



## WILDFIRES

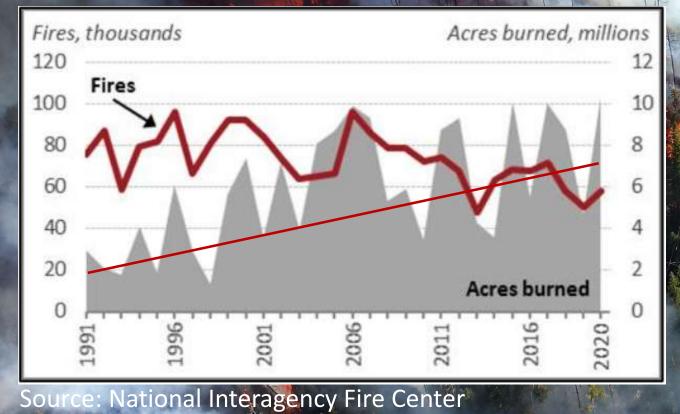
Wildfires are one of the greatest challenges we currently face. These fires are devastating, and cost billions of dollars in property damage, business loss, and firefighting resources as well as human lives. In addition, these fires destroy our natural resources.

Wildfires are responsible for 5% - 20% of global man-made CO<sub>2</sub> emissions.

The current products used to combat them (fire retardants) are toxic and dangerous to humans, animals and the environment.

From 2010-2020 there have been an average of 62,693 wildfires each year.

Annual wildfires and acres burned 1991-2020





The map below shows wildfires in the United States from 2010 to 2020. The map was created using images from NASA's MODIS satellite. <a href="http://firms.modaps.eosdis.nasa.gov/firemap/">http://firms.modaps.eosdis.nasa.gov/firemap/</a>





## ECONOMIC EFECTS



## BUILDINGS DESTROYED

2016 - 4,312

<u>2017</u> – 12,306

<u>2018</u> – 25,790

<u>2019</u> – 963

<u>2020</u> – 17,663

Over 4.5 million buildings are at high to extreme wildfire risk in the USA.

## TOTAL ECONOMIC IMPACT

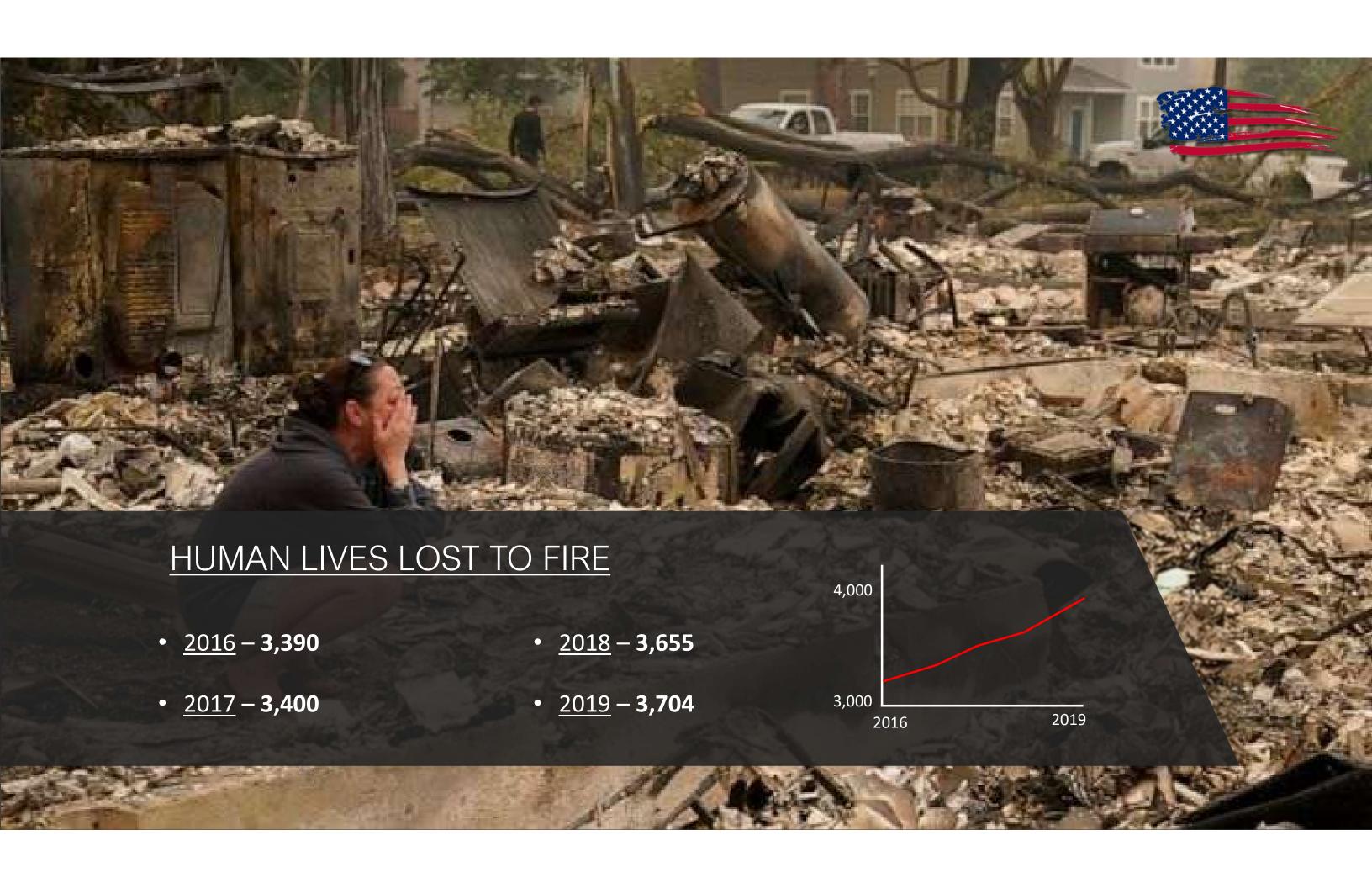
2016 - \$347.8 Billion

2017 - \$348 Billion

2018 - \$148.5 Billion

2019 - \$459.8 Billion

2020 - \$130 - \$150 Billion





"We are going to have to re-evaluate some of our strategies. The conditions are like we have never seen before in our firefighting career."

Daryl Osby, Chief of the Los Angeles County Fire Department

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## FS-01 is not a fire retardant, it is a FIRE SUPPRESSANT.

It is non-toxic and biodegradable.

The last decade has seen an increase in the intensity of wildfires, and all predictions show it will only get worse. Fire Retardants have been used for the last 70 years and they are ineffective and toxic.

## Fire retardants do not stop fire.

The US Forest Service banned the use of these products close (300ft) to any water source.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization International Bureau



(10) International Publication Number WO 2021/030544 A1

(43) International Publication Date 18 February 2021 (18.02.2021)

WIPO PCT

Published:

- with international search report (Art. 21(3))

C08F 2/44 (2006.01)

(51) International Patent Classification:

(21) International Application Number: PCT/US2020/046099

C08F 220/06 (2006,01)

(22) International Filing Date:

C05G 3/80 (2020.01)

13 August 2020 (13,08,2020)

(25) Filing Language:

(26) Publication Language:

English

(30) Priority Data:

14 August 2019 (14.08.2019) US

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  - (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, DA, DD, DG, DH, DN, DR, DW, DY, DZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.
  - (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM. KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

#### Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- of inventorship (Rule 4.17(iv))

#### (54) Title: FIRE SUPPRESSANT

(57) Abstract: A fire suppressant including technical urea 10-30% (by weight), ammonium sulphate 20-50%, and sodium bentonite 12-26%. The fire suppressant further includes polypropylene glycol (polyglycol), alkyl sulfonic acid, castor oil, guar gum, and/or triethanolamine dodecylbenzene sulfonate. The fire suppressant does not pose any ties to print to completely benign and is classified as non-toxic. It does not cause any damage to aquifers or groundwater, and it biodegrades in 30 completely benign and is classified as non-toxic. triethanolamine dodecylbenzene sulfonate. The fire suppressant does not pose any risk to plant or animal life since the product is



**FS-01** has an international patent.



## **COMPETITOR**

SK Capital Partners acquired in 2018 the ICL fire division and renamed it as Perimeter Solutions. Since then, they bought more companies related to fire retardants.

Perimeter Solutions is the owner of Phos-Chek® fire retardants, Solberg's® foams, Fire-Trol® and other related brands.

Phos-Check is the main fire retardant used in the USA and Australia (95% +)

Phos-Chek is currently the only product qualified by the USFS.

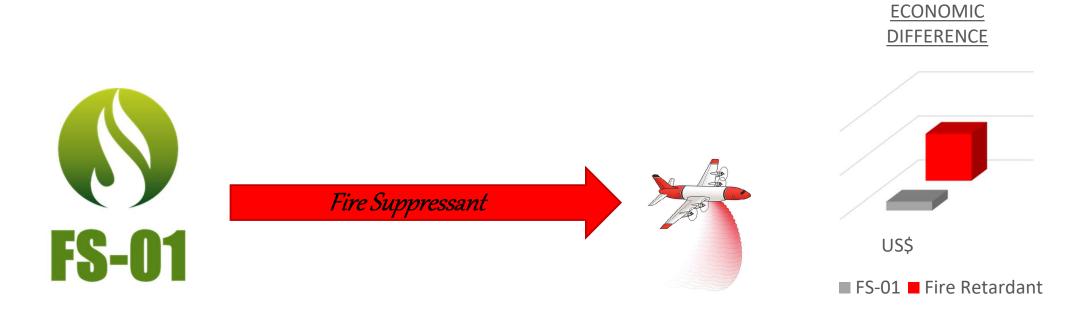
FS-01 is a fire suppressant vs. Phos-Chek is a long term fire retardant (LTFR). Due this is a new technology, the USFS only has a qualification as LTFR (for now).



		PHOS-CHEK*  Fire Retardant, Class A Foam & Gel	FS-01	
	EFFECTIVENESS IN EXTINGUISHING FIRES	40%-60%	100%	
	FIRE BLOCKING	X	$\sqrt{}$	The Last
	BIODEGRADABLE	X	$\checkmark$	
The state of the s	NON TOXIC	X	$\checkmark$	
A 200A.2	NON CONTAMINATING	X	$\checkmark$	
	REDUCTION IN ACREAGE BURNED	20%-50%	80%	
State of the State	SAFETY	50%	100%	200
	INCREASE OR DECREASE IN THE COSTS OF FIRE EXTINCTION	+ 15%	- 30% / -50%	
			The first of the second	

#### COMPARATIVE EFFECTIVENESS IN FIRE EVENTS: RETARDANTS VS. FS-01 FIRE SUPPRESSANT



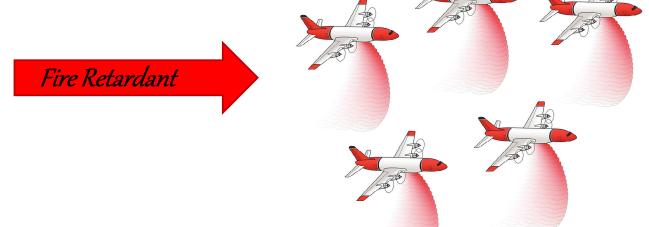


#### **ECONOMIC FACTORS AND DIFFERENCES**

#### **Fire Suppressant: FS-01**

- One Single Application
- Non-Toxic and Biodegradable
- Mixture Ratio: 15%
- Product Quantity: 1,800 liters
- *Product Cost:* **US\$ 12,060**
- Flight Cost: US\$ 9,000
- No Additional Applications or Ground Combat Required
- Burned Area Reduction: -80%
- Fewer Human and Material Losses
- <u>TOTAL FIRE COST</u>: **US\$ 21,060**





#### **Fire Retardants**

- Multiple Applications Required (Between 4 and 6)
- Toxic to Aquatic Environments
- *Mixture Ratio: 20-25%*
- Product Quantity: 13,620 liters
- *Product Cost:* **US\$ 49,032**
- Flight Cost: US\$ 45,000
- Additional Applications and Ground Combat Required to

Extinguish the Fire Once Weakened

- Burned Area Reduction: -20/30%
- Continued Loss of Lives and Homes
- <u>TOTAL FIRE COST:</u> **US\$ 104,032**

(Includes the required ground combat cost: US\$ 10,000)

## PHOS-CHEK®

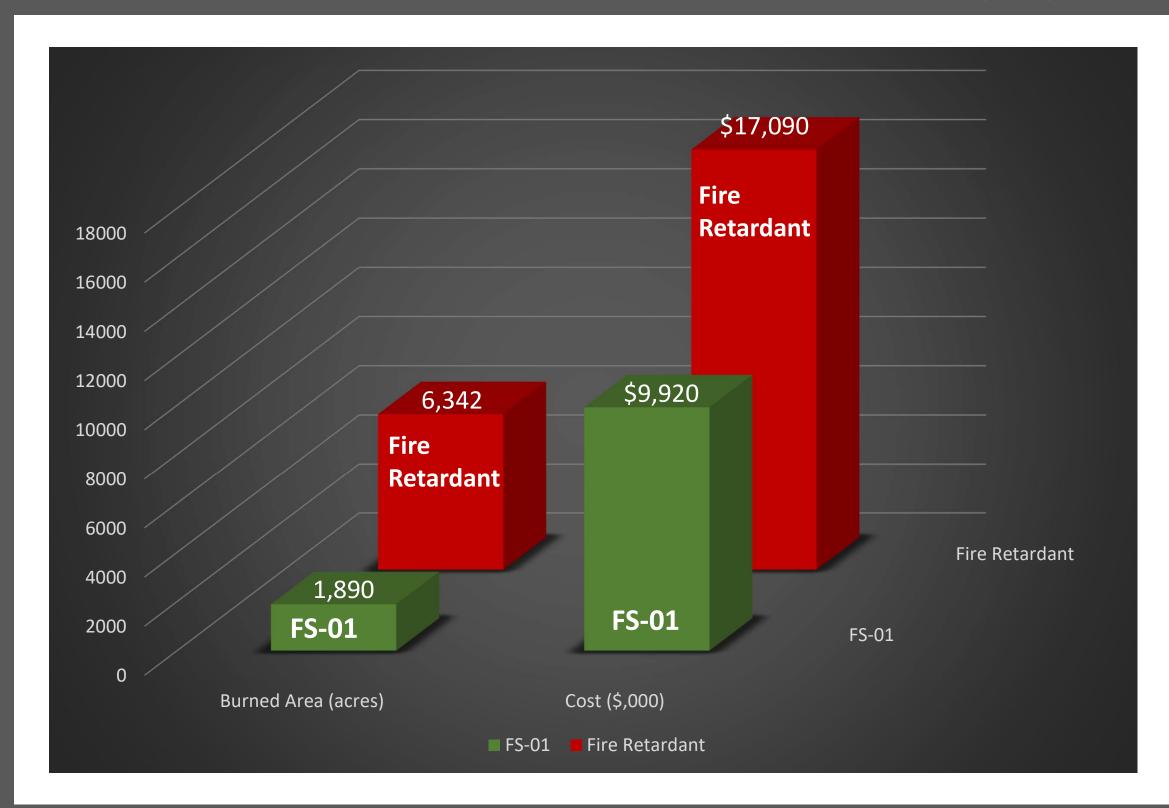
## CAMP FIRE (Nov. 2018) - PARADISE, CALIFORNIA



Real numbers using Phos-Chek VS. estimated numbers using FS-01



## **COMPARATIVE DIRECT IMPACT: Fire Retardant (red) vs. FS-01 (green)**



## We can reduce:

- Burned acres 80%
- Suppression cost50%



**FS-01** has undergone a five-year testing phase, during which the product has been used in tests as well as real-life fires by authorities in Spain, Portugal, Brazil, Chile and Australia. The product has proven to be 100% effective in these areas where applied correctly.

Experts on the matter have also certified the use of the product. Currently, we have certificates from:

- Professor Vega, Galicia Center for Forestry Studies (Centro de Estudios Forestales de Galicia).
- Government of Galicia, Spain.
- Military Emergency Unit (Unidad Militar de Emergencias), Spain.
- Portuguese Center for Forest Fire Studies (Centro de Estudios de Incendio Florestais de Portugal).
- Association for the Development of Industrial Aerodynamics (Associação para o Desenvolvimento da Aerodinámica Industrial), Portugal.
- Associated Energy, Transportation, and Aeronautic Laboratory (Laboratório Associado de Energia, Transporte e Aeronáutica), Portugal.
- Municipal Fire and Civil Protection Department (Municipal de Bombeiros e Protecção Civil), Vila Nova de Gaia, Portugal.
- Brazilian Institute for the Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis), Brazil.
- Approval by the Center for Emergencies of the European Union.

### **INTERNATIONAL CERTIFICATES**



36080 Pontevedra (España) Telet : 34 986 80 50 00 - Fax: 34 986 85 64 20



CENTRO DE INVESTIGACIÓN FORESTAL - LOURIZÁN

Como puede apreciarse en la tabla 5, en la zona tratada con el agente extintor se produjo una reducción drástica de la temperatura máxima alcanzada, tanto en el matorral como en la hojarasca.

Igualmente las duraciones de temperaturas superiores a los umbrales indicados cayeron totalmente a valores propios de ausencia de llama.

#### CONCLUSIONES

- 1) La quema que se llevó a cabo puede ser considerada como un fuego típico en estas formaciones de matorral, que suelen generar intensidades altas, debido a la edad, altura y carga del matorral presente en ellas. En algunos momentos el avance del fuego se vio frenado por el efecto de un viento de baja velocidad y desviado respecto al eje longitudinal de la parcela. Sin embargo, en el tramo donde el fuego alcanzó la zona tratada con producto, desarrolló una gran intensidad, gracias a que el viento sopló con más velocidad (7 km/h) y más alineado con el eje de la parcela.
- 2) Las estimaciones efectuadas y los datos de las temperaturas obtenidas indican que, en las proporciones utilizadas, la mezcla presentó una efectividad total en la extinción del frente de llamas, ya que el fuego se extinguió sin sobrepasar el limite de la zona tratada.
- 3) En esta experiencia no se consideró la comparación con la aplicación de la misma dosis de riego con agua sin la adición del agente extintor.
- 4) Esta prueba puede considerarse solo como un ensayo demostrativo, siendo necesario efectuar un testado del producto con una base experimental mas amplia para obtener un resultado mas concluyente y homologable.

Vº Bº Director del Centro

Fdo: Gabriel Toval Hernández

Fdo: José Antonio Vega Hidalgo

DIRECÇÃO MUNICIPAL DE BOMBEIROS E PROTECÇÃO CIVIL







#### 7. Conclusão

Os incêndios florestais são a principal ameaça à nossa área florestal, pelo que encontrar soluções eficazes na prevenção e aplicar novas tecnologias no combate é muito importante.

A demonstração do produto LICET-F, teve como principal objectivo apresentar a sua eficiência no combate, no caso demonstrado pode-se dizer combate indirecto.

Ficou aqui demonstrada a todos os presentes a sua elevada eficiência dado a parcela de demonstração apresentar todas as especificações de uma situação real, associada às condições atmosféricas adversas (vento forte e baixa humidade).

A época de Verão está próxima e nada melhor do que num grande incêndio, com a presença de diversas entidades com carácter decisivo, poder aplicar este produto e tirar se dúvidas houvesse as suas conclusões.

Vila Nova de Gaia, 4 de Abril de 2011.

N.º Municipal de Emergência - 707 24 24 00



SERVICO PÚBLICO FEDERAL MINISTÉRIO DO MEIO AMBIENTE - MMA INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS NATURAIS RENOVÁVEIS - IBAMA

Oficio Nº 322 /2008- IBAMA/DIRETORIA DE PROTEÇÃO AMBIENTAL

Brasília-DF, 3 de setembro de 2008.

Prezado Senhor.

Após demonstrações do produto LICET-F realizadas por essa empresa para os técnicos especializados do Centro Nacional de Prevenção e Combate aos Incêndios Florestais - PREVFOGO, vinculado a esta Diretoria de Proteção Ambiental - DIPRO do IBAMA, vimos comunicar que o referido produto foi considerado tecnicamente eficiente para o bloqueio e redução da violência das chamas, pelo que esta Diretoria decidiu por desencadear processo específico e qualificado para a aquisição do produto LICET-F com vistas ao suprimento das equipes de brigadistas distribuídas ao longo das 80 bases que estão sendo estruturadas na região do "Arco do Fogo" na Amazônia.

Assim, e considerando que nos encontramos no auge do período de estiagem na Região Centro-Oeste e na porção sul da Região Norte do País, consultamos V.Sa. quanto as condições efetivas de produção e de logística de distribuição que esta empresa apresenta para fornecimento inicial de aproximadamente 100 ton do produto LICET-F no prazo aproximado de 30

Flávio Montiel da Rocha Diretor de Proteção Ambiental

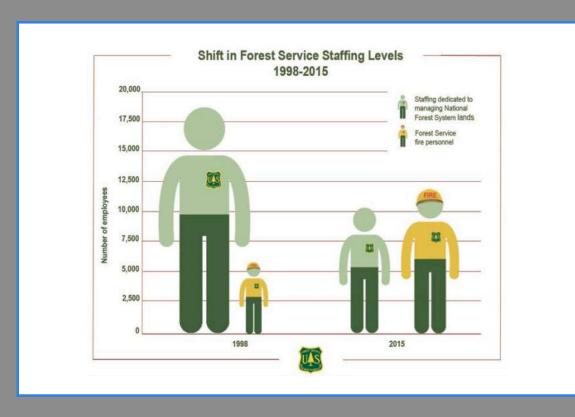
Ilmo. Sr. Paulo Habinoski Diretor Administrativo Rio Sagrado Industrial Química Ltda Rodovia Régis Bittencourt Br 116 Km 71 Quatro Barras - PR CEP 83420-000 Fax: (41) 3672 2031

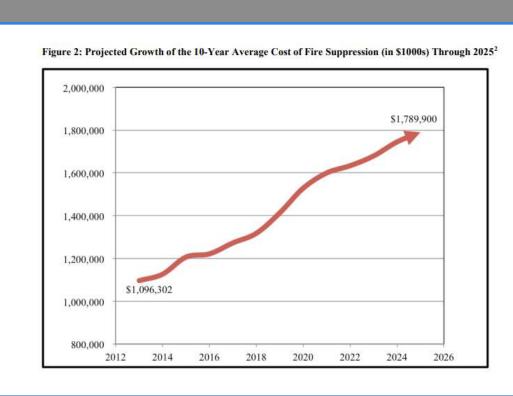
FS-01 was originally named Licet.

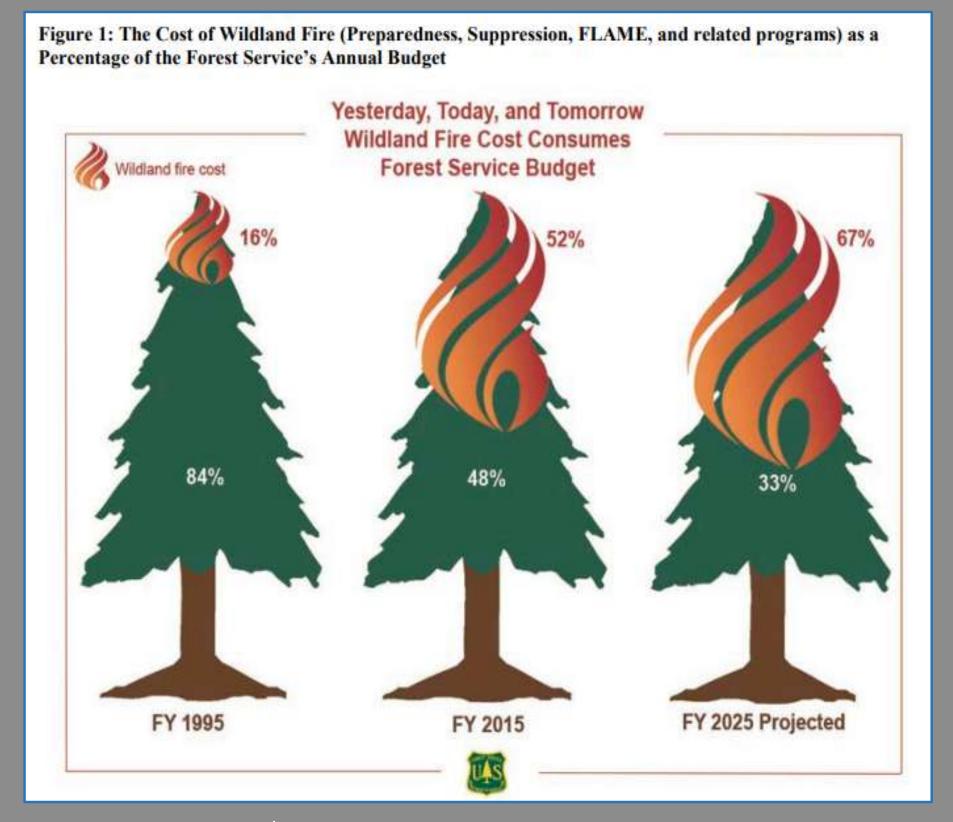




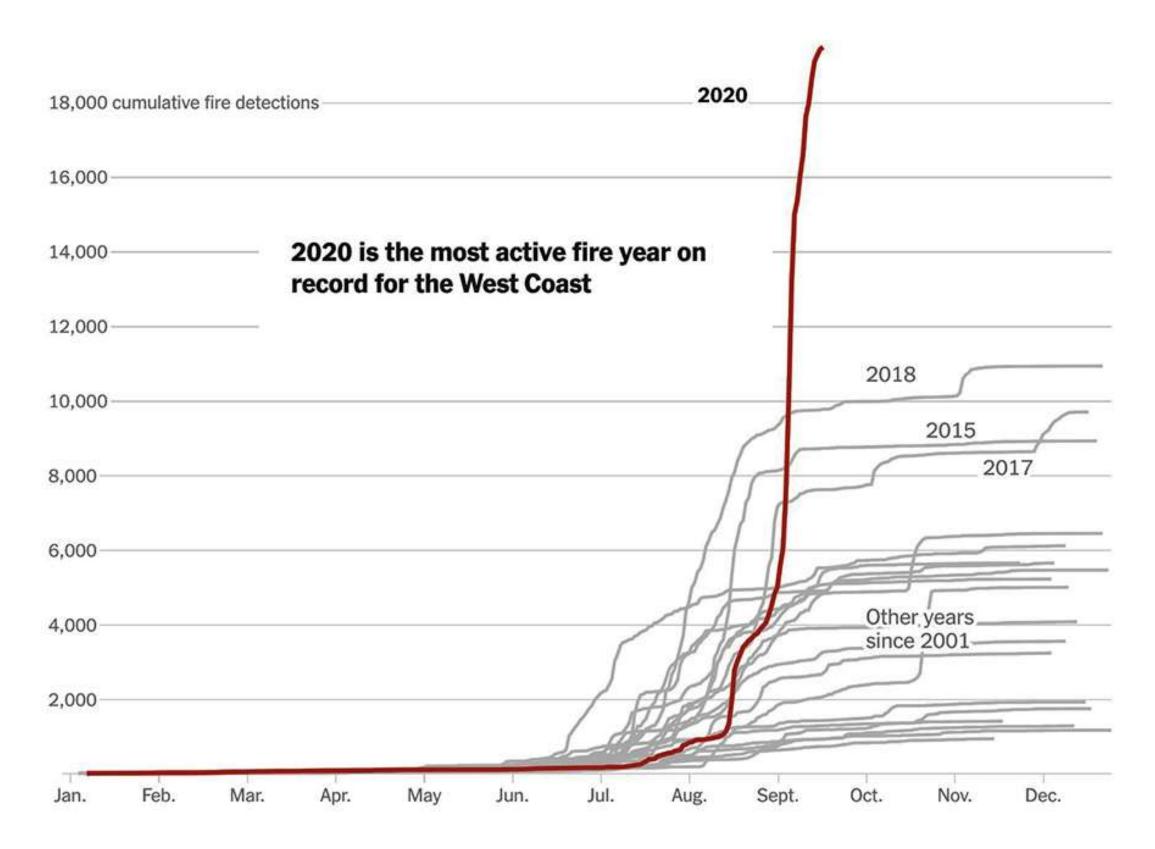
### Graphs show the USFS projections on fire suppression costs as fires become more virulent.







The suppression budget for 2017 was \$1.3 Billion. The real cost was \$2.4 Billion.



Note: Cumulative sum of fire detections across California, Oregon and Washington. Data as of Sept. 21. Instruments on Terra and Aqua have experienced periodic outages. 

Source: NASA Terra and Aqua satellite data, based on detections with greater than 95 percent confidence levels.



## **COMPETITOR SALES**:

Total fire retardant sales by Perimeter Solutions on wildfires:

average of \$350 – \$450 Million

USFS 2020 contract awarded to Perimeter: \$195.4 Million

DOI 2020 contract awarded to Perimeter: \$24.8 Million

Currently Phos-Chek is the only product qualified by the USFS.

Cal Fire (California Fire Dept.) and USFS only uses Phos-Chek.

As a private company, Perimeter Solutions is secretive and always declines to comment on its annual sales. These amounts are an estimate based on various sources and the USFS contract sales.







FS-01 is approved for use by the European Union and is registered under the REACH regulation with the European Chemicals Agency.

**REACH** (EC 1907/2006) aims to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances. This is done by the four processes of REACH, namely the registration, evaluation, authorization and restriction of chemicals. REACH also aims to enhance innovation and competitiveness of the EU chemicals industry.

## FREE OF PFAS

NON-TOXIC

BIODEGRADABLE



RESULTS THAT MATTER

Scientific Test	Concentrated	Sample Mixed with					
	<u>Sample</u>	<u>Water</u>					
Biodegradability	96% after 28 days Practically Biodegradable	100% after 28 days Biodegradable					
Scientific Tests	Sample Mi	xed with Water					
Fish Toxicity Brachydanio rerio	LC-50 (96h) = 6,930 mg/L	Classified as <b>Non-Toxic</b>					
Worm Toxicity Eisenia foetida	LC-50 (96h) = 4,697.3 mg/L	Classified as <b>Non-Toxic</b>					
Dalphindae Toxicity Daphnia magna	CE-50 (48h) = 10,000 mg/L	Classified as <b>Non-Toxic</b>					
Oral Toxicity	DL-50 (OCDE 423) = 2,000 mg/kg <b>Irritating</b>	Classified as <b>Non-Toxic</b> and <b>Non-</b>					
Dermal Toxicity	DL-50 (OCDE 402) = 2,000 mg/kg    Irritating	Classified as <b>Non-Toxic</b> and <b>Non-</b>					
Eye Irritation	BCOP 8.74	Classified as <b>Non-Irritating</b>					
Eye Corrosion	OCDE 405 Aluminum = 0.1350 mm/year	Classified as Non-Corrosive					
Metal Corrosion	Copper = 0.0699 mm/year Iron = 0.0415 mm/year Brass = 0.0763 mm/year	Classified as Non -Corrosive					

## LABORATORY TESTS





## EFFECTIVENESS ON REAL FIRES











## FS-01 REACTS BY COOLING THE AREA AND PUTING OUT THE FIRE

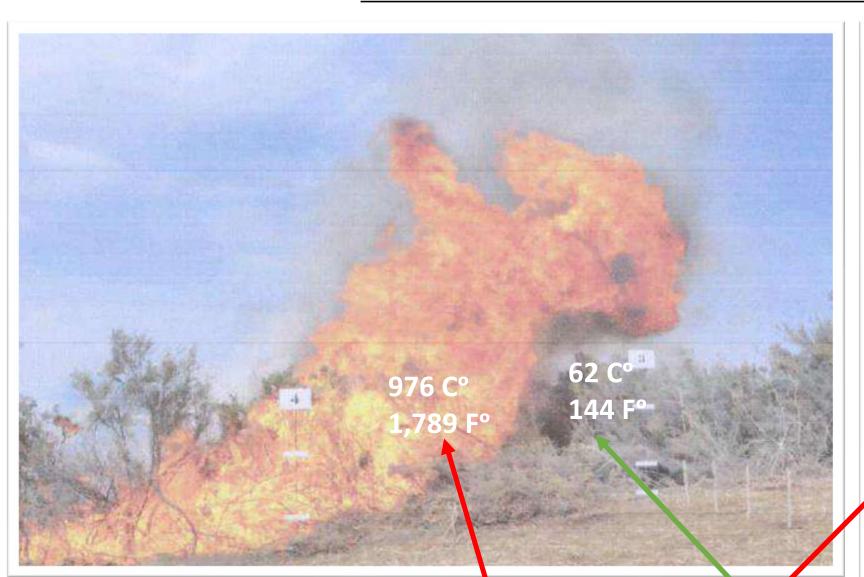




Table 5.Maximum	n Temperatu	res (°C) and	time in:	seconds du	iring which	temperat	ures remain	ed above			
	60, 350 and 700 degrees Celsius.										
		Non Trea	ted Area		Are	Area with Extinguishing Agent					
	E	Bush	Lea	af litter	E	Bush	Lea	flitter			
	Average	Range	Average	e Range	Average	Range	Average	Range			
Maximun T (°C)	976	846 – 1102	457	17 - 923	62	29 – 96	18	17- 18	_		
Time with $T > 60$ °C	(S) 286	236 - 341	322	0 - 553	8.5	0 - 17	0				
Time with T > 350°C	49	21 - 69	65	0 - 114	0		0				
Time with T > 700°C	18	6 - 35	0		0		0				

## TEST PERFORMED BY THE STATE OF COLORADO (USA)

Sept. 2022



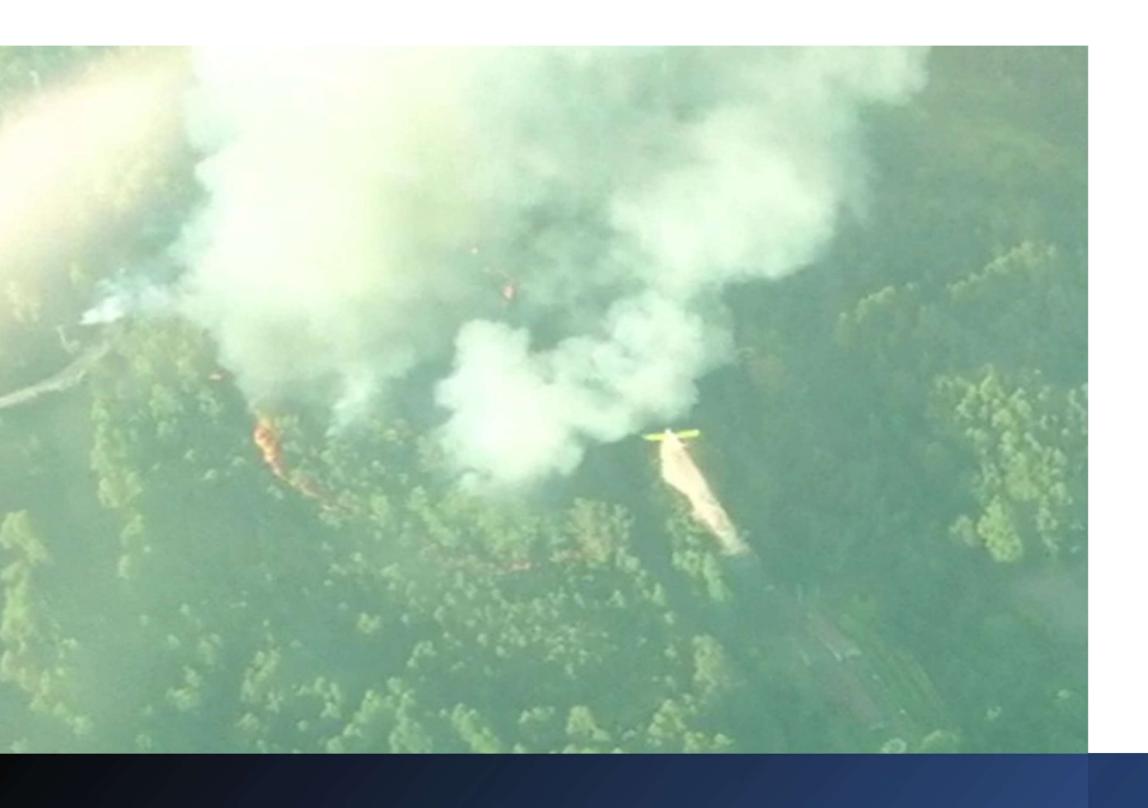














FS-01 application in a real wildfire in Spain

# CLICK THE VIDEOS BELOW TO WATCH A DEMONSTRATION OF **FS-01**

(If links don't work, please copy and paste in browser)

## https://youtu.be/bln8dEchhQE

This video shows a test where the product was applied on the right half of the area. When the fire reaches the application area, it stops in its tracks.

## https://youtu.be/W61lbf-KSeY

This video shows a pool filled with burning gasoline. It demonstrates the difference between fighting fire with water versus with FS-01.

## https://youtu.be/nFXvJOTTBOY

This video shows an application of the product in a real fire from a plane (Hercules C-130 equipped with MAFFS). The product can be applied from any firefighter aircraft without any modification.

### https://youtu.be/5h-hXnGwH Q

This video shows an application area to which gasoline is applied several times. The gasoline is not capable of igniting the treated area.





FS-01 WAS TESTED ON

STRUCTURAL FIRES

RESULTS SHOW LESS

TIME AND LESS WATER

ARE REQUIRED TO

**EXTINGUISH** 

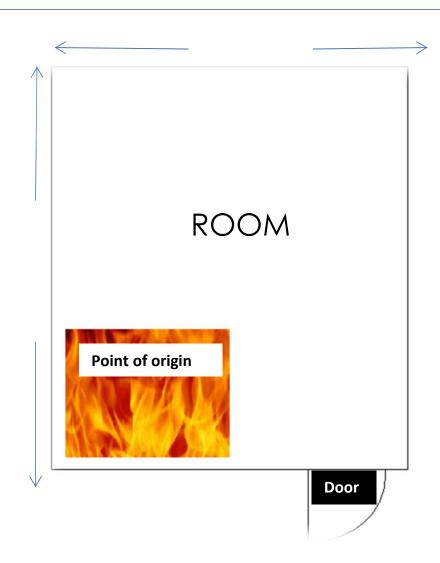
THE FIRE.





## TEST ON STRUCTURE (2013)





A fire was started in one of the rooms of the structure with flammable fuel mixed with an accelerant (gasoline).

## **METHODS USED**

## Firefighting backpack

- Capacity: 4 Gall.
- Adjustable nozzle.



- self-containedbreathing apparatus
- Communicationsystem(walkie-talkie)

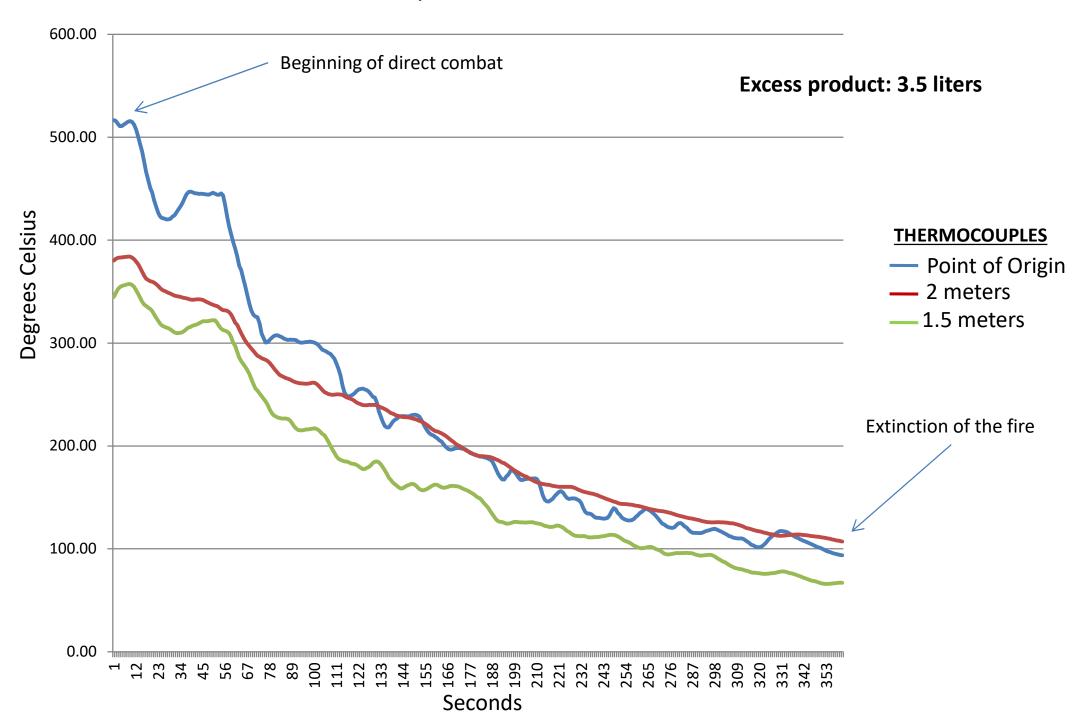




Seconds

#### TABLE 6

## Combat with 15-Liter backpacks of FS-01. Direct combat.



# OIL & GAS MARKET

GREEN CANYON developed a specific product designed for the Oil & Gas market. FS-02 lowers the temperatures of the fire dramatically and will allow the extinction safe and fast.



## MILITARY

**VIDEO PRESENTATION (click here)** 



- Free of PFAS: FS-01 is the only proper substitute for the recently banned cancerous fire retardants (not free of PFAS), used on military bases. FS-01 is Non-Toxic and Biodegradable.
- During an attack or an accident, it will prevent fire from destroying essential infrastructure on the bases.
- During an attack in the field, it will save the lives of our heroes if they are trapped in a vehicle on fire.
- Maintaining its effectiveness even if mixed with sea water, FS-01 will stop a fire on a military vessel, saving it from destruction and keeping it ready for combat.
- To protect civilians in armed conflict against fires cause by incendiary devices.

FS-02 will prevent the destruction caused by fire, keeping the military running, safe, and ready to defend our Country.



FIRE FIGHTING FOAMS CONTAINING CANCEROUS PFAS HAVE BEEN USED IN HUNDREDS OF MILITARY BASES, CANTAMINATING THE AREA AND THE GROUND WATER, AFFECTING MILITARY PERSONNEL AND THE ADJACENT POPULATION.

CANCER RATES ARE INCREASING IN THE AFFECTED AREAS.

https://www.youtube.com/watch?v=W61lbf-KSeY

FS-01 & FS-02 DO NOT CONTAIN

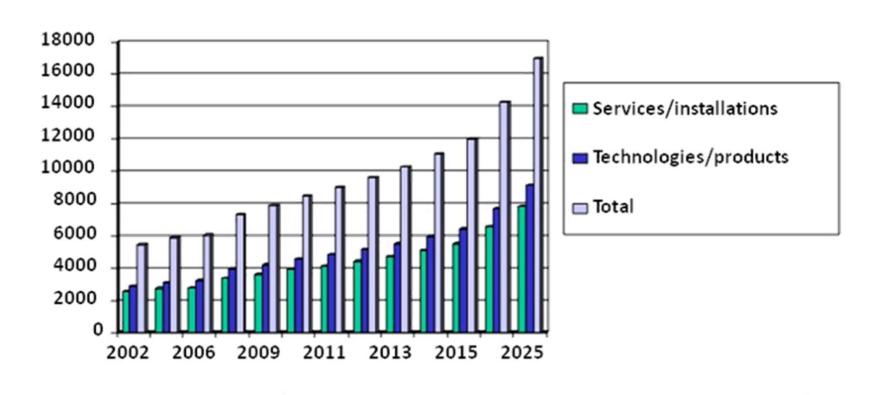
**PFAS** 

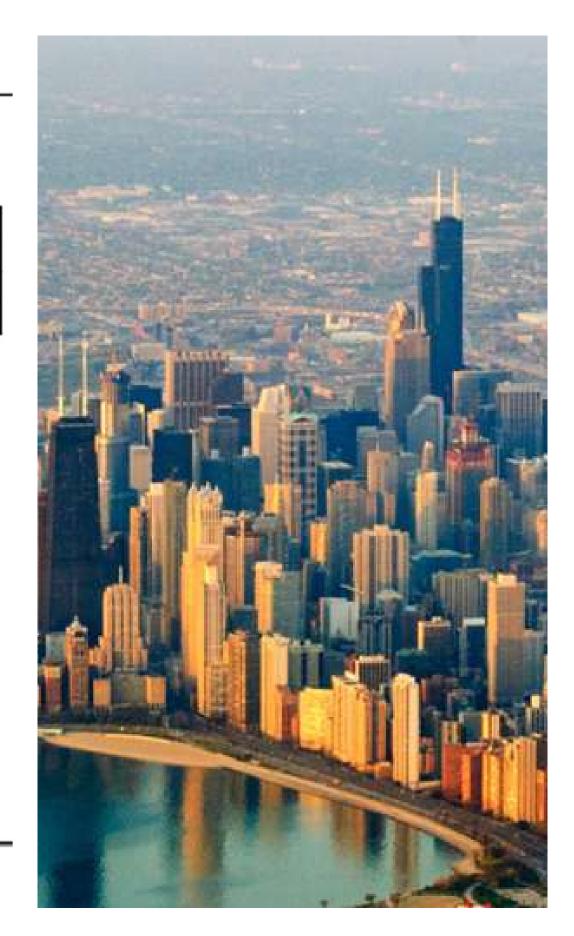
### **MARKET EVOLUTION**

## 7.10.3. Markets for active fire protection -- USA/NAFTA

#### 7.10.3.1 The total market for active fire protection in USA/NAFTA 2002-2008-2025 in Mio. €

	2002	2004	2006	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025
Services/installations	2570	2779	2803	3389	3639	3923	4164	4448	4740	5118	5540	6598	7837
Technologies/products	2905	3123	3268	3952	4242	4573	4854	5185	5526	5968	6459	7693	9137
Total	5475	5902	6071	7341	7881	8496	9018	9633	10266	11086	11999	14291	16974



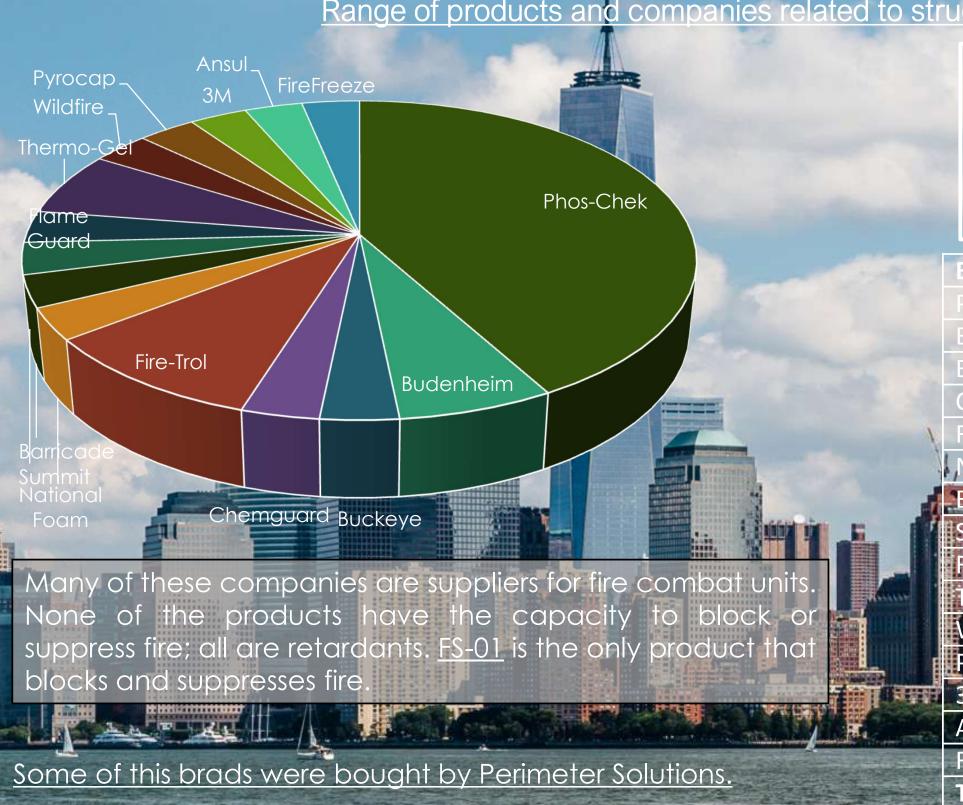


Helmut Kaiser Consultancy, Tübingen 2008

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## COMPETITIVE ENVIRONMENT

Range of products and companies related to structural fires



Of all these comapnies, only Phos-Chek and Budenheim sell long-term retardants for wildfires. Phos-Chek (Perimeter Soutions Co.) is sold in the USA, NAFTA countries, and Australia, and Budenheim's product Buma is sold in Europe. Recently, Buma was purchased by Perimeter Solutions. This means FS-01 currently has only one competitor.

Brands	Nº Products
Phos-Chek	13
Budenheim	1
Buckeye	
Chemguard	
Fire-trol	3
National Foam	
Barricade Barricade	1 1
Summit	
Flame Guard	
Thermo-Gel	2
Wildfire <b>Fig.</b>	
Pyrocap Pyrocap	
3M	
Ansul	1
FireFreeze	1
Total	31



