

Appendix J: Borax Report for Pilgrim Project



United States
Department of Agriculture

Forest Service

Shasta-Trinity National Forest
Shasta McCloud Management Unit

McCloud Ranger Station

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Route To:

Subject: Borax Report for Pilgrim Project

To: Dennis Poehlmann, IDT Leader

I. Introduction

The presence of root disease within the project area is described in the EIS and includes both blackstain and Annosus root disease areas which are quite common in pine stands within the McCloud Flats where the project is located. The presence of root disease has had a long history in the project area with blackstain root disease infection centers being recognized in densely stocked ponderosa pine stands in the early 1970's and annosus root disease centers identified in 1980¹.

Annosum root disease is caused by the fungus, *Heterobasidion annosum*, which infects cut conifer stumps following thinning or cutting operations. Overland infection in regards to annosum root disease is through spores produced by the fungus which occupy freshly cut stump surfaces. The disease colonizes the stump and major lateral roots where it may remain up to 50 years depending on site conditions. The potential increase in annosum infection as a result of harvest activities is limited through the use of Borax applied on stump surfaces ≥ 14 " diameter during harvest operation. Borax is toxic to annosus spores and therefore prevents infection².

Borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ sodium tetraborate decahydrate) is used as a registered pesticide (fungicide) EPA Reg. No. 2935-501, EPA Est. No. 66196-CA-01 (WILBUR-ELLIS SPORAX[®]).

For prevention of *Heterobasidion annosum* (annosus) root disease, borax is applied to freshly-cut stump surfaces at a rate of one pound per 50 square feet of stump surface within four hours of creation. This is equivalent to one pound of borax on 36 sixteen-inch stumps (Sporax label, Wilbur-Ellis Company). Borax applications will follow all State and Federal rules and regulations as they apply to pesticides. It is estimated that approximately 1 pound of Borax/acre would be applied in thinning prescription stands and 1-2 pounds of borax per acre in harvest and replant stands based on borax application history in the area.

The Sporax label and material safety data sheet are displayed below:

¹ Freeman, Wilfred, *Biological Evaluation of Tree Mortality on McCloud Flats*, Forest Insect and Disease Management, May, 1977

² Kliejunas, John and Bill Woodruff, *Pine Stump Diameter and Sporax Treatment in Eastside Pine Stands*, Report No R04-01, June 2004





WILBUR-ELLIS

SPORAX

A BORAX FUNGICIDE FOR CONTROL OF ANNOSUS ROOT DISEASE

ACTIVE INGREDIENT
 SODIUM TETRABORATE DECAHYDRATE
 (Na₂B₄O₇·10H₂O) 100%
 Boric Oxide (B₂O₃) equivalent 37.50%

EPA Reg. No. 2935-501

EPA Est. No. 2935-CA-01

KEEP OUT OF REACH OF CHILDREN DANGER	
FIRST AID	
If in eyes:	Hold eyelids open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If swallowed:	Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor.
If on skin or clothing:	Remove contaminated clothing and wash skin with soap and water. Rinse skin with plenty of water for 15-20 minutes. Call poison control center or doctor for treatment advice.
If inhaled:	Move person to fresh air. If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact: (800) 424-9300 CHEMTREC (transportation & spills); (800) 900-4044 Poison Control Center (human health); (800) 345-4735 ASPCA (animal health)	

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER
Corrosive. Causes irreversible eye damage. Harmful if swallowed. Do not get in eyes or on clothing. Wear goggles or face shield. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash clothing before reuse. Do not leave container where children or animals may gain access.
PERSONAL PROTECTIVE EQUIPMENT (PPE)
Applicators and other handlers must wear: Long-sleeved shirt and long pants, shoes, socks and waterproof gloves.
ENVIRONMENTAL HAZARDS
Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high-water mark. Do not contaminate water when disposing of equipment washwaters or rinsate. Borax carelessly spilled or applied to cropland or growing plants - including trees or shrubs - may kill or seriously retard plant growth.

IN CASE OF EMERGENCY, CALL CHEMTREC: (800) 424-9300

NET CONTENTS: 25 POUNDS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

USE FOR CONTROL OF ANNOSUS ROOT DISEASE IN CONIFER STANDS: It has been established that the fungus, Heterobasidion annosum, often infects cut conifer stumps following thinning or cutting operations, and that the disease can spread from infected stumps to residual trees in the stand.

Several chemical agents have been used to limit the development of annosus root disease. Research has shown that Borax prevents establishment and growth of annosus in cut stumps of conifer tree species not already infected.

Before using the WILBUR-ELLIS SPORAX for stump treatment control of annosus infection, contact Local, State or Federal Forestry or plant pathology specialists to verify the most economical and efficient methods and materials for your situation.

Use of WILBUR-ELLIS SPORAX for this purpose includes all conifer tree species occurring in the stand being treated. WILBUR-ELLIS SPORAX should be applied to stump surface of the cut tree as soon after felling as practical. For most efficient use, apply immediately after cutting, but avoid delaying treatment more than one day.

The best method of application is to sprinkle the material "salt-shaker" style on the freshly cut stump surface. Complete coverage, including exposed side areas and any splinters, is necessary. Also level rather than sloping stump surfaces are preferred, especially in areas of high rainfall. "Shaker-top" applicators are available in most farm and garden shops in one or two pound sizes.

Apply enough WILBUR-ELLIS SPORAX to lightly cover entire stump surface. At proper rates of application, one pound of this product will adequately cover 50 square feet of stump surfaces; that is, 260 six-inch stumps, 158 eight-inch stumps, 80 ten-inch stumps, or 60 twelve-inch stumps.

When dry method is used, moisture in the exposed wood from freshly cut stumps, dew or rain, will dissolve the product and leach it into the wood.

STORAGE AND DISPOSAL

PROHIBITIONS: Do not contaminate water, food or feed by storage or disposal. Do not store where children or animals may gain access. Open burning and dumping prohibited. Do not reuse empty container.

PESTICIDE DISPOSAL: Pesticide, spray mixture or rinsate that cannot be used or chemically reprocessed should be disposed of according to procedures approved by Federal, State or Local disposal authorities.

CONTAINER DISPOSAL: Consult Federal, State or Local disposal authorities for approved procedures.

WARRANTY STATEMENT

WILBUR-ELLIS COMPANY warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials or the manner of use or application, all of which are beyond the control of WILBUR-ELLIS COMPANY. In no case shall WILBUR-ELLIS COMPANY be liable for consequential, special or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the Buyer. The exclusive remedy of any buyer or user of this product for any and all losses, injuries, or damages resulting from or in any way arising from the use, handling or application of this product, whether in contract, warranty, tort, negligence, strict liability or otherwise, shall not exceed the purchase price paid for this product or at WILBUR-ELLIS COMPANY'S election, the replacement of this product. WILBUR-ELLIS COMPANY MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE. WILBUR-ELLIS Logo® and IDEAS TO GROW WITH® are registered trademarks of WILBUR-ELLIS COMPANY.

F-703

Manufactured by:

WILBUR-ELLIS COMPANY
 P.O. Box 16458 - Fresno, California 93755



PO BOX 16458 • FRESNO CA 93755

MATERIAL SAFETY DATA SHEET

PRODUCT/TRADE NAME:

SPORAX

I. NAME

PRODUCT/TRADE NAME: SPORAX
EPA REGISTRATION #: 2935-501
CHEMICAL NAME/COMMON NAME:
Sodium Tetraborate Decahydrate

II. HAZARDOUS INGREDIENTS

	CAS#	OSHA PEL	ACGIH TLV
Sodium Tetraborate Decahydrate	1303-96-4	NE	NE

III. PHYSICAL DATA

SPECIFIC GRAVITY (H₂O = 1): NA
MELTING POINT: 62°C
VAPOR DENSITY (AIR = 1): NA
% VOLATILES BY VOL.: NA
ODOR: None
APPEARANCE: White Crystalline Solid
FLASH POINT/METHOD: NA
VAPOR PRESSURE (mmHg): NA
SOLUBILITY IN H₂O: Partially

IV. FIRE & EXPLOSION HAZARD

EXTINGUISHING MEDIA: Water Fog Foam Alcohol Foam
 CO₂ Dry Chemical Other
FIRE FIGHTING PRECAUTIONS & HAZARDS:
This product is not flammable. It also can act as a fire retardant.

V. CARCINOGEN STATUS

OSHA NTP IARC No Listing Type

VI. REACTIVITY

Stable HAZARDOUS POLYMERIZATION
 Unstable May Occur Will Not Occur
AVOID: Elemental Zircon
HAZARDOUS DECOMPOSITION PRODUCTS: NA

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE OF SPILL: Vacuum or sweep up and reuse or place in a disposal container.
DECONTAMINATION: Treat area with detergent and water. Repeat as necessary until area is clean.
ENVIRONMENTAL HAZARDS: Dike to prevent entering drains, sewers or water courses.
DISPOSAL: Dispose of in accordance with federal, state and local regulations.

VIII. HEALTH PRECAUTION DATA

INGESTION: Acute oral LD₅₀ (rat) 6.13 g/kg (U.S. Borax). Do not ingest. Wash thoroughly before eating, drinking or smoking.
INHALATION: May cause slight nasal irritation.
SKIN ABSORPTION: Not expected to cause irritation.
EYE EXPOSURE: Causes irreversible eye damage. Wear proper eye protection to prevent exposure.
EFFECTS OF OVEREXPOSURE: Symptoms of overexposure are sneezing, coughing and eye damage. Ingestion may cause nausea, vomiting, diarrhea and facial flushing.
FIRST AID: In all cases, get prompt medical attention. If ingested, give several glasses of water. Do not induce vomiting. For skin exposure, wash with water. For eye exposure, irrigate a minimum of 15 minutes with water. If inhaled, remove to fresh air.

IX. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Use NIOSH/MSHA - approved respiratory protection for nuisance particulates.
PERSONAL PROTECTIVE EQUIPMENT: Safety goggles or glasses with side shields and brow protection.
VENTILATION: Local exhaust ventilation recommended for control of nuisance dust.

X. SPECIAL PRECAUTIONS

Keep out of the reach of children. Read and follow all label instructions.

XI. REGULATORY DATA

SARA HAZARD CLASS: Acute Chronic Flammable
 Pressure Reactive None

SARA 313: Yes No Chemical:
SARA 302: Yes No Chemical:

TPO:
CERCLA: Yes No Chemical:
RQ:

RCRA: Yes No
NFPA HAZARD RATING:

Health:	[2]	NFPA HAZARD RATING SCALE:
Fire:	[0]	0 = Minimal 3 = Serious
Reactivity:	[0]	1 = Slight 4 = Severe
Special:	[]	2 = Moderate

HMIS CODES:		HMIS HAZARD RATING SCALE:
Health:	[2]	0 = Minimal 3 = Serious
Fire:	[0]	1 = Slight 4 = Severe
Reactivity:	[0]	2 = Moderate

DATE PREPARED: March 31, 1993

REVISED DATE: February 5, 2002

Notice: This information was developed from information on the constituent materials. No warranty is expressed or implied regarding the completeness or continuing accuracy of the information contained herein, and Wilbur-Ellis disclaims all liability for reliance thereon. The user should satisfy himself that he has all current data relevant to his particular use.

*Technical Material NE - Not Established NA - Not Applicable

24 Hour Emergency Phone Number
CHEMTREC: (800) 424-9300



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The following contract clauses are included in the timber sale contract for the prevention and removal of spilled hazardous substances and to provide instructions for the application of borax to stumps.

B6.34 – Sanitation and Servicing. Purchaser shall take all reasonable precautions to prevent pollution of air, soil, and water by Purchaser's Operations. If facilities for employees are established on Sale Area, they shall be operated in a sanitary manner. In the event that Purchaser's Operations or servicing of equipment result in pollution to soil or water, Purchaser shall conduct cleanup and restoration of the polluted site to the satisfaction of Forest Service.

Purchaser shall maintain all equipment operating on Sale Area in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid. Purchaser shall not service tractors, trucks, or other equipment on National Forest lands where servicing is likely to result in pollution to soil or water. Purchaser shall furnish oil-absorbing mats for use under all stationary equipment or equipment being serviced to prevent leaking or spilled petroleum-based products from contaminating soil and water resources. Purchaser shall remove from National Forest lands all contaminated soil, vegetation, debris, vehicle oil filters (drained of free-flowing oil), batteries, oily rags, and waste oil resulting from use, servicing, repair, or abandonment of equipment.

B6.342 – Hazardous Substances. Purchaser shall notify the National Response Center and Contracting Officer of all releases of reportable quantities of hazardous substances on or in the vicinity of the Sale Area that are caused by Purchaser's employees or contractors, directly or indirectly, as a result of Purchaser's Operations, in accordance with 40 CFR 302.

C6.412# - Treatment of Stumps. (9/2004) Within areas shown on Sale Area Map, Purchaser shall treat stumps of all live and dead conifer trees equal to or greater than 14 inches stump diameter, unless otherwise agreed in writing. Treatment shall be with an EPA registered borate compound, which is registered in California for prevention of annosus root disease.

Treatment shall consist of removal of sawdust and other loose debris from the cut surface of the stump and application of a thin layer of the borate compound uniformly over the entire cut surface of the stump, including exposed wood surfaces on the sides, at the rate specified on the product label. For colorant use, Purchaser shall follow directions on the colorant label. Treatment shall be completed within four hours after felling.

Any surface irregularities on the stump which will prevent application of a uniform layer of borax shall be cut level prior to treatment. Purchaser shall provide the borate compound and apply it in compliance with the State of California laws and regulations pertaining to pesticides and pest control operations. Purchaser shall provide Forest Service with a copy of the "Monthly Summary of Pesticide Use Reports" submitted to the appropriate County Agricultural Commissioner.

II. Effectiveness of Borax

Use of borax on stumps in the Pilgrim project is limited to stumps 14 inches in diameter and greater based on the **latest** scientific research by Kliejunas and Woodruff (2004)³. This research paper cites survey results from the McCloud Ranger District which is where the Edson project is located. “Stump diameters were measured during a survey on the McCloud Ranger District, Shasta-Trinity NF (DeNitto 1988). Results suggested that stumps less than 14 inches (35.6 cm) in diameter will not support active annosus infection centers.” This same survey was also cited in Dave Schultz’s report for the Edson Sale⁴ where he described no infection of 14 inch diameter pine stumps, less than 5% infection of 18 inch diameter stumps and approximately 10% infection of 22 inch diameter pine stumps. However, he did note that “the percent of pine stumps infected with *H. annosum* increases abruptly in the 18 inch stump class, so there would be serious consequences if there was less than 100% compliance by the applicator.”

Several other studies have demonstrated the efficacy of using borax as a stump treatment in California. Graham (1971)⁵ in a study on the Lassen National Forest found that less than 1% of borax treated Jeffrey and ponderosa pine stumps (8 to 16” in height) became colonized 4 weeks after artificial inoculation with annosum compared to over 61% of the untreated control stumps similarly inoculated and examined became colonized. Smith (1970)⁶ in a study on the Eldorado National Forest and the Lassen National Forest demonstrated that borax treatment of stumps in a white fir pole stand reduced infection significantly with 50 to 70% of the non-treated stumps becoming infected after inoculation compared to none of the borax treated stumps becoming infected. Kliejunas (1989)⁷ summarized the existing literature on borax effectiveness in the eastside pine type.

III. Alternatives to Borax Application

Discontinue Logging: Discontinuing all timber harvesting is not a feasible alternative as thinning over-dense stands to meet objectives for forest health and fire reduction is essential to meeting the purpose and need of the proposed project. The No Action alternative in the EIS details the effects of no harvesting of trees.

Present logging techniques help prevent damage to residual trees and thereby reduce the points of entry for annosum spores. Design techniques in the Pilgrim Project such as directional felling, the use of

³ Kliejunas and Woodruff, 2004. *Pine Stump Diameter and Sporax® Treatment in Eastside Pine Type Stand*. USDA Forest Service, Pacific Southwest Region, Report Number R04-01, 7 p.

⁴ Dave Schultz, Forest Entomologist, Input for Edson Sale (Report No. 04-02), March 2004

⁵ Graham, D.A. 1971. *Evaluation of borax for prevention of annosus root rot in California*. Plant Disease Reporter. 55(6)June 1971:490-494

⁶ Smith, R.S., Jr. 1970. *Borax to control Fomes annosus infection of white fir stumps*. Plant Disease Reporter 54: 872-875.

⁷ Kliejunas, J. T. 1989. *Borax stump treatment for control of annosus root disease in the eastside pine type forests of Northeastern California*. pg. 159-166 in Proceedings of the Symposium on Research and Management of Annosus Root Disease in Western North America. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station.

feller/bunchers and the adherence to Best Management Practices will reduce the incidence of tree wounding.

Seasonal Restrictions: Cutting when annosus spores are lowest has been suggested, but there are no data or studies to support the efficacy of such a treatment in California. Morrison (1999)⁸ determined there was no significant difference in season of cutting in coastal British Columbia. Schmitt et al (2000)⁹ state that restricting cutting to summer months may reduce potential of stump and wound colonization, but give no data to evaluate, nor do they state that this would eliminate the need for Sporax. Ammon and Patel (2000)¹⁰ recommend thinning during dry, hot months in the SE US or during winter months in the NE US, but also give no data to evaluate, nor do they state that this would eliminate the need to treat the stumps otherwise. Phelps et al (undated) demonstrated that in the SE US, summer thinning only slightly reduced infection over controls and that borax treatment was much more effective. Filip and Morrison (1998)¹¹ and Stambaugh (1989)¹² report that cutting in the summer (April thru August) in the SE US, south of latitude 34°N appears to reduce losses caused by annosus root disease. Filip and Morrison (1998) state that seasonal logging has not been demonstrated in the interior west to be effective.

Seasonal Restrictions (cont): In Russell et al (1973)¹³, monthly spore patterns in Washington and Oregon peaked in the fall, with a lesser peak in the spring, but airborne spores were present in large numbers nearly year-round. In James and Cobb (1984)¹⁴, spores are produced in the Stanislaus and San Bernardino National Forests throughout the year. In their summary, Filip and Morrison (1998) state that although many materials have been tested, in the western US only borax is recommended and used operationally. Based on the data in James and Cobb (1984) and Russell et al (1973), it is likely that in the relatively mild climate of California where spores are produced throughout the year, restricting logging to a certain season would not be effective in reducing annosus root disease infection.

Prescribed Burning: There is no literature supporting prescribed burning as a control of annosus in California ecosystems. In the Western US, annosus conks are most often found inside stumps or under the bark. In the Southeast US, where the burning method was developed, conks are formed in the duff at the

⁸ Morrison, D.J. and A.L.S. Johnson. 1999. Incidence of *Heterobasidion annosum* in precommercial thinning stumps in coastal British Columbia. *Eur. J. For. Path.* 29(1999):1-16.

⁹ Schmitt, Craig L., John R. Parmeter, and John T. Kliejunas. 2000. *Annosus Root Disease of Western Conifers*. Forest Insect and Disease Leaflet 172. US Department of Agriculture Forest Service

¹⁰ Ammon, Vernon and Mukund V. Patel. 2000. *Annosum Root Rot. Ornamental and Tree Diseases. Plant Disease Dispatch Sheets*. M-416

¹¹ Filip, G.M. and Morrison D.J. 1998. Chapter 23 - North America. In, *Heterobasidion annosum: Biology, Ecology, Impact and Control*. Editors: S. Woodward, J. Stenlid, R. Karjalainen, and A. Huttermann. pg.405-427. CAB International.

¹² Stambaugh, W.J. 1989. *Annosus root disease in Europe and the Southeastern United States: Occurrence, research, and histoical perspective*. pg. 3-9 in Proceedings of the Symposium on Research and Management of Annosus Root Disease in Western North America. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station

¹³ Russell, K.W., J.H. Thompson, J.L. Stewart, C.H. Driver. 1973. *Evaluation of chemicals to control infection of stumps by Fomes annosus in precommercially thinned western hemlock stands*. State of Washington Department of Natural Resources, DNR Report No. 33. 16 pages

¹⁴ James, R.L., F.W. Cobb, Jr. 1984. *Spore deposition by Heterobasidion annosum in forests of California*. *Plant Disease Reporter*. 68(3):246-248.

base of trees and could be killed by prescribed fire. Prescribed burning would not be feasible as a control method for annosus because of the need to destroy the stumps. In 1994, a field trial was attempted in which fire would be used to destroy infected stumps (Pronos 1994)¹⁵. This trial was unsuccessful because the stumps were still too wet to burn, even three years after harvest.

Froelich et al 1978¹⁶ studied prescribed burned plots versus unburned plots in loblolly and slash pine plantations in the Coastal Plain of the southern United States. The study concluded that prescribed burned plots developed less infection than unburned plots. However, they also point out that other studies have resulted in an apparent increased severity of annosus root rot and that prescribed burning to reduce annosus root rot may not have practical application outside of the Coastal Plain or on soils with heavier texture than those in the study. The study further concludes that “borax, when applied to the fresh stump, has proved to be the most effective treatment in preventing losses.”¹⁷

Froelich et al 1978 and Ammon & Patel 2000 are focused on management of forests in the Coastal Plain of the southern United States. Flip & Morrison 1998 mention prescribed burning only in their discussion of impacts and management in the southeastern United States – but in none of the other regions of North America. There is no literature supporting prescribed burning as a control of annosus in California ecosystems.

Removal of Injured Trees: There is no literature supporting the removal of injured trees as an effective control method of annosus in California ecosystems. Damaged and injured trees are routinely designated for removal during marking of all silvicultural treatments. Trees damaged during logging are routinely removed by the purchaser under timber sale contract clause B2.131(b). While the removal of injured trees will eliminate some sources of infection, there are no data or studies that indicate that the practice will eliminate the need for borax application.

Mechanical Removal of Stumps: Mechanical removal of stumps is not feasible due to high costs and environmental impacts. Kliejunas et al 2005 reports that results 12 years after treatment indicate that removal of infected trees and roots in a southern California campground may have significantly reduced conifer mortality caused by annosus root disease¹⁸. Treatment consisted of removing all conifer trees, stumps, and visible roots from six annosus centers prior to development of a campground. The largest of these sites was approximately 0.75 acre.

Removal of infected stumps and roots would be effective in preventing the spread of annosus through trees roots but would not prevent annosus infection through freshly cut stumps surfaces unless all new stumps were also removed.

¹⁵ Pronos, J. 1994. *Attempts to destroy stumps in an annosus root disease center buffer strip*. Appendix pages xiv-xivi. In, Proceedings of the 43rd Annual Meeting, California Forest Pest Council, November 16-17, 1994. Rancho Cordova, CA

¹⁶ Froelich, R.C., C.S. Hodges, Jr., S.S. Sackett. 1978. *Prescribed burning reduces severity of annosus root rot in the South*. Forest Science. 24(1):93-100.

¹⁷ Froelich et al 1978, pages 98-99

¹⁸ Kliejunas et al 2005, page 158.

While stump removal may be appropriate on a small scale in high-value sites such as campgrounds, it is not a suitable method of controlling annosus root disease over large acreages due to high costs and environmental impacts. Of particular concern are:

- the potential for increased erosion due to disturbance of soil and ground litter.
- additional soil compaction from heavy equipment.
- impacts to visual quality due to soil disturbance and burn piles.
- impacts to habitat for sensitive mollusks and fungi (including S&M species).
- the increased risk of noxious weeds becoming established in areas of exposed soil.

Use of Bio-pesticides: *Phlebiopsis gigantea* and/or *Streptomyces griseoalbus* are not currently registered for use as a biopesticide by the US Environmental Protection Agency and California. This method of control may be feasible in the future if efficacy can be demonstrated in California and if they are registered as biopesticides by both US Environmental Protection Agency and California. Until such time as both efficacy and registration are met, these two remain indefensible options.

Cultural Control: This is already recognized as a method to reduce impacts from annosus root disease. From the R-5 Supplement to FSH 3409.11 (Chapter 60) (USDA Forest Service 1994a): Species Conversion. Because of host specificity of *H. annosum* favor the non-infected host species.

Both strains of annosus root disease are prevalent in the Pilgrim project area. The P-group infects pines and incense-cedar. The S-group infects true fir and Douglas-fir. Since all conifer species in the area are affected by one of these strains borax would be applied to all stumps 14 inches in diameter and greater.

Cultural Control (cont): The stands in the Pilgrim Project are ponderosa pine stands consisting of ponderosa pine with minor components of white fir and incense cedar. Therefore a species conversion from Ponderosa pine to White fir/mixed conifer would entail regeneration harvests on approximately 2000 acres rather than the 375 acres that is proposed. Intermediate commercial thinning treatments are proposed to reduce stand densities to recommended levels for forest health and fire resistance. The sanitation prescription is designed to capture most of the mortality of the next 5 years while still maintaining existing mature stands. Pine trees that become infested with bark beetles during the life of the project may be removed to capture imminent mortality and reduce the probability of catastrophic fire. Species diversity is desired and will be included where possible when selecting trees to leave in the thinning treatments.

A mixed conifer planting mixture is also proposed in the majority of harvest/replant areas.

IV. Human Risk Assessment

A peer reviewed Human Health and Ecological Risk Assessment¹⁹ is a document written by professional toxicologists concerning the risks of using borax for stump treatments. The 2006 publication concludes

¹⁹ USDA Forest Service. Human Health and Ecological Risk Assessment for Borax (Sporax®) – Final Report. February 2006. Prepared for USFS by Syracuse Environmental Research Associates, Inc. (SERA Inc.).

that except for the most extreme exposure scenario considered in this risk assessment – i.e., the direct consumption of Sporax from a tree stump by a child – the use of Sporax in Forest Service programs will not substantially contribute to boron exposures in humans. In addition, the use of Sporax in Forest Service programs will not typically or substantially contribute to concentrations of boron in water or soil. (*page x, 2nd paragraph*)

The Human Health Risk Assessment details three scenarios:

- worker exposure via spill of granular product to the lower legs and hands
- ingestion of applied Sporax by a child
- exposure via consumption of water contaminated by accidental spill or by run-off.

For worker exposure from granular Sporax spilled on the lower legs and hands, hazard quotients are well below the level of concern. Thus, workers do not appear to be at risk from Sporax under typical application conditions. (*page xiv, 2nd paragraph*)

For the general public, hazard quotients for consumption of Sporax from a tree stump by a child...are below levels of exposure associated with nonlethal effects such as diarrhea and vomiting... Thus, while this exposure scenario raises concern in that the Reference Dose (Rfd) could be substantially exceeded in a child directly consuming Sporax from a treated stump, the most likely adverse effects would probably be vomiting and diarrhea. (*page xiv, 3rd paragraph*)

For consumption of water from a pond contaminated by Sporax due to runoff, none of the hazard quotients exceed the level of concern, even for the highest application rate of 5 lbs Sporax/acre. The highest hazard quotient for consumption of water contaminated by an accidental spill is 0.7, associated with a child consuming water contaminated by the spill of 25 pounds of Sporax into a small pond. Thus, based on this risk assessment, the only exposure scenario that appears to present a significant potential risk is exposure by direct consumption under upper bound conditions. (*page xiv, 4th paragraph*)

Details of the assumptions and calculations involved in the exposure assessments are included in the final report. A summation of the Human Health Risk Assessment's findings is listed below:

3.4.2 Workers

...based on the available information and under the foreseeable conditions of application, there is no route of exposure or scenario suggesting that workers will be at any substantial risk from acute exposures to Sporax. (*page 3-25, 1st paragraph*)

...even if workers were to repeatedly spill granular Sporax on the lower legs and hands every day, the hazard quotient associated with longer term exposures would be far below the level of concern. (*page 3-25, 3rd paragraph*)

...eye irritation is likely to be the only overt effect as a consequence of mishandling Sporax. This effect can be minimized or avoided by prudent industrial hygiene practices during the handling of the compound. The Sporax label requires eye protection during application. (*page 3-25, last paragraph*)

3.4.3 General Public

With the exception of the direct consumption of Sporax applied to a tree stump by a small child, none of the hazard quotients exceed the level of concern. *(page 3-26, 1st paragraph)*

...even at the highest application rate, there does not appear to be a risk associated with acute or chronic exposure to water contaminated by runoff. *(page 3-26, 4th paragraph)*

3.4.4 Sensitive Subgroups

...exposure of pregnant women to borate compounds places the developing fetus at risk. *(page 3-27, 2nd paragraph)*

...males with underlying testicular dysfunction could be at increased risk for boron-induced testicular toxicity. However, no data are available to quantify this risk. *(page 3-27, 2nd)*

Application of Sporax does not require mixing of any components therefore reports of accidents involving mixing would not make sense and are not known in the Region. If there have been spill incidents into streams, these have not been reported to the Regional Office. As per FSH 2109.14, (USDA Forest Service 1994b) all pesticide incidents must be reported to the Regional Office (Regional Pesticide-Use Specialist). All applications of pesticides on Forest Service projects in California follow all applicable Federal and California rules and regulations, including requirements for worker protection, storage, and environmental protection. Personnel are instructed to scoop up any spilled material and place it back in the application container. Using proper spill procedures, it is highly unlikely that humans or the environment would be harmed from borax treatments.

V. Ecological Risk Assessment

The 2006 Human Health and Ecological Risk Assessment uses the following scenarios to assess the risk of borax application:

Exposure of wildlife species

- direct consumption of applied Sporax
- ingestion of contaminated water

Exposure of aquatic species

- water contaminated by an accidental spill or by runoff

Exposure of terrestrial plants

- soil contaminated by runoff

Details of the assumptions and calculations involved in the exposure assessments are included in the final report. A summation of the 2006 Human Health Risk Assessment's findings is listed below:

4.4.2 Terrestrial Organisms

4.4.2.1 Terrestrial Vertebrates

...the exposure scenarios considered in this risk assessment are the direct consumption of Sporax applied to tree stumps (acute exposure), consumption of water contaminated by an accidental spill (acute exposure), and acute and chronic exposure by consumption of water contaminated by runoff. With the exception of direct consumption of Sporax applied to tree stumps, none of the exposure scenarios are associated with hazard quotients that exceed the level of concern. (page 4-19, 2nd paragraph)

For the direct consumption scenario, there appears to be very little risk to either mammals or birds. Sporax applied to tree stumps does not appear to have attractant effects for deer and no clinical signs of toxicity were observed in deer allowed free access to Sporax-treated stumps. (page 4-19, 3rd paragraph)

Risks associated with other exposure scenarios are very low...risk of exposure via the longer term consumption of contaminated water is characterized for a small mammal and range from 0.000003 to 0.005 and are below the level of concern by factors of about 200 to over 330,000. . . .this reflects the fact that the use of Sporax in Forest Service programs will not substantially contribute to or increase concentrations of boron in water or soil beyond those that are associated with the normal occurrence of boron in the environment. (page 4-19, 4th paragraph)

4.4.2.2 Terrestrial Plants

...nontarget terrestrial plants do not appear to be at risk from exposure to borax at the maximum application rate used by the Forest Service. However, this risk assessment is based on data from relatively few terrestrial plant species. It is possible that more sensitive species exist and may be at risk for boron-induced toxicity. (page 4-20, 1st paragraph)

4.4.2.3 Other Terrestrial Organisms

Since borax is used effectively in the control of fungi and insects, adverse effects of environmental exposures to insects and nontarget microorganisms is possible. However, given the atypical application method for Sporax, widespread exposures are not likely. (page 4-20, 2nd paragraph)

4.4.3 Aquatic Organisms

4.4.3.1 Aquatic Animals

With the exception of amphibians, all HQs²⁰ associated with exposure of aquatic animals to water contaminated by an accidental spill are well below the level of concern. For worst-case scenario of the spill of 25 pounds of Sporax into a small pond, the HQ for amphibians of 1.3 only marginally exceeds the level of concern; HQs for spill of 6.25 and 12.5 pounds of Sporax are below the level

²⁰ HQ = Hazard Quotient. The estimated dose divided by the toxicity value.

of concern. Based on the results of this analysis, if large amounts of borax accidentally contaminate surface waters, amphibians may be at risk. However, for all other aquatic animals, there is no indication that adverse effects will occur. *(page 4-20, 4th paragraph)*

Hazard quotients for acute and chronic exposure of aquatic animals to water contaminated by runoff are all below the level of concern, even at the maximum application rate of 5 lbs Sporax/acre. *(page 4-20, 5th paragraph)*

...there is no basis for asserting that effects on nontarget aquatic species are likely for either acute or longer-term exposures. *(page 4-21, 1st paragraph)*

4.4.3.2 Aquatic Plants

The highest HQ for any exposure scenario is 0.3 associated with algae for the accidental spill of 25 pounds of Sporax into a small pond. All other HQs for the accidental spill scenario and for acute and longer-term exposures to water contaminated by runoff are well below the level of concern. Thus, based on this analysis, there is no basis for asserting that effects on aquatic macrophytes or algae are likely for either acute or longer-term exposures. *(page 4-21, 3rd paragraph)*

4.4.3.2 Aquatic Microorganisms

The results of this risk assessment indicate that more sensitive microorganisms may be at risk following accidental spill of large quantities of Sporax into a small pond, but that exposure *via* runoff does not present a risk to aquatic microorganisms. *(page 4-21, 5th paragraph)*