

# Testing of New Fluorine-Free Green Surfactant Mixtures to Replace AFFF

**WP20-5381**

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Project Outbrief

April 20, 2021



**REPORT DOCUMENTATION PAGE**

Form Approved  
OMB No. 0704-0188

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<b>1. REPORT DATE (DD-MM-YYYY)</b> 20/04/2021		<b>2. REPORT TYPE</b> ESTCP Project Outbrief		<b>3. DATES COVERED (From - To)</b> 4/7/2020 - 4/6/2022	
<b>4. TITLE AND SUBTITLE</b> Testing of New Fluorine Fluorine-Free Green Surfactant Mixtures to Replace AFFF				<b>5a. CONTRACT NUMBER</b> 20-P-0040	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b> Thierry Carriere Kevin Roth				<b>5d. PROJECT NUMBER</b> WP20-5381	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> ADA Technologies, Inc 11149 Bradford Rd Littleton, CO 80127				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> WP20-5381	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Environmental Security Technology Certification Program 4800 Mark Center Drive, Suite 16F16 Alexandria, VA 22350-3605				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> ESTCP	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b> WP20-5381	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.					
<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b> The technical objectives of this project are listed below: <ul style="list-style-type: none"> <li>● One-year proof-of-concept project aimed at developing new, superior fluorine-free concentrate formulations.</li> <li>● Acquire key Class B fire test data on small and increasingly larger pan fires (heptane and gasoline).</li> <li>● Evaluate the new concentrate formulations and their potential for full-scale military qualification in a potential follow-on project.</li> <li>● Demonstrate the viability and performance of these surfactant proprietary mixtures designed to meet the stringent performance requirements of MIL-F-24385F.</li> </ul>					
<b>15. SUBJECT TERMS</b> New Fluorine-Free, Green Surfactant Mixtures, AFFF					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>  UNCLASS	<b>18. NUMBER OF PAGES</b>  10	<b>19a. NAME OF RESPONSIBLE PERSON</b> Kevin Roth
<b>a. REPORT</b>  UNCLASS	<b>b. ABSTRACT</b> UNCLASS	<b>c. THIS PAGE</b> UNCLASS			<b>19b. TELEPHONE NUMBER (Include area code)</b> 303-874-8287

# WP20-5381: Testing of New Fluorine-Free Green Surfactant Mixtures to Replace AFFF

Performer: ADA Technologies, Inc.

## Technology Focus

- *Fluorine-Free Fire Suppression Foam*

## Demonstration Site

- *N/A*

## Demonstration Objectives

- *Develop a Fluorine-Free foam matching or approaching the fire extinguishment performance of the legacy AFFF on heptane and gasoline pool fires*

## Project Progress and Results

- *ADA foam formulation 42.8.1 at 6% concentration is matching AFFF on 5 ft<sup>2</sup> pool fire at equal flow rate. Initial data on 12.5 ft<sup>2</sup> pool fire confirms this.*

## Implementation Outlook

- *Need ADA foam performance data on 28 ft<sup>2</sup> pool fire in follow-on project and confirm low eco-toxicity before evaluating outlook.*

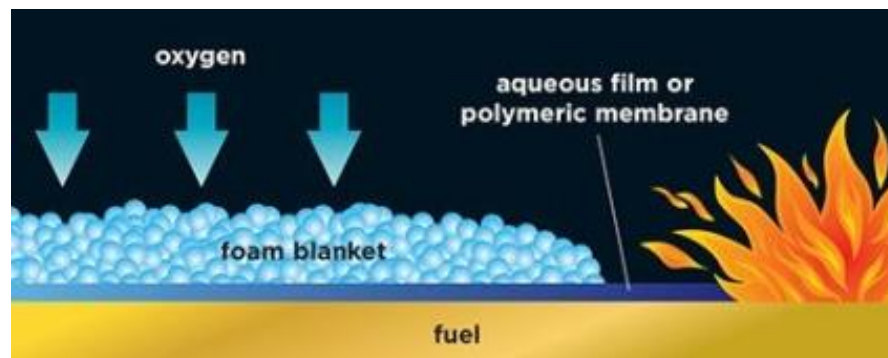


# Technical Objectives

- One-year proof-of-concept project aimed at developing new, superior fluorine-free concentrate formulations.
- Acquire key Class B fire test data on small and increasingly larger pan fires (heptane and gasoline).
- Evaluate the new concentrate formulations and their potential for full-scale military qualification in a potential follow-on project.
- Demonstrate the viability and performance of these surfactant proprietary mixtures designed to meet the stringent performance requirements of MIL-F-24385F.

# Technical Approach

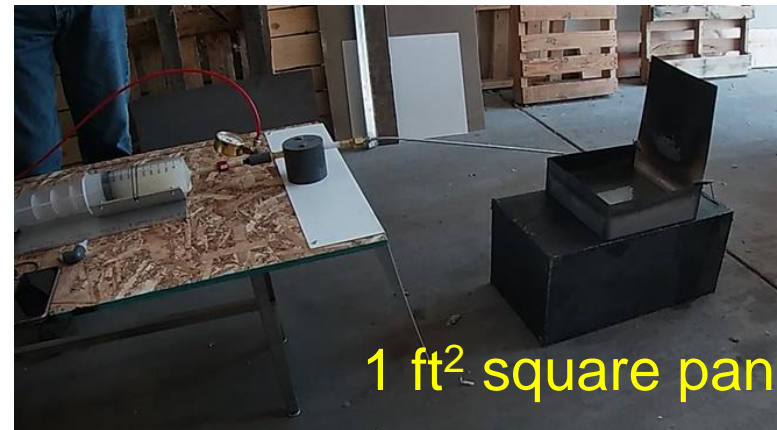
- Utilize surfactants that are commercially available and biodegradable
  - ◆ Minimize product cost
  - ◆ Environmentally friendly
- Three main components: AGA, APG (non-ionic sugar surfactants), and OSS (surface tension depressant), all compliant with the Stockholm Convention.
  - ◆ Optimize foam stability
  - ◆ Minimize surface tension
- Work with combinations of foam enhancers and stabilizers
- Methodology: collect new agent performance data on 2B (5 ft<sup>2</sup>) and 5B (12.5 ft<sup>2</sup>) pan fires (heptane and gasoline) to identify and refine viable candidate(s).
- Small pan test used to fine tune surfactant composition.
- Aquatic toxicity of the selected foams will be evaluated as part of the project as well.



# Technical Progress

Completed 1 ft<sup>2</sup> pan fire screening in September 2020

- 13 formulations extinguished heptane fire
- 11 formulations achieved burnback times greater than 360 seconds on heptane
- 5 formulations suppressed gasoline fires
- 4 formulations achieved burnback times greater than 360 seconds on gasoline
- Formulations ranked for downselection



RANK	Formula	Volume applied to fire [cc]	Surface Tension [dynes/cm]	Approx rate applied [mL/min]	Score
	MIL-SPEC AFFF	175	18	328	2339
1	43.8	270	25	360	2200
2	42.8	290	23	387	2175
3	22.6	280	26	410	2161
4	49.8	280	21	467	2153
5	22.6.3	275	27.75	434	2147
6	22.6.5	300	28	419	2129

# Technical Progress

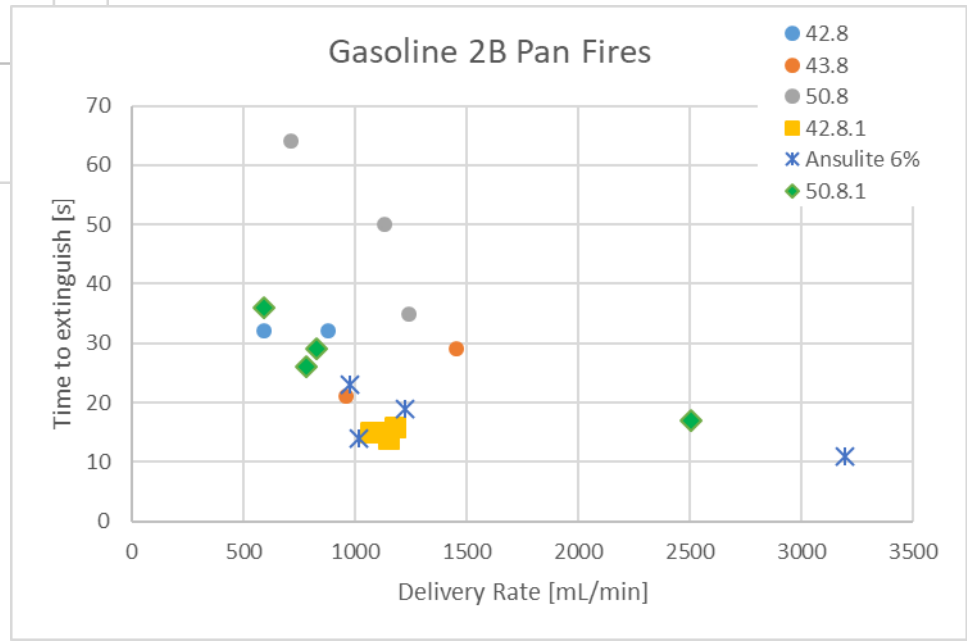
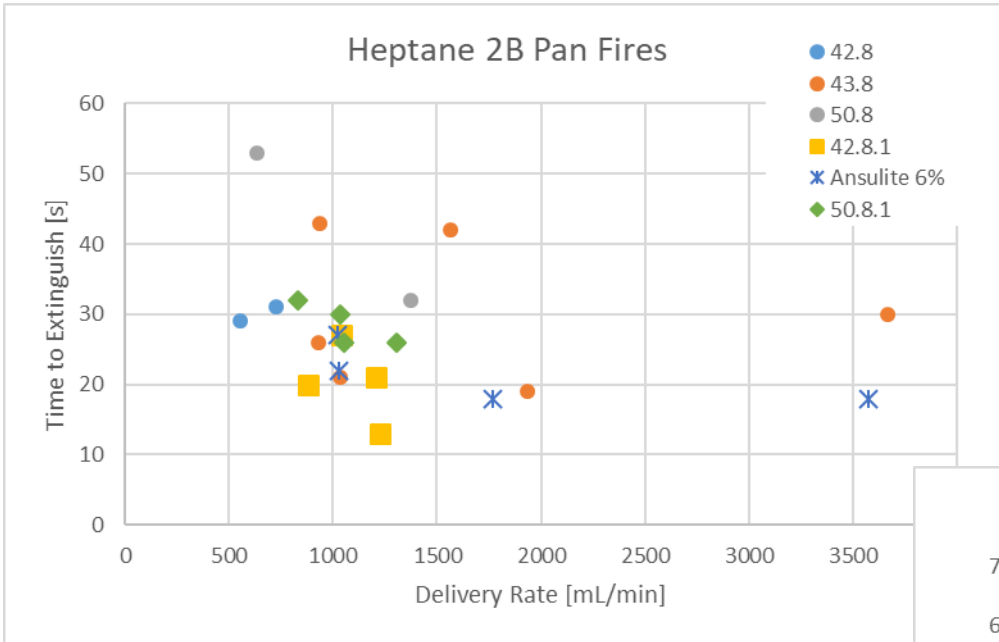
Completed 5 ft<sup>2</sup> round pan fire tests in March 2021

- 3 formulations tested - extinguished both gasoline and heptane fires
- Formulation 42.8.1 was best and matched AFFF
- Extinguishment time: 20 s for AFFF and 42.8.1 at 1000 cc/min on heptane
- Good performance observed for 42.8, 43.8 and 50.8.1 (other ADA formulations) – but slightly slower than AFFF and 42.8.1.



# Technical Progress

5 ft<sup>2</sup> round pan fire test results



# Technical Progress

12.5 ft<sup>2</sup> (5B) square pan fire tests started in April 2021

- First few tests indicate similar results to those obtained on the 5 ft<sup>2</sup> pan fires
- Formulation 42.8.1 (ADA) at 6% concentration matches MIL-SPEC AFFF: extinguishment in 27 s on 5B heptane, at 2100 cc/min delivery rate
- Formulation 50.8 (ADA) not as good so far.



# Issues

- COVID forced ADA to perform 5B tests in house rather than at local Fire Department Training Center resulting in slight delay
- Experienced weather delays.
- Otherwise no unanticipated or unresolved issues.