Appendix HAZ-1

2019 Update of Herbicide Toxicity Information

APPENDIX HAZ-1

Update of Herbicide Toxicity Information

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APPENDIX HAZ-1
Update of the 2015 Herbicides Appendix (Appendix HAZ-2)

OVERVIEW

Appendix HAZ-2 of this PEIR describes in detail the potential human health and ecological effects from the chemicals that were proposed for use under the 2017 VTP Draft EIR, including the potential for direct effects of herbicide use to humans and wildlife and the indirect effects associated with potential impacts on the environment. These chemicals evaluated in Appendix HAZ-2 are the same as proposed in this PEIR for the CalVTP except for borax, which is a fungicide, and NP9E-based surfactants. The chemicals analyzed in this PEIR appendix are herbicides. For the purposes of this analysis, the terms herbicide and chemical are used interchangeably.

Information on chemicals was initially prepared by the California Department of Forestry and Fire Protection (CAL FIRE) in 2010 and was peer-reviewed and updated in 2015 by Dr. Bill Williams. This appendix (HAZ-1) includes updated information on the herbicides proposed for use by CAL FIRE and provides an overview of the new information, studies, and reports that have been published since Appendix HAZ-2 was peer reviewed and updated in 2015. These appendices (HAZ-1 and HAZ-2) together provide detailed descriptions and characteristics of the herbicides proposed for use in the CalVTP and include information from 2010 to present day (2019). This Appendix includes the latest information needed to evaluate the safety of the base product active ingredients and current formulations. The herbicides and associated chemical compounds proposed for use under the CalVTP including the following:

- Borax (tetraborate decahydrate);
- Clopyralid (monoethanolamine salt);
- Glyphosate (isopropylamine salt, potassium salt, dimethylamine salt & diammonium salt);
- Hexazinone;
- Imazapyr (isopropylamine salt);
- Sulfometuron Methyl;
- Triclopyr (butoxyethyl ester & triethylamine salt);
- Nonylphenol 9 Ethoxylates (NP9E);
- Cleantraxx (penoxsulam & oxyfluorfen);
- Velpar (hexazinone); and
- Indaziflam.

All formulations of chemicals containing 2,4-D were removed from the 2015 list of fundable herbicides, due to toxicological concerns. Nonylphenol ethoxylate (NP9E) is a surfactant that contains the active ingredient nonylphenol (NP) and its ethoxylates (USFS 2003b). Currently, there is continuing concern regarding the toxicity of NP9E compounds to aquatic organisms (SERA 1997a, 2011b and USFS 2003b). Estrogen mimicry, a potential for NP9E, is a remaining concern for both aquatic and terrestrial organisms. Of the active ingredients proposed for use, NP9E is commonly used with clopyralid, glyphosate and/or triclopyr formulations. Four active ingredients of glyphosate (diammonium salt, dimethylamine salt, isopropylamine salt, potassium salt) and two active ingredients of triclopyr (butoxyethyl ester and triethylamine salt) are also being proposed for use under the CalVTP.

Recent publications regarding the possible onset of disease associated with exposure to Roundup has led to class action and personal lawsuits against Monsanto and Bayer, manufacturers and distributors of glyphosate, the active ingredient in the Roundup. Some studies support these claims while others refute them, both are included in this appendix. Registration of the glyphosate diammonium salt has been cancelled for two manufacturers (Nu Fam and Syngenta) by the U.S. Environmental Protection Agency (U.S. EPA).

Descriptions of the chemicals in Appendix HAZ-2 include everything known about the toxicity, ingredients and additives associated with each of the chemicals. Recent available information about each of these parameters is included herein. Due to the number of potential application scenarios it is not feasible to provide risk evaluations for each of the specific uses in each potential project areas under the CalVTP. Rather, the risk estimates are based on the basic exposure estimates listed in Sections 3.1 and 3.2 of Appendix HAZ-2 and are assumed to be still relevant in most cases. Discussions about fate and transport of the herbicides is updated below where new information is available.

Approach:

Extensive searches on the chemical properties and toxicity of each of the herbicides proposed for use under the CalVTP were conducted to obtain recent information on potential toxicity and adverse effects to human health and wildlife, including aquatic life. Where more recent information (2015 to 2019) has been identified it is included as supplemental information in the summaries below. The following databases and search engines were queried:

- ECOTOX (toxicity to fish and aquatic life);
- IRIS (Integrated Risk Information System; toxicity to human health);
- U.S. EPA RED and review databases;
- CHEMFATE (environmental fate);
- BIODEG (degradation);
- HSDB (Hazardous Substances Data Bank);
- CCRIS (Chemical Carcinogenesis Research Info System);
- ATSDR ToxFAQs (Agency for Toxic Substances and Disease Registry chemical fact sheets);
- National library of Medicine (PubChem); and
- EXTOXNET (Extension Toxicology Network's pesticide information project).

Although this extensive source of chemical data includes most publications, there may be instances in which a report or university study is preliminary and is therefore not included. Some manuscripts accepted for publication but not yet printed have been included herein. References included in the 2017 CalVTP PEIR may be quoted, but the actual reference has not been included in the listing of relative references 2015-2019.

The general toxicity characteristics of each of the chemical proposed for use under the CalVTP are provided in the table below.

Overview General Toxicity Characteristics

Chemical	Formulation	Human Toxicity
Glyphosate (Roundup) (Roundup Pro) (RoundupProMax)	Isopropylamine salt, potassium salt, dimethylamine salt & diammonium salt	Overall low toxicity. Skin and eye irritation possible. No evidence of neurotoxicity, immunotoxicity, or acute toxicity. Reproductive toxicity at very high doses. Recent claims of carcinogenicity (class 2A) based on animal studies. Unvalidated claims. Very low toxicity via oral and dermal routes. Possible endocrine-disruptor.1
Borax	Tetraborate decahydrate	Overall low toxicity. No evidence of carcinogenicity, neurotoxicity, immunotoxicity, or general toxicity. Reproductive and developmental toxicity at very high doses.
Clopyralid (Lontrel T&O) (Cody Clopyralid) (Alligare) (Confront) (Thistledown)	Monoethanolamine salt	Very low toxicity if ingested. Clopyralid is classified by the U.S. EPA as "not likely to be a human carcinogen."19 Clopyralid caused birth defects in laboratory animal studies at doses that were severely toxic to the mother. No birth defects were observed in animals given clopyralid at doses several times greater than those expected during normal exposure. Not mutagenic (capable of changing genetic material [DNA] of an organism).
Hexazinone (Valpar) (Pestanal)	Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione]	Acute (oral and dermal) toxicity is low. Hexazinone can be highly irritating and corrosive to the eye. The U.S. EPA has evaluated the dietary risk associated with hexazinone and has determined that there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to hexazinone when considering dietary, drinking water, and residential exposure and all other non-occupational sources of pesticide exposure for which there is reliable information.
Imazapyr (Imazapyr 2SL)	isopropylamine salt	Overall low toxicity. No evidence of carcinogenicity, neurotoxicity, immunotoxicity, or reproductive/developmental toxicity. Slightly toxic via acute oral, dermal, and inhalation routes. No evidence of carcinogenicity or mutagenicity.
Sulfometuron Methyl	Methyl 2-[[[[[94,6-dimethyl-2-pyrimidinyl)amino]carbonyl]sulfonylbenzoatee) "Oust" Herbicide	Low toxicity via oral, dermal, and inhalation routes. Classified as ''not likely to be carcinogenic to humans.'' No mutagenicity or genetic toxicity.
Triclopyr (Turflon Ester) (Garlon 3) (Garlon 4)	Butoxyethyl ester & triethylamine salt	Overall low toxicity (moderate toxicity if ingested) (technical triclopyr acid). Slightly toxic via acute oral, dermal, and inhalation routes (TEA and TBEE) slightly toxic by acute oral and dermal routes. Practically nontoxic by inhalation. Not carcinogenic (technical triclopyr acid).
Nonylphenol 9 Ethoxylates (NP9E)	NPEs are surfactants that are part of the broader category of surfactants known as alkyphenol ethoxylates (APEs). NPEs represent approximately 80% to 85% of the volume of APEs.	Acute (oral and dermal) toxicity is low. NP9E can be highly irritating and corrosive to the skin and eye. NP9E does not have significant skin sensitizing potential. NP9E is not mutagenic, or in vivo micronucleus assay. There are no data on its carcinogenic potential.
Penoxsulam & **oxyfluorfen Mix (Cleantraxx)**	**oxyfluorfen**- 2-chloro-1-(3-ethoxy-4-nitrophenoxy) 4-(triftuoromethyl) **penoxsulam** 3-(2,2-Difluoroethoxy)-N-(5,8-dimethoxy[l,2,4]triazolo[l,5-c]pyrimidin2-y1)-a,a,a-trifluorotoluene-sulfonamid	Oxyfluorfen has very low toxicity by ingestion or through dermal exposure (low skin irritation). No evidence of carcinogenicity in long term studies with rats. Questionable mutagenicity, no teratogenicity or reproductive effects. Penoxsulam is practically non-toxic to birds and mammals, very toxic to fish, worms and bacteria.
Indaziflam (Specticle)	N-[(1R,2S)-2,3-dihydro-2,6-dimethyl-1H-inden-1-yl]-6-[(1RS)-1 fluoroethyl]-1,3,5-triazine-2,4-diamine	Low acute toxicity via the oral, dermal, and inhalation routes of exposure. It is not irritating to the eye or skin and is not a dermal sensitizer.

For the purposes of this appendix, information identified that alters the characterization of toxicity or effects as described in Appendix HAZ-2 of this PEIR is included below. Six of the herbicides proposed for use under the CalVTP have new or updated information; however, it does not alter the characterization of toxicity or effects since publication of Appendix HAZ-2. These six herbicides include:

- Hexazinone;
- Imazapyr;
- Sulfometuron Methyl;
- Triclopyr;
- Nonylphenol 9 Ethoxylates (NP9E); and
- Cleantraxx

Because there is no new information that changes the characterization of toxicity or effects as described in Appendix HAZ-2, these herbicides are not discussed further herein. Refer to Appendix HAZ-2 for detailed information regarding their toxicity and potential effects to humans and the environment.

Borax (tetraborate decahydrate)

Overview of Information Provided in Appendix HAZ-2

A Registration Evaluation Decision was completed by the U.S. EPA (1993b) for boric acid and its salts. Subsequently, certain aspects of toxicity for boric acid and its salts were re-examined in a Tolerance Re-registration Eligibility Decision (T.R.E.D.). Additional information was suggested using a revised Registration Evaluation Decision (R.E.D.) in 2014 but is still on the docket for review (U.S. EPA 2006e and 2009a respectively). The most recent U.S. Forest Service (USFS) risk assessment for borax, completed by SERA (2006a), specifically assessed the fungicidal product Sporax®, which is 100% sodium tetraborate decahydrate.

Borate compounds are often used as fire suppressants by the Borate Bombers used by CAL FIRE and regional fire departments to battle wildfires and some urban fires. Borax is one of the salts of the element boron. Chemically it is referred to as disodium tetraborate decahydrate ($Na_2B_40_7 \bullet 10H_2O$, CAS# 1303-96-4) (U.S. Borax 2008). Borax contains 11.34% boron. Boron is always chemically bound to oxygen forming borates (e.g., borax or boric acid). Boron is a naturally occurring element widespread in nature. The average concentration in the earth's crust has been estimated to be 10 parts per million (ppm) and in seawater, 4.6 ppm (Schoderboeck et al. 2011, TOXNET 2006). Borax itself is a white, odorless, alkaline, water soluble powder. In 1993 the U.S. EPA completed a RED (EPA 1993b) for boric acid and its salts.

Boric acid generally is of moderate acute toxicity and has been placed in Toxicity Category III for most acute effects including oral and dermal toxicity, and eye and skin irritation (toxicity categories are defined in Appendix HAZ-2). Sodium tetraborate (anhydrous borax) products have been placed in Toxicity Category I indicating a high degree of acute toxicity for eye irritation effects.

Recent Borax Information (2015-2019)

Although an additional review and possible re-registration of boron products was planned to occur in 2014, it does not appear that the review has been completed. The current docket listings for 2015-2019 do not include borax. Several Borax compounds are listed in the registration que at EPA (EPA-HQ-OPP-2005-0062, Boric Acid Case 0024, 40 CFR 180). The most recent toxicity information is based on the 1993 R.E.D. and additionally, in the recent U.S. EPA *Pesticide Registration Status* the U.S. EPA provided the following:

> *"The use of currently registered pesticide products containing boric acid and its sodium salts in accordance with approved labeling will not pose unreasonable risks or adverse effects to humans or the environment. Therefore, all uses of these products are eligible for reregistration. These products will be reregistered once the required product-specific data, Confidential Statements of Formula and revised labeling are received and accepted by EPA. Boric acid products that already have been re-registered under the General Registration Standard will remain reregistered as long as current labeling and Confidential Statements of Formula are submitted and demonstrate that these products still meet the criteria set forth in the Standard. Boric acid products which also contain other active ingredients will be reregistered only after the other active ingredients are determined to be eligible for reregistration"*

No other publications or reports generated between 2015-2019 were identified that would substantially alter the physiochemical characteristics or the potential effects to biota associated with exposure to Borax as previously described in Appendix HAZ-2.

Clopyralid

Overview of Information Provided in Appendix HAZ-2

While extensive toxicity data was submitted to the U.S. EPA by clopyralid registrants, U.S. EPA has yet to complete or propose a R.E.D. for this active ingredient. Despite this, clopyralid tolerance and acute and chronic toxicity information was released by the U.S. EPA after new clopyralid crop uses were evaluated (FR 2002a, 2002b; U.S. EPA 2009b). The initial USFS risk assessment for clopyralid specifically evaluated the product Transline®, which contains the monoethanolamine salt of clopyralid (SERA 1999). Since then, another assessment of clopyralid was completed by SERA (2004a). The risk to fish and aquatic invertebrates was assessed as low for the representative uses. The risk to algae and aquatic plants was assessed as low for exposure to the active substance clopyralid alone.

A U.S. EPA review was conducted in 2018 to evaluate potential new uses and applications to select fruits and various crop groups. Results included specific allowances for selected crops. It also concluded that the existing toxicology database for clopyralid is considered complete for hazard characterization and human health risk assessment with no changes to the prior assessments. Further the review team indicated that no additional studies are required (U.S. EPA 2018).

Recent Clopyralid Information (2015-2019)

Recent panel reviews by European Food Safety Authority (EFSA 2017, 2018) considered the status of clopyralid in Europe based on earlier risk assessments (2012) to consider the renewal of the registration of clopyralid as an herbicide on winter cereals and grassland. The panel's review of the available risk assessment information did not substantially alter the mammalian and toxicity information. The acute and long-term risk to birds and mammals from oral exposure via residues in food items and contaminated drinking water was assessed as low. No risk assessment for secondary poisoning was triggered based on the low octanol/water partitioning coefficient (log Pow < 3).

Numerous other recent publications refining the chemical characteristics information of clopoyralid were identified but none that would substantially alter the basic information or characterization of the potential effects of clopyralid use by CAL FIRE and as indicated in Appendix HAZ-2. Most of the recent studies were directed to improve residue estimates and effects at the microsomal and macrophyte level.

Glyphosate

Overview of Information Provided in Appendix HAZ-2

Glyphosate [N-(phosphonomethyl)glycine] is a nonselective, post-emergent, and systemic herbicide registered for use in agricultural and nonagricultural areas. It is the active ingredient in Aquamaster and Roundup ProMax and is applied to a variety of feed and food crops and agricultural drainage, sewage, and

irrigation systems. There are several formulations of glyphosate, including an acid, monoammonium salt, diammonium salt, isopropylamine salt, potassium salt, sodium salt, and trimethylsulfonium or trimesium salt.

A R.E.D. was completed for glyphosate by the U.S. EPA (1993c), though toxicity and tolerances have been re-evaluated several times as a result of additional chemical uses, as well as new glyphosate salts being registered (e.g. FR 2007, 2011; U.S. EPA 2006b, 2006c). Glyphosate was also recently evaluated by the U.S. EPA in scoping documents for a proposed R.E.D. (U.S. EPA 2009c). Specific glyphosate formulations and surfactants were evaluated in the mid-1990s (SERA 1996a & 1997a respectively). Since then, complete glyphosate risk assessments have been conducted numerous times (e.g. SERA 2003a). The USFS contracted SERA to update a glyphosate program description, as well as a human and ecological health risk assessment (SERA 2010 & 2011b respectively). Due to public concerns about some commercial products that include the active ingredient and other stabilizing or enhancing components, rather than simply evaluating the active ingredient, the most recent assessment for glyphosate considered the relative toxicity of technical grade glyphosate, glyphosate formulations, and the polyoxyethylene amine surfactant.

Recent Glyphosate Information (2015-2019)

Of all the proposed herbicides for use by CAL FIRE, the one likely to receive the most scrutiny and public concern is glyphosate (specifically as RoundUp) in its many commercial products. Several dozen reports have been reviewed for Roundup and glyphosate due in part to the public concern about the 2015 World Health Organization (WHO) designation as a Probable Carcinogen and the highly publicized court cases implicating Roundup exposure to the onset of Non-Hodgkins' Lymphoma (NHL). The juries in these cases have awarded several million dollars to the plaintiffs based on little actual demographically supported exposures to the product based primarily on studies reported to support the claims of diseases linked to glyphosate exposure. Results that challenge the claims of a disease linkage to glyphosate exposure (Williams et al. 2016) suggest that the claims are not supported by the actual exposure and carcinogenicity data. Of the numerous studies that counter the claim of linkages to diseases, especially cancer, one example using a large multi-state and region evaluation of farm workers and others, is provided by Koutros et.,al., (2017) "Glyphosate was not statistically significantly associated with cancer at any site, and in this large, prospective cohort study, no association was apparent between glyphosate and any solid tumors or lymphoid malignancies overall, including NHL and its subtypes".

The U.S. EPA publishes numerous notices of chemical cancellations annually. Notices in March 2015, in the table below, cancel registration for some glyphosate and imazapyr products under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) section 3 (7 U.S.C. 136a). These registrations are listed in sequence by registration number in the table below for the glyphosate products that are relevant to the CalVTP.

Product Cancellations

Registration No.	Company No.	Product name	Chemical name
000100-01135	100 Syngenta	ZPP 1560 AS Herbicide	Glyphosate diammonium salt.
000100-01293	100 Syngenta	Traxion GT	Glyphosate.
000100-01325	100 Syngenta	Flexstar GT Herbicide	Glyphosate; Sodium salt/fomesafen.
035935-00030	35935 Nufarm Limited,	Glyphosate Technical	Glyphosate.
035935-00033	35935 Nufarm Limited,	Glyphosate Technical	Glyphosate.
035935-00034	35935 Nufarm Limited,	Glyphosate Technical (NUP-05068)	Glyphosate.
035935-00037	35935 Nufarm Limited,	Imazapyr Technical	Imazapyr.

Glyphosate has come under increased scrutiny in the last few years as claims of carcinogenicity and endocrine disruption have been reported in the popular media. These two areas of public concern about the possible effects of glyphosate to humans are discussed in more detail below.

The U.S. EPA has classified glyphosate as Category III for oral and dermal toxicity (U.S. EPA 1993), and the isopropylamine and ammonium salts of glyphosate that are used as active ingredients in registered herbicide products exhibit low toxicity to mammals via the oral and dermal routes. Although no scientific evidence had unequivocally indicated that glyphosate is carcinogenic or mutagenic (U.S. EPA 1993), a recent report by the WHO (WHO, 2015) suggests that it "may probably be carcinogenic" although the WHO researchers fail to report a statistically significant finding. Use of the term "probably" generally indicates the linkage is not statistically defensible. The WHO report is a summary of discussions by a panel review convened specifically to update information on several chemicals, including the herbicides tetrachlorvinphos, parathion, malathion, diazinon, and glyphosate, in order to evaluate and update the existing information about the potential for adverse effects.

The lack of a definitive correlation between glyphosate and cancer by the WHO panel is due, in part, because the information and data provided in the reports contain numerous confounding factors. Because the WHO publication has received so much attention, this claim should be considered, but it is clearly not supported by the work of several other researchers (Rhomberg et al. 2012; Mink et al. 2012) who do not attribute any carcinogenic effects to humans from potential exposure to glyphosate. Glyphosate is poorly biotransformed in rats and is excreted via feces and urine; neither the parent compound nor its major breakdown product bioaccumulates in animal tissue (Williams et al. 2000).

In response to the WHO declaration that glyphosate is a "probable carcinogen," numerous scientists have called the designation into question. It has been shown that the WHO panel ignored negative results available to them. One critical report on the WHO designation is provided by an independent study by four expert panels that did a comparison of the results presented by the WHO panel but included other reports with conflicting conclusions (Williams et al. 2016) suggesting that "the available literature shows no solid evidence linking glyphosate exposure to adverse developmental or reproductive effects at environmentally realistic exposure concentrations".

The reports and data reviewed by WHO were supplemented by reports and data provided to WHO but not used in their report (reasons for rejection of those data by WHO were not supported by typical scientific discipline):

> **"*We decided to remove it because … you couldn't put it all in one paper*."** Aaron Blair, former epidemiologist at the US National Cancer Institute, explaining why new data on glyphosate and cancer were not reviewed or published by the WHO panel.

The conclusions of other (independent) panels are in sharp contrast to those of the WHO report. These new panels of experts and independent researchers reviewed all relevant information pertaining to glyphosate exposure, including animal carcinogenicity, genotoxicity, and epidemiologic studies. These panels reported that incidences of neoplasms in the animal bioassays were found not to be associated with glyphosate exposure on the basis that they lacked statistical strength, were inconsistent across studies, lacked dose-response relationships, were not associated with preneoplasia, and/or were not plausible from a mechanistic perspective. The overall weight of evidence from the genetic toxicology data supports a conclusion that glyphosate (including glyphosate-based formulations and glyphosate degradation products) "does not pose a genotoxic hazard and, therefore, should not be considered support for the classification of glyphosate as a genotoxic carcinogen" (Williams et al. 2016). The assessment of the epidemiological data found that the data do not support a causal relationship between glyphosate exposure and NHL. In fact, The American Cancer Society statistics list NHL as approximately four percent of all cancers and lists the following risk factors as contributing to development of this cancer: age, gender, ethnicity, geography, family history, as well as possible exposure to certain chemicals and drugs.

The claim of causal connection of glyphosate exposure and NHL is the basis of lawsuits (DeWayne Johnson v. Monsanto Company, et al. 2016) against Monsanto, the primary producer of glyphosate. During the trial, the plaintiff indicated that due to an accident during mixing he was "drenched" with concentrated Roundup. During the trial, he indicated that he was inadvertently drenched with Roundup/Ranger Pro after an equipment malfunction and was exposed to windblown sprays, a possible misuse of the product based on label guidance A universal premise in science is "correlation is not causation." "Weak correlations between the sporadic exposure to glyphosate and onset of NHL are insufficient to assign a finding of reasonable certainty of the source of the cancer." (National Association of Wheat Growers et al. v. Lauren Zeise (Director, California Office of Environmental Health Hazard Assessment [OEHHA] and Xavier Becerra [California State Attorney General]).

Numerous other independent researchers have challenged the validity of the WHO assessment on the carcinogenicity of glyphosate (Blair 2017, as detailed in a recent synthesis report (Kelland 2017)). Blair, a former panel member, has testified Roundup Products Liability Litigation MDL no. 2741, Case no. 16-md-02741-VC) that several published reports rebutting the assessment of the WHO panel were purposely not included by the WHO panel report. Note that the classification for glyphosate is 2A (Probably carcinogenic) by the International Agency for Research on Cancer (IARC) in contrast to the long-held classification of D (not carcinogenic) by U.S. EPA after decades of studies and evaluations. The disparity of results and studies on the carcinogenicity of glycogen is illustrated in the latest Agency for Toxic Substances and Disease Registry (ATSDR) Toxicity Profile for glyphosate in which the recognized classifications vary from D to A:

Disparity of Cancer Classifications

HHS	Carcinogenicity Classification	No Data	NTP 2016
EPA	Carcinogenicity Classification	Group D	IRIS1989
IARC	Carcinogenicity Classification	Group 2A	IARC 2017

On July 30, 2015, U.S. EPA released an updated review of its newer ("cutting edge") processes proposed for evaluation of Tier 1 endocrine-disrupting screening results for 52 chemicals. U.S. EPA hopes that more definitive, defensible recommendations for linking specific chemicals to potential endocrine-disrupting effects will result. More recently, the U.S. EPA evaluated whether glyphosate products are endocrine disruptors and determined that based on weight of evidence considerations using the laboratory mammals, no additional testing for mammals or wildlife was recommended for glyphosate. The results of the U.S. EPA

reviews have reported there was no convincing evidence of potential interaction of glyphosate exposure with the estrogen, androgen, or thyroid pathways (U.S. EPA 2015).

There have also been reported adverse effects on bees and butterflies. However, the impacts reported have generally been associated with indirect effects from foraging on treated vegetation (e.g., milkweed loss for butterflies) and effects outside of recommended label uses (Agrawal, et a; 2015).

Several additional panels were convened in Europe in response to the declaration by the IARC that glyphosate is probably carcinogenic. The conclusions of the independent panels are in sharp contrast to those of the WHO report. This new panel of experts reviewed all relevant information pertaining to glyphosate exposure, including animal carcinogenicity, genotoxicity, and epidemiologic studies. As a result, following their compiled results of the review of the evidence, the panels concluded that "the data do not support IARC's conclusion that glyphosate is a "probable human carcinogen" and, consistent with previous regulatory assessments, further concluded that glyphosate is unlikely to pose a carcinogenic risk to humans." Substantial other evidence, contrary to the IARC proclamation of carcinogenicity, supports the conclusion that impacts to human health from the use of glyphosate are not significant nor supported by all the data available to the IARC (Koutros et. al. 2018). In fact, conflicting information, suggesting that glyphosate is not carcinogenic, has been reported by the three other WHO agencies, including the WHO International Programme on Chemical Safety, WHO Guidelines for Drinking Water Quality and the WHO Core Assessment Group. Further, a 2018 report by Tarone, who is an accredited statistician, was critical of the IARC findings of glyphosate being a probable carcinogen and indicated that a re-examination of the animal studies cited by IARC resulted in a contrary finding.

Tarone concluded that the data used was scientifically deficient and could not corroborate the finding by the WHO panel on glyphosate. Tarone, and others (European Chemicals Agency, U.S. EPA), reported that the IARC panel highlighted certain positive results from rodent studies, which they relied upon in the deliberations, but ignored contradictory negative results from the same studies, and an inappropriate statistical test was used. The author concluded that when all of the relevant data from the rodent carcinogenicity studies of glyphosate are evaluated together, it is clear that there is not sufficient evidence supporting the notions that glyphosate as an animal carcinogen. Even a conclusion that there are low levels of animal carcinogenicity would be difficult to support (Helmut, et at. 2015, Tarone 2018).

Aaron Blair, an emeritus scientist at the U.S. National Cancer Institute, who led IARC's review of glyphosate, said these studies "would have made it less likely that glyphosate would meet the agency's criteria for being classed as 'probably carcinogenic (Blair 2017). The European Chemicals Agency concluded in March 2017 that "the available scientific evidence did not meet the criteria to classify glyphosate as a carcinogen." This assessment, like IARC's, looked for any potential cancer hazard glyphosate may pose to humans at any dose, not the actual cancer risk it poses at a specific dose.

As with the potential use of any chemical by the CAL FIRE if new information about the potential risk of a product becomes available, and it is shown that a scientific consensus indicates that a credible or even a hypothetical risk may be related to the use of the product could present a significant human health risk, it would be re-evaluated for use by CALFIRE. Generally, new information is provided and evaluated by any of the regulatory agencies that oversee the registration of these products. Historically, many products have been used, then retired, when the state of the science has evolved (e.g., Atrazine and 2,4-D). However, after decades of laboratory and field testing of glyphosate, the most compelling available evidence does not currently support the carcinogenicity of glyphosate.

While no other substantive reports or information have demonstrated relevant toxicity, endocrine disruption, or carcinogenicity links, it is likely that U.S. EPA will continue to provide updated reviews of the potential risks in the next several years. Current data indicate that glyphosate is non-toxic to humans. Therefore, no acute or chronic impacts to healthy or physiologically sensitive populations would occur from typical herbicide application under the CalVTP. CAL FIRE staff applying glyphosate, as described in the PEIR, would wear appropriate personal protective equipment (PPE) and incorporate relevant best management practices (BMPs) to minimize risk of ingestion, inhalation, or other contact with herbicides by applicators or the public.

Analysis of the current scientific evidence available demonstrates that CAL FIRE's proposed use of glyphosate would not result in significant impacts to human health. Further. the process of evaluation and registration of herbicides and pesticides used by CAL FIRE is overseen by the U.S. EPA, which released a draft risk assessment in December 2017 concluding that "glyphosate is not likely to be carcinogenic to humans" (U.S. EPA 2017a) (EPA-HQ-OPP-2009-0361-0068).

BIBLIOGRAPY AND REFERENCES IDENTIFIED 2015-2019

Borax

No new publications or reports generated between 2015-2019 were identified that would substantially alter the physiochemical characteristics or the potential effects to biota associated with exposure to Borax as described in Appendix HAZ-2.

Cleantraxx (oxyfluorfen & Penoxsulam)

Oxyfluorfen

No new publications or reports generated between 2015-2019 were identified that would substantially alter the physiochemical characteristics or the potential effects to biota associated with exposure to Oxyfluorfen as described in Appendix HAZ-2. U.S. EPA Reg. No 72167-32, 2007.

Penoxsulam

No new publications or reports generated between 2015-2019 were identified that would substantially alter the physiochemical characteristics or the potential effects to biota associated with exposure to Penoxsulam as described in Appendix HAZ-2. U.S. EPA Reg. No 62719-548, 2007.

Clopyralid

Recent Clopyralid Publications 2015-2019

Several recent publications refining the chemical characteristics information were identified but none that would substantially alter the basic information or characterization of the potential effects of clopyralid as indicated in the 2015 Appendix document.

Ahrens, C. & Kröger, 2017. F. Final report – Field soil dissipation study with one spring application of GF-1966 (Clopyralid) at one site in North EU and one site in South EU to bare soil in 2016 - 2017. Eurofins Agroscience Services, Stade, Germany; Eurofins Study S16-01795 DAS Study No. 160394.

Arena, M. D Aiteri, S Barmaz, A Brancato, et.al. 2018. Peer review of the pesticide risk assessment of the active substance clopyralid. European Food Safety Authority (EFSA)2018.

Autonomus 2018. Single Dose Toxicokinetics Study and Bone Marrow Determination of Clopyralid Spiked Impurities through Oral Gavage in CD-1 mice. DAS Study No. 171315.

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Hexazinone

Recent hexazinone Publications 2015-2019

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Imazapyr

Recent Imazapyr Publications 2015-2019

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Sulfometuron methyl

Recent Sulfometuron methyl Publications 2015-2019

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Triclopyr

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