GelTech FireIce – Safety Information

Human and Environmental

FireIce from GelTech is a superabsorbent polymer which meets the highest environmental and toxicological standards ensuring a work environment that carries no risk of human or animal exposure.

Superabsorbent polymers are used primarily as intermediate and raw materials in a variety of consumer and industrial products; the products are cross-linked polymers of partially neutralized acrylic acid. In the dry form the product is a fine powder of crystalline like structure. Upon swelling with water, it yields a gel. The retention of water is facilitated by the negative carboxylic groups of the polymer and their hydration with water molecules, due to its crosslinking the product is essentially insoluble in water.

FireIce complies with all regulatory requirements under Federal, State, and local agencies that oversee both laboratory testing and working environment human health and safety concerns. FireIce exceeds all plausible standards of human exposure including approval as a food additive.

This testing and approval process includes the Environmental Protection Agency (EPA), the Occupational Safety and Health Agency (OSHA), US Food and Drug Administration (FDA), United States Department of Agriculture (USDA), Mine Safety and Health Administration (MSHA) as well as recognized third party laboratories and testing facilities.

FireIce is a superabsorbent polymer which exhibits a low toxicological profile. Under appropriate test conditions there have been no signs of acute oral toxicity and no acute dermal toxicity. Furthermore, sub-acute oral toxicity and sub chronic dermal toxicity have not been observed. The eye irritation potential is very low and the product has a good compatibility following systemic injection or implantation and towards blood. It is not per se cytotoxic. Absorption after oral uptake is negligible. Some absorption is observed after intra tracheal application in the dry powder state but without any systemic toxicity. The product shows no evidence of an allergic contact sensitization in guinea pigs and humans. The same applies for irritative properties. No mutagenic and teratogenic potency was found. GelTech / FireIce does not serve as a growth substrate for pathogenic microorganisms therefore it can be assumed that the product is deemed safe for ingestion by animals or to be in contact with food for human consumption as outlined in Sec 177.1211 Cross-liked polyacrylate copolymers.

The presented eco toxicological and environmental studies were performed according to international recognized test methods and incompliance with the Principles of Good Laboratory Practice (GLP) by the United States government regulatory agencies responsible for the testing and approval of the superabsorbent polymer fire suppressant marketed under the name FireIce.

Additional independent laboratory findings are included where applicable or requested in addition to required testing performed by government regulatory agencies.

Table of Contents

M.S.D.S

Material Safety Data Sheet

Release Date: August 2007
Revised Date: August 2011

Product Name: **Firelce®**

Section I Company Information

GeiTech Solutions, Inc.
1460 Park Lane South, Suite 1
Jupiter, Florida 33458
Telephone: 561.427.6144
Fax: 561.427.6182

Section II Hazardous Ingredients / Identity Information

Hazardous Components Specific chemical identity: Common name(s)	**OSHA PEL**	**ACGIH TLV**	**Other Limits Recommended**	% **(Optional)**
Manufacturer's recommended exposure guideline for respirable particulate	—	—	0.05mg/m^3	—

Product Identification

Chemical Name	**CAS Number**	%
Proprietary Ingredient	31212-13-2	92 to 98
Water	7732-18-5	2 to 8

Component Information /Information on Non-Hazardous Components: The components of this product are not regulated as hazardous under 29 CFR and 49 CFR. All components are listed in TSCA CFR 40 700.

NFPA/HMIS Health- 1, Fire- 0, Reactivity- 0, Specific Hazard- None

Dot Class Not Regulated

Section III Physical / Chemical Characteristics

Boiling Point (in solution) .....225°F (107°C)
Vapor Pressure (mm Hg.)..... Not applicable
Vapor Density (AIR =1) ..... Not applicable
Appearance and Odor .....Off white, odorless

Bulk Density (apparent- glee): 0.5
Melting Point ..... Not applicable
Evaporation Rate (Butyl Acetate= 1) ..... Not applicable
Freezing Point (in solution) .....26°F (-3°C)

Section IV Fire And Explosion Hazard Data

Flash Point (method used).....Not available
Flammable Limits.....Not available LEL – UEL–
Extinguishing Media .....As with any fire, wear positive pressure, self-contained breathing apparatus in any closed space when fighting fires.
Unusual Fire and Explosion Hazards .....Becomes slippery when wet. Under certain confined conditions, a fine dust of this material in air may cause a dust explosion if ignited.

Section V Reactivity Data

Stability .....Unstable .....Conditions to avoid: None known
Stable – X
Incompatibility (materials to avoid) .....Strong Oxidizers
Hazardous Decomposition or By-products.....None known
Thermal Decomposition .....CO, CO_2, Hydrocarbons
Hazardous Polymerization .....May not occur – X .....Conditions to avoid: None known

Section VI Health Hazard Data

Route(s) of Entry .....Inhalation? Yes Skin? Yes Ingestion? Yes

Acute contact with the eyes is minimally irritating as concentrate and non-irritating as a mixed fire chemical. Acute contact with the skin is non-irritating as concentrate and slightly irritating as a mixed fire chemical.

Care must be taken to minimize exposure and prevent workplace inhalation of concentrated respirable dust. Personal Protective Equipment (PPE) is recommended for eye and inhalation exposure when handling this product. (A similar product, ground very finely, produced an inflammatory tissue response in the lungs in a lifetime exposure inhalation in laboratory testing).

According to the United States Forest Service Specification 5100-306A, this product meets the Specification and is considered to be non-toxic to mammals.

Acute Oral Toxicity: LD50 >505 mg/Kg (Concentrate), LD50>5050 mg/Kg (Mixed Fire Chemical)

Acute Dermal Toxicity: LD50 > 2020 mg/Kg (Concentrate), LD50>2020 mg/Kg (Mixed Fire Chemical)

Primary Dermal Irritation: Concentrate is non-irritating (Score: 0.0, Toxicity Category IV),
Mixed Fire Chemical is slightly irritating (Score: 0.3, Toxicity Category IV)

Primary Eye Irritation: Concentrate is minimally irritating (Score: 2.0, Toxicity Category IV),
Mixed Fire Chemical is non-irritating (Score: 0.0, Toxicity Category IV)

Above testing results as reported by the United States Forest Service and is a summary of Mammalian Toxicity Testing of FireIce® Water Enhancer. FireIce® is compliant with the United States Forest Service Specification 5100-306A and all results are acceptable to the USFS.

Fish Toxicity test results in accordance with USDA Forest Service Specification 5100-306A are as follows and all results are acceptable to the USFS: OPPTS 850.1075 on rainbow trout (approximately 60-days post hatch) in ASTM soft water. Requirement 96-hr LC50 must be ≥10 mg/L.

Result: FireIce® Fire Chemical is LC50 = 348 mg/L

Section VII Precautions For Safe Handling And Use

Steps to be taken in case material is released or spilled: Vacuum (using HEPA filter equipped system) if possible to avoid generating airborne dust. Avoid adding water, the product will become slippery when wet.

Waste Disposal Method: Dispose of in accordance with federal, state and local regulations.

Precautions to be taken in Handling and Storing: Store in a cool, dry place. Avoid breathing powder. Avoid skin and eye contact.

Other Precautions: Slippery when wet.

Section VIII Control Measures

Respiratory Protection (specific type) .....Use NIOSH/MSHA approved or equivalent with high efficiency filter for particulate levels above 0.05mg/m³

Ventilation .....Local Exhaust .....As appropriate to control airborne dust levels below the applicable exposure limits
Mechanical (general).....As appropriate
Other .....None

Protective Gloves.....Impervious/rubber (only necessary during mixing process)
Eye Protection .....Safety goggles (only necessary during mixing process)
Other Protective Clothing .....None
Work/Hygienic Practices .....Use good housekeeping practices

2.

[Title 21, Volume 3]

[Revised as of April 1, 2001]

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[**CITE**: **21CFR177**.**1211**]

[Page 241-242]

TITLE 21--FOOD AND DRUGS

CHAPTER I--FOOD AND DRUG ADMINISTRATION, DEPARTMENT OF HEALTH AND HUMAN SERVICES (CONTINUED)

PART 177--INDIRECT FOOD ADDITIVES: POLYMERS--Table of Contents

Subpart B--Substances for Use as Basic Components of Single and Repeated Use Food Contact Surfaces

Sec. 177.**1211** Cross-linked polyacrylate copolymers.

Cross-linked polyacrylate copolymers identified in paragraph (a) of this section may be safely used as articles or components of articles intended for use in contact with food in accordance with the following prescribed conditions:

(a) Identity. For the purpose of this section, the cross-linked polyacrylate copolymers consist of:

(1) The grafted copolymer of cross-linked sodium polyacrylate identified as 2-propenoic acid, polymers with N,N-di-2-propenyl-2-propen-1-amine and hydrolyzed polyvinyl acetate, sodium salts, graft (CAS Reg. No. 166164-74-5); or

(2) 2-propenoic acid, polymer with 2-ethyl-2-(((1-oxo-2-propenyl)oxy)methyl)-1,3-propanediyl di-2-propenoate and sodium 2-propenoate (CAS Reg. No. 76774-25-9).

(b) Adjuvants. The copolymers identified in paragraph (a) of this section may contain optional adjuvant substances required in the production of such copolymers. The optional adjuvant substances may include substances permitted for such use by regulations in parts 170 through 179 of this chapter, substances generally recognized as safe in food, and substances used in accordance with a prior sanction or approval.

(c) Extractives limitations. The copolymers identified in paragraph (a) of this section, in the finished form in which they will contact food, must yield low molecular weight (less than 1,000 Daltons) extractives of no more than 0.15 percent by weight of the total polymer when extracted with 0.2 percent by weight of aqueous sodium chloride solution at 20 deg.C for 24 hours. The low molecular weight extractives shall be determined using size exclusion chromatography or an equivalent method. When conducting the extraction test, the copolymer, with no other absorptive media, shall be confined either in a finished absorbent pad or in any suitable flexible porous article, (such as a “tea bag” or infuser), under an applied pressure of 0.15 pounds per square inch (for example, a 4x6 inch square pad is subjected to a 1.6 kilograms applied mass). The solvent used shall be at least 60 milliliters aqueous sodium chloride solution per gram of copolymer.

(d) Conditions of use. The copolymers identified in paragraph (a)(1) of this section are limited to use as a fluid absorbent in food-contact materials used in the packaging of frozen or refrigerated poultry. The copolymers identified in paragraph (a)(2) of this section are limited to use as a fluid absorbent in foodcontact materials used in the packaging of frozen or refrigerated meat and poultry.

[64 FR 28098, May 25, 1999, as amended at 65 FR 16817, Mar. 30, 2000]

United States Department of Agriculture **Forest Service** **Missoula Technology & Development Center** **5785 Highway 10 West Missoula, MT 59808**

File Code: 5162
Date: September 16, 2010

Mr. Rob Rosovich
Gel Tech Solutions, Inc.
1460 Park Lane S. Suite 1
Jupiter, FL 33458

Hello Rob,

The mammalian toxicity tests on your water enhancer, GelTech FireIce, (formulation identification #00612/2008), have been completed in accordance with Forest Service Specification 5100-306a. Tests were performed on the concentrate and a 0.18 lb/gal dilution of the concentrate in water. Results are summarized in the attached table. A complete set of reports of the testing are being sent to you via surface mail.

Acute oral toxicity test results for the concentrate is greater than 505 mg/Kg and the dilution is greater than 5050 mg/Kg of body weight. The results for both concentrate and dilution are acceptable.

Acute dermal toxicity test results for both the concentrate and dilution are greater than 2020 mg/Kg of body weight. These results are acceptable.

Primary eye irritation test results for single-wash and double-wash eyes exposed to the concentrate are mildly and minimally irritating, respectively. The corresponding results for single-wash and double-wash eyes exposed to the dilution are minimally irritating for both. The results for all of the eye irritation tests are acceptable.

Primary dermal irritation test scores for the concentrate and dilution are 0.0 and 0.3, respectively. These results are acceptable.

If you have any questions related to this work, please contact me at 406-329-4859, or email at szylstra@fs.fed.us.

Sincerely,

Shirley Zylstra

SHIRLEY ZYLSTRA
Wildland Fire Chemical Systems

CC: K.Windell
C. Johnson

Table 1
Summary of Mammalian Toxicity Tests
GelTech FireIce
Formulation Identification # 00612/2008
Concentrate and mixed at 0.18 lb/gal

Requirements		Performance	
Concentrate	Mixed Fire Chemical	Concentrate **10-HS-06**	Mixed Fire Chemical **10-HS-07**
Acute Oral Toxicity			
LD_{50}>500 mg/Kg. If LD_{50}≥50, but <500, recommend protective gear and safe handling procedures. No LD_{50}≤ 50 mg/Kg is acceptable	LD_{50}>5000 mg/Kg	LD_{50}>505 mg/Kg	LD_{50}>5050 mg/Kg
Acute Dermal Toxicity			
LD_{50}>2000 mg/Kg. If LD_{50}≥200, but <2000, recommend protective gear and safe handling procedures. No LD_{50}≤ 200 mg/Kg is acceptable	LD_{50}>2000 mg/Kg	LD_{50}>2020 mg/Kg	LD_{50}>2020 mg/Kg
Primary Eye Irritation – Single-wash Eyes			
Mildly irritating. If more irritating, recommend protective gear and safe handling procedures.	Mildly irritating.	Mildly irritating. Toxicity category III Irritation score: 14.7	Non- irritating. Toxicity category IV Irritation score: 0.0
Primary Eye Irritation – Double-wash Eyes			
Mildly irritating. If more irritating, recommend protective gear and safe handling procedures.	Mildly irritating.	Minimally irritating. Toxicity category IV Irritation score: 2.0	Non- irritating. Toxicity category IV Irritation score: 0.0
Primary Dermal Irritation			
Primary irritation score: <5.0 If more irritating, recommend protective gear and safe handling procedures.	Primary irritation score: <5.0	Primary irritation score: 0.0 Non-irritating Toxicity category: IV	Primary irritation score: 0.3 Slightly irritating Toxicity category: IV

United States Department of Agriculture **Forest Service** **Missoula Technology & Development Center** **5785 Highway 10 West Missoula, MT 59808**

File Code: 5162
Date: February 8, 2011

Mr. Rob Rosovich
Gel Tech Solutions, Inc.
1460 Park Lane S. Suite 1
Jupiter, FL 33458

Rob,

The fish toxicity tests have been completed on GelTech FireIce (formulation ID# 00612/2008), the water enhancer product that you submitted for evaluation in accordance with USDA Forest Service Specification 5100-306a. The preliminary results and required performance are summarized below. I will send you a copy of the formal test report as soon as we receive it from the laboratory.

The fish toxicity test is performed as described in OPPTS 850.1075 on rainbow trout (approximately 60-days post hatch) in ASTM soft water. There is a requirement that the 96-hr. LC_{50} must be $\geq$10 mg/L. The preliminary results indicate your product had an LC_{50} = 348 mg/L. These results are acceptable.

If you have any questions related to this work, please contact me at 406-329-4859, or email at szylstra@fs.fed.us.

Sincerely,

Shirley Zylstra

SHIRLEY ZYLSTRA
Physical Scientist
Wildland Fire Chemical Systems

CC: C. Johnson

U.S. Department of Labor

Mine Safety and Health Administration
Approval and Certification Center
765 Technology Drive
Triadelphia, West Virginia 26059

11 OCT 2012

Suitability No. FFA 2/0
A&CC PAR No. 100106

GelTech Solutions, Inc.
Attn: Rob Rosovich
1460 Park Lane South, Suite 1
Jupiter, FL 33458

Dear Mr. Rosovich:

The review of your application dated September 8, 2011 for the FireIce Water Enhancing Fire Suppression Chemical, application code number 830529, has been completed.

The fire fighting agent and information provided meet the requirements of the voluntary program as outlined in the Guidelines for the Suitability of New or Novel Mine Fire Fighting Agents, ASAP 3025. The FireIce fire fighting agent is suitable for use in mines and MSHA Suitability Number FFA 2/0 has been assigned to this fire fighting agent.

Acute oral toxicity

Up to 5 % mixed solution applied as gel in saline was applied once with a stomach tube to 5 male and 5 female rats each. No abnormal findings were evident at any time point during examinations over 14 days. Bodyweight development was normal; necropsy revealed no visible organ alterations. The LD50 was> 5,000 mg/kg body weight. Application of an aqueous extract of the SAP to 6 male and 6 female rats with the drinking water for 1 day led to no adverse effects. Deaths did not occur and no visible organ changes were detected. Neither the polymer nor the mixed solution is of acute toxicity after oral administration.

Subacute oral toxicity

The oral toxicity of mixed gel, administered daily to 10 male and 10 female rats per group via the diet over consecutive weeks at concentrations of up to 5 % was investigated. No toxicologically significant changes were induced. The differences observed between treated and control animals were modifications in urinary ion excretion in the treated animals. Both findings were considered to be related to the relatively high concentration of sodium in the test substance and therefore of no toxicological relevance.

HET-CAM-Test

The hen's egg test is an alternative test method to the Draize rabbit eye test. For this test 200 mg of dry product, the swollen gel or an extract were applied onto the sensitive chorioallantoic membrane (CAM) of the developing chicken egg. There were only slight irritative effects leading to vascular injection but no adverse effects with respect to hemorrhaging, or coagulation. Thus the potential of the product to cause adverse effects on membranes seems to be very low.

Cytotoxicity in vitro

The product was examined regarding its influence on mammalian cells in a cell culture system using 3T3 fibroblasts of mice. The cells were incubated for 24 hours with an extract of the product in concentrations up to 1.5 % (v/v) in cell culture medium. No adverse effects on the morphology or viability of the cells were observed. Extraction of product with cell culture medium (10 g/medium) led to a concentration dependent decrease in cell viability due to complex formation (binding) of essential cations in the medium. Following supplementation of the bound cations, adverse effects were not observed any longer. Further cell toxicity tests were executed using the agar diffusion cell culture technique, which is appropriate for solid specimens as well. The product was applied as dry granulate and as a suspension (30 g/l saline). There was no indication of cytotoxic effects.

Intravenous and intra peritoneal application

Intravenous and intra peritoneal compatibility of SAP was tested after systemic injection in mice. Following intra peritoneal application of 50 ml/kg extract in sesame oil or 10 g/kg extract in polyethylene glycol no toxic reactions of the animals were observed within 72 hours. Intravenous instillation of a gel extract (15 g/l saline) produced systemic effects and mortality in dose levels greater than40 ml/kg. Histopathological examination revealed dose dependent toxic alterations of liver and spleen. The no observed effect level (NOEL) was less than 10 ml/kg, a dose which led only to minimal hepatic effects.

Subcutaneous and intramuscular implantation

Subcutaneous and intramuscular compatibility of a gel and the granulate of product was tested in rabbits after implantation. Histopathology revealed no abnormal reactions in the surrounding tissue. Furthermore, there were no significant deviations from normal values in hematology, clinical chemistry, and other standard toxicological parameters. No signs of toxicity were observed.

Escherichia coli reverse mutation assay

Extracts of the product were tested in tryptophan requiring strains of Escherichia coli for their ability to induce point mutations in the absence or presence of a metabolic activation system. In concentrations of up to 5,000 µg/plate no mutagenic events could be observed. Furthermore, no cytotoxicity was detected.

UDS in rat hepatocytes in vitro

The product was tested for its ability to induce unscheduled DNA synthesis (UDS) in isolated rat hepatocytes in vitro. Treatment with up to 1,500 µg/ml of equivalent extracted material in saline with 10 % (v/v) ethanol did not produce a mean net grain count greater than zero (0), nor were 20 % or more cells to be found in repair. The test substance therefore showed no genotoxic activity.

Teratogenicity

Pregnant female rats were exposed in a teratology study to respirable levels (particle size< 10 µm) of product at 0.3, 1.0and 10 mg/m³ for 6 hours/day from day 6 to day 15 of gestation. On day 20 of gestation the rats were necropsied and examined for the number of implantations, early and late resorptions, live and dead fetuses and number of corporalutea. The fetuses were observed for weight, external, soft tissue and skeletal alterations. No effects were detected: The highest test concentration is the no observed effect level (NOEL).

United States Department of Agriculture

The mammalian toxicity tests on your water enhancer, GelTech FireIce, (formulation identification #00612/2008), have been completed in accordance with Forest Service Specification 5100-306a. Tests were performed on the concentrate and a 0.18 lb/gal dilution of the concentrate in water. The results for both concentrate and dilution are acceptable. These results are acceptable.

Primary eye irritation test results for single-wash and double-wash eyes exposed to the concentrate are mildly and minimally irritating, respectively. The corresponding results for single-wash and double-wash eyes exposed to the dilution are minimally irritating for both. The results for all of the eye irritation tests are acceptable.

Fish

The fish toxicity tests have been completed on GelTech FireIce (formulation ID# 00612/2008), the water enhancer product that you submitted for evaluation in accordance with USDA Forest Service Specification 5100-306a. The fish toxicity test is performed as described in OPPTS 850.1075 on rainbow trout (approximately 60-days post hatch) in ASTM soft water. There is a

requirement that the 96-hr. LC50 must be ≥10 mg/L. The preliminary results indicate your product had an LC50 = 348 mg/L. These results are acceptable.