

Specification 5100-304b  
January 2000  
Superceding  
Specification 5100-304a  
February 1986

**UNITED STATES DEPARTMENT OF AGRICULTURE**  
**FOREST SERVICE**  
**SPECIFICATION FOR**  
**LONG TERM RETARDANT, WILDLAND FIRE,**  
**AIRCRAFT OR GROUND APPLICATION**

1. SCOPE.

1.1. Scope. The fire retardants described in this specification are for aircraft or ground application use in wildland fire fighting. After mixing with water, retardant is applied to the fire area to slow or stop combustion.

2. APPLICABLE DOCUMENTS.

2.1. Government Documents. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those in effect on the date of the invitation for bids or request for proposals.

USDA Forest Service Research Paper

INT 121 - Effects of Ammonium Sulfate and Ammonium Phosphate on Flammability

USDA Forest Service Documents

9951 1802—SDTDC - Manufacturer Submission Procedure for Qualification Testing of Wildland Fire Chemical Products

9951 1803—SDTDC - Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products

National Long Term Bulk and Full Service Retardant Contract

---

Beneficial comments, recommendations, additions, deletions and any pertinent data that may be used in improving this document should be addressed to: USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198 by using the Specification Comment Sheet at the end of this document or by letter.

---

Code of Federal Regulations (CFR)

- 40 CFR 160 - Good Laboratory Practice Standards
- 40 CFR 792 - Good Laboratory Practice Standards
- 40 CFR 264.33 - Resources Conservation And Recovery Act (RCRA) Acutely Hazardous and Toxic Products
- 40 CFR 302.4 - Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Hazardous Substances
- 40 CFR 355 - CERCLA Extremely Hazardous Substances (EHS), Appendix A
- 40 CFR 372 - Superfund Amendment and Reauthorization Act (SARA), Title III, Section 313

Federal Standard

FED-STD-123 - Marking for Domestic Shipment (Civilian Agencies)

International Agency for Research on Cancer (IARC)

International Agency for Research on Cancer Monographs

United States Environmental Protection Agency (EPA) Health Effects Guidelines (OPPTS)

Series 870 Acute Toxicity and Irritation Studies.

- 870 - 1100 - Acute Oral Toxicity Study
- 870 - 1200 - Acute Dermal Toxicity Study
- 870 - 1300 - Acute Inhalation Toxicity Study
- 870 - 2400 - Primary Eye Irritation Study
- 870 - 2500 - Primary Dermal Irritation Study

United States Department of Health and Human Services

Annual - National Toxicology Program's (NTP) Annual Report on Carcinogens

United States Department of Labor/Occupational Safety and Health Administration (OSHA)

Form 174 - Material Safety Data Sheet (MSDS)

Copies of USDA Forest Service standards, research papers and other documents are available from the Branch Chief for Fire Equipment and Chemicals at USDA Forest Service, P.O. Box 96090, Washington, DC 20090-6090.

Copies of federal standards are available from General Services Administration, Federal Supply Service Bureau, Standards Section, Suite 200, 470 East L'Enfant Plaza SW, Washington, DC 20407.

2.2. Non-Government Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issue of these documents are those in effect on the date of approval.

Institute of Electrical and Electronics Engineers (IEEE)/American Society for Testing and Materials (ASTM)

SI 10 - Standard for Use of the International System of Units (SI); The Modern Metric System

Address requests for copies to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

2.3. Other Publications. The following documents provide applicable information for the study of wildland fire chemical products.

National Association of Corrosion Engineers International (NACE) Standard Test Method.

TM-01-69 - Test Method for Laboratory Testing of Metals for the Process Industries

Address requests for copies to National Association for Corrosion Engineers International, P.O. Box 218304, Houston, Texas 77218.

USDA Forest Service Manual (FSM)

5160, Section 5162 - Fire Management Chemicals.

USDA Forest Service Research Paper

INT 134 - An Evaluation of the Drop Characteristics and Ground Distribution Patterns of Forest Fire Retardants

2.4. Order of Precedence. In the event of conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS.

3.1. Qualification. Retardant shall be qualified in accordance with 4.1 and 4.2. Retardant shall be classified as indicated in 3.3.

3.1.1. Review Prior to Product Submittal. A review shall be conducted prior to submittal of a product for testing and evaluation. The manufacturer of each product is required to provide a completed confidential formulation disclosure sheet for each product submitted. A designated Forest Service representative shall review the confidential formulation disclosure sheet, technical data sheet, additional screening data for thickened products, the product Material Safety Data Sheet (MSDS), and the MSDS for each ingredient. The review will determine whether the product is in compliance with Forest Service policy regarding the use of chemicals that may be on any of the indicated regulatory lists as follows. The status of each chemical with regard to d, e and f is informational and is included in order to assure proper handling and storage.

- a. 40 CFR 355 Appendix A
- b. National Toxicology Program's Annual Report on Carcinogens
- c. International Agency for Research on Cancer (IRAC) monographs for potential carcinogens
- d. 40 CFR 302.4
- e. 40 CFR 261.33
- f. 40 CFR 372

### 3.2. Definitions.

3.2.1. Ingredient. An ingredient is as each single chemical used by the manufacturer in the formulation of the product.

3.2.2. Component. A component is each combination of ingredients packaged by the manufacturer for use in preparation of the product by the user. A component may be a single ingredient, or a combination of ingredients, wet or dry, that is added to water when preparing the mixed retardant. Examples of components, for the purpose of this specification, are a liquid concentrate or a gum-thickener if it is added to the mix at the airtanker base.

3.2.3. Dry Concentrate. A dry concentrate is a dry powder which, when mixed with water, forms the mixed retardant. For the purposes of this specification, a dry concentrate is also a component.

3.2.4. Wet Concentrate. A wet concentrate is a liquid/fluid concentrate which, when added to water, forms the mixed retardant. For the purposes of this specification, a wet concentrate is also a component.

3.2.5. Mixed Retardant. Mixed retardant consists of a wet or dry concentrate, and other component(s), mixed with water at the qualified mix ratio.

3.2.6. Long Term Retardant. Long term retardant is a product containing salts which acts as a fire retardant. It contains water which serves primarily to aid in uniform disbursement of the retardant salts over the target area. When the water is completely evaporated, the remaining salts continue to serve as a fire retardant until they are removed.

3.3. Classification. Retardant shall be classified under the storability, viscosity, color, use, and mixability designations indicated below. The procurement activity shall specify the classifications determined as necessary by the agency fire administrator. See 6.2.

3.3.1. Storability. Mixed retardant storability shall be described as storable (A), not storable (B), and for immediate use (C).

3.3.1.1. Storable. The “A” level storability designation shall be described as “Storable for 1 year.” Products may require recirculation to obtain a homogeneous and usable product. The resulting mixed retardant may be stored for an extended period of time. Mixed retardant can be recirculated in storage.

3.3.1.2. Not Storable. The “B” level storability designation shall be described as “Not storable beyond 30 days.” Products shall be mixed or blended during transfer to aircraft or other application devices. No additional mixing or circulation shall be necessary. These products shall not be routinely stored in the mixed form. Recirculation typically is not available.

3.3.1.3. Immediate Use. The “C” level storability designation shall be described as “For immediate use of less than 24 hours.” Products shall be applied from helicopter or ground-based equipment.

3.3.2. Viscosity. Viscosity shall be determined by the use of a Brookfield model LVF viscometer, operated at 60 rpm. Spindle number 2 shall be used for measuring viscosity from 1 to 500 centipoise (cP). Spindle number 4 shall be used for measuring viscosity above 500 cP. Viscosity designations shall be described as no viscosity (N), low (L), medium (M), or high (H) viscosity.

3.3.2.1. No Viscosity. The “N” designation shall be assigned to retardant with a viscosity between 1 and 60 cP and shall be described as having a value of “No viscosity.”

3.3.2.2. Low Viscosity. The “L” designation shall be assigned to retardant with a viscosity between 61 and 250 cP and shall be described as having a value of “Low viscosity retardant.”

3.3.2.3. Medium Viscosity. The “M” designation shall be assigned to retardant with a viscosity between 251 and 1,000 cP and shall be described as having a value of “Medium viscosity retardant.”

3.3.2.4. High Viscosity. The “H” designation shall be assigned to retardant with a viscosity greater than 1,000 cP and shall be described as having a value of “High viscosity retardant.”

3.3.3. Color. Retardant color designations shall be described as uncolored (U) or colored (C).

3.3.3.1. Uncolored. The “U” designation shall be assigned to a mixed retardant that contains no ingredients which impart color and is not visible when normally applied to natural fuels. The product in the container may have some earth-tone color due to salts, inhibitors, or other ingredients.

3.3.3.2. Colored. The “C” designation shall be assigned to a mixed retardant that contains iron oxide to impart visibility from the air at the time of use. The application ceases to have visual impact on a landscape level following two years of historically normal exposure to weathering elements.

3.3.4. Use. The type of equipment used to apply retardant dictates the physical properties of the retardant solution. Retardant use designations shall be described as fixed-wing airtanker (FW), helicopter fixed-tank (HF), helicopter bucket (HB) or ground-based application equipment (G).

3.3.4.1. Fixed Wing Airtanker. The “FW” designation shall be assigned to products designed to be applied from fixed-wing airtankers and shall include Single Engine Airtankers (SEATS).

3.3.4.2. Helicopter Fixed Tank. The “HF” designation shall be assigned to products designed to be applied from any tank in direct contact with the helicopter.

3.3.4.3. Helicopter Bucket. The “HB” designation shall be assigned to products designed to be applied from any bucket suspended below the helicopter in excess of 15 feet (4.6 m). No retardant is likely to contact the helicopter during normal fire operations.

3.3.4.4. Ground Based Application Equipment. The “G” designation shall be assigned to products designed to be applied from ground based application equipment.

3.3.5. Mixability. Retardant mixability designations shall be described as low shear (LS) or simple dilution (SD).

3.3.5.1. Low Shear. The “LS” designation shall be assigned to mixed retardant prepared by using moderate amounts of agitation, typically obtained from the use of an in-line eductor or simple impeller batch mixer. An example would be a three blade agitator at 1800 rpm.

3.3.5.2. Simple Dilution. The “SD” designation shall be assigned to mixed retardant prepared by blending water and concentrate with no additional agitation.

#### 3.4. Mammalian Toxicity and Irritation.

3.4.1. Components. When tested in accordance with 4.5.1, the toxicity of all components shall meet the performance requirements indicated in Table 1. Requirement definitions are provided in the test procedures for the respective toxicity test.

Table 1. Mammalian toxicity and irritation requirements for all components

TEST	REQUIREMENT
Acute oral toxicity	LD <sub>50</sub> >500 mg/kg is acceptable. If LD <sub>50</sub> ≥50 but ≤500 mg/kg, is acceptable with approved protective gear and safe handling procedures recommended by the product supplier. LD <sub>50</sub> <50 mg/kg is not acceptable.
Acute dermal toxicity	LD <sub>50</sub> >2000 mg/kg is acceptable. If LD <sub>50</sub> ≥200 but <2000 mg/kg, is acceptable with approved protective gear and safe handling procedures recommended by the product supplier. LD <sub>50</sub> <200 mg/kg is not acceptable.
Primary eye irritation	Mildly irritating or less is acceptable. If more irritating, is acceptable with approved protective gear and safe handling procedures recommended by the product supplier.
Primary dermal irritation	Primary irritation score <5 is acceptable. If more irritating, is acceptable with approved protective gear and safe handling procedures recommended by the product supplier.
Acute inhalation toxicity	Inhalation LC <sub>50</sub> >2 mg/l is acceptable. Inhalation toxicity testing is required if oral LD <sub>50</sub> is ≤500 mg/kg or dermal LD <sub>50</sub> ≤1000 mg/kg.

3.4.1.1. Review of Mammalian Toxicity and Irritation Test Results. When the results of testing of the components indicate that protective gear and safe handling procedures are needed, the manufacturer shall make recommendations to be added to the product label and the Material Safety Data Sheet (MSDS), as described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC. A member of the Safety and Health Branch at the Forest Service National Headquarters shall review these recommendations and approve as appropriate.

3.4.2. Mixed Retardants. When tested in accordance with 4.5.1, the toxicity of all mixed retardants shall meet the performance requirements indicated in Table 2. Requirement definitions are provided in the test procedures for the respective toxicity test.

Table 2. Mammalian toxicity and irritation requirements for mixed retardant

TEST	REQUIREMENT
Acute oral toxicity	LD <sub>50</sub> >5000 mg/kg
Acute dermal toxicity	LD <sub>50</sub> >2000 mg/kg
Primary eye irritation	Mildly irritating
Primary dermal irritation	Primary irritation score <5

3.5. Combustion-Retarding Effectiveness. When tested in accordance with 4.5.2, mixed retardant shall have a superiority factor at least as great as the superiority factor of the standard chemical. The standard shall be a 10.6 percent solution of diammonium phosphate (DAP) in water which shall be tested at the same time as the mixed retardant.

3.6. Determination of Optimum Mixing. In accordance with 4.5.3, the set of conditions for preparing the mixed retardant shall be determined.

3.7. Physical Properties. When tested in accordance with 4.5.4, the refractometer reading of active salt content, viscosity, density, and pH; and steady state viscosity of the mixed retardant shall be determined. This information shall be used for lot acceptance and quality assurance (LA/QA).

3.8. Product Stability. When tested in accordance with 4.5.5, retardant components and mixed retardant shall meet all applicable requirements for storability, laboratory separation and viscosity loss.

3.8.1. Outdoor Storability. When tested in accordance with 4.5.5.1, retardant components and mixed retardant shall meet all applicable requirements for outdoor storability.

3.8.1.1. Components. When tested in accordance with 4.5.5.1.1.1, components shall be stored outdoors for 1 year. There shall be no separation resulting in particles larger than 0.25 inch (0.625 cm) sieve-size. Mixed retardant, prepared from the stored components shall be tested to determine the physical properties as indicated in Table 3. These values shall be within the allowable variation from the original values, determined in 3.7, physical properties, on the fresh retardant, and shall meet the requirements for uniform and intergranular corrosion referenced in 3.9.

Table 3. Physical Properties of Mixed Retardant Prepared from Components Physical Properties Stored for 1 Year

PROPERTY	ALLOWABLE VARIATION FROM ORIGINAL VALUE
Active Salt	± 5 %
Viscosity	± 15 %
Density	± 1 %
pH	± 0.75 units

### 3.8.1.2. Mixed Retardant.

3.8.1.2.1. Storable. When tested in accordance with 4.5.5.1.2, the test sample, after 1 year of storage, shall exhibit acceptable performance characteristics as indicated in items a through e.

- a. No separation resulting in particles larger than 0.25 inch (0.625 cm) sieve-size.
- b. Meets the corrosion requirements shown in Table 4 for uniform and intergranular corrosion when tested in accordance with 4.5.6.
- c. Active salt shall be the same (±5 percent) as the original salt content value determined in 3.7.
- d. Viscosity shall be at least 60 percent of the steady state viscosity, as determined in 4.5.4.2.1.
- e. Density shall be the same (±1 percent) as the original density value determined in 3.7.

3.8.1.2.2. Not Storable. When tested in accordance with 4.5.5.1.2, the stored retardant shall exhibit acceptable performance characteristics as indicated in a to d; after 30 days of storage and without recirculation or agitation. In addition, the test sample shall be collected from the top, bottom, and middle of the stored retardant container.

- a. No separation resulting in particles larger than 0.25 (0.625 cm) inch sieve size.
- b. Active salt shall be the same (±5 percent) as the original salt content value determined in 3.7.
- c. Viscosity shall be at least 60 percent of the steady state viscosity, as determined in 4.5.4.2.1.
- d. Density shall be the same (±1 percent) as the original density value determined in 3.7.

3.8.1.2.3. Immediate Use. There is no outdoor storage requirements for immediate use.

3.8.2. Laboratory Separation. When tested in accordance with 4.5.5.2, mixed retardant shall meet all applicable requirements of 3.8.2.1.

### 3.8.2.1. Mixed Retardant.

3.8.2.1.1. Storable. After 1 year of storage, the mixed retardant, when tested in accordance with 4.5.5.2, shall exhibit acceptable performance by:

- a. No separation into one or more transparent or colorless layers amounting to more than 50 percent of the mixed retardant.
- b. Refractometer reading shall be the same ( $\pm 5$  percent) as the original salt content value determined in 3.6.
- c. Viscosity shall be at least 60 percent of the steady state viscosity as determined in 4.5.4.2.1.
- d. Density shall be the same ( $\pm 1$  percent) as the original density determined in 3.6.

3.8.2.1.2. Not Storable. After 30 days of storage, the mixed retardant, when tested in accordance with 4.5.5.2, shall exhibit acceptable performance by:

- a. No separation into one or more transparent or colorless layers amounting to more than 50 percent of the mixed retardant.
- b. Refractometer reading shall be the same ( $\pm 5$  percent) as the original salt content value determined in 3.6.
- c. Viscosity shall be at least 60 percent of the steady state viscosity as determined in 4.5.4.2.1.
- d. Density shall be the same ( $\pm 1$  percent) as the original density determined in 3.6.

3.8.2.1.3. Immediate Use. After 24 hours of storage, the mixed retardant, when tested in accordance with 4.5.5.2, shall exhibit acceptable performance by:

- a. No separation into one or more transparent or colorless layers amounting to more than 50 percent of the mixed retardant.
- b. Refractometer reading shall be the same ( $\pm 5$  percent) as the original salt content value determined in 3.6.
- c. Viscosity shall be at least 60 percent of the steady state viscosity as determined in 4.5.4.2.1.
- d. Density shall be the same ( $\pm 1$  percent) as the original density determined in 3.6.

3.8.3. Viscosity Loss. When tested in accordance with 4.5.5.3, and determined in 4.5.4.2.1, mixed retardant shall not have a loss of steady state viscosity of greater than 40 percent.

3.8.3.1. Storable. When tested in accordance with 4.4.5.3, mixed retardant shall not have a viscosity loss of greater than 40 percent when tested for 1 year.

3.8.3.2. Not Storable. When tested in accordance with 4.5.5.3, mixed retardant shall not have a viscosity loss of greater than 40 percent when tested for 30 days.

3.8.3.3. Immediate Use. When tested in accordance with 4.5.5.3, mixed retardant shall not have a viscosity loss of greater than 40 percent when tested for 24 hours.

3.9. Corrosion.

3.9.1. Uniform Corrosion. When tested in accordance with 4.5.6.1, fresh wet components and freshly mixed retardant from fresh components shall not exhibit values exceeding those indicated in Table 4 for the alloys listed.

3.9.2. Intergranular Corrosion. Any attack of a metal at the grain boundary of a test coupon exposed during uniform corrosion testing. As specified below the following uses shall not be acceptable.

3.9.2.1. Fixed Wing Airtanker. When tested in accordance with 4.5.6.2, mixed retardant shall not exhibit intergranular corrosion to 2024-T3 aluminum.

3.9.2.2. Helicopter Fixed Tank. When tested in accordance with 4.5.6.2, mixed retardant shall not exhibit intergranular corrosion to 2024-T3 aluminum and AZ-31B magnesium.

3.9.2.3. Helicopter Bucket. There are no intergranular corrosion requirements for helicopter bucket.

3.9.2.4. Ground Based Application Equipment. There are no intergranular corrosion requirements for ground-based application equipment.

3.10. Pumpability. When tested in accordance with 4.5.7, the pumpability of all wet components (including liquid/fluid concentrates) and mixed retardants prepared from dry concentrates, shall be determined. A minimum flow rate of 18 gallons (67.5 liters) per minute is required.

3.11. Abrasion. When tested in accordance with 4.5.8, all wet component (including liquid/fluid concentrates) and mixed retardants prepared from dry concentrates, shall be tested for the abrasiveness of the retardant to aluminum 2024-T3. Total abrasion of the disc and the wear plate shall not exceed 0.010 inch, when rotated at 1800 rpm for 50 hours.

3.12. Air Drop Characteristics. When deemed necessary by the Forest Service and when tested in accordance with 4.5.9, the air drop characteristics of mixed retardant shall be determined.

3.13. Field Visibility.

3.13.1. Uncolored Retardant. When tested in accordance with 4.5.10, during the operational field evaluation, as defined in 3.14, mixed retardant shall not be noticeably visible as determined by an experienced observer team. This team is designated by the Forest Service and may consist of an Air Tactical Group Supervisor (ATGS), lead plane pilot, airtanker pilot, and/or others.

3.13.2. Colored Retardant. When tested in accordance with 4.5.10, during the operational field evaluation, as defined in 3.14, mixed retardant visibility shall be determined to be acceptable by an experienced observer team. This team is designated by the Forest Service and may consist of an Air Tactical Group Supervisor (ATGS), lead plane pilot, airtanker pilot, and/or others.

Table 4. Maximum Allowable Corrosion Rates (mils-per-year) for Wildland Fire Chemical Products.<sup>1</sup>

Alloy: Immersion: Temperature: °F Temperature: °C	2024-T3 Aluminum				4130 Steel				Yellow Brass				Az31B Magnesium			
	Total		Partial		Total		Partial		Total		Partial		Total		Partial	
	70	120	70	120	70	120	70	120	70	120	70	120	70	120	70	120
	21	49	21	49	21	49	21	49	21	49	21	49	21	49	21	49
-----mils-per-year-----																
<b>COMPONENTS</b>																
Wet components (except helicopter fixed tank) <sup>2</sup>	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	---	---	---	---
Wet components for helicopter fixed tank	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
<b>MIXED RETARDANTS</b>																
Fixed-wing airtankers <sup>3</sup>	2.0	2.0	2.0	2.0	2.0	2.0	5.0	5.0	2.0	2.0	5.0	5.0	---	---	---	---
Helicopter fixed tank <sup>4</sup>	2.0	2.0	2.0	2.0	2.0	2.0	5.0	5.0	2.0	2.0	5.0	5.0	2.0	4.0	2.0	4.0
Helicopter bucket <sup>2</sup>	2.0	2.0	2.0	2.0	2.0	2.0	5.0	5.0	2.0	2.0	5.0	5.0	---	---	---	---
Ground-based application equipment <sup>2</sup>	2.0	2.0	2.0	2.0	2.0	2.0	5.0	5.0	2.0	2.0	5.0	5.0	---	---	---	---
<p><sup>1</sup> All corrosion rates shall be determined by 90-day weight loss tests. All uniform corrosion rates are the maximum allowable average of all replicates.</p> <p><sup>2</sup> Magnesium corrosion tests shall be performed for performance information.</p> <p><sup>3</sup> Intergranular corrosion tests shall be performed on aluminum coupons; no intergranular corrosion is allowed. Magnesium corrosion tests shall be performed for performance information.</p> <p><sup>4</sup> Intergranular corrosion tests shall be performed on aluminum and magnesium coupons; no intergranular corrosion is allowed.</p>																

3.14. Operational Field Evaluation. After meeting requirements of 3.4 through 3.12, an analysis shall be undertaken to determine the need for an operational field evaluation. The analysis will document the rationale for no field test or one of the three levels of testing which are described in 3.14.1, 3.14.2 and 3.14.3. Retardant for the operational field evaluation shall be purchased by the Government according to the classification established during qualification testing. The product shall be required to perform satisfactory under operational conditions during a typical fire season for a minimum usage of 200,000 gallons (756,000 liters). An acceptable test should include fire fighting operations on a variety of fuel types, slopes, aspects, and exposures. Operations should include both routine and accelerated burning conditions and multiple ignitions over several months.

3.14.1. Monitored Operational Evaluation. A monitored operational evaluation shall be conducted for formulations that are similar to existing, fully or conditionally qualified and approved products. Similar is defined as formulations that contain alternate source ingredient(s) but do not change the type or amount of the ingredient.

3.14.2. Limited Operational Evaluation. A limited operational evaluation shall be conducted for formulations that have undergone minor changes in the type and amount of ingredient(s) and any changes in the color enhancing agent by type or amount of ingredient.

3.14.3. Full Operational Evaluation. A full operational evaluation shall be conducted for formulations that are determined by the Forest Service to be essentially a new product or a significant change of product type for the supplier. Formulations may contain new types or amounts of ingredient(s) and may include new mixing, handling and storage requirements.

3.15. Metric Products. Products manufactured to metric dimensions will be considered on an equal basis with those manufactured using inch-pound units, provided they fall within the tolerances specified using conversion tables contained in the latest revision of IEEE/ASTM SI 10, and all other requirements of this specification are met.

#### 4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1. Wildland Chemical Qualification Testing. Qualification testing for wildland chemicals includes laboratory testing and a field operational evaluation.

4.2. Manufacturer Submission Process. The manufacturer shall make a request to the USDA Forest Service, Branch Chief for Fire Equipment and Chemicals, P.O. Box 96090, Washington, DC 20090-6090 for the appropriate submission documents and forms, to include Forest Service Publication 9951 1802—SDTDC, for manufacturer submittal of a wildland fire chemical product for qualification evaluation.

4.2.1. Collection Agreement and Test Fee. The manufacturer shall enter into separate collection agreements with Missoula Technology and Development Center/Wildland Fire Chemical Systems (MTDC/WFCS) and San Dimas Technology and Development Center (SDTDC) in order to pay for all costs incurred for testing/evaluation performed at each location during the evaluation of a wildland fire chemical product. See Forest Service Publication 9951 1802—SDTDC.

4.2.2. Product Information. As required by 3.1, all product information must be provided to the Forest Service and reviewed by the designated agency official, as described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC, prior to acceptance of samples for testing.

4.2.2.1. Confidential Formulation Disclosure Sheet. The manufacturer shall submit a Confidential Formulation Disclosure Sheet that includes the required information on all ingredients contained in the formulation. Full disclosure of the types and amounts of each chemical in the product, the Chemical Abstract Services (CAS) number, quality or grade, manufacturer, and manufacturing process must be indicated for each ingredient.

4.2.2.2. Health and Safety Information. The manufacturer shall submit to the Forest Service the following safety information:

- a. Material Safety Data Sheet for the proposed retardant.
- b. Material Safety Data Sheet for each ingredient of the proposed retardant.
- c. Material Safety Data Sheet for any other component of the proposed retardant.
- d. Summary of any toxicity or related safety test results conducted by or for the manufacturer prior to submission to the Forest Service.

4.2.2.3. Technical Data Sheet. A Technical Data Sheet shall be submitted by the manufacturer providing all required information on the physical properties and characteristics of the retardant. A description of field mixing and handling requirements shall be included.

4.2.2.4. Additional Screening Data. Additional screening data containing the following information is required for thickened products:

- a. A graph of retardant viscosity versus time since mixing, for at least 24 hours at a temperature test of 70 °F (21 °C).
- b. A table of retardant viscosity versus temperature of water used for mixing. Viscosity shall be measured at 10 minutes, 1 hour, and 24 hours following mixing. Temperatures of the tap water used for mixing range from 40 °F (4 °C) to 100 °F (38 °C) in 10 °F (5.6 °C) intervals.
- c. A table of retardant viscosity at 70 °F (21 °C), 1 hour and 24 hours following mixing, versus thickener concentration from 10 percent to 200 percent of the gum concentration, if the thickener is added separately.
- d. A table of the effect of temperature on viscosity. Using a retardant sample prepared with 70 °F (21 °C) water and allowed to sit for 24 hours, measure the viscosity of retardant at temperatures from 40 °F (4 °C) to 100 °F (38 °C) at 10 °F (5.6 °C) intervals.
- e. A table of hardness versus viscosity at 70 °F (21 °C) for 1 hour and 24 hours after mixing, if water hardness affects hydration.
- f. A table of mix time and speed versus viscosity 1 hour and 24 hours after mixing.
- g. A description of the proposed packaging, handling, mixing, and associated hardware i.e., 1 ton bags with batch mixer or air slide with eductor.

4.2.3. Submission of Laboratory Samples. When requested, and at no cost to the Government, the manufacturer shall provide product as indicated in Table 5.

Table 5. Test sample packaging

PRODUCT TYPE	PACKAGING	QUANTITY
Dry concentrate	10 containers (plastic buckets)	Each to be added to 25 gallons (93.8 liters) of water
Wet concentrate	200 gallons (850 liters) (plastic buckets)	≤50 lbs (22.5 kg) each
Other components	25 gallons (93.8 liters) (plastic buckets)	≤50 lbs (22.5 kg) each

4.2.3.1. Shipping. The laboratory test sample shall be shipped at the manufacturer's expense to the MTDC/WFCS facility in Missoula, Montana. The following information shall accompany the sample:

- a. Product identification
- b. Manufacturer's name or trademark
- c. Date of manufacture
- d. Unique lot number
- e. Number of gallons and/or pounds per container
- f. Material Safety Data Sheet

#### 4.3. Qualification.

4.3.1. Qualification Tests. The samples submitted shall be subjected to the applicable tests listed in 4.5 to determine if they meet the requirements of 3.4 through 3.13. These tests will be conducted at Forest Service facilities or other laboratories designated by the Forest Service. Following satisfactory completion of laboratory testing, an operational field evaluation may be conducted as required in 3.14.

4.3.2. Notice of Qualification. When the information submitted in accordance with 4.2.3 has been approved and the product is found to meet all requirements of 3.4 through 3.14, a Notice of Product Qualification shall be issued in writing by the National Director, Fire and Aviation Management, USDA Forest Service, within 45 days following completion of testing.

4.3.3. Notice of Failure to Qualify. The manufacturer shall be notified in writing within 45 days following completion of testing if qualification cannot be granted. Written notification shall include test results obtained for each test where unacceptable performance was determined.

4.3.4. Qualification of Changed or Modified Product. Prior to making any changes in the formulation, including the type, quantity, quality, processing, supplier, manufacturer, or manufacturing site of individual ingredients, the retardant manufacturer shall notify the National Director, Fire and Aviation Management, USDA Forest Service. At the option of the Forest Service, qualification testing may be required.

4.4. Acceptance Inspection and Quality Assurance Tests. During qualification testing, the Forest Service test facility shall establish minimum requirements and procedures for lot acceptance and quality assurance.

4.4.1. Acceptance Inspection and Tests. Lot acceptance tests shall be conducted in accordance with the procedures and requirements established during the qualification test. The acceptance tests shall generally be conducted at the delivery sites of each lot delivered and shall consist of visual observations and simple measurements. One truckload shall be considered a lot for the purpose of inspection.

4.4.2. Quality Assurance Tests. Quality assurance tests shall be conducted in accordance with the test procedure and requirements established during product qualification. These quality assurance tests shall be conducted by the Forest Service or at independent laboratories at the discretion of the Forest Service.

4.4.3. Other Acceptance Tests. The Forest Service reserves the right to perform any of the tests or inspections required by this specification or any other tests deemed necessary to determine that supplies and services conform to the requirements of this specification and original product submission.

4.5. Test Procedure. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC. Test methods include 4.5.1 for mammalian toxicity and irritation testing; 4.5.2 for combustion retarding effectiveness; 4.5.3 for determination of optimum mixing; 4.5.4 for product stability; 4.5.5 for corrosion; 4.5.6 for pumpability; 4.5.7 for abrasion; 4.5.8 for air drop characteristics; 4.5.9 for field visibility; and 4.5.10 for operational field evaluation testing.

4.5.1. Mammalian Toxicity and Irritation Tests. As required by 3.4, mammalian toxicity and irritation testing on all wet and dry components, and mixed retardant, shall be conducted by an independent biological testing laboratory approved by the Government. All testing shall be conducted in compliance with 40 CFR 160 and 792 Good Laboratory Practice Standards, in accordance with EPA/OPPT Health Effects Test Guidelines, Series 870 which will include:

- a. acute oral toxicity study 870 -1100;
- b. acute dermal toxicity study 870 -1200;
- c. acute inhalation toxicity study 870 - 1300 when deemed necessary as indicated by Table 1;
- d. primary eye irritation study 870 - 2400 and the eyes of three test animals shall be exposed to the test product for 30 seconds. The exposed eyes shall then be washed with room-temperature, deionized water for 1 minute. Examinations, schedules, and ratings shall be the same as for the standard test;
- e. primary dermal irritation study 870 - 2500.

4.5.1.1. Reporting of Test Results. The results of this testing shall be certified by the testing laboratory and submitted directly to the Program Leader, MTDC/WFCS, Missoula, Montana. When required, as determined by the Forest Service, the Program Leader shall summarize the results and submit them for review, as described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC, to the Safety and Health Branch at the Forest Service National Headquarters.

4.5.2. Combustion Retarding Effectiveness Test. As required by 3.5, the combustion retarding effectiveness of the mixed retardant shall be determined. The effect of the mixed retardant on the rate of fire spread and rate of fuel weight loss shall be determined by burning treated 8 foot fuel beds. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.2.1. Fuel Bed Preparation. The fuel beds shall be built 18 inches (0.46 m) wide and 3 inches (37.2 mm) deep, and shall contain either 4 pounds (1.8 kg) of aspen excelsior or 6 pounds (2.7 kg) of ponderosa pine needles.

4.5.2.2. Application of Retardant on Fuel Beds. Mixed retardant shall be sprayed uniformly on to each bed. Coverage levels of one gallon per hundred square feet (GPC) and two GPC shall be used. Each treated bed shall be dried to remove the water contained in the retardant.

4.5.2.3. Standard Test Conditions. The fuel beds shall be burned under the following standard test conditions. The temperature shall be  $90\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$  ( $32\text{ }^{\circ}\text{C}$ ), relative humidity shall be 20 percent  $\pm$  2 percent and a wind velocity shall be 5 miles per hour (2.2 meters per second)  $\pm$  0.25 miles per hour.

4.5.2.4. Comparison of Treated and Untreated Parameters. The burning parameters for each treated bed shall be compared with the same parameters for untreated beds to determine reduction in burning characteristics. In addition, the same test shall be performed on untreated fuel beds for use as the control; and fuel beds treated with 10.6 percent diammonium phosphate for use as the standard.

4.5.3. Determination of Optimum Mixing. As required by 3.6, optimum mixing of the retardant shall be determined, in order to obtain maximum stability and performance characteristics. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.4. Physical Properties. As required by 3.7, mixed retardant shall be tested to determine the refractometer reading, active salt content, steady state viscosity, density, and pH. These test results shall define the standard characteristics for the submitted product.

4.5.4.1. Active Salt Content Test. As required by 3.7, wet and dry concentrates, and mixed retardant shall be tested to determine the active salt content. Testing will be performed in accordance with accepted standard methods selected by the Forest Service.

4.5.4.2. Viscosity Test. As required by 3.7, the viscosity of a retardant sample shall be measured using a Brookfield Viscometer, model LVF, or equal, set at 60 rpm with the appropriate spindle to measure viscosity. Use spindle No. 2 for viscosity from 1 to 500 cP and spindle No. 4 for a viscosity greater than 500 cP.

4.5.4.2.1. Steady State Viscosity. As required by 3.7, the viscosity at 10 minutes, 1 hour, 4 hours, 8 hours, 1 day, 2 days, and 3 days after mixing shall be determined. Viscosity values shall be graphed against time. The viscosity value corresponding to the plateau of the viscosity curve, typically 24 hours, shall be determined as the steady state viscosity.

4.5.4.3. Density Test. As required by 3.7, the density of the wet concentrate and mixed retardant shall be determined to the nearest 0.001 g/mL. Density testing shall be conducted by the use of a fluid displacement or electronic density meter.

4.5.4.4. pH Value Test. As required by 3.7, the pH of wet concentrate and mixed retardant shall be determined. pH testing shall be conducted using a full range pH meter, with units capable of being read to 0.1 pH.

4.5.4.5 Refractometer Reading. As required by 3.7, the refractometer reading of the mixed retardant shall be determined by using a hand held refractometer.

4.5.5. Product Stability Testing. As required by 3.8, all components and the mixed retardant shall be tested for product stability (outdoor storage, laboratory separation, viscosity loss). Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.5.1. Outdoor Storage Test. As required by 3.8.1, components and mixed retardant shall be tested to determine storage characteristics in outdoor weather conditions.

4.5.5.1.1. Components.

4.5.5.1.1.1. Dry Components. As required by 3.8.1.1, each dry component shall be stored in 5-gallon (19L) plastic buckets outdoors at SDTDC and MTDC/WFCS for 1 year. At the end of the year, the samples shall be examined visually to determine that there are no changes in the general condition, such as fluidity, absence of hard lumps, from the original sample. The entire sample shall be mixed using the conditions developed in 4.5.3. The mixed retardant shall then be tested in accordance with 4.5.4.1 for active salt content, 4.5.4.2 for viscosity, 4.5.4.3 for density, and 4.5.4.4 for pH value.

4.5.5.1.1.2. Wet Components. As required by 3.8.1.1, each wet component shall be stored in a 5-gallon (19L) polyethylene carboy containing an approximately 2.0 inch x 12.0 inch x 0.13 inch (5 cm x 30 cm x 0.3 cm) mild steel coupon outdoors at SDTDC and MTDC/WFCS. At the end of the one year storage period, the sample shall be inspected visually to determine that there are no changes in the general condition of the components (crystals greater than 0.25 inch) from the original samples. The sample shall be recirculated for about 1 minute with low shear and then used to prepare mixed retardant. The mixed retardant shall then be tested in accordance with 4.5.4.1 for active salt content, 4.5.4.2 for viscosity, 4.5.4.3 for density, 4.5.4.4 for pH value, 4.5.6.1 for uniform corrosion and 4.5.6.2 for intergranular corrosion.

4.5.5.1.1.3. Gum Thickened Mixed Retardants. Gum thickened mixed retardants, prepared from stored wet concentrates, will be tested in accordance with 4.5.5.1.2.2 for mixed retardant, not storable for greater than a 30 day storage period.

4.5.5.1.2. Mixed Retardant.

4.5.5.1.2.1. Storable. As required by 3.8.1.2.1, the mixed retardant shall be stored in 5-gallon (19L) polyethylene carboys, each containing an approximately 2 inch x 12 inch x 0.13 inch (5 cm x 30 cm x 0.3 cm) mild steel coupon, outdoors at SDTDC and MTDC/WFCS. During the 1-year storage period, the sample shall be visually inspected monthly and any visual changes noted. At the end of the storage period, the sample shall be mixed for 1.0 minute with low shear. The recirculated sample shall then be tested in accordance with 4.5.4.1 for active salt content, 4.5.4.2 for viscosity, 4.5.4.3 for density, 4.5.4.4 for pH value, 4.5.6.1 for uniform corrosion and 4.5.6.2 for intergranular corrosion.

4.5.5.1.2.2. Not Storable. As required by 3.8.1.2.2, the mixed retardant shall be stored in 5-gallon (19L) polyethylene carboys, each containing an approximately 2 inch x 12 inch x 0.13 inch (5 cm x 30 cm x 0.3 cm) 2024-T3 aluminum coupon, outdoors at SDTDC and MTDC/WFCS. During the 30 day storage period, the sample shall be visually inspected weekly and any visual changes noted. At the end of the storage period, the carboy shall be opened. Samples, 250 milliliters each, shall be collected from the top and the bottom of the stored product. The remainder of the stored product shall be mixed for one minute with low shear. A 250 mL sample shall be collected from the mixed product. Each sample shall be tested in accordance with 4.5.4.1 for active salt content, 4.5.4.2 for viscosity, 4.5.4.3 for density, and 4.5.4.4 for pH value.

4.5.5.2. Laboratory Separation Test. As required by 3.8.2, mixed retardant and all wet components shall be tested for laboratory separation. A 1-liter straight-sided glass jar containing an approximately 1 inch x 1 inch x 0.13 inch (2.5 cm x 2.5 cm x 0.3 cm) coupon containing 800 milliliters of retardant, shall be capped tightly to prevent evaporation and allowed to sit undisturbed at 70 °F (21 °C)  $\pm$  5 °F for the test period. The coupon material is a mild steel for storable retardant, and is 2024-T3 aluminum for not storable and immediate use retardant. The sample separation, in terms of color change and opacity, shall be measured using a ruler readable to 0.1 inch. Measurements shall be made monthly for the storable retardant, weekly for not storable mixed retardant, and at 1 hour, 4 hours, 8 hours, and 24 hours for immediate use retardant. All times shall be from the time of mixing. The percent separation shall be calculated from the heights of each layer and the total sample.

4.5.5.3. Viscosity Loss Test. As required by 3.8.3, mixed retardant shall be tested for viscosity loss. A 1 liter straight sided glass jar containing an approximately 1 inch x 1 inch x 0.13 inch (2.5 cm x 2.5 cm x 0.3 cm) coupon and 800 milliliters of retardant shall be stored at 70 °F (21 °C)  $\pm$  5 °F for the duration of the test period. The coupon material is a mild steel for the storable mixed retardant, and is 2024-T3 aluminum for not storable and immediate use retardant. Viscosity measurements shall be taken monthly for the storable retardant, weekly for not storable mixed retardant, and at 1 hour, 4 hours, 8 hours, and 24 hours after mixing for immediate use retardant. Calculate the percent loss in viscosity using the steady state viscosity as the base.

4.5.6. Corrosion Tests. As required by 3.9, liquid components and mixed retardant shall be tested for uniform corrosion and mixed retardant shall be tested for intergranular corrosion. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.6.1. Uniform Corrosion. As required by 3.9.1, wet liquid components and mixed retardant shall be tested for uniform corrosion, as described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC and summarized below.

4.5.6.1.1. Test Alloys. The uniform corrosion to 2024-T3 aluminum, 4130 steel, yellow brass and Az31B magnesium caused by each wet component and mixed retardant shall be determined. The required number of replicates for each test can be found in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.6.1.2. Test Coupon Preparation. Test specimens (coupons approximately 1 inch x 4 inch x 0.13 inch [2.5 cm x 10.2 cm x 0.3 cm]) of the specified alloy shall be engraved with a unique identification code and measured to determine precise dimensions. The coupons shall be degreased, cleaned to remove oxidation films, rinsed in distilled water, dried and weighed.

4.5.6.1.3. Test Conditions. Each test coupon shall be totally or partially immersed in the test solution, contained in a glass jar. The jars are closed with Bakelite lids and placed in an incubator at the test temperature (70 °F and 120 °F [21 °C and 49 °C] ). After sitting undisturbed for 90 days the jars shall be removed from the incubator and opened. The test coupon is rinsed under a forceful stream of water to remove residual test solution and loose corrosion products. The coupon shall be cleaned with the appropriate solution, rinsed in distilled water, and dried.

4.5.6.1.4. Corrosion Calculations. Each exposed coupon is cleaned, dried and weighed. The change in weight is used to calculate the corrosion rate. All corrosion rates for the same alloy, immersion condition and temperature shall be averaged. The average corrosion rate is compared to the allowable corrosion rates found in Table 4.

4.5.6.2. Intergranular Corrosion Test. As required by 3.9.2, mixed retardant shall be tested for intergranular corrosion. At least one coupon for each exposure and temperature from the uniform corrosion tests on the specified alloys shall be sliced as shown in Figure 1. The coupon will be mounted, polished to 0.3 micron alumina finish, and etched with Keller's reagent using standard metallurgical techniques. The coupon will then be examined microscopically with a magnification of 500.

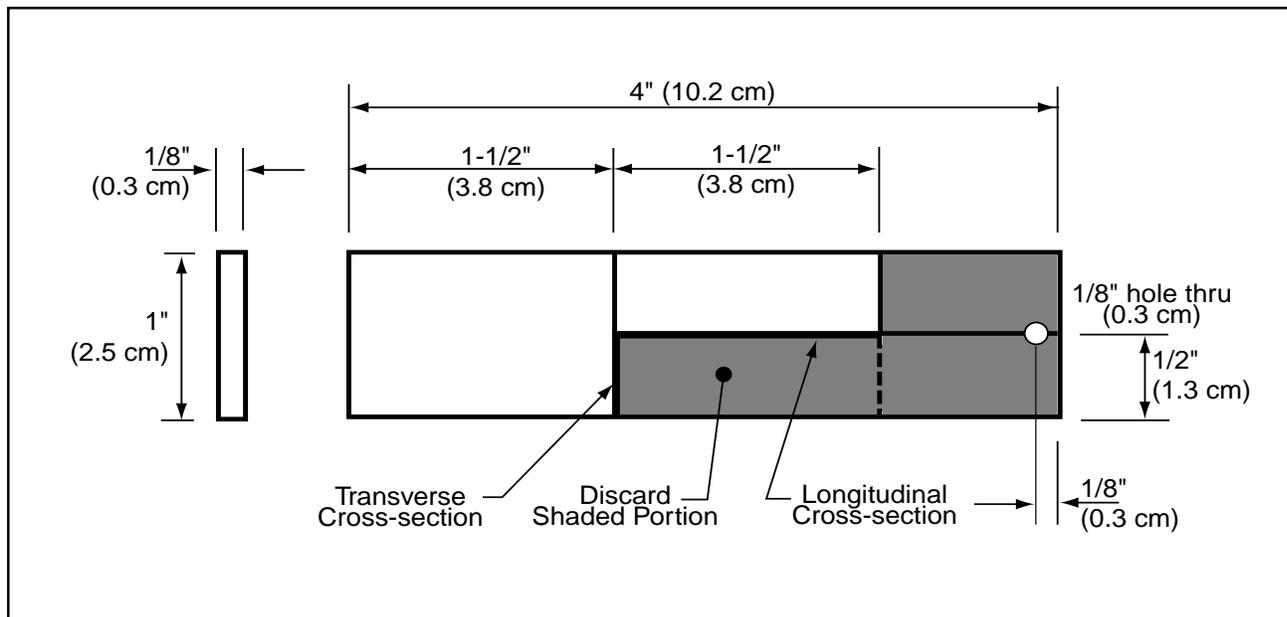


Figure 1. Coupon diagram.

4.5.7. Pumpability Test. As required by 3.10, the pumpability of the retardant shall be determined. Wet components shall be tested in the concentrated form. Dry components shall be tested as mixed retardants. All wet components and dry concentrates used to prepare mixed retardant shall be aged by the Forest Service for one year prior to testing. The test apparatus consists of a storage tank, a pump and a scale-mounted weighing tank. The retardant is transferred from the storage tank to the weighing tank using the specified pump and plumbing system. The change in weight over time is used to calculate the flow rate of the product. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.8. Abrasion Test. As required by 3.11, the abrasiveness of the retardant to aluminum 2024-T3 shall be determined. Wet components shall be tested in the concentrated form. Dry components shall be tested as mixed retardant. A disc and a wear plate made of aluminum 2024-T3 shall be used to determine abrasion characteristics. The aluminum plate and disc are parallel to each other with a 0.020-inch gap between them, submerged in retardant. The top plate is then rotated at 1800 rpm for 50.0 hours. The plate and disc are measured to the nearest 0.001 inch before and after the test. The maximum wear on the disc and the wear plate are added to give the total abrasion. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.9. Air Drop Characteristics Test. As required by 3.13, and as deemed necessary by the Forest Service, the mixed retardant shall be tested to determine the air drop characteristics. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.10. Field Visibility Tests. As required by 3.13, the mixed retardant shall be tested to determine visibility on a variety of fuel types and conditions (slope, aspect, daylight conditions, and weather). An experienced aerial observer team shall evaluate the visibility of each product, applied by air or ground application depending on manufacturer's designated use. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

4.5.11. Operational Field Evaluation. As required by 3.14, the Forest Service shall undertake an analysis to address any concerns arising from the nature of the formulations and/or results of the laboratory evaluation. The testing shall be completed prior to conducting an operational field evaluation. If an operational field evaluation is needed a test plan will be developed. The evaluation will be conducted in accordance with the developed test plan. Detailed test methods are described in Standard Test Procedures for the Evaluation of Wildland Fire Chemical Products, 9951 1803—SDTDC.

## 5. PACKAGING, PACKING AND MARKING

5.1. Packaging. The retardant shall be delivered in accordance with standard commercial practice, current Federal and interstate regulations, and the current National Long Term Fire Retardant Contract.

5.2. Marking. Individual containers shall be legibly marked in accordance with Federal Standard 123. Markings shall include the following:

- a. Product identification by storability, viscosity, color, use, and mixability designations.
- b. Manufacturer's name and trademark.
- c. Date of manufacture.
- d. Amount of water to be blended with contents of container.
- e. Net weight of sack.
- f. Unique lot and batch numbers.

## 6. NOTES.

6.1. Intended Use. The fire retardants described in this specification are for aircraft or ground application for use in wildland fire fighting. After mixing with water, the retardant is applied to the fire area to slow or stop combustion.

6.2. Acquisition Requirements. Acquisition documents should specify the following:

- a. Title, number and date of the specification.
- b. Retardant classification for use, FW, HF, HB, or G. See 3.3.4.

6.3. Qualification. The contracting officer should verify that the bidder possesses a currently valid notice of qualification obtained in accordance with 4.1.

6.4. Notice. When Government documents, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever.

6.5. Preparing and Qualifying Activity. USDA Forest Service, San Dimas Technology and Development Center, San Dimas, California in coordination with Missoula Technology and Development Center, Missoula, Montana.



**United States Department of Agriculture, Forest Service  
Standardization Document Improvement Proposal**

**Instructions:** This form is provided to solicit beneficial comments which may improve this document and enhance its use. Contractors, government activities, manufacturers, vendors, or other prospective users of this document are invited to submit comments to the USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, California 91773-3198. Attach any pertinent data which may be used in improving this document. If there is additional documentation, attach it to the form and place both in an envelope addressed to the preparing activity. A response will be provided when a name and address are included.

**Note:** This form shall not be used to submit request for waivers, deviation, or for clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

Standard Number and Title: **Specification 5100-304b—Long Term Retardant, Wildland Fire, Aircraft or Ground Application**

Name of Organization and Address:

\_\_\_\_\_ Vendor                      \_\_\_\_\_ User                      \_\_\_\_\_ Manufacturer

1. \_\_\_\_\_ Has any part of this document created problems or required interpretation in procurement use?  
       \_\_\_\_\_ Is any part of this document too rigid, restrictive, loose or ambiguous? Please explain below.

Give paragraph number and wording:

Recommended change(s):

Reason for recommended change(s):

Remarks:

Submitted by: (Print or type name and address—Optional)

Telephone number: (Optional)

Date:

*fold and close for mailing*

---

---

---

---

USDA Forest Service  
San Dimas Technology & Development Center  
ATTN: Fire Program Leader  
444 East Bonita Avenue  
San Dimas, California 91773-3198

---

*fold and close for mailing*