn or comparable material. Example: jersey, interlock and rib.

**Non-fusible** - Garments that will not melt or form molten plastic when exposed to heat. Common non-fusible fabrics are leather, wool, silk, cotton, linen, rayon/viscose and monoacrylics.

**Novoloid Fiber** - A manufactured fiber containing at least 85% by weight of a cross-linked novolac. Novoloid is flame resistant and non-melting.

**PBI** - A manufactured fiber (polybenzimidazole) in which the fiber forming substance is a long chain aromatic polymer having recurrent imidazole groups as an integral part of the polymer chain. A high performance fiber with high chemical resistance that does not burn in air. It has no melting point and does not drip when exposed to flame. The fiber and fabrics from PBI retain Guideline for Selecting Fire Resistant Workwear 11 April 1999 their flexibility dimensional stability and significant strength without embrittlement even when exposed to flame or extreme heat. It can be used in 100% form or blended with other forms. It has high moisture regain and low modulus with comfort properties similar to cotton.

**Woven fabric** - woven fabrics consist of interlace yarns that are perpendicular to each other. By using various combinations of three basic weaves, plain, twill, and satin, it is possible to produce an almost unlimited variety of constructions.
Appendix A  Flame Resistant Clothing Requirements by Work Discipline
# Flame Resistant Clothing Requirements by Work Discipline

<table>
<thead>
<tr>
<th>WHO</th>
<th>CLOTHING TYPE</th>
<th>WHERE</th>
<th>WHEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Operators Plant/Field</td>
<td>Flame Resistant Outer Layer. Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>Total working hours</td>
</tr>
<tr>
<td>2. Maintenance other than welders</td>
<td>Flame Resistant Outer Layer. Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>Total working hours</td>
</tr>
<tr>
<td>3. Supervisor</td>
<td>Flame Resistant Outer Layer. Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>On site supervision or during on site work activities including inspections or other duties</td>
</tr>
<tr>
<td>4. Management</td>
<td>Flame Resistant Outer Layer. Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>On site work activities including inspections or other duties</td>
</tr>
<tr>
<td>5. Contractors Class “A”</td>
<td>Flame Resistant Outer Layer. Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>Total working hours</td>
</tr>
<tr>
<td></td>
<td>Class “B”</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments</td>
<td>All live operating sites or process areas</td>
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<tr>
<td></td>
<td>Class “C”</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments</td>
<td>All live operating sites or</td>
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<tr>
<td>6. Construction Plant/Pipe Line</td>
<td>Non-fusible garments recommended</td>
<td>Non hazardous areas</td>
<td>Work sites where request for variance approval is given</td>
</tr>
<tr>
<td>a) Grass Roots (initial)(NewBuild)</td>
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<td></td>
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<tr>
<td>WHO</td>
<td>CLOTHING TYPE</td>
<td>WHERE</td>
<td>WHEN</td>
</tr>
<tr>
<td>--------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>b) Modifications, Expansions, and Turnarounds: (Welders)</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments and/or appropriate welding clothing and accessories</td>
<td>All live operating sites or process areas</td>
<td>Total working hours</td>
</tr>
<tr>
<td>Other Trades</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments</td>
<td>All live operating sites or process areas</td>
<td>Total working hours</td>
</tr>
<tr>
<td>7. Technical Support Staff Engineers, Managers, Technicians, SESR Staff</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>On site work activities including inspections or other duties</td>
</tr>
<tr>
<td>8. Consultants/Service Companies</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments</td>
<td>All live operating sites or process areas</td>
<td>At all times</td>
</tr>
<tr>
<td>9. Well Completions Servicing (workovers)</td>
<td>a) Flame Resistant Outer Layer non-fusible undergarments</td>
<td>All Work sites</td>
<td>At all times</td>
</tr>
<tr>
<td></td>
<td>Impermeable Flame resistant Outer Layer</td>
<td>All work sites</td>
<td>In situations where clothing may become contaminated with flammable liquids (i.e., rod jobs and stripping tubing)</td>
</tr>
<tr>
<td>10. Well Completions Servicing (workovers)</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments</td>
<td>All live operating sites or process areas</td>
<td>At all times</td>
</tr>
<tr>
<td>a) Welders</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments and/or appropriate welding clothing and accessories</td>
<td>All live operating sites or process areas</td>
<td></td>
</tr>
<tr>
<td>11. Drilling</td>
<td>a) Flame Resistant Outer Layer non-fusible undergarments</td>
<td>All well sites</td>
<td>Drill stem testing; well control operations; mixing oil based mud; handling of any flammable chemical or fuel</td>
</tr>
<tr>
<td>WHO</td>
<td>CLOTHING TYPE</td>
<td>WHERE</td>
<td>WHEN</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>b) Non-fusible garments recommended</td>
<td></td>
<td>When probability of exposure to flammable liquids is low</td>
</tr>
<tr>
<td></td>
<td>c) Impermeable Flame Resistant Outer Layer</td>
<td></td>
<td>In situations where clothing may become contaminated with flammable liquids</td>
</tr>
<tr>
<td>12. Drilling Welders</td>
<td>Flame Resistant Outer Layer Non fusible undergarments and/or appropriate welding clothing and accessories</td>
<td>All live operating sites or process areas</td>
<td>At all times</td>
</tr>
<tr>
<td>13. Hot Oiling</td>
<td>Flame Resistant Outer Layer non-fusible undergarments</td>
<td>All Work sites</td>
<td>At all times</td>
</tr>
<tr>
<td>14. Regulatory Personnel</td>
<td>a) Flame Resistant Outer Layer non-fusible undergarments</td>
<td>All live operating sites or process areas</td>
<td>a) during Inspections or extended exposure</td>
</tr>
<tr>
<td>15. Trucking</td>
<td>Flame Resistant Outer Layer Non-fusible undergarments</td>
<td>All live operating sites or process areas</td>
<td>At all times</td>
</tr>
<tr>
<td>16. Summer Students, and Trainees</td>
<td>a) Flame Resistant Outer Layer Non-fusible undergarments recommended but not supplied by</td>
<td>All live operating sites or process areas</td>
<td>a) At all times when conducting hands on work, or on site activities</td>
</tr>
<tr>
<td>17. Emergency response personnel</td>
<td>a) Flame Resistant Outer Layer Non-fusible undergarments recommended but not supplied by</td>
<td>Anywhere</td>
<td>Possibility of exposure to any flammable materials</td>
</tr>
<tr>
<td>18. Visitors</td>
<td>Non-fusible garments. Flame resistant garment preferred.</td>
<td>No abnormal operating conditions, continuous supervision, short periods</td>
<td>Work sites where request for variance approval is given</td>
</tr>
</tbody>
</table>