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LAW GROUP

May 24, 2018

City of Chico Planning Department
Attn: Senior Planner Mike Sawley
PO Box 3420, Chico, CA 95927
mike.sawley@chicoca.gov
sent via electronic mail

Re: Stonegate Vesting Tentative Subdivision Map and General Plan Amendment / Rezone Draft Environmental Impact Report (SCH # 2016062049)

Dear Mr. Sawley,

We submit the following comments on behalf of our client, AquAlliance, in opposition to the Stonegate Vesting Tentative Subdivision Map and General Plan Amendment / Rezone Draft Environmental Impact Report (hereafter "Project" or "DEIR"). As noted in this letter and in comments separately submitted by AquAlliance, its members, and members of the public, the proposed Project should be thoroughly revised and reconsidered due to its significant, unanalyzed, and unmitigated impacts to the rare and endangered biological communities in the Project area, among other key issues of concern. We thank you in advance for your careful consideration of the numerous public comments and opposition you will receive regarding the Project, and we look forward to working with the City in this regard.

A. CEQA Overview

An EIR is an "informational document" meant to "provide public agencies and the public in general with detailed information about the effect which a proposed project is likely to have on the environment" and "demonstrate to an apprehensive citizenry that the agency has, in fact, analyzed and considered" the environmental impacts of a project. (*Center for Biological Diversity v. Dept. of Fish & Wildlife* (2015) 62 Cal.4th 204, 245, citations omitted.) As an informational document, CEQA "requires full environmental disclosure." (*Communities for a Better Environment v. City of Richmond* (2010) 184 Cal.App.4th 70, 88; see also Cal. Code Regs., tit. 14, § 15121, subd. (a) [hereafter Guidelines].) Although "technical perfection" is not required, an EIR must be "adequa[te], complete[], and a good-faith effort at full disclosure," with "informed and balanced" decisionmaking. (Guidelines, § 15003, subds. (i)-(j).) "[A]n agency must use its best effects to find out and disclose all that it reasonably can." (*Id.* § 15144.) For each of the reasons discussed, below, the DEIR falls short of CEQA's informational and substantive requirements, and should be revised and recirculated.

B. Biological Resources

The EIR fails to properly disclose, analyze, and mitigate impacts to biological resources. The Project Area contains several rare and unique biological resources with federal, state, and local protections. Critically, the Project Area contains core vernal pool habitat, which supports the federally-endangered Butte County meadowfoam ("BCM") and vernal pool tadpole shrimp ("VPTS") and the federally-threatened vernal pool fairy shrimp ("VPFS"). The EIR discounts the unique significance of these populations and proposes inadequate and undeveloped mitigation measures to attempt to make up for the destruction and disturbance of these habitats.

Butte County Meadowfoam

The DEIR acknowledges that the project Site contains approximately 16,542 individuals (5.14 acres) of Butte County meadowfoam. (DEIR IV.D-23.) Yet the DEIR leaves out a key detail: that the BCM surrounding the City of Chico are genetically unique from populations north and south of the City. (See generally Christina Sloop, Application of Molecular Techniques to Examine the Genetic Structure of Populations of Butte County Meadowfoam (*Limnanthes floccosa ssp. californica*) (2009).) The City was aware of this information, as the California Department of Fish and Wildlife ("CDFW") specially requested that the EIR consider it and use it when selected appropriate mitigation measures in a 2015 letter. (See CDFW Preliminary Comments (Nov. 19, 2015) at 2.) This information is critical to an understanding of the environmental setting, the project's impacts, as well as the feasibility and adequacy of any mitigation measures or alternatives.

The DEIR also fails to disclose the designation of the Project Site as core habitat under the U.S. Fish and Wildlife Service's ("USFWS") 2006 Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (hereafter Recovery Plan). Although the Project Site does not include designated critical habitat for the species, as the DEIR notes, the Site is designated as Zone 1 core habitat, "reflecting the highest priority areas" for BCM recovery. (See USFWS Preliminary Comments (Nov. 24, 2015) at 2; see also Recovery Plan at III-96.) As the Recovery Plan recognizes:

> designation of critical habitat may not include all of the habitat areas that may eventually be determined to be necessary for the recovery of the species. For these reasons, critical habitat designations do not I-3 signal that habitat outside the designation is unimportant or may not be required for recovery. Some areas within Zone 1 and Zone 2 core areas were excluded from critical habitat for economic reasons (U.S. Fish and Wildlife Service 2005), creating a discrepancy between the core area boundaries and critical habitat. We anticipate that some lands in recovery core areas outside of the areas designated as critical habitat will be necessary for recovery.

(Recovery Plan at I-2–3.) Therefore, although the Project Area is not designated BCM "critical habitat," this does not diminish the area's importance to the species' recovery. The Project Area is Zone 1 core habitat for BCM, and the City must disclose this information in the EIR and consider it when assessing the project's effects, and proposing mitigation measures and alternatives.

The DEIR further failed to mention the Project Site's prime soil type for BCM recovery. As mentioned in a 2015 letter to the City, the CDFW noted, "[t]he Draft Butte County Regional Conservation Plan (BRCP) . . . conducted an extensive analysis of the soil types known to support BCM, and used this to define primary and secondary modeled habitat for BCM." (CDFW Letter at 3.) The analysis determined that "[t]he Project site is located on primary modeled habitat for BCM." (*Ibid.*) The DEIR must disclose, evaluate, and consider this important information.

The City's failure to disclose the genetic uniqueness of the BCM populations affected by the Project and the area's prime habitat characteristics are violations of CEQA, which requires an agency to "use its best efforts to find out and disclose all that it reasonably can." (Cal. Code Regs., tit. 14, § 15144 [hereafter Guidelines].) As a result, the public and decisionmakers cannot fully evaluate and consider the Project's true impacts on BCM. "[O]nly through an accurate view of the project may the public and interested parties and public agencies balance the proposed project's benefits against its environmental cost, consider appropriate mitigation measures, assess the advantages of terminating the proposal and properly weigh other alternatives." (*City of Santee v. County of San Diego* (1989) 214 Cal.App.3d 1438, 1454.) By not disclosing the unique characteristics of these BCM populations and their habitat, the City has inaccurately described the existing environmental baseline, and the project's environmental effects.

Furthermore, the failure to disclose and consider the genetic uniqueness of the BCM populations in the Project Area results in inadequate mitigation and an inaccurate significance determination. The Project will result in a direct impact to 2.33 acres of occupied BCM habitat. (DEIR IV.D-52.) The DEIR calls these impacts "potentially significant impacts under CEQA unless mitigated to: (1) avoid a net loss of occupied habitat, or (2) provide a 19:1 ratio of preserved occupied habitat relative to the occupied habitat that would be directly impacted by the project and a 5:1 ratio of the same for indirect impacts." (*Ibid.*) The DEIR proposes on-site and/or off-site restoration, ultimately concluding that compensatory mitigation will reduce impacts to a less than significant level. (*Id.* at IV.D-52–53.)

However, given the genetic uniqueness of the BCM populations directly impacted by the Project, compensatory mitigation elsewhere, even at a 19:1 ratio, simply *cannot* reduce the Project's impacts to less than significant. Although the CDFW suggested "consider[ing] the genetically unique occurrences when selecting appropriate mitigation" in 2015, it appears the City has ignored this recommendation. (See CDFW Letter at 3.) *Any* direct impacts to BCM at the Project Site are significant and unavoidable. As the USFWS also noted in 2015, "[e]ven partial development of this site could potentially preclude our ability to achieve our recovery goal of 99% because the avoided Butte County meadowfoam habitat would likely be significantly and adversely impacted by edge effects of development." (USFWS Letter at 2.) Simply put, direct impacts to these BCM populations cannot be mitigated, and the City should either revise the Project to avoid impacts to BCM or revise its inaccurate determination that the impacts to BCM will be less than significant with mitigation.

The DEIR also fails to disclose and consider the negative edge effects of the 2.57 acres of occupied BCM habitat located on the proposed on-site open space preserve. (See DEIR at IV.D-52.) Instead, the DEIR discusses vague "indirect impacts." (*Id.*) Development near these populations, even if contained within the on-site preserve, "would likely be significantly and adversely impacted by edge effects of development." (*Ibid.*) A buffer, as proposed by the City, cannot mitigate these impacts. The City must disclose and evaluate these edge effects and revise its significance determination accordingly.

Additionally, the DEIR must fully explain the details of all mitigation banks. As requested by the CDFW:

> the Project EIR should provide specific detail on the direct, indirect, permanent and

> temporary impacts to all Special-Status Species habitats on-site and provide measures to reduce the impacts to below the level of significance pursuant to CEQA. Permanent impacts and loss of habitat require permanent habitat protection in the form of purchasing mitigation credits from a Department approved mitigation bank or providing suitable mitigation property that is secured by a recorded conservation easement, including a fully funded long-term management endowment, a designated 501.3.c certified non-profit management entity, and a management plan.

(CDFW Letter at 3.) The DEIR fails to mention any designated certified non-profit management entity, and the City must include this provision for any proposed mitigation measures involving mitigation banks. (See DEIR at II-25.) Without this information, the public and responsible agencies have not been assured that the DEIR's proposed mitigation measures are feasible and adequate.

Vernal Pool Tadpole Shrimp and Vernal Pool Fairy Shrimp

Similar to the impacts to BCM, the Project's impacts to the federally-endangered vernal pool tadpole shrimp and federally-threatened vernal pool fairy shrimp are significant and unavoidable, and the mitigation measures proposed by the City are inadequate. The DEIR states that the Project will result in direct impacts to 9.35 acres and indirect impacts to 4.51 acres of vernal pools and other aquatic resources, with the potential for an additional 0.16 acres impacted. (DEIR at IV.D-49.) "Project activities within these habitats may cause mortality and/or other adverse impacts to populations of vernal pool crustaceans present within the Study Area." (*Ibid.*) The DEIR does not propose any specific means to avoid or protect these areas, instead concluding that "[i]f VPFS and/or VPTS are either presumed present or determined by surveys to be present, and avoidance is not feasible, then impacts to their habitat shall be mitigated at a 2:1 ratio." (*Id.* at IV.D-50.)

Yet the DEIR again fails to mention that Chico is Zone 1 core habitat for both VPFS and VPTS, that the Recovery Plan recommends 80% of VPFS and VPTS occurrences be protected, and that 85% of VPFS habitat and 95% of VPTS habitat in Chico is suitable for protection. (Recovery Plan at III-103, 105.) Again, the DEIR's destruction of this important core habitat cannot be properly mitigated to less-than-significant levels with mitigation bank credits, and the City should either revise the Project to avoid impacts to VPTS and VPFS or revise its determination that these impacts will be less than significant with mitigation.

Mitigation Measures

The DEIR improperly defers mitigation measures and proposes mitigation measures that are not fully enforceable. CEQA requires mitigation measures to be "fully enforceable through permit conditions, agreements, or other measures." (See Pub. Resources Code, § 21081.6, subd. (b); Guidelines § 15126.4, subd. (a)(2).) "Formulation of mitigation measures should not be deferred until some future time." (Guidelines, § 15126.4, subd. (a)(1)(B).) An agency may defer formulating mitigation measures only when the it "commit[s] itself to specific performance criteria for evaluating the efficacy of the measures" and does not undertake "the 'activity' constituting the CEQA project . . . without mitigation measures being in place . . . ." (*POET, LLC v. Cal. Air Resources Board* (2013) 218 Cal.App.4th 681, 738.) This may be necessary where, for instance, "'practical considerations prohibit devising such measures early in the planning process . . . .'" (*Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1359, 1394, quoting *Sacramento Old City Assn. v. City Council* (1991) 229 Cal.App.3d 1011, 1028-1029.) In such a case, the agency would be required to "'commit itself to eventually devising measures that will satisfy specific performance criteria . . . .'" (*Id.*)

A significant issue is the deferral of the design of the Mitigation, Monitoring, and Reporting Program as required by CEQA. (See Pub. Resources Code, § 21081.6.) A monitoring program is required to "ensure compliance" with mitigation measures "during project implementation." (*Id.* § 21081.6, subd. (a)(1).) The DEIR states that the program "will be prepared as part of the Final EIR" (DEIR at I-9), but this step should be taking during the *draft* stage, when the document is subject to public review and comment and the agency is required to respond (see Pub. Resources Code, § 21081.6, subd. (c)). Mitigation measures must contain "complete and detailed performance objectives, which will be used to ensure compliance through the monitoring program." (*Ibid.*) There does not appear to be reason why development of a monitoring plan is not practical at this stage, and the City has not committed itself to any specific performance criteria for evaluating the efficacy of mitigation. (See *POET*, 281 Cal.App.4th at 738; see also *Gentry*, 36 Cal.App.4th at 1394.) The DEIR's deferral of this important task is in violation of CEQA, and the City must design a monitoring program and revise and recirculate the EIR prior to the final EIR stage.

Additionally, some of the specific mitigation measures the City proposes improperly defer key elements to a later date or lack enforceability. For instance, MM-BIO-1A (concerning special-status and nesting bird species) lacks provisions for continued monitoring by a qualified biologist, making enforcement of the measure difficult. (See DEIR at IV.D-46–47.) Without continued monitoring, the City will be unable to know if "an active nest becomes inactive" and work can continue. (*Id.* at IV.D-47.) Including continued biological monitoring provisions in the mitigation, monitoring, and reporting plan could alleviate these problems.

MM-BIO-1B improperly defers mitigation until a later date. The DEIR states that if roosting pallid bats are present during the maternity roosting season, no disturbance buffers will be established around roost sites. (*Id.* at IV.D-48.) Yet the DEIR improperly defers determination of the minimum buffer size, stating the size "depend[s] on existing screening around the roost site (such as dense vegetation), the roost type, species present, as well as the type of construction activity which would occur around the roost site." (*Ibid.*) Given the City knows the one species this measure refers to and the type of construction planned, it should have at least a minimum no disturbance buffer size, which would allow for some flexibility depending on the conditions. If developing this measure is not practical at this stage, the City must commit itself to specific performance criteria for evaluating the efficacy of mitigation. (See *POET*, 281 Cal.App.4th at 738; see also *Gentry*, 36 Cal.App.4th at 1394.)

MM-BIO-1C (concerning western spadefoot) also defers aspects of the measure to a later day. For instance, the measure includes "appropriate erosion-control measures," but provides only a list of potential measures without specifying which, if any, will be used. (DEIR at IV.D-49.) The City should evaluate potential measures and clearly state which ones will be used under which conditions, or commit itself to specific performance criteria. (See *POET*, 281 Cal.App.4th at 738; see also *Gentry*, 36 Cal.App.4th at 1394.) Otherwise, the measure lacks full enforceability and improperly defers the development of mitigation measures. (See Guidelines

§ 15126.4, subds. (a)(1)(B), (a)(2).)

MM-BIO-2B is another mitigation measure that improperly defers mitigation. The DEIR states that "[p]rior to the start of construction activities, the Applicant shall implement a comprehensive, adaptive Weed Control Plan for pre-construction and construction invasive weed abatement." (DEIR at IV.D-55.) The DEIR goes on to state features of the plan, many of which are at present vague and unenforceable, such as "[t]he timing of weed control treatment shall be determined for each plant species" and "weed infestations shall be treated prior to construction according to control methods and practices for invasive weed populations." (*Ibid.*) Without more specificity, this Weed Control Plan is not yet "fully enforceable through permit conditions, agreements, or other legally-binding instruments." (Guidelines, § 15126.4, subd. (a)(2).) To comply with CEQA, the City must develop the Weed Control Plan. (See Guidelines, § 15126.4, subd. (a)(1)(B).) Alternatively, it must explain why the plan is not practicable at this stage and commit itself to itself to any specific performance criteria for evaluating the efficacy of mitigation. (See *POET*, 281 Cal.App.4th at 738; see also *Gentry*, 36 Cal.App.4th at 1394.)

Similarly, MM-BIO-1C, MM-BIO-1D, MM-BIO-1E, MM-BIO-2A, MM-BIO-2B, and MM-BIO-4 all defer the design and development of aspects of these mitigation measures until consultation and coordination with the USFWS, CDFW, and/or the Army Corps of Engineers. The developer(s) applied to the Corps for a 404 permit and the Public Notice with a comment period took place from March 10, 2017 – April 10, 2017. It is our understanding that the permit process has been delayed due to the applicant's failure to provide the Corps with requested information. With the 404 and consultation processes in abeyance, the public and decisionmakers cannot evaluate or comment on proposed mitigation measures or know whether a proposed measure is fully enforceable. (See Pub. Resources Code, § 21081.6, subd. (b); Guidelines § 15126.4, subd. (a)(2).)

Staging, Spoils, and Borrow Sites

The DEIR fails to "include an analysis of the estimated impacts to habitat and species associated with all potential staging, spoils and transportation trip plan locations," as requested by the CDFW in its 2015 letter. (CDFW Letter at 3.) For all locations "where construction equipment, soil, rock or other materials will be stored, relocated to or staged for the Project," the "direct and indirect impacts associated with storage and spoils sites should be identified and analyzed as part of the Project as these sites may contribute to impacts to habitats and species and may require additional mitigation." (*Ibid.*) The DEIR's failure to disclose and evaluate these additional impacts is in violation of CEQA's requirement that an agency "use its best efforts to find out and disclose all that it reasonably can." (Guidelines, § 15144.)

Lake and Streambed Alteration

The CDFW also requested the EIR identify all areas subject to a lake and streambed alteration agreements. (CDFW Letter at 3-4.) Although the DEIR discloses that the Project is "potentially subject" to CDFW jurisdiction and may require a Streambed Alteration Agreement, the DEIR only generally identifies these locations as "[a]pproximately 8.86 acres of the project site, including intermittent streams, non-wetland swales, and riparian woodland communities." (DEIR at IV.D-40–41.) The City must identify with particularity the affected resources and potential impacts. As requested by CDFW in 2015, the EIR should have "includ[ed] a delineation of lakes, streams, and associated habitat that will be temporarily and/or permanently impacted by the proposed project including an estimate of impact to each habitat type," and its failure to do so is in violation of CEQA's disclosure requirements. (CDFW Letter at 4.) Identifying these locations at a later date prevents the public and decisionmakers from evaluating the Project's impacts on these resources.

Consultation and Take Permits

The DEIR recognizes that consultation with the USFWS and the CDFW will be a necessary part of Project planning and mitigation. We encourage the City to require that the Project applicant initiate consultation as soon as possible. (See USFWS Letter at 1 ["The Service believes that reinitiation of section 7 consultation is warranted."].) The City must also obtain proof that all required Incidental Take Permits and Authorizations from the wildlife agencies have issued prior to beginning construction. (See *ibid.* [discussing how the 1995 Biological Opinion authorized the incidental take of BCM, vernal pool tadpole shrimp, and vernal pool fairy shrimp]; see also CDFW Letter at 2 ["As currently proposed the Project would need to consult with the Department to obtain an Incidental Take Permit for take of a State-listed species (FGC § 2081)."].)

C. Project Alternatives

Commenters on the Project at the Notice of Preparation stage indicated their concern about the Project's impacts east of Bruce Road. (See DEIR Appx. B, Stonegate Vesting Tentative Subdivision Map Meeting at 25, 38.) An area of undeveloped space currently exists to the west of Bruce Road south of the proposed Project Site. An alternative with development only on the west side of Bruce Road is feasible and should be evaluated and considered by the City. The Project's 40+ acres west of Bruce could accommodate a significant number of residential units if a New Urbanist approach was taken. The Doe Mill Neighborhood north of 20th Street on the east side of Bruce Road has such development and produced an average of seven units per acre with a mix of densities. Another example of a compact neighborhood in another part of town, Westside Green, will average 12 units per acre of mixed uses and is an "eco-conscious development"[1] that is prized for its affordability and reflection of historic Chico. Eliminating the community commercial for the west of Bruce Road parcel as is suggested in the DEIR will enable the construction of significantly more residential units. The community commercial in the Stonegate proposal is not necessary with the significant existing commercial development a short distance to the west along Forest Avenue and 20th streets and what will be in walking distance in the Meriam Park development just north of 20th and west of Bruce Road.

Containing the Project to the west of Bruce Road would significantly reduce adverse impacts to species and habitats. The Schmidbauer BCM Preserve and the majority of the observed BCM populations on the Project Site occur on the east side of Bruce Road. (DEIR Figs. IV.D-3, IV.D-4.) The DEIR proposes direct impacts to 2.33 acres of observed BCM, the vast majority of which will occur on the west side of Bruce Road. (See DEIR Fig. IV.D-4.) Figure IV.D-3 reveals the undeveloped area south of the Project Site west of Bruce Road contains few, if any, BCM. (See DEIR Fig. IV-D-3.) It also proposes indirect impacts to 0.24 acres of observed

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[1] See Melissa Daugherty, *Greening the West Side* (May 24, 2007) Chico News & Review <https://www.newsreview.com/chico/greening-the-west-side/content?oid=325975>.

BCM, all of which occur west of Bruce Road. (See DEIR IV.D-4.) The Project Side west side of Bruce Road also contains the rare plant shieldbract monkeyflower. (See *ibid.*) Habitat-wise, the area east of Bruce Road contains a significant area of sensitive biological communities, including vernal pool habitat and seasonal wetlands, and, *unlike* the Project Site area west of Bruce Road, contains perennial marsh (1.24 acres), perennial drainage (5.12 acres), ephemeral drainage (0.30 acres), and intermittent drainage (0.48 acres). (See DEIR Fig. IV.D-2; see also DEIR at IV.D-3.)

Impacts to these rare, unique, and sensitive biological resources are significant and should be avoided. As discussed above, the BCM populations are genetically unique and exist on core BCM habitat and soil. (See CDFW Letter at 2, 3; see also Recovery Plan at III-96.) Also discussed above, these sensitive habitats are core Zone 1 habitats for the federally-threatened VPFS and federally-endangered VPTS. (Recovery Plan at III-103, 105.) Vernal pool habitat "provide[s] important foraging and resting habitat for waterfowl and shorebirds" and supports special-status wildlife including "western spadefoot (for aquatic breeding) and vernal pool branchiopods (fairy and tadpole shrimps), some of which are listed under the Endangered Species Act." (DEIR at IV.D-13.) Seasonal wetlands "provide hydrologic connectivity between vernal pools and other seasonal water features, facilitating the dispersal and movement of aquatic organisms," including western spadefoot, VPTS, and VPFS. (*Id.* at IV.D-14.) And Perennial marsh habitat supports "a variety of invertebrate species," "fishes and breeding by common amphibians," "foraging, shelter, and nesting by a variety of birds," and the rare shield-bracted monkeyflower. (*Id.* at IV.D-12, IV.D-24.) Given the greater prevalence of BCM and sensitive habitats supporting special-status species in the area east of Bruce Road, an alternative concentrating development west of Bruce Road would avoid the majority of significant impacts to these biological resources.

Yet the City quickly dismissed an "alternative involving development only west of Bruce Road." (DEIR at VII-3.) The lack of detail and further analysis of this feasible and less harmful alternative violates CEQA's requirements that an EIR "contain a meaningful discussion of both alternatives and mitigation measures," even if an "agency ultimately finds mitigation measures adequate or proposed alternatives infeasible." (*Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal. App. 3d 692, 731.) Furthermore, CEQA requires that "public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects." (Pub. Resources Code, § 21002.) Responsible wildlife agencies have long-supported an alternative for development only west of Bruce Road, and the courts have held that the alternatives considered in an EIR should not omit information that is highly relevant to a responsible agency's permitting function. (*Banning Ranch Conservancy v City of Newport Beach* (2017) 2 Cal.5th 918.) The City failed to even include this area as part of the Study Area, preventing the public from knowing the existing environmental conditions of that site and comparing the potential impacts of such an alternative with the proposed Project. (See DEIR Fig. IV.D-4.) The fact that this alternative would substantially lessen impacts on listed species and key habitats makes it one the City should have evaluated further. We urge that the City further evaluate this alternative and revise and recirculate the DEIR for public review and comment.

The DEIR fails to justify its determination that "[a]n alternative involving development only west of Bruce Road was rejected as infeasible as it would not meet most of the project objectives including the objectives to provide a significant number of single family (460 lots) and multi-family residential units (12.4 acres) to help meet the City's needs for housing. This alternative was further deemed infeasible, as it would not provide revenue to local businesses during project construction and operation in a financially feasible manner." (DEIR VII-3.) The DEIR states that the alternative would not meet "most" of the project objectives, which is facially untrue, as the DEIR includes eight project objectives, and argues that this alternative would not meet three of them. (See CEQA Guidelines § §§15126.4(a)(1), 15126.6(a) [alternative should meet most project objectives].) The DEIR's bias against this alternative is thus apparent from the outset.

In turn, to attempt to exclude this alternative, the DEIR fails to compare the alternative to the actual project objectives themselves, and instead creates new and artificially narrow objectives, asserting that this alternative would fail to provide 460 single family lots and 12.4 acres of multi-family residential units. But these precise figures are not actually included among the DEIR's stated project objectives. (See DEIR at III-22.) Instead, these numbers describe the project itself, which of course the alternative would not be equal to. (See DEIR at III-10; CEQA Guidelines §15126.6(a)–(b) [alternatives should not be excluded simply because they would impede attainment of project objectives "to some degree."]) To the extent the DEIR believes development of 460 single family lots and 12.4 acres of multi-family residential units actually do comprise the project objectives, such objectives are patently illegal as being so narrowly drawn that only the proposed project itself could meet them. (See, *North Coast Rivers Alliance v. Kawamura* (2015) 243 Cal.App.4th 647, 668 [Project objectives should not be so narrowly defined that they preclude consideration of reasonable alternatives for achieving the project's underlying purpose]; *Habitat & Watershed Caretakers v City of Santa Cruz* (2013) 213 Cal.App.4th 1277, 1299.) The CEQA Guidelines assume that the alternatives described in an EIR will not necessarily attain all of the project's objectives. *Watsonville Pilots Ass'n v City of Watsonville* (2010) 183 CA4th 1059, 1087. There is no requirement that the alternatives included in an EIR satisfy every basic objective of the project. *California Native Plant Soc'y v City of Santa Cruz* (2009) 177 CA4th 957, 991. And the DEIR fails entirely to analyze whether additional units could be built on the lots west of Bruce Road, to meet the City's housing goal objectives. The proposed developer already owns the lots west of Bruce Road, and it does not appear that including higher density development west of Bruce Road would preclude attainment of any of the draft project objectives. The DEIR should therefore analyze this alternative.

Finally, the DEIR fails to provide any support for its assertions that this alternative "would not provide revenue to local businesses during project construction and operation in a financially feasible manner." (DEIR VII-3.) This project objective is so vague and ambiguous as to impermissibly thwart CEQA's requirement that a "clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings." (CEQA Guidelines, § 15124, subd. (b).) Here, the overly vague and ambiguous project objective provides no guidance at all, and give the lead agency virtually unfettered discretion to interpret and apply it. Nowhere does the DEIR provide any explanation of how the proposed project would meet this project objective, nor how the rejected alternative would not. It is hard to imagine how significant construction west of Bruce Road would not still provide revenue to local businesses during project construction and operation. A determination that an alternative is not economically feasible must be supported by evidence and analysis showing that it cannot reasonably be implemented based on economic constraints. (See *Kings County Farm Bureau v City of Hanford* (1990) 221 Cal.App.3d 692, 737; *Center for Biological Diversity v County of San Bernardino* (2010) 185 Cal.App.4th 866, 884 [claim of economic infeasibility must be based on "meaningful comparative data" coupled with supporting evidence]; *City of Fremont v San Francisco Bay Area Rapid Transit Dist.* (1995) 34 Cal.App.4th 1780, 1787.)

D. Pesticide Impacts

The DEIR fails to assess numerous potentially significant impacts resulting from additional pesticide applications at the Project site. In fact, the DEIR only mentions the word "pesticide" two times, stating:

> Increased urban pollutants, such as petroleum products from automobiles, and fertilizers, herbicides, and **pesticides** associated with the suburban development may contribute to long-term degradation of water quality. These indirect impacts and appropriate mitigation are discussed in detail in Section IV.I, Hydrology and Water Quality, of this Draft EIR. (DEIR IV.D-60.)
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> Stormwater discharges are affected by urban pollutants that contribute to the degradation of water quality in surface waters near the project site. Urban pollutants in stormwater include petroleum hydrocarbons, sediments, metals, **pesticides**, and trash. Past, current and reasonably foreseeable projects in the vicinity of the project site could result in cumulative impacts associated with stormwater discharges, similar to the potential impacts from construction of the proposed project. (DEIR V-7.)

This is a woefully inadequate analysis of a potentially significant impact. The DEIR cannot simply rest on the assumption that compliance with California's Phase II Municipal Stormwater Permit will avoid this impact. For example, in April of 2018, U.S. EPA approved revisions to the State of California's "303(d)" list of impaired water bodies, at that time adding 225 *additional* waterways to the list that are impaired by pesticide toxicity.[2] Clearly the mere existence of applicable Clean Water Act permits has not reduced or avoided this significant effect throughout the state. In particular, a vexing statutory gap exists between the regulatory authority of the State and Regional Water Boards, who adopt permits implementing the Clean Water Act, and the State Department of Pesticide Regulation, which regulates the application of pesticides, but has no jurisdiction over discharges to waters of the state and United States. As a result, Clean Water Act permits leave significant discretion and flexibility to regulated parties in ways that, as demonstrated by the 225 newly added impaired waterways, fail to actually protect water quality. Therefore, the DEIR must do more than allude to the existence of applicable CWA permits to reasonably assess the potentially significant effects of this project. A full explication of when, where, how, and what pesticides may be applied in the project area as a result of the proposed project, and what the ultimate receptors for those pesticide applications might be, is required.

California Proposition 65 prohibits the discharge of pesticides listed under Prop 65 into any drinking water source, in any amount. CWA permits do not regulate this. The DEIR therefore must analyze what pesticides may be used by the proposed project, whether they are

[2] https://www.waterboards.ca.gov/rwqcb5/water_issues/tmdl/impaired_waters_list/2014_int_rpt_dev/2014_2016_int_rpt/2018_0406_usepa_appr_ltr_final.pdf

included on the list of Prop 65 pesticides, and whether such pesticides would be put into the environment in any place that they may pass into a ground or surface drinking water source.

Pesticides are also known to be particularly harmful to certain protected, threatened, and endangered species, and U.S. EPA has developed a robust and growing program to help project planners ensure that their pesticide usage will not result in take of endangered species or adverse modification of critical habitat.[3] The DEIR must undertake a reasonable and good faith investigation into these potential project effects and impacts, the combinations of which are too many to fully cover in this comment. For example, the California Department of Food and Agriculture produced an Environmental Impact Report showing levels of concerns were exceeded for Sacramento splittail, arroyo chub, desert pupfish, riparian brush rabbit, tricolored blackbird, western yellow-billed cuckoo, purple martin, yellow rail, certain amphibians, aquatic invertebrates such as fairy shrimp, pollinators, terrestrial insects, and other species.[4] This DEIR, while acknowledging that some of these species reside in the proposed project area, and that the proposed project would result in an increase in pesticide application in the area, fails to analyze the effects that those pesticides would have on these species.

E. Public Utilities

The DEIR fails to meaningfully describe wastewater flows from the project to the wastewater treatment plant in its analysis of potentially significant effects. The DEIR simply states “The Chico treatment plant has a capacity to treat 9.0 mgd but currently receives 7.0 mgd from Cal Water’s Chico service area. The net increase of 0.2099 mgd attributable to the proposed project represents a little more than three (3) percent of flows received from the Cal Water service area (7.0 mgd), and would not exceed the capacity of the treatment plant.” However, flows to the wastewater treatment plant—or from the project site—are not uniform each and every day. Here, it appears that the treatment plant is approaching its maximum capacity, and increases in flows due to wet weather could exceed that capacity. Indeed, the DEIR is internally contradictory on this point, elsewhere stating “as of 2006, the average daily dry weather flow is approximately 7.2 mgd. Table 4.12.5-3 of the General Plan EIR described the project wastewater flows through the year 2025, projecting 11.8 mgd for the year 2015, 13.5 mgd for the year 2020.” (DEIR IV.P-1.) These figures appear far higher than the 7.0 mgd the DEIR uses in its analysis, which should accordingly be revised to provide an accurate assessment of the project’s environmental effects.

In addition, the DEIR should reduce its significant greenhouse gas generating impacts by requiring that all homes built be powered by solar energy. Just this month the California Energy Commission adopted a rule to require most new homes built in California after January 1, 2020, to be built with rooftop solar panels. The DEIR does not present a clear timeline for construction of this proposed development, but, it is quite possible that some homes would be built after January 1, 2020. Given how near the January 1, 2020 deadline is, there is nothing inherent in that arbitrary date that will make mandatory rooftop solar feasible after that date, but not before. Accordingly, requiring rooftop solar on all new homes is a potentially feasible mitigation measure for the proposed project’s significant greenhouse gas impacts that the DEIR should evaluate and impose now.

[3] https://www.epa.gov/endangered-species
[4] https://www.cdfa.ca.gov/plant/peir/

One unaddressed source of potentially adverse impacts to both human health and the environment is the use of utility poles treated with pentachlorophenol. These utility poles have been documented to drip dioxins and other carcinogenic materials into the surrounding environment, including human contact, and accumulation in sediments of aquatic habitat, resulting substantial endangerment to public and environmental health, and potentially resulting in violations of the federal Resource Conservation and Recovery Act, the federal Endangered Species Act, and California Proposition 65. (See Attachment 1; *Ecological Rights Foundation v. Pacific Gas & Electric Company*, 874 F.3d 1083 (9th Cir. 2017).) PG&E itself, for example, circulates public notification stating:

> The Safe Drinking Water and Toxic Enforcement Act of 1986, commonly referred to as Proposition 65, requires the governor to publish a list of chemicals "known to the State of California" to cause cancer, birth defects or other reproductive harm. It also requires California businesses to warn the public quarterly of potential exposures to these chemicals that result from their operations.
>
> Pacific Gas and Electric Company (PG&E) uses chemicals in our operations that are "known to the State of California" to cause cancer, birth defects or other reproductive harm.
>
> For example, PG&E uses natural gas and petroleum products in our operations. PG&E also delivers natural gas to our customers and uses wooden utility poles treated with wood preservatives. Petroleum products, natural gas and their combustion by-products and wood preservatives contain chemicals "known to the State of California" to cause cancer, birth defects or other reproductive harm.[5]

These chemicals should be evaluated for their potential to become entrained and discharged in stormwater runoff, including potential human and special status species receptors in the stormwater pathway, as well as the ultimate discharge location. The DEIR, however, is unclear whether utility poles treated with pentachlorophenol would be used, where they and utility rights of way would be located, and where stormwater would be directed and infiltrated. The DEIR should evaluate this exposure risk, and feasible mitigation measures and alternatives, such as the use of composite, recycled material poles, buried utility lines, or other measures.[6]

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[5] https://www.pge.com/includes/docs/pdfs/myhome/myaccount/explanationofbill/billinserts/5.16_Prop65.pdf

[6] See, e.g.,

https://www.utilityproducts.com/articles/print/volume-8/issue-6/product-focus/line-construction-maintenance/use-of-composites-increases-in-the-utility-and-telecommunication-industries.html

http://electricenergyonline.com/show_article.php?article=243

https://www.king5.com/article/tech/science/environment/pse-installed-toxic-utility-poles-in-kenmore-wetland/346507066

https://archive.epa.gov/epawaste/conserve/smm/wastewise/web/txt/util.txt (Chapter 3)

F. Conclusion

Thank you again for your careful consideration of these comments. As is apparent, the proposed Project would result in numerous significant and unavoidable impacts that the DEIR fails to adequately assess. AquAlliance urges that the proposed Project be denied, or that DEIR be revised and recirculated to correct these deficiencies, including full evaluation of an alternative to the proposed Project to limit development to the west side of Bruce Road.

Please feel free to contact us at any time, for any reason.

Sincerely,

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ATA Law Group
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ATTACHMENT 1

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ECOLOGICAL RIGHTS FOUNDATION

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA

ECOLOGICAL RIGHTS FOUNDATION,

Plaintiff,

v.

PACIFIC GAS AND ELECTRIC COMPANY,

Defendant.

Civil Case No.: C10-00121 RS

DECLARATION OF WILLIAM J. ROGERS IN SUPPORT OF PLAINTIFF'S MOTION FOR PARTIAL SUMMARY JUDGMENT ON RCRA CLAIM

Hearing date: August 21, 2014
Time: 1:30 PM
Location: Courtroom 3, 17th Floor

I, William J. Rogers, hereby declare under penalty of law that the following is true and correct:

1. I have personal knowledge of the facts stated herein and would testify as to the truth of these facts if called to do so. I submit this declaration in support of Ecological Rights Foundation's ("ERF") Motion for Summary Judgment on its RCRA Claim

2. I am a Full Professor and Senior Researcher in Environmental Science at West Texas A&M University. I served until recently as Associate Dean of Academic and Research Environmental Health, Safety and Compliance responsible for all aspects of student and research faculty and staff health and safety. As shown in my attached curriculum vitae, I have a doctorate in Fish and Wildlife Science specializing in environmental and ecological risk assessment and modeling of contaminant effects. I also have a Bachelors of Science degree in Biology and Masters of Science degree in Biology. I am also a member of the Institute of Hazardous Materials Management and a Certified Hazardous Materials Manager at the highest level (Masters Level # 1694). I am also a member of the Society of Environmental Toxicologists and Chemists (SETAC), member of the Society of Risk Assessment, editorial board member and scientific and technical reviewer for the journal *Ecotoxicology* and a working member of the Texas Commission on Environmental Quality (TCEQ) Ecological Risk Working Group.

3. I have specific experience in human health, environmental and ecological risk assessment from exposure to heavy metals, chlorinated organic compounds including PCBs, Dioxins/Furans, PAHs and pesticides, hydrocarbons and industrial wastes. Specific work includes testing and evaluation, development of "ecological protective cleanup levels" and site remediation of those chemicals. I am the principal investigator for the TCEQ effort to develop ecological "protective cleanup levels" for chemical contaminants in specific habitats found in Texas. I have provided support to the United Nations Environmental Program, World Bank and United Nations Food and Agricultural Organization on environmental cleanup, human health risk assessment and environmental monitoring in Azerbaijan, Russia and Romania. I have served as an advisor to the Chlorine Manufacturers Association Board addressing human health and environmental effects of "persistent toxic bio-accumulating chlorinated chemicals (PTBs)" and have written a position paper on the risk and cleanup of "persistent organic

pesticides (POPs)" for the World Bank. I served as the southwest regional coordinator on the Secretary of Interior's Task Force on Selenium and Other Toxic Substances (with independent National Academy of Science panel oversight) and organized both screening level and detailed human health and environmental risk assessments for all Dept. of Interior water supply and irrigation projects in the Southwestern United States. I have managed large-scale human health and ecological risk assessments at such sites as the Department of Energy Pantex Nuclear Weapons Plant and Oak Ridge National Laboratories. I was the principle author of the Ecological Risk Assessment Program Plan for Evaluation of Waste Sites on the Department of Energy Savannah River Plant. I have over 35 years of experience in virtually all aspects of environmental risk assessment, restoration, and protection. I have publications and numerous presentations that deal directly with human, environmental and ecological risk assessment. A listing of my publications and technical papers are included in my attached curriculum vitae (Exhibit A). I have taught and continue to teach Ecological Risk Assessment at the university masters level and Agricultural Human/Environmental Health Risk Assessment at the doctoral level.

4. I am also qualified by the U.S. Fish and Wildlife Service in instream flow methodology, which studies the effects of scouring flows and maintenance of aquatic habitats. I have conducted numerous studies in sedimentation and basic scouring flow requirements and removal of sediments during my nine-plus years with the Bureau of Reclamation, which is an agency that builds dams and manages water and sediments. In addition, I have over twenty years of experience in modeling chemical fate and transport. For my doctoral research I developed an integrated contaminant fate and transport model based ecological risk assessment model. I have over twenty years of conducting human health risk assessments and the conduct of contaminant natural attenuation and both physical and biological fate and transport in the environment. I have conducted sediment load studies, sediment scouring and loading assessments, as well as flow effects on streambed morphology and sediment transport.

5. I am familiar with the procedures, methods and models used in environmental, human and ecological risk assessment as well as those used in laboratory analytical work and EPA accepted quality assurance and validation requirements. I am compensated at a rate of $150.00/hr for technical work and at a rate of $200.00/hr. for testimony.

6. I was retained as an expert by Ecological Rights Foundation ("ERF") to assess the pollutant characteristic and ecological impacts from storm water discharged from Pacific Gas and Electric ("PG&E")'s corporation yards located at: (1) 4801 Oakport Street, Oakland, California ("Oakport Facility"), (2) 24300 Clawiter Road, Hayward, California ("Clawiter Facility"); (3) 1099 West 14th Street, Eureka, California ("West 14th St. Facility"); and (4) 2475-2555[1] Myrtle Avenue, Eureka, California ("Myrtle Facility") (collectively "the Facilities"). I have performed a screening level risk assessment, comparing the levels of pollutants detected in sediment, soil and water samples collected at the Facilities to various regulatory benchmarks utilized by regulators and risk assessors as screening tools to determine whether pollutants are present at elevated levels in a fashion that warrants further investigation.

7. Ecological risk assessment is based on a weight-of-evidence approach using multiple lines of evidence. The benchmarks I used include various environmental screening values that are regularly used by EPA, the California Water Resources Control Board, Regional Water Quality Control Boards and other regulatory agencies as standards for screening level risk assessments for ecological risk and human health. These benchmarks were developed based upon supporting data showing that in many circumstances the presence of pollutant levels exceeding these benchmark values are correlated with adverse impacts on organisms ("eco-receptors"). I performed the comparisons as one step in my evaluation of whether various pollutants are present or are likely present in storm water discharges from the Facilities or in surficial sediments/grit at the Facilities that may be discharged from the facilities to San Francisco or Humboldt Bays.

8. For this screening-level ecological risk assessment, I reviewed selected historical documents on the properties as well as documents that provide needed background information on the site land use, surrounding sites land use, habitats found on site and expected aquatic and terrestrial

[1] PG&E operates a business office in addition to the service center at this address. The office, which is adjacent to and surrounded by the corporation yard are both on one contiguous parcel. PG&E apparently uses both addresses to refer to this facility.

species. I reviewed photographs and video images of the Facilities. I have reviewed peer-reviewed studies and toxicity testing and relied in part on the results of those studies. I have used standard scientific methods and procedures in the analysis of potential for environmental and ecological adverse risks that can be or have the potential to be attributable to contaminants found on and associated with activities at the PG&E Facilities. I have utilized specific literature sources from state, federal and scientific sources as referenced throughout the report. I have relied on the samples collected by SWAPE and analytical testing conducted by TestAmerica as referenced throughout the report. I reviewed climatic and precipitation data for the San Francisco Bay and Eureka, California areas. I also reviewed the expert report of Matthew Hagemann and his Declaration in Support of Plaintiff's Motion for Partial Summary Judgment on Clean Water Act Claim ("Hagemann Declaration") and the expert report of David Parker and his Declaration in Support of Motion for Summary Judgment, Clean Water Act Claims ("Parker Declaration").

9. Field samples of soil/sediment and surface water were collected by SWAPE at four PG&E sites that ultimately drain to either San Francisco Bay or Humboldt Bay as follows:

San Francisco Bay

4801 Oakport St., Oakland, CA (Oakport)

24300 Clawiter Rd., Hayward, CA (Clawiter)

Humboldt Bay

2475-2555 Myrtle Ave. Eureka, CA (Myrtle Ave)

14th St and Railroad Ave., Eureka, CA (14th Street)

10. I have reviewed the sampling protocol used by SWAPE, local and regional climatic data on the sampling dates, chain-of-custody and laboratory receipt of samples documentation, the laboratory quality assurance and control data documenting the usability of the collected data. I applied the EPA Contract Laboratory Program protocol for validating data and I conclude that the data in the packages

was usable for risk assessment. The Oakport site and Clawiter site samples were delivered to Test America on February 16th, 2011 and the Myrtle Ave. and 14th St. samples were delivered to Test America on March 19, 2011. A summary of the results is included as Exhibit B along with Clean Water Act section 303 water quality standards applicable to San Francisco and Humboldt Bays and their tributaries, U.S. Environmental Protection Agency ("EPA") Benchmark values, the San Francisco Bay Regional Water Quality Control Board Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater (ESLs), and the California State Water Resources Control Board General Industrial Permit Order 97-03-DWQ benchmarks to assist in identifying potential pollutant constituents. Additional screening benchmarks are included in the "Screening Benchmarks" section of this report which specifically addresses dioxins and furans as well as PCP along with discussion on the rationale for the use of those screening values. Screening benchmarks and the screening analysis was presented as background to identify potential pollutant constituents occurring in the sampled media.

Background and Environmental Setting

San Francisco Bay

11. San Francisco Bay and the Delta region of California form the largest estuary on the Pacific coast of the United States. It is a shallow, productive estuary that covers up to about 1,600 square miles and drains more than 40 percent of the state, or 60,000 square miles (OEHHA 2011 from California Academy of Sciences 2010). An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater. San Francisco Bay consists of three parts: North, Central and South. The northern part, San Pablo Bay, is connected to Suisun Bay by the Carquinez Strait, which receives water from the Sacramento River and San Joaquin River. The water then flows into the central largest portion, San Francisco Bay and joins the Pacific Ocean by the Golden Gate. Salinity and water circulation patterns in the northern and central portions of the bay are controlled by freshwater from the Sacramento and San Joaquin Rivers. Circulation patterns and salinity of the southern part of the bay are regulated by a combination of ocean and northern bay waters (OEHHA, 2011 from California Academy of Sciences, 2010). The entire San

Francisco Bay estuary includes San Pablo Bay, Suisun Bay, San Francisco Bay and five other bays: Honker, Richardson, San Rafael, San Leandro and Grizzly (OEHHA, 2011 from BCDC, 2010).

12. San Francisco Bay is an important habitat for birds and marine mammals and acts as a staging and wintering area for approximately one million migratory waterfowl and one million shorebirds. It serves as a breeding habitat for many species of birds and contains a significant resident breeding population of Pacific harbor seals (Grigg 2003). California's Dungeness crab, California halibut, and Pacific salmon rely on the bay as a nursery. The bay also serves as habitat for populations of two of California's endangered birds, the California clapper rail (EPA 2010) and the California least tern (CDPR 2012). The bay is also home to the San Francisco Bay National Wildlife Refuge Complex, a collection of seven National Wildlife Refuges administered by the US Fish and Wildlife Service.

13. San Francisco Bay was listed in the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments for numerous contaminants including dioxin compounds (including 2,3,7,8-TCDD), furan compounds, PCBs and dioxin-like PCBs (SFRWQCB 2007). The Office of Environmental Health Hazard Assessment (OEHHA; 1994) issued fish consumption advisories for San Francisco Bay and limited fish consumption based on potential consumer risk. In 2000 EPA and the San Francisco Estuary Institute found concentrations of dioxins in white croaker, shiner surfperch, and striped bass that exceeded human health screening levels (EPA 2000b). Although PCBs accounted for 80% of the TEQ contamination, levels of dioxin alone exceeded levels considered to be safe for human health. In 2011 OEHHA issued a new Health Advisory and Safe Eating Guidelines for San Francisco Bay fish and shell fish which recommended further restriction based on species of fish and shell fish (OEHHA 2011). The 2011 advisory further expanded the list of species that should not be consumed under any circumstances and further restricted the weekly consumption of other species.

14. Polychlorinated dioxins (PCDDs) and polychlorinated furans (PCDFs); are produced via a number of processes including incineration of wastes, production of bleached wood pulp, herbicides, and chlorophenolic wood treatment products. There are very few sources of naturally occurring dioxins, forest fires being the primary source. The San Francisco Bay area has known background levels of PCDDs and PCDFs. In collaboration with NOAA, USEPA (2000a) sampled 99 locations in the San

Francisco Bay region and found a median and mean PCDD/F concentration (TEQ) of 2 and 5 parts-per-trillion (ppt) dry weight, respectively.

PG&E's San Francisco Bay Site Descriptions

15. 24300 Clawiter Rd., Hayward CA Site (Clawiter): The Clawiter site is located on the south side of San Francisco Bay, approximately 2 miles east of the shoreline. During a rainfall event, runoff from the Hayward site is discharged to a municipal storm sewer system which deposits storm water into a flood control channel near the intersection of West Street and Clawiter Road. The discharge channel discharges into San Francisco Bay just north of the San Mateo Bridge. Since the sites drains into the San Francisco Bay estuary which is dominated by saltwater from the Pacific Ocean, sediment and water concentrations were compared to benchmarks protective of marine organisms.

16. 4801 Oakport St.,Oakland, CA (Oakport site): The Oakport site is located on the north side of San Leandro Bay, directly adjacent to the East Creek Slough which drains into San Leandro Bay. During a rainfall event, runoff from the Oakland site is transported downslope into an outfall that feeds into the San Leandro Bay. Since San Leandro Bay is dominated by saltwater from the Pacific Ocean and is inhabited by saltwater/marine fauna, sediment and water concentrations were compared to benchmarks protective of marine organisms.

Humboldt Bay

17. Humboldt Bay is a natural bay and a multi-basin, bar-build coastal lagoon located along the rugged North Coast of California entirely within Humboldt County. It is second only to San Francisco Bay in size. It is the site of the largest commercial oyster production operation in the state. Humboldt Bay and its tidal sloughs are open to fishing year-around and the bay is home to a national wildlife refuge complex for the protection of wetlands and bay habitats for migratory birds. The bay is a source of subsistence and commercial fishing for a variety of saltwater fish, crustaceans and mollusks. The bay is also used by over 300 species of birds and is a key part of the Pacific Flyway. Large numbers of Great Egrets nest in colonies in and around Humboldt Bay, and rely on fish and aquatic invertebrates for sustenance. The bay is also listed as one of the most important stopovers for the Pacific Brant, which rest and feed on large eelgrass beds prior to their migration to their nesting grounds in Alaska.

18. Humboldt Bay was listed in the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments for dioxin toxic equivalents and PCBs (Eureka Plain HU, Humboldt Bay; NCRWQCB 2007). This listing was based on multiple lines of evidence that indicated exceedance of OEHHA's screening level of 0.3 ppt dioxin TEQ in fish tissue. Mussels sampled in Humboldt Bay had dioxin concentrations ten to forty times higher than mussels collected outside the bay. A composite oyster sample collected in the bay contained a dioxin level of 10.9 parts-per-trillion, over 36 times the OEHHA screening value. In 2010, the California North Coast Regional Water Quality Control Board decided not to delist from the 303(d) list due to numerous exceedances of the OEHHA screening level in fish tissue (NCRWQCB 2010). The decision also noted a number of exceedances of sediment quality guidelines for protection of Marine Habitat Beneficial Use.

PG&E's Humboldt Bay Site Descriptions

19. 2475-2555 Myrtle Ave., Eureka CA (Myrtle Ave. site): The Myrtle Ave. site is located approximately one mile south of Arcata Bay, which is a tidally influenced estuary that makes up the north end of the larger Humboldt Bay. During a rainfall event, runoff from the Myrtle Ave. site is transported via the Humboldt County storm water System which discharges into Third Slough. Since the site drains directly into a estuarine system (freshwater/brackish stream), and flows into a saltwater estuary downstream, sediment and water concentrations were compared to benchmarks protective of both marine and freshwater aquatic organisms.

20. 1009 West 14^{th} St. and Railroad Ave., Eureka, CA (14^{th} St. site): The 14^{th} St. site is located on the west side of Eureka, approximately one quarter mile east of Humboldt Bay. During a rainfall event, runoff from the 14^{th} St. site is transported via the City of Eureka storm water system which discharges into Humboldt Bay through an outfall at the foot of West 14^{th} Street. Since this area of Humboldt Bay receives tidal influx from the Pacific Ocean, sediment and water concentrations were compared to benchmarks protective of marine organisms.

Toxicological Profile of Dioxins and Furans

21. Polychlorinated dibenzo-p-dioxins (PCDDs or "dioxins"), dibenzo furans (PCDFs or "furans") (sometimes collectively referred to collectively as "dioxins"), and biphenyls (PCBs) constitute

a group of persistent environmental chemicals. Polychlorinated dibenzo-p-dioxins occur as 75 different isomers. There are 22 possible tetrachlorodibenzo-p-dioxin isomers, but only one isomer that contains chlorines at only the 2,3,7, and 8 positions. 2,3,7,8-TCDD is formed from the incineration of wastes and production of bleached wood pulp and paper. It also occurs as a contaminant in the manufacture of various pesticides (HSDB, 2012). Dioxins and furans are also common impurities in pentachlorophenol (PCP) wood treating products (Geomatrix, 2007). The California State Water Resources Control Board analyzed commercial PCP products and found high concentrations of dioxin and furan congeners in PCP products (Palmer et al. 1988). PCP is used as a heavy duty wood preservative (for telephone poles and railroad ties).

22. As reported in the ATSDR, utility telecommunication and railway right-of-ways may be contaminated by leaching of dioxins associated with chlorophenol-treated railway ties and utility poles. A study in British Columbia showed that PCDDs and PCDFs were not detected in parkland ditch sediments (control area), but were detected in farmland, utility, and railway right-of-way ditch sediments (Wan and van Oostdam 1995). Total mean PCDD concentrations (mainly OCDD and HpCDD) ranged from 18.8 to 277 ng/kg (ppt) (dry weight) in ditch sediments and ballasts respectively. Concentrations of PCDDs were much higher in ditch sediment adjacent to utility poles (mean 2,576 ng/kg (ppt) [dry weight]) than in sediment 4 meters downstream (14 ng/kg CDDs [dry weight]) or 4 meters upstream of the utility poles (not detected). CDD concentrations in ditch water were also higher close to the poles (mean 13,142 ng/L [ppt] than 4 meters downstream of the poles (mean 4,880 ng/L [ppt]). The authors concluded that utility poles and railway ties are a potential constant source of CDD/CDF contamination to both water and sediment in aquatic environments through ditch runoff. (ATSDR pp441-442)

23. Several PCDDs and PCDFs have been shown to cause toxic responses similar to those caused by 2,3,7,8-TCDD which is considered the most potent of the congeners. The toxic responses include dermal toxicity, immunotoxicity, carcinogenicity and adverse effects on reproduction, development and endocrine functions (WHO 1998). To facilitate both ecological and human risk assessment the World Health Organization (WHO) assembled a panel of experts to develop "Toxicity Equivalent Factors (TEFs)" which are applied to the specific congeners to provide a "Toxicity

Equivalent Quotient (TEQ)" to 2,3,7,8-TCDD. The TEFs were developed for Humans/Mammals, Fish and Birds due to the varied toxic response by the receptor groups. In 2005, WHO updated the TEF tables slightly modifying some of the TEFs. The TEF for each PCDD/PCDF congener is summed to give a total toxicity equivalency quotient (TEQ). Concentrations of PCDD/PCDFs are reported using the human/mammal TEQ unless otherwise noted. The EPA In its recent "Reanalysis of Key Issues Related to Dioxin Toxicity in Response to NAS Comments, Volume 1" (February 2012) reconfirmed the use of the WHO, 2005 TEQs for human/mammal receptors.

ATSDR Toxicological Profile for Chlorinated Dibenzo-p-Dioxins

24. Due to their hydrophobic nature and resistance toward metabolism, dioxins and furans accumulate in fatty tissues of animals and humans. The Department of Health and Human Services (DHHS) has determined that it is reasonable to expect that 2,3,7,8-TCDD may cause cancer. The EPA has determined that 2,3,7,8-TCDD is a probable human carcinogen when considered alone and when considered in association with phenoxy herbicides and/or chlorophenols. The EPA has determined also that a mixture of CDDs with six chlorine atoms (4 of the 6 chlorine atoms at the 2, 3, 7, and 8 positions) is a probable human carcinogen.

25. Due to the high likelihood that the dioxins and furans remain in the fatty tissues of the host organism, contaminants in the host will ultimately be passed on to upper trophic level predators in a process called biomagnification. This places high trophic level predators like game fish, marine mammals, eagles and humans that feed on the prey at the greatest risk. As such, compounds at sub-detectable levels in environmental media can be found at high levels in upper trophic level organisms.

26. The degree to which chemicals biomagnify in ecosystems can be estimated using bioconcentration factors. Bioconcentration factors are the ratio of concentrations in an organism to concentrations in environmental media. Chemicals with high bioconcentration factors are more likely to bioaccumulate to high levels in the organism. OEHHA (2000) reported water-to-fish bioconcentration values for 2,3,7,8-TCDD ranging from 2,670 to 635,000 with a recommended default value of 19,000. EPA (1999) reported bioconcentration factors of 1.59 for soil-to-soil invertebrates, .0056 soil to plant, 1,560 water to aquatic plant, 3,302 water to algae, 4,235 water to fish and 19,596 sediment to benthic

invertebrates. To determine the expected concentration of the 2,3,7,8-TCDD in higher trophic levels the bioconcentration factor (BCF) can be multiplied by a food chain multiplier (FCM). For example, a sediment to benthic organism BCF of 19,596 would be multiplied by a FCM of 27 (based on a Log K_{ow} =6.8) for a biomagnification of 529,092 to an upper trophic level 4 receptor. In this way, concentrations of dioxins/furans at relatively low levels in environmental media can biomagnify to unsafe levels in upper trophic level organisms such as marine mammals, salmon and eagles.

27. Dioxins do not move readily through soils and sediments because they generally attach to sediment particles. Soils and sediments represent the most significant "sink" for dioxins. Once dioxins, particularly 2,3,7,8-TCDD, enter the soil and sediments, they are very slow to degrade. 2,3,7,8-TCDD has a degradation half-life of ten years or longer (i.e., over 10 years the concentration of dioxin in a given medium is expected to decrease by one half). The half-life of dioxins that bioaccumulate in tissues of living organisms also have very long half-lives. The estimated volatilization half-life of dioxins from a model pond is 58 years if adsorption is considered. Hydrolysis is not expected to be an important environmental fate process since dioxins lack functional groups that hydrolyze under environmental conditions.[2] Due to the recalcitrance of dioxins, their tendency to adhere to sediments, and their long degradation half-lives, dioxins will adhere to sediment particles and be transported during rainfall and flood events along with suspended sediments picked up and entrained by storm water runoff flows. In this fashion, dioxins would necessarily be transported along with suspended sediments to wherever storm water flows ended up. In the case at hand, this means that storm water flows at the Facilities would tend to move dioxin contaminated surface sediments/grit from the Facilities into San Francisco and Humboldt Bays--the water bodies into which storm water from the Facilities flows.

Human Health Risks:

28. The Department of Health and Human Services (DHHS) has determined that it is reasonable to expect that 2,3,7,8-TCDD may cause cancer. The EPA has determined that 2,3,7,8-TCDD

[2] *See* ToxNet. Hazardous Substances Data Bank. National Institutes of Health, U.S. National Library of Medicine, published on the Internet at via: http://toxnet.nlm.nih.gov/

is a probable human carcinogen when considered alone and when considered in association with phenoxy herbicides and/or chlorophenols. The EPA has determined also that a mixture of CDDs with six chlorine atoms (4 of the 6 chlorine atoms at the 2, 3, 7, and 8 positions) is a probable human carcinogen.

29. According to the ATSDR, exposure to 2,3,7,8-TCDD can cause reproductive damage and birth defects in animals. Decreases in fertility, altered levels of sex hormones, reduced production of sperm, and increased rates of miscarriages were found in animals exposed to 2,3,7,8-TCDD in food. Rats and mice that were exposed to small amounts of 2,3,7,8-TCDD in food for a long time developed cancer of the liver and thyroid, and other types of cancer. The results of the oral animal studies suggest that the most sensitive effects (effects that will occur at the lowest doses) are immune, endocrine, and developmental effects. It is reasonable to assume that these will also be the most sensitive effects in humans.

Screening Level Benchmarks for Risk Assessment

30. In order to evaluate whether or not the levels of PCDD/PCDFs have the potential to cause adverse effects on wildlife, samples of soil, sediment and water were taken from the PG&E sites that drain directly into Humboldt or San Francisco Bay or into tributaries that drain into either bay. Sample results were compared to screening benchmarks compiled by Buchman (2008) and other sources. The on-site concentrations were compared to screening benchmarks in order to calculate a hazard quotient (HQ). EPA (2012a) guidance defines a "Hazard Quotient" as follows:

> **Hazard Quotient:**
>
> The ratio of an exposure level by a contaminant (e.g., maximum concentration) to a screening value selected for the risk assessment for that substance (e.g. LOAEL or NOAEL). If the exposure level is higher than the toxicity value, then there is the potential for risk to the receptor. (See Ecological Risk Assessment Guidance Step 2 for more details.)
>
> **Screening Level Risk Calculation (Hazard Quotient)**
>
> Ecological risk can be estimated numerically using the ***Hazard Quotient*** (HQ) approach. The HQ is a ratio, which can be used to estimate if risk to harmful effects is likely or not

due to the contaminant in question. The HQ is calculated using one of the following equations:

Hazard Quotient Equations

1. **HQ = Dose / Screening Benchmark**
2. **HQ = EEC / Screening Benchmark**

- *Dose* = an estimated amount of how much contaminant is taken in by a plant or animal, in terms of the body weight of the plant or animal (e.g., mg contaminant/kg body weight per day);
- *EEC* = estimated (maximum) environmental contaminant concentration at the site; how much contaminant is in the soil, sediment, or water (e.g, mg contaminant/kg sediment)
- *Screening benchmark* = generally a **No-Adverse Effects Level** concentration; if the contamination concentration is below this level, the contaminant is not likely to cause adverse effects.

After the calculation...

If...	*Then...*
HQ > 1.0	**Harmful effects are likely due to the contaminant in question**
HQ = 1.0	**Contaminant *alone* is not likely to cause ecological risk**
HQ < 1.0	**Harmful effects are NOT likely**

31. Site sediment/soil and water concentrations were compared to screening benchmarks compiled by Buchman (2008) and other sources. When feasible, two benchmarks were chosen to represent a more conservative/protective threshold (lower values) and a less conservative/protective

threshold (higher value) to more accurately determine the degree of toxicity in samples. Site concentrations were also compared to California Toxic Rule water quality criteria (Attachment B). The following summaries describe what each benchmark represents and how it was derived.

Dioxin Sediment Quality values Used as Screening Benchmarks

Sediment Benchmarks – Marine

1. **US EPA Region 5 Ecological Screening Levels for dioxins**: USEPA Region 5 (2003) developed ecological screening levels for dioxins in soil based on exposure to a masked shrew (*Sorex cinerus*). This small burrowing mammal would be similar in exposure patterns to other small mammals found in coastal California such as the Pacific Shrew (*Sorex pacificus*) or Marsh Shrew (*Sorex bendirii)*. Levels of dioxins/furans and PCP found above the Region 5 Ecological Screening Level would therefore be expected to cause harm to small mammals, which are important prey for hawks, eagles, reptiles and large mammals. EPA Region V has published these ecological screening levels on the Internet at: http://epa.gov/region05/waste/cars/pdfs/ecological-screening-levels-200308.pdf

2. **Apparent Effects Threshold (AET):** The AET was used as a more protective (lower) benchmark for dioxins/furans and is based on empirically derived relationships between sediment concentrations and observed toxicity bioassay results, or benthic community impacts (Gries and Waldow 1996). Paired dose-response observations are ranked in increasing order. The highest nontoxic sample then sets the AET. The AET for the most sensitive species or endpoint is used, in order to be protective of the marine ecosystem as a whole. AETs were developed for species native to Pacific Northwest (Puget Sound, Washington), making them appropriate for use in studies at San Francisco and Humboldt Bay. The AET published in Buchman (2008) establishes the marine sediment TEQ at 3.6 ppt expressed as 2,3,7,8-TCDD.

EPA Region IX in a memo dated January 13, 2010 "*Compilation and discussion of sediment quality values for dioxin, and their relevance to potential removal of dams on the Klamath River*" recommended sediment screening values for the Klamath Basin Secretarial Determination. The document provides recommendations for ecological receptor protection as well as for human health protection in both soils and sediments. A review of that memo supports the use of an area background level for San Francisco Bay at 2-5 ppt mean and median values respectively. It also supports the use of the following risk-based screening levels which are well below and supportive of the AET provided in the Buchman (2008) NOAA Squirts Tables as follows:

3. **Oregon DEQ Sediment Quality Value for the Protection of Human Consumers (ODEQ 2007):** These values are risk-based sediment guidelines for the protection of human seafood consumers. These screening-level values are suggested to determine the need for bioaccumulation testing or modeling. There are two values: The lower value, 0.0011pg/g dioxin TEQ represents the threshold for potential risk to subsistence human seafood consumers. The higher value, 1.1 pg/g (ppt) dioxin TEQ represents the threshold for potential risk to the general population of human seafood consumers. It should be noted that these values are 3,272 to 3.2 times lower than the AET.

This sediment quality value is relevant for a number of reasons. San Francisco Bay was placed on the State of California's 303(d) list of impaired waters for dioxins in 1998 as a result of elevated concentrations of dioxins and furans in fish. The San Francisco Estuary Institute's ("SFEI") Regional Monitoring Program has conducted studies of contaminants in Bay sport fish since 1994 and has found that dioxin concentrations have remained unchanged over this time period and, in some species, continue to greatly exceed screening values for human consumption. A San Francisco Bay seafood consumption study conducted by SFEI and the California Department of Health Services found that about one in ten anglers who consume Bay fish eat more than is recommended by the health advisory. Asians and African Americans were more likely to eat above the health advisory limits compared to other groups. Asians were also more likely to follow fish consumption practices such as eating skin that increase their exposure to dioxins. Many anglers reported that they share their catch with other members in their household. Many anglers reported that other household members ate some of the fish they caught from San Francisco Bay. About 40% reported women of childbearing age eat some of the fish they catch (In addition, about 5% of the fish-consuming anglers interviewed were themselves women of childbearing age).The study also found that awareness and understanding of the health advisory was poor. (SFEI. 2000. San Francisco Bay Seafood Consumption Study. San Francisco Estuary Institute). An executive summary of the report can be found here: http://www.sfei.org/sites/default/files/Final%20Exec%20Summ%20v.15_0.pdf

4. **Oregon DEQ Sediment Quality Value for the Protection of Wildlife Consumers (ODEQ 2007):** These values are effects-based sediment guidelines for protection of wildlife consumers for mammals at 0.052-1.4 ppt dioxin TEQ and for birds 0.7-3.5ppt dioxin TEQ. The low and high values represent chemical concentrations in sediment at and below which chemicals are not expected to accumulate in the tissues of prey items (e.g. fish) above NOAEL/LOAEL based levels.

5. **Oregon DEQ Sediment Quality Value for the Protection of Fish (ODEQ 2007):** Effects-based protection of fish 0.56 ppt dioxin TEQ. For marine and freshwater, this benchmark value represents chemical concentrations in sediment at and below which chemicals would not be expected to accumulate in tissues of fish or other aquatic organisms above levels acceptable to the organisms.

After review of the EPA IX, 2010 recommendations, the Oregon DEQ effects-based sediment quality values for mammals (0.052-1.4ppt), birds (0.7-3.5ppt) and fish (0.56ppt) I found to be appropriate for use in this screening-level risk assessment. Values for birds and mammals were developed for both individuals (lower number; NOAEL) and population (higher number; LOAEL). Bird number is based on the lower of the great blue heron, eagle and osprey (for egg-based effects), whereas the mammal number is based on the mink. A rigorous and transparent risk-based approach was used to derive these numbers, using toxicity equivalency factors (TEFs) from Van den Berg et al. (1998) and (2006). Biota-sediment accumulation factors are 75th percentile values derived by the Washington Department of Health (1995). Although the source is not mentioned, food ingestion rates are comparable to those in the EPA (1993) *Wildlife Exposure Factors Handbook.* The TRVs are rigorous values used to derive Great Lakes Water Quality Criteria and are based on the Nosek et al. (1992, 1993) study on pheasants[3] as well as the Tillitt et al. (1996) study on mink[4].

These effects-based values are well below the Buchman, 2008 AET of 3.6 for all but the upper bound for birds at 3.5. The Oregon effects-based levels for mammals and fish are 67 times lower than the AET values used in this assessment.

The Ecological screening level for fish is based on tissue residue levels from Jarvinen and Ankley (1999) and USACE (2013) Environmental Residue Effects Database-two widely used tissue residue level databases. The derivation of these values is transparent and it is reasonable to apply these values at other sites on the Pacific coast.

Source: http://www.deq.state.or.us/lq/pubs/docs/cu/GuidanceAssessingBioaccumulative.pdf

6. **Environment Canada – Effects-Based Protection of Benthos (Environment Canada 2002) 0.85-21.5 ppt.** These values represent threshold effect/probable effect levels based on benthic sediment toxicity data (with a safety factor of 10 applied). These values are for fresh water and marine. They are not intended to address bioaccumulation.

7. **Probable Effects Level (PEL)** – The PEL is the least protective (highest) benchmark in Buchman's (2008) tables for dioxins/furans. Similar to AET's, NOAA derived PEL values by comparing sediment concentrations of given pollutants and observations of whether these concentrations appear to be toxic in bioassay tests on both marine and freshwater species or in observations of marine and freshwater benthic communities (i.e., whether the indigenous benthic community that lives in sediments with given measured concentrations of pollutants appear to be suffering adverse impacts). PEL values represent the geometric mean of the sample results for which toxic effects were observed. Thus, the PEL represents a value at which adverse impacts on living organisms are considered probable, as PELs are designed to be the threshold between samples which

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[3] Although this TRV is based on exposure via intraperitoneal injection, there are no other bird-based TRVs which incorporate effects on reproduction. EPA has allowed the use of this TRV in ecological risk assessments.

[4] TRV was derived using field-caught fish from Saginaw Bay Michigan which also contained trace levels of organic pesticides; however, this TRV has been used by EPA and others, and is comparable to other TRVs based on rodents.

were a) occasionally and b) frequently associated with adverse effects on aquatic marine life. Therefore, concentrations exceeding the PEL are likely to be associated with adverse effects. *See* NOAA, Office of Response and Restoration, frequently asked questions (FAQ s) about SQuiRTs, published on the NOAA website at: http://response.restoration.noaa.gov/environmental-restoration/environmental-assessment-tools/squirt-cards-faq.html.

8. **Upper Effects Threshold (UET) –** NOAA developed UETs using the apparent effects threshold (AET) methodology as described above. However, the bioassay toxicity tests relied upon were performed using freshwater species and benthic community endpoints. Again, UETs are equal to the highest concentration of a pollutant observed without having an observed adverse impact on the target species. *See*, http://response.restoration.noaa.gov/environmental-restoration/environmental-assessment-tools/squirt-cards-faq.html http://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf

Sediment Benchmarks – Freshwater

1. **Upper Effects Threshold (UET) –** The UET is a more protective (lower) benchmark for dioxins/furans in Buchman's (2008) tables. UETs were developed using the apparent effects threshold (AET) methodology as described above. However, the toxicity tests were performed using freshwater species and benthic community endpoints. The final value is based on the concentration which results in toxicity to the most sensitive species.

2. **Probable Effects Level -** PELs were the least protective (higher) value for dioxins/furans compiled by Buchman (2008) in freshwater systems. PELs were developed and applied to freshwater ecosystems using the previously mentioned PEL methodology. The same benchmark for 2,3,7,8-TCDD TEQs in marine systems applies to freshwater systems (MacDonald et al. 2000). For 2,3,7,8-TCDD dioxin, this benchmark is based on toxicity to *Hyalella azteca*, a widespread and abundant species of amphipod crustacean. It is a favorite food source of waterfowl, small fish, amphibians and aquatic insects making them a keystone species in the aquatic ecosystem.

3. **Environment Canada – Effects-Based Protection of Benthos (Environment Canada 2002) 0.85-21.5 ppt.** These values represent threshold effect/probable effect

levels based on benthic sediment toxicity data (with a safety factor of 10 applied). These values are for fresh water and marine. They are not intended to address bioaccumulation.

Surface Water Benchmarks

1. **Ambient Water Quality Criteria –** USEPA (2002) developed ambient water quality criteria for the protection of human health. Although these values are based on the protection of humans, bioaccumulation of dioxins to fish tissue would also pose a substantial risk to higher trophic levels of organisms that eat fish, such as marine mammals (i.e. seals), eagles, and other upper trophic level organisms. The organism-only screening benchmark was used which assumes that the receptor is exposed through consumption of contaminated fish. This value was only applied to 2,3,7,8-TCDD dioxin equivalents due to the absence of screening criteria for dioxins/furans in aquatic systems.

2. **Region IV Chronic Screening Values –** USEPA Region IV developed chronic screening values for freshwater for a number of chemicals including 2,3,7,8-TCDD TEQs, which were used by Oak Ridge National Laboratory (1996) to screen contaminants of concern on their site. This screening value was only applied to 2,3,7,8-TCDD TEQ, and is protective of bioaccumulation to fish tissue.

3. **Great Lakes Water Quality Criteria –** EPA (1995) also developed water quality criteria for the Great Lakes after finding that a number of chemicals, including dioxins and furans, were accumulating to high levels in fish and shellfish (Whittle et al. 1992). The benchmark was therefore developed for the protection of bioaccumulation in higher trophic level organisms, and levels exceeding the benchmark would be expected to bioaccumulate significantly. This benchmark was only applied to 2,3,7,8-TCDD TEQs due to their bioaccumulative nature.

4. **EPA National Recommended Water Quality Criteria –** the EPA (2012b) recommended water quality criteria for aquatic life (saltwater chronic value) was used for PCP in marine receiving water bodies. The chronic value was used because after a runoff event marine organisms would be chronically exposed to runoff transported off-site.

Note: there are no marine/saltwater surface water benchmarks available for 2,3,7,8-TCDD dioxin equivalents. In the absence of marine/saltwater benchmarks, surface water benchmarks developed for freshwater systems were applied to evaluate water which drains into marine/saltwater receiving bodies.

Soil Benchmarks

Sediments in industrial areas can be become soil when they are transported via runoff to edge or riparian/coastal habitat where terrestrial vegetation has become established. Terrestrial organisms that forage and dwell in these areas could then be exposed to contaminants, which could in the case of dioxins, result in biomagnification up the terrestrial food chain. San Francisco and Humboldt Bay tidal marshes provide habitat for small mammals, including the Suisun shrew, salt marsh wandering shrew, and salt marsh harvest mouse. The endangered salt marsh harvest mouse and the Suisun shrew are totally dependent on wetlands. The salt marsh harvest mouse can be found in salt and brackish habitat and in diked and tidal areas. They hide in dense pickleweed, which they use for food and shelter.

1. **Region 5 Ecological Screening Level –** USEPA Region 5 (2003): USEPA Region 5 developed ecological screening levels in soil based on exposure to a masked shrew (*Sorex cinerus*). This small burrowing mammal would be similar in exposure patterns to other small mammals found in coastal California such as the Pacific Shrew (*Sorex pacificus*) or Marsh Shrew (*Sorex bendirii)*. Levels of dioxins/furans and PCP found above the Region 5 Ecological Screening Level would therefore be expected to cause harm to small mammals, which are important prey for hawks, eagles, reptiles and large mammals.

Results of Screening-Level Risk Assessment

32. ERF's sampling at the Facilities was intended to collect samples of water, sediment, surficial soils and other materials to determine the presence of pollutants in storm water flows and surficial materials that could be transported off-site from Facilities and ultimately into nearby San Francisco and Humboldt Bays via storm water runoff or motor vehicle tracking off-site where off-site storm water flows could then transport materials into municipal separate storm water systems that discharge into these Bays."

33. ERF's investigations were the functional equivalent of a robust RCRA Assessment (RFA), which is appropriate given that ERF is pursuing a RCRA claim for "corrective action," i.e., for remedial measures designed to address contamination from solid wastes.

Notably, EPA's RCRA RFA Guidance provides:

> The first step in the RCRA Corrective Action process is a RCRA Facility Assessment (RFA). The RFA is designed to identify all areas of potential release and includes the investigation of releases or potential releases to various media, including air, surface water, ground water, and soils. During the RFA, investigators gather information on areas of concern at the facility. They evaluate this information to determine whether there are releases that warrant further investigation and/or other action, such as interim measures to control pollutant releases.
>
> The RFA should identify all areas of potential release at RCRA facilities and include the investigation of releases to all media: air, surface water, ground water, and soils. EPA and/or State investigators should use the full complement of RCRA authorities to secure appropriate action. These include §7003 (actions to abate conditions that may present an imminent and substantial endangerment to human health or the environment). RFA Guidance 1-3.

There are three steps in the RFA process, each requiring the collection and analysis of data to support initial release determinations:

1. The preliminary review (PR) focuses primarily on reviewing or evaluating existing information, such as maps, aerial photographs, inspection reports, permit applications, historical monitoring data, and interviews with personnel who are familiar with the facility.

2. The visual site inspection (VSI) entails the on-site collection of visual information to obtain additional evidence of releases.
3. The sampling visit (SV) fills data gaps that remain upon completion of the PR and VSI by obtaining sampling and field data.

According to an EPA RCRA "Hotline training" document,

> "To issue a §7003 order…, EPA must possess evidence that the waste handling may present an imminent and substantial endangerment to human health or the environment. Evidence may be documentary, testimonial, or physical and may be obtained from a variety of sources, including inspections, investigations, or requests for production of documents or other data pursuant to §§3007, 3013, or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §104. This evidence must be reliable enough to enable a reasonable person to conclude that the action is appropriate. The phrase "may present" indicates that the standard of proof does not require certainty. That is, an order may be issued if there is sound reason to believe that an endangerment exists; evidence of actual harm is not required." EPA Hotline training Chap. 8 Enforcement and Compliance, http://www.epa.gov/wastes/inforesources/pubs/training/enforc.pdf

34. ERF's sample results showed concentrations of dioxins, pentachlorophenol and other contaminants in settlements and storm water at the Facilities that exceeded screening benchmarks--and for dioxins in particular, by very large factors. Out of all four PG&E sites, only the Myrtle Ave. site in Eureka does not drain directly into a marine receiving water body. Therefore, samples from the Clawiter, Oakport, and 14th St. sites were screened using marine/saltwater benchmarks. The Myrtle Ave. site drains into freshwater and saltwater catchments, so samples from this site were screened using both freshwater and saltwater benchmarks.

San Francisco Bay Sites:

35. Both sites in the San Francisco Bay area discharge to the San Francisco Bay, a marine/estuarine habitat. Both sites in the San Francisco Bay region contained concentrations of 2,3,7,8-TCDD TEQs and PCP in sediment, soil and water that exceeded screening benchmarks.

Clawiter Facility (Hayward, CA):

36. The Clawiter Facility is located on the south side of San Francisco Bay, approximately 2 miles east of the San Francisco Bay shoreline. During a rainfall event, storm water runoff from the Clawiter Facility is discharged to the Hayward MS4. The Hayward MS4 deposits storm water into the Alameda County Flood Control Channel, which is located a short distance away from the Clawiter Facility near the intersection of West Street and Clawiter Road. The Alameda County Flood Control Channel is a tributary of San Francisco Bay. The point where storm water enters the Alameda County Flood Control Channel from the Clawiter Facility to the point where the Alameda County Flood Control Channel empties into San Francisco Bay is about 2 miles. The lower reaches of the Alameda County Flood Control Channel are tidally influenced, i.e., it receives tidal saltwater flow from San Francisco Bay during high tides. Since storm water discharges from the Clawiter Facility eventually drain into the lower Alameda County Flood Control Channel and San Francisco Bay, which are essentially saltwater environments, I compared concentrations of pollutants in samples taken from the Clawiter Facility to benchmarks for marine ecosystems.

37. At the Clawiter Facility, concentrations of dioxins in the HAYSED-4 sample exceeded the marine sediment AET by a factor of 2,722 and the marine sediment PEL by a factor of 456 (Exhibit E). This sample (HAYSED-4) was taken adjacent to the utility pole storage area. Similar to samples taken at the other Facilities, the analysis results showed that the sample contained high concentrations of two dioxin congeners, OCDD and Hepta-CDD, that are particularly known to be found in pentachlorophenol-treated wood--indication that the nearby utility poles were a source of the dioxins detected in the sample. This sample (HAYSED-4) also contained concentrations of pentachlorophenol which exceeded the marine sediment AET by a factor of 2,588. The remaining sediment samples taken by ERF at the Clawiter Facility (HAYSED-1, HAYSED-2, and HAYSED-3 also exceeded the AET for dioxins by factors of 128, 1667, and 2,056, respectively, and further exceeded the PEL for dioxins by

factors of 21.4, 279, and 344 times, respectively. Dioxin concentrations in the HAYSED-1, HAYSED-2, HAYSED-3 and HAYSED-4 samples also exceeded EPA Region V's dioxin soil screening level for the shrew by 2,312; 30,151; 37,186; and 49,246 times, respectively, indicating that the levels of dioxins detected in the samples were many times higher than levels known to exhibit the characteristic of toxicity to a mammal species. Storm water flows at the Clawiter Facility flow past the HAYSED-1, HAYSED-2, HAYSED-3 and HAYSED-4 locations and eventually into the storm water discharge pipe that transmits storm water flow from the Facility into the Hayward municipal separate storm water system that in turn discharges into the Alameda County Flood Control Channel. The Alameda County Flood Control Channel is a tributary to San Francisco Bay. Storm water flows at the Clawiter Facility would tend to pick up and entrain dioxin contaminated sediments at the HAYSED-1, HAYSED-2, HAYSED-3 and HAYSED-4 locations and transport these sediments off-site via the Clawiter Facility storm drain system into the Hayward MS4 and then into the Alameda County Flood Control Channel.

38. At the Clawiter Facility, concentrations of dioxins in the HAYWTR-1 & HAYWTR-2 storm water samples exceeded EPA ambient water quality criteria by 784,314 and 10,392 times, respectively; exceeded EPA Region IV chronic screening levels by 400 and 5.3 times, respectively; and exceeded EPA Great Lakes criteria by 1,290,323 and 17,097, respectively. As discussed in the Hagemann Declaration, ERF took the HAYWTR-1 sample in a storm water conveyance culvert located adjacent to pentachlorophenol treated utility poles. As with the OAKWTR-1 and OAKWTR-2 samples, the extremely high levels of dioxins detected in this sample demonstrated that dioxin present in the utility poles is being transferred into storm water that makes contact with the utility poles. As the culvert where the sample was taken conveys storm water into the Clawiter Facility storm drain system that eventually discharges storm water into the Hayward MS4, this sample also supports the conclusion that the Clawiter Facility discharges storm water containing high levels of dioxins into the Hayward MS4 that in turn discharges into the Alameda County Flood Control Channel. As also discussed in the Hagemann Declaration, ERF took the HAYWTR-2 sample from the last accessible point in the Hayward Facility storm water conveyance system before this conveyance system discharges storm water into the Hayward MS4. ERF took a sample of storm water that was still flowing and thus the sample was

directly indicative of the levels of dioxins in a discharge of storm water from the Clawiter Facility. ERF's sample results demonstrated that the Clawiter Facility is discharging elevated levels of dioxins to the Hayward MS4 which in turn discharges to the Alameda County Flood Control Channel.

39. Storm water discharge from the Clawiter Facility flows into the Hayward MS4 and from there into the Alameda County Flood Control Channel. Accordingly, before storm water from the Clawiter Facility reaches San Francisco Bay it will be diluted with storm water flows from the watershed that provides flow to the Hayward MS4 and the Alameda County Flood Control Channel. I have reviewed the declarations and reports of David Parker on this issue. David Parker has performed an analysis of the maximum dilution of storm water that will occur at the point where the Alameda County Flood Control Channel discharges into San Francisco Bay. As he points out, this dilution is 47 to 1. Even when so diluted, the levels of dioxins that will be transported from the Clawiter Facility to San Francisco Bay well exceed applicable benchmarks. In addition, when storm water from the Clawiter Facility is discharged into the Alameda County Flood Control Channel just north of the Facility, the dilution ratio is 9.3 to 1. My attached Exhibit C is a table comparing the levels of dioxins that will still be present after dilution of storm water at the point where storm water flows from the Clawiter Facility will reach San Francisco Bay as well as when the flows enter the Alameda County Flood Control Channel.

40. Both water samples (HAYWTR-1 & HAYWTR-2) taken from the Clawiter site exceeded at least one water quality benchmark (*See*, Exhibit K).

Oakport Facility, (Oakland, CA):

41. The Oakport Facility is located on the north side of San Leandro Bay, directly adjacent to the East Creek Slough which drains into San Leandro Bay. San Leandro Bay is an inlet of San Francisco Bay. During a rainfall event, storm water runoff from the Oakport site is transported downslope into an outfall located on the edge of San Leandro Bay. Since storm water discharges from the Oakport Facility drain directly into San Leandro Bay, which is essentially a saltwater environment, I compared concentrations of pollutants in samples taken from the Oakport Facility to benchmarks for marine ecosystems.

42. All three sediment samples (OAKSED-1, OAKSED-2 & OAKOUTSED-1) taken from the Oakland site exceeded the marine AET and PEL for dioxins in sediment (Attachment C-1). One sample (OAKSED-2) contained concentrations of 2,3,7,8-TCDD equivalents that exceeded the marine AET by a factor of 1,306 and the PEL by a factor of 219. The OAKSED-2 sample was taken adjacent to a utility pole storage area and contained high concentrations of OCDD and Hepta-CDD indicating a source of dioxin representative of that found in PCP-treated wood. PCP was also found in sample OAKSED-2 at concentrations which exceeded the marine AET by 2,705 times. Sample OAKOUTSED-1, which was a sample of San Francisco Bay sediments collected at the site's outfall location, contained concentrations of 2,3,7,8-TCDD dioxin equivalents which exceeded the AET by a factor of 13 and the PEL by a factor of 2, indicating the migration of dioxins from the pole storage area to the outfall where it flows into San Francisco Bay. Dioxin concentrations in samples OAKOUTSED-1, OAKSED-1 and OAKSED-2 exceeded the soil screening level for the shrew by 246, 13500 and 23,600 times the screening level (*see*, Exhibit D), indicating the likelihood for adverse effects on terrestrial organisms.

43. The levels of dioxins in the three sediment samples, OAKSED-1, OAKSED-2 & OAKOUTSED-1, that ERF took at or adjoining the Oakport Facility exceeded the marine AET and marine PEL for dioxins in sediment, as well as other screening values. (*See*, Exhibit E). The OAKSED-1 sample contained concentrations of dioxins that exceeded the marine sediment AEL by 750 times and the marine sediment PEL by a factor of 126. ERF collected the OAKSED-1 sample adjacent to a utility pole storage area. Analysis of the sample showed that the sample contained high concentrations of two dioxin congeners, OCDD and Hepta-CDD, that are particularly known to be found in pentachlorophenol-treated wood--indication that the nearby utility poles were a source of the dioxins detected in the sample. ERF also detected pentachlorophenol in the OAKSED-1 sample at concentrations which exceeded the marine AET by 271 times--an indication that because pentachlorophenol was detected at high levels that the source of the dioxins in the sample was the pentachlorophenol mixture in the treated utility poles. Storm water flows at the Oakport Facility move past the OAKSED-1 sample location and then flow into the Facility storm drain system that eventually discharges off-site into San Francisco Bay via the Oakport Facility outfall. Storm water flows on the

Oakport Facility would tend to transport sediments located at this sample location eventually off-site into San Francisco Bay.

44. ERF also took the OAKSED-2 sample (consisting of wood waste and sawdust generated by a PG&E worker cutting up a utility pole at this location) along the flow path of storm water at the Facility. Storm water flows past this sampling location would also tend to transport the sawdust at this location into the Oakport Facility storm water system and eventually off-site into San Francisco Bay via the Oakport Facility storm water outfall. ERF took the OAKOUTSED-1 sample at the location where the storm water outfall discharges storm water from the Oakport Facility. Notably, concentrations of dioxins at the OAKSED-2 sample location exceeded the marine sediment AEL by a factor of 1,306 and the marine PEL by a factor of 219.

45. The OAKOUTSED-1 sample consisted of San Francisco Bay sediments collected directly at the outfall (point of storm water discharge) from the Oakport Facility. OAKOUTSED-1 contained concentrations of dioxins which exceeded the AET by a factor of 13 and the PEL by a factor of 2, indicating the migration of dioxins from the pole storage area to the outfall area where the Oakport Facility discharges storm water into San Francisco Bay. As described above, NOAA's SQuiRT tables support a predictive conclusion that any pollutant concentrations exceeding an AET value will cause adverse impacts on living organisms inhabiting marine areas and pollutant levels less than AET values may (but will not necessarily) result in no adverse impacts on marine species. NOAA's SQuiRT tables support a predictive conclusion that any pollutant concentrations exceeding a PEL will probably have an adverse impact on benthic organisms.

46. Dioxin concentrations in samples OAKOUTSED-1, OAKSED-1 and OAKSED-2 also exceeded EPA Region V's dioxin soil screening level for the shrew by 246, 13,568 and 23,618 times, respectively, indicating that the levels of dioxins detected in the samples were many times higher than levels known to exhibit the characteristic of toxicity to a mammal species. While shrews do not inhabit the areas where these samples were taken, comparisons of the sample results to this EPA Region V screening value nonetheless provide useful information. It is common practice in the field of environmental risk assessment to rely on data showing toxicity to a given organism that does not

actually inhabit the target area being assessed to show risk to the wildlife that does inhabit the target area. The species so tested or assessed in given data are considered to be surrogates for other life forms--analogous to the use of canaries in coal mines to warn miners of the presence of potentially toxic levels of carbon monoxide or other gases. If a substance exhibits toxicity to one species, the assumption is made in the field of ecological risk assessment is the substance risks exhibiting toxicity to other species.

47. As discussed in the Hagemann declaration, ERF collected the OAKSED-1 and OAKSED-2 samples at locations within the pathway of storm water flows at the Oakport Facility that lead to the Oakport outfall that discharges storm water off-site into San Leandro/San Francisco Bay. As discussed above, dioxins detected at these sample locations will adhere to sediments. These sediments will then become suspended/entrained in and transported by storm water flows during rainfall and flood events. These dioxin-contaminated suspended sediments, during rainfall events, will be transported into San Leandro/San Francisco Bay. Evidence for this occurring is provided by the sample results for the OAKOUTSED-1 and OAKWTR-4 samples. These samples were taken off-site, of the storm water flowing from the Facility into San Leandro Bay, and of San Leandro Bay sediments at the Oakport Facility outfall. As noted, elevated dioxins were detected in both samples. In my opinion, dioxins and furans on the Oakport Facility are the primary source for the dioxins detected in the OAKOUTSED-1 and OAKWTR-4 samples. The sample locations are immediately down gradient of a known source of dioxins—stacks of utility poles freshly-treated with pentachlorophenol, as well as sawdust and other wood wastes from the treated poles and sediments contaminated by pentachlorophenol oils washing off the freshly-treated poles. Further evidence is that the storm water conveyance system where this sampling took place appears to service only the Oakport facility.

48. As described above, ERF collected the OAKWTR-4 sample from flowing storm water being discharged at the Oakport outfall. At high tide, the Oakport outfall is subject to tidal influx from San Leandro Bay. At low tide, however, the outfall is above the water level in San Leandro Bay. At low tide, freshwater flows of storm water in the Oakport Facility flushes out the influx of tidal water from San Leandro Bay into this outfall. ERF collected the OAKWTR-4 sample at low tide when the outfall had been flushed of tidal water-- this was confirmed by the low specific conductance reading that Ms.

Brady gathered from the discharge flow she sampled. Ms. Brady noted that the specific conductance level was 208 umhos. Specific conductance in freshwater ranges from 100 to 2,000 umhos, specific conductance in brackish water ranges from 1,301 to 28,800 umhos, and specific conductance in marine water is greater than 28,800 umhos.[5] The specific conductance reading that Ms. Brady noted in the field indicated that for all practical purposes the sample was 100% freshwater, *i.e.*, storm water runoff from the Oakport Facility undiluted by any meaningful amount of tidal influx from San Leandro Bay. In my opinion, the OAKWTR-4 sample is representative of a storm water discharge from the Oakport Facility and this sample demonstrated unquestionably that the Oakport Facility is discharging elevated levels of dioxins to San Leandro/San Francisco Bay.

49. At the Oakport Facility, concentrations of dioxins in the OAKWTR-1, OAKWTR-2, and OAKWTR-4 storm water samples exceeded EPA ambient water quality criteria by 160,784; 23,529; and 21,569 times, respectively; exceeded EPA Region IV chronic screening levels by 82, 12, and 11 times, respectively; and exceeded EPA Great Lakes criteria by 264,516; 38,710; and 35,484 times, respectively[6]. ERF took the OAKWTR-1 sample from standing water underneath utility pole storage racks at the Oakport Facility. The extremely high levels of dioxins detected in this sample demonstrated that dioxin present in the utility poles is being transferred into storm water that makes contact with the utility poles. As discussed in the Hagemann Declaration, storm water flows past the OAKWTR-1 sample location into a storm drop inlet located about 15 feet away. The drop inlet conveys to storm water flow into the Oakport Facility storm drain system that leads to the Oakport outfall that discharges

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[5] Pure distilled water or purified water used in laboratory settings will have specific conductance values of significantly less than 100, but freshwater flows found in the field will typically have specific conductance values of 100 or more. *See* United States Geological Survey report published on the Internet at http://sofia.usgs.gov/publications/wri/93-4057/specificc.html; *see also* California State Water Resources Control Board, Electrical Conductivity/Salinity Fact Sheet published on the Internet at http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/3130en.pdf.

[6] Most of the surface water benchmarks (EPA ambient water quality criteria, Great Lakes Criteria, EPA California Toxic Rule, and ESL's for estuary habitats) use the International Toxic Equivalents Factors (I-TEFs) developed by the North Atlantic Treaty Organization in 1989. In my evaluation, concentrations of dioxins in samples were calculated using the more conservative 2005 WHO TEFs. Use of the I-TEFs would result in approximately 10% higher dioxin concentrations (and higher hazard quotients) than those reported here. *See*: pg. 29 of NOAA SQuiRTs table, available on the internet at: http://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf

to San Leandro Bay. ERF took the OAKWTR-2 sample of standing rainwater present in a storm water drop inlet located adjacent to the utility pole storage area. The extremely high levels of dioxins detected in the sample also demonstrated that dioxin present in or on the utility poles is being transferred into storm water that not only makes contact with utility poles but that flows into nearby storm water conveyances. While these two samples were not of flowing storm water, it is my opinion they nonetheless provide useful information establishing that dioxins would be present in flowing storm water past these two sample locations. There is no reasonable basis to conclude that dioxins would be present in ponded storm water at these two locations but would not be present in flowing storm water at these two locations given that the samples unquestionably show that dioxins can be transferred from the stacks of utility poles into storm water that flows past the utility poles. The samples collected by ERF should be viewed as likely providing more conservative estimates of the levels of dioxins than would be expected in at least the "first flush" (i.e., the first large pulse of storm water flow at the initial onset of a storm) storm water flows past these locations. These samples were taken shortly after the conclusion of runoff events. It is well-known that first flush storm water flows tend to be highest in the concentrations of pollutants. At the time that ERF took its samples, a significant amount of dioxins, pentachlorophenol and other pollutants would have already been transported off-site by the first flush flows. Thus, the pollutant concentrations presented in the ERF samples may actually underestimate the concentrations of dioxins, pentachlorophenol, and other pollutants present in storm water flows at the Oakport Facility.

Comparison of Clawiter and Oakport Site Concentrations to Background in San Francisco Bay

50. The EPA has officially determined that San Francisco Bay is contaminated with dioxins to a level that is deleterious to wildlife and that dioxins contamination exceeds applicable Clean Water Act water quality standards. The EPA has listed San Francisco Bay on the Clean Water Act section 303(d) list of water bodies that do not meet water quality standards due to dioxins contamination. The levels of dioxins detected in ERF 's samples taken within or just beyond the boundaries of the Oakport and Clawiter Facilities (OAKOUTSED-1, OAKSED-1&2 and HAYSED-1, 2, 3 &4) significantly exceed levels of dioxins generally recorded for San Francisco Bay. EPA Region 9 (2000a) establishes a

2-5 ppt background for San Francisco Bay. Samples from the Hayward (HAYSED-4) and Oakland (OAKSED-2) sites exceeded this level by a factor of 1,960 and 940, respectively. Sample OAKOUTSED-1, collected in San Francisco Bay sediments at the outfall from the Oakport site exceeds San Francisco Bay background levels by a factor of 10. Furthermore, high levels of the OCDD and Hepta-CDD congeners are indicative that the source of dioxin is the presence of PCP wood preservatives, which would not occur in dioxin transported through atmospheric deposition (Cleverly et al. 1997, Ogura et al. 2001). High levels of PCP in samples (HAYSED-3, HAYSED-4, & OAKSED-2) also indicate the presence of PCP-treated wood and wastes on site and are further evidence that the PCP is the source of the elevated dioxins and furans. As discussed above, repeated storm water flows will tend to transport contaminated sediments from these Facilities into San Francisco Bay, introducing a source of dioxins contamination that significantly exceeds existing levels of dioxins contamination in San Francisco Bay generally.

Humboldt Bay Sites

51. All samples taken at the Myrtle Ave. and 14th St. sites contained concentrations of 2,3,7,8-TCDD dioxin equivalents and PCP that exceeded screening benchmarks for sediment, soil and water.

Myrtle Ave. Site:

52. The Myrtle Facility is located approximately one mile south of Arcata Bay, which is a tidally influenced estuary that makes up the north end of the larger Humboldt Bay. During a rainfall event, runoff from the Myrtle site is transported via the Humboldt County MS4 which in turn discharges into a water body known as the Third Slough. The Third Slough is a freshwater stream which flows into a brackish marsh and eventually into Humboldt Bay, a marine/estuarine receiving water body. Since the Myrtle Facility discharges storm water into a freshwater stream that eventually flows into a saltwater estuary and then Humboldt Bay, I compared concentrations of pollutants in samples taken from the Myrtle Facility to benchmarks for both marine and freshwater ecosystems.

53. At the Myrtle Facility, concentrations of dioxins in the MYRTDUMPSED-1 and MYRTDUMPSED-2 samples exceeded the marine AET by 38.9 and 156 times, respectively and the

marine sediment PEL by 6.5 and 26 times, respectively. Additionally, concentrations of dioxins in the MYRTDUMPSED-1 and MYRTDUMPSED-2 samples exceeded the freshwater UET by 38.9 and 156 times, respectively and the freshwater PEL by 6.5 and 26 times, respectively. I compared dioxins concentrations in the sediment samples to both marine and freshwater benchmarks because storm water from the Myrtle Facility initially first flows to a freshwater stream which in turn flows into a saltwater estuary which is connected to a marine environment--Humboldt Bay. Thus, sediments that flow off-site from the Myrtle Facility have the potential to adversely impact both freshwater and marine/saltwater environments. Concentrations of dioxins in the MYRTDUMPSED-1 and MYRTDUMPSED-2 samples also exceeded the EPA Region V screening levels for the shrew by factors of 704 and 2,814, respectively. The analysis results also showed that samples contained high concentrations of two dioxin congeners, OCDD and Hepta-CDD, which are particularly known to be found in pentachlorophenol-treated wood--indication that the nearby utility poles were a source of the dioxins detected in the samples. The samples also had high levels of pentachlorophenol-- further indication that the source of dioxins in the samples was due to the presence of dioxins impurity in the pentachlorophenol used to treat the utility poles. ERF took the MYRTDUMPSED-1 and MYRTDUMPSED-2 samples from inside roll-off bins into which PG&E had deposited sediments gathered from the Myrtle Facility. The samples thus demonstrated that sediments present at the Myrtle Facility contained highly elevated levels of dioxins--a source for potential loading of dioxins into storm water flows discharged from the Facility.

54. At the Myrtle Facility, concentrations of dioxins in the MYRTWTR-1 & MYRTWTR-2 storm water samples exceeded EPA ambient water quality criteria by 862,745 and 215,686 times, respectively; exceeded EPA Region IV chronic screening levels by 440 and 110 times, respectively; and exceeded EPA Great Lakes criteria by 1,419,355 and 354,889 times, respectively. As discussed in the Hagemann Declaration, ERF took the MYRTWTR-1 sample from sheet flow flowing from a utility pole storage area across a paved area towards a nearby storm drop inlet. The presence of a thick and bright sheen in the water flowing from the utility pole storage area, and extremely high levels of dioxins and pentachlorophenol detected in the MYRTWTR-1 sample shows that dioxins are transferred from the utility poles into rainwater that falls upon the utility poles and then conveyed via storm water runoff into

the Facility's storm drain system that conveys flow into the local MS4 which in turn discharges into the Third Slough. ERF took the MYRTWTR-2 sample from the drop inlet at the northern boundary of the site (this drop inlet is marked "Drains to the Bay"). This drop inlet is located at the last accessible point for the Facility's storm drain conveyance underground piping system that flows off-site into the local MS4. Thus, given that this sample was taken from the last accessible point in the Facility storm drain system, the sample results from this location are representative of the storm water discharged by the Facility directly into the Eureka MS4 and show that the Facility discharges the pollutant dioxins into the Eureka MS4 and eventually into the Third Slough and Humboldt Bay. I further note that the sample results should be viewed as a conservative estimate of pollutant loading given that the sample was not taken during the first flush when pollutant levels would be at their highest. Mr. Hagemann observed a visible oily sheen in this sheet flow that originated at the pole storage area and extended to the drop inlet. According to Mr. Hagemann, and evidenced by the photos and video I have reviewed from the site inspection, the sheen was clearly visible on top of the flowing water in all of the drop inlets along the storm water drain line that runs to the southwest corner of the Facility. See, Exhibit F. This is consistent with observations of similar sheen during the inspections at the other three facilities. It is my opinion that the sheen is caused by waste pentachlorophenol/oil mix that washes off freshly treated poles, waste poles, and other Treated Wood Wastes that are stored at the facility.

West 14th St. Site:

55. The West 14th St. Facility is located on the west side of Eureka, approximately one quarter mile east of Humboldt Bay. During a rainfall event, storm water runoff from the West 14th St. Facility is transported via a City of Eureka MS4 which in turn discharges into Humboldt Bay through an outfall at the foot of West 14th Street. Since Humboldt Bay is essentially a saltwater environment, I compared concentrations of pollutants in samples taken from the West 14th St. Facility to benchmarks for marine ecosystems.

56. At the West 14th St. Facility, concentrations of dioxins in the EURSED-1, EURSED-2 & EUROUTSED-1 sediment samples exceeded marine sediment AEL by 5,556; 1500, and 556 times, respectively, and exceeded the marine sediment PEL by 930, 251, and 93, respectively. In addition,

concentrations of dioxins in the EURSED-1, EURSED-2 & EUROUTSED-1 sediment samples exceeded EPA Region V screening level for shrew by 100,503; 27,136; and 10,050 times, respectively. The analysis results also showed that samples contained high concentrations of two dioxin congeners, OCDD and Hepta-CDD, that are particularly known to be found in pentachlorophenol-treated wood--indication that the nearby utility poles were a source of the dioxins detected in the samples. The samples also had high levels of pentachlorophenol--further indication that the source of dioxins in the samples was due to the presence of dioxin impurity in the pentachlorophenol used to treat the utility poles. As discussed in the Hagemann Declaration, ERF took the EURSED-1 sample from beneath the treated utility pole storage area at the West 14th St. Facility. ERF took the EURSED-2 sample from inside an uncovered roll-off bin that contained sediments and treated wood waste collected from the West 14th St. Facility. ERF took the EUROUTSED-1 sample at the point where an outfall from the West 14th St. Facility discharges storm water into an off-site wetland drainage ditch. This ditch conveys flow into a pipe which in turn flows into the Eureka MS4. The Eureka MS4 then conveys storm water flow into Humboldt Bay.

57. Storm water flows at the West 14th St. Facility flow past the EURSED-1 location and eventually into the storm water discharge pipe that transmits storm water flow from the Facility into a ditch and pipe that direct flow to the Eureka MS4. Storm water flows at the Facility further flow past the area where the “treated wood waste” roll-off bin was located; the bin was leaking water that in turn was picked up by the storm water flow. Storm water flows at and from the West 14th St. Facility would tend to pick up and entrain dioxin-contaminated sediments at the EURSED-1 location and transport these sediments off-site via the West 14th St. Facility storm drain system into the Eureka MS4 and then into Humboldt Bay.

58. At the West 14th St. Facility, concentrations of dioxins in the EURWTR-1 & EURWTR-2 storm water samples exceeded EPA ambient water quality criteria by 121,569 and 843,137 times, respectively; exceeded EPA Region IV chronic screening levels by 62 and 430 times, respectively; and exceeded EPA Great Lakes criteria by 200,000 and 1,387,097 times, respectively. As discussed in the Hagemann Declaration, ERF took the EURWTR-2 from flowing storm water located down gradient of

the pole storage area at the Facility and slightly up gradient of a nearby storm drain drop inlet. Storm water flows at the Facility flow past the sample location into the drop inlet, which in turn conveys flow into the storm water conveyance system at the Facility which discharges storm water into a ditch and pipe which lead to the Eureka MS4 and then into Humboldt Bay. The presence of a large oily sheen present in the storm water flowing from the freshly treated pole storage area to the drop inlet, and the extremely high levels of pentachlorophenol, dioxins and furans found in the sample, clearly establish that rainwater which strikes the utility poles picks up these pollutants and conveys them in storm water flows that eventually lead off-site into Humboldt Bay. (Exhibit F).

59. The EURWTR-1 sample was taken immediately up gradient of the third chamber of an oil water separator, it is my opinion that the sample demonstrates that pollutants are being discharged from the West 14th St. Facility in elevated levels. Oil water separators, also known as water quality inlets ("WQIs"), trapping catch basins, or oil/grit separators, consist typically of one or more chambers that promote sedimentation of coarse materials and separation of free oil (as opposed to emulsified or dissolved oil) from stormwater.[7] As one authoritative study noted, a "WQI achieves slight, if any, removal of nutrients, metals and organic pollutants other than free petroleum products."[8] The study also indicated that sediment accumulation did not increase over time in the WQI, suggesting that the sediments become re-suspended during storm events. The authors concluded that although a WQI effectively separates free floating oil and grease from water, re-suspension of the settled matter appears to limit removal efficiencies. Actual removal only occurs when the residuals are removed from the WQI. In sum, the third chamber of the oil water separator might have provided some minimal removal of dioxins and other pollutants in the EURWTR-1 sample, but is unlikely to have significantly lowered the levels of emulsified waste treatment oils and the dioxin/furan contaminants. It can be stated as a virtual certainty that the third chamber of the oil water separator would not have reduced the concentrations of

[7] *See generally*, CASQA (2003) California Stormwater BMP Handbook 1 of 6, New Development and Redevelopment, published on the Internet at www.cabmphandbooks.com.
[8] *Id*.

dioxins to zero. This is also evidenced by the elevated levels of pentachlorophenol, dioxins and furans found present in the sediments off-site at the facility's outfall.

60. According to A.J. Doudna, PG&E's Senior Environmental Specialist who oversees environmental compliance at the West 14th Street facility, the oil/water separator where this sample was collected primarily operates as a catch basin for sediments. The oil/water separator does not appear to utilize a coalescer or skimmer. There is no carbon filtration. According to Mr. Doudna, any oil removed from this unit would have to be done manually, by pump truck. I have seen no evidence that the unit at the West 14th Street has been regularly maintained or pumped out. Oil that is left in the oil/water separator will likely become emulsified and then likely eventually pass through the unit.

61. There are storm water treatment options that could work effectively at this facility and other PG&E facilities where PCP treated poles and TWW are stored and handled. For example, at the L.D. McFarland utility pole treating facility located in Tacoma, Washington, the company has a dedicated treated lumber storage area that is paved. All storm water from the storage area is collected and routed to a treatment system. The storm water is treated using a mixed media filter, bag filters, and activated carbon polishing unit before it is discharged from the facility. In my opinion, this type of filtration system is a pollution control measure that PG&E should evaluate for its facilities where new utility poles are stored. (*see* Exhibit G). (Fact Sheet and NPDES Wastewater Discharge Permit Evaluation for L.D. McFarland Company, Ltd., Oregon Department of Environmental Quality).

62. At the 14th St. site in Eureka, all sediment samples (EURSED-1, EURSED-2 & EUROUTSED-1) exceeded screening benchmarks for 2,3,7,8-TCDD dioxin equivalents as well as PCP. The highest concentrations of 2,3,7,8-TCDD dioxin equivalents of all four sites was found in a sample of PCP-treated wood waste (EURWOOD-1) collected immediately outside the property boundary adjacent to the utility pole storage racks, (where there was visual evidence that the wood waste had been swept or shoveled offsite by PG&E employees) (Attachment E-7). This sample (EURWOOD-1) contained 36,000 ppt of 2,3,7,8-TCDD dioxin equivalents and the highest concentrations of PCP from all samples taken (1,400,000 parts-per-billion) indicating a likely source of contamination. Sediment samples taken from areas surrounding the pole storage racks indicate migration of dioxins and PCP to

other areas of the property including the outfall location. The sample at the outflow location (EUROUTSED-1) exceeded the marine AET for 2,3,7,8-TCDD dioxin TEQs by a factor of 555 and the marine PEL by a factor of 93 (Exhibit H) indicating migration of dioxins from the pole storage racks to the outfall. Other sediment samples taken from this location exceeded the AET over 5,500-fold (EURSED-1) and the marine PEL over 930-fold (EURSED-1). All samples taken from the location (EURWTR-1, EURWTR-2, EURSED-1, EURSED-2 & EUROUTSED-1) exceeded the screening benchmarks for both water and soil (Exhibits I and J).

63. Storm water discharge from the West 14th St. Facility flows into the Eureka MS4 and from there into Humboldt Bay. Accordingly, before storm water from the West 14th St. Facility reaches Humboldt Bay it will be diluted with storm water flows from the watershed that provides flow to the Eureka MS4. David Parker has performed an analysis of the maximum dilution of storm water that will occur in this fashion. As he points out this dilution is 69 to 1. Even when so diluted, the levels of dioxins that will be transported from the West 14th St. Facility to Humboldt Bay well exceed applicable benchmarks. See Exhibit C for a table comparing the levels of dioxins that will still be present after dilution of storm water at the point where storm water flows from the West 14th St. Facility will reach Humboldt Bay.

64. As discussed in the Hagemann Declaration, ERF took the EURWTR-1 sample from the second chamber of a three chamber oil water separator vault located down gradient from the Facility's pole storage area and immediately upgradient of the Facility storm drain conveyance outfall that discharges storm water into an offsite drainage ditch. ERF took this sample from the last location on site from which the Facility’s subsurface storm drain system could be accessed, a point located a short distance away from the offsite outfall from which the Facility's storm water is discharged into an off-site drainage ditch that in turn conveys storm water flow to the Eureka municipal storm water system. Mr. Hagemann could not take a sample from the outfall discharge pipe that conveyed flows from this oil water separator off of the West 14th Street Facility because the end of the outfall pipe was partially submerged in an off-site vegetated channel. Thus any sampling effort at this end of pipe location would only have gathered a mixture of water in the channel and storm water running from PG&E's outfall pipe.

He also could not take a sample from the third chamber of the oil water separator, because an enclosed pipe blocked access to flow in this third chamber.

65. Even though the EURWTR-1 sample was taken immediately up gradient of the third chamber of an oil water separator, I think that the sample demonstrated that pollutants are being discharged from the West 14th St. Facility in elevated levels. Oil water separators, also known as water quality inlets ("WQIs"), trapping catch basins, or oil/grit separators, consist typically of one or more chambers that promote sedimentation of coarse materials and separation of free oil (as opposed to emulsified or dissolved oil) from storm water.[9] As one authoritative study noted, a "WQI achieves slight, if any, removal of nutrients, metals and organic pollutants other than free petroleum products."[10] The study also indicated that sediment accumulation did not increase over time in the WQI, suggesting that the sediments become re-suspended during storm events. The authors concluded that although a WQI effectively separates free floating oil and grease from water, re-suspension of the settled matter appears to limit removal efficiencies. Actual removal only occurs when the residuals are removed from the WQI. In some, the third chamber of the oil water separator might have provided some minimal removal of dioxins and other pollutants in the EURWTR-1 sample, but is unlikely to have significantly lowered the levels of dioxins. Furthermore, it can be stated as a virtual certainty that the third chamber of the oil water separator would not have reduced the concentrations of dioxins to zero. In sum, it is my opinion that the EURWTR-1 sample results can be relied on for a conclusion that the West 14th St. Facility is discharging significant levels of dioxins during storm events. This opinion is bolstered by the fact that the EURWTR-1 sample was taken well after the first flush of storm water flows at the Facility, i.e., well after the point at which pollutant concentrations would likely be at their highest.

66. Based on the above findings it is likely that the samples taken at the 14th Street Site oil/water separator are representative of post oil/water separation pollutant concentrations in the storm

[9] *See generally*, CASQA (2003) California Stormwater BMP Handbook 1 of 6, New Development and Redevelopment, published on the Internet at www.cabmphandbooks.com.
[10] *Id.*

water discharge. Evidence of 14th Street oil/water separator's ineffectiveness at removing dioxins and furans from storm water is also found in the sediment sample collected immediately beyond the Site boundary where the oil/water separator discharges into a wetland vegetated drainage ditch. As discussed above, the sampled sediments in the wetland ditch at the outfall pipe (EUROUTSED-1) contained elevated levels of pentachlorophenol, dioxins and furans. The dioxin TEQ levels in the sample exceeded the marine AET by a factor of 555 and the marine and fresh water PEL by a factor of 93.

67. The EPA, the California North Coast Regional Water Quality Control Board, and the State Board have officially determined that Humboldt Bay is contaminated with dioxins to a level that is deleterious to wildlife and that dioxins contamination exceeds applicable Clean Water Act water quality standards. The EPA has listed Humboldt Bay on the Clean Water Act section 303(d) list of water bodies that do not meet water quality standards due to dioxins contamination. Although low background levels of dioxins are present in Humboldt Bay, concentrations of dioxin equivalents in samples found at the Myrtle Ave. and 14th St sites far exceed these background levels. The City of Eureka (2005) sampled 55 locations at the waterfront moorage facilities and found maximum concentrations of 6.03 parts-per-trillion to as little as .78 ppt TEQ. These background levels are similar to those found in San Francisco Bay. In EPA's Environmental Monitoring Assessment Program (2000) sampled 56 sites in San Francisco Bay and found mean an median TEQs of 5ppt and 2ppt respectively which represents the San Francisco Bay background levels (EPA, 2010). Given the high levels of OCDD and Hepta-CDD in the samples from the Humboldt Bay Sites, as well as high levels of PCP, found in wood and sediment samples on the property, the most likely source of dioxin is PCP-treated utility poles and wood waste.

68. The Oakport Facility is located immediately adjacent to San Leandro Bay and discharges storm water from an outfall located immediately on the shoreline directly into San Leandro Bay. ERF took samples of storm water discharged from this outfall--which constituted direct measurement of the transport of polluted storm water from the Oakport Facility into San Leandro Bay (which is an inland feature of San Francisco Bay). (See, Declaration of Matt Hagemann In Support Of Plaintiffs' Motion For Partial Summary Judgment On Claim One, August 2, 2012 ECF 197-1).

69. ERF witness David Parker and I collectively have performed an analysis that has some quantitative basis concerning the movement of storm water and the pollutants entrained within it from the Clawiter, 14th Street, and Myrtle Avenue Facilities into San Francisco and Humboldt Bays. Based on field evaluation and the performance of certain equations, Dr. Parker analyzed the amount of dilution that storm water leaving these three facilities will undergo by the time this storm water comingles with other storm water runoff in the watersheds in which the Facilities are located. (Declaration of David B. Parker In Support Of Plaintiffs' Motion for Partial Summary Judgment On Claim One, ¶¶ 17-31; Expert Report of David B. Parker). I used Dr. Parker's conclusions concerning this dilution to reach conclusions concerning predicted concentrations of pollutants originating in storm water runoff from these Facilities.

70. As discussed above, dioxins and furans do not move readily through soils and sediments because they generally attach to sediment particles and are very slow to degrade. Soils and sediments represent the most significant "sink" for dioxins and furans. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions (HSDB, 2012). Based on these characteristics, dioxins and furans would be expected to adhere to sediment particles and to be transported during rainfall and flood events in runoff flow and transport of those particles to conveyance channels and ultimately to receiving waters. Due to the recalcitrance of these pollutants and the long degradation half-lives, transport from bed-load or source areas such as source area soils, accumulated sediments from those source areas into storm flow conveyances would be considered a significant transport mechanism for those pollutants into receiving waters such as Humboldt and San Francisco Bays.

71. It might take some time for sediments located at the Facilities to be moved by a series of storms into San Francisco and Humboldt Bays--but typically less than one day, due to the close proximity of the sites to the receiving waters. Transport of sediments from the Facilities into receiving waters is dependent upon the intensity and duration of the rainfall event--in average intensity storms the time would be within minutes. For example, assuming a conservative flow velocity of sediment transport during average intensity storm water flows of 4 feet per second (in my opinion, transport of

sediments within storm drain pipes would be at least 4 feet per second during a storm of average intensity. Note: 2 feet per second is typically considered the minimum velocity to keep sediments from accumulating in storm water conveyances, and storm drain pipe systems are usually engineered to generate average flow velocities of 4 ft. per second to ensure that sediments do not accumulate and block pipes.) and a distance of 525 feet from the Clawiter Facility to the Alameda Flood Control Channel, about 1400 feet from West 14th St. Facility to Humboldt Bay, and 5200 feet from the Myrtle Facility to the Third Slough, it would take 2 minutes for sediments to be transported from the Clawiter Facility into Alameda Flood Control Channel, 6 minutes for sediments to be transported from the West 14th St. Facility into Humboldt Bay, and 22 minutes for sediments to be transported from the Myrtle Avenue Facility to the Third Slough (distance/4/60 seconds=minutes). Storms of less than average intensity might not transport sediments from the Clawiter, West 14th St. Facility and Myrtle Facilities as rapidly and it might take more than one storm to transport sediments from these three facilities to receiving waters when storms are of very short duration (i.e., when storms last only a few minutes), but sediments at most will tend to be transported into receiving waters within a few days (in the case of a series of short storms spaced a few days apart during the typical California rainy season). Dioxins are of such long life that elevated levels of dioxins will still be present in sediments/grit originating on the Facilities that are eventually transported into San Francisco Humboldt Bays and other receiving waters. I would further note that while dioxins have a propensity to adhere to sediments, adherence is not 100%. This is evidenced, for example, by dioxins showing up in significantly elevated levels in water samples taken by ERF from the Facilities during or shortly after rain events. Some amount of dioxins that are present in utility poles or in sediments/grit located on the Facilities will tend to be partitioned or mixed into the storm water that flows past the utility poles or sediments. The amount of dioxins that partitions into storm water will tend to be rapidly (i.e., within minutes or at most hours) transported via storm water flows from the Facilities into San Francisco or Humboldt Bays.

72. An additional concern with the transport of high levels of dioxins from the PG&E Facilities into San Francisco and Humboldt Bay waters is that some dioxins congeners once deposited into the sediments of these Bays will serve as a cumulative reservoir of dioxins that may, through a

process known as dehalogenation, break down into even more toxic chemical compounds over time that will persist for many years before eventually breaking down into harmless compounds.

73. While I have focused my analysis on dioxins as the pollutants that pose the greatest pollution risks in storm water discharges in motor vehicle traffic from the Facilities, there are other pollutants present in sediments found at the Facilities and storm water discharges from the Facilities. Other pollutants besides dioxins detected in ERF's sampling of sediments and storm water flows at and off the Facilities include various polynuclear aromatic hydrocarbons, petroleum hydrocarbons and various heavy metals, including arsenic, copper, zinc and lead. Exhibit B summarizes the levels of these pollutants detected in excess of benchmark values for these pollutants. These pollutants are also persistent in the environment, i.e., do not break down into harmless compounds rapidly (or in the case of metals, at all). These other pollutants will be similarly subject to the fate and transport mechanisms described above for dioxins, i.e., Polynuclear aromatic hydrocarbons, petroleum hydrocarbons and various heavy metals absorbed onto sediments at the Facilities will tend to be transported along with suspended sediments in storm water flows from the Facilities. The portion of these pollutants that are partitioned into storm water flows at the facilities will tend to be transported by these flows rapidly off-site into San Francisco and Humboldt Bays.

Risk Characterization/Conclusions

74. My analysis demonstrates that the levels of certain pollutants, particularly pentachlorophenol, dioxins and furans, are highly elevated in wastes, soils and sediments on the Facilities as a direct result of these pollutants leaking or oozing from stored freshly-treated utility poles and from discarded used utility poles and other treated wood wastes that have been sawed up and/or stored uncovered on site, are present in storm water runoff from the Facilities, and, due to the runoff from the Facilities, are accumulating in San Francisco Bay and Humboldt Bay sediments. My analysis further demonstrates that while these pollutants, at some of the Facilities, will likely be diluted somewhat by the time storm water flows from the Facilities mixed with storm water runoff from surrounding areas reaches San Francisco or Humboldt Bays, storm water runoff from the Facilities will still cause pollutant loading into San Francisco and Humboldt Bays at elevated levels and that there is

reasonable cause for concern that human health and the environment may be seriously harmed from these discharges and the resulting pollutant accumulation. Due to the extreme toxicity of the chemicals being discharged from the Facilities, the ecological sensitivity of the bays in which the chemicals are being discharged, both of which are listed as impaired for dioxins and furans based on elevated levels in fish and shellfish, and the fact that bays are important sources of food for humans, I conclude that pollutants originating from the Facilities, particularly from the storage of freshly-treated utility poles, and storage and disposal of discarded used utility poles and other treated wood wastes, have accumulated and will continue to accumulate to dangerous levels in the San Francisco and Humboldt Bay environments. The presence and discharges of these chemicals from the Facilities into San Francisco and Humboldt Bays presents an imminent and substantial endangerment to human health and the environment.[11]

75. Specifically, observations made by Matt Hagemann and other ERF representatives in on-site inspections and off-site reconnaissance, review of aerial photography, and other information received from PG&E has all confirmed that each of the Facilities for years have stored significant quantities of new utility poles and discarded, used utility poles and treated wood wastes. It is well known that dioxins and furans are present as contaminants in pentachlorophenol wood treatment mixtures. Thus I would expect high levels of dioxins and furans in sediments located near stored utility poles treated with pentachlorophenol and in storm water runoff from areas where utility poles are stored. The data that I have discussed in this report confirms this and indicates that there are extremely high levels of dioxin and furans in sediments and storm water on and near the PG&E Facilities compared to background levels of dioxins and furans found in Humboldt and San Francisco Bays and in

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[11] Storm water discharges from the Facilities typically involve co-mingled storm water runoff from both areas where new utility poles are stored and areas affected by the handling and disposal of treated wood waste, making it difficult to isolate in storm water sample results the level of pollutants added by storage of new poles versus handling and disposal of treated wood waste. It is my opinion from looking at the overall scale of the Facilities and scale of these two activities on the Facilities, plus the targeted measurements of sediments and materials in waste bins at the Facilities, that each significantly contributes to the levels of dioxins and furans in sediments at the Facilities and in storm water discharges from the Facilities. Thus, both activities pose an imminent and substantial endangerment to the health of persons and the environment in that both activities are leading to the off-site depositing of dangerous levels of pollutants in the environment.

uncontaminated areas generally. Moreover, the fact that high levels of pentachlorophenol, and the specific dioxin congeners OCDDs and Hepta-CDDs were detected in SWAPE's samples, and the consistency of the dioxin/furan and PCP levels found in samples from all four of the Facilities, indicate that the sources of dioxins and furans detected in these samples are pentachlorophenol-treated wood and wood wastes--not atmospheric deposition or combustion sources. As the stacks of new pentachlorophenol-treated utility poles and treated wood wastes were the only sources of pentachlorophenol-treated wood nearby the sample locations, the conclusion is unmistakable that PG&E's treated new and discarded wood is the significant source of the pentachlorophenol, dioxins and furans in ERF's samples.

76. I have reviewed a number of samples of treated wood waste (treated wood, such as poles and crossarms that are taken out of service or otherwise deemed no longer usable) collected at the Facilities. These include samples of wastes collected from uncovered treated wood waste roll-off bins (MYRTDUMPSED-1, MYRTDUMPSED-1, EURSED-2); a sample of sawdust collected from the pavement near where a PG&E employee was observed cutting waste poles into smaller pieces for disposal (OAKSED-2); a sample of surface soil collected from where out-of-service waste poles were stored for a number of years (HAYSED-2); and a sample of wood waste collected immediately outside the 14th St. Facility’s property boundary adjacent to the utility pole storage racks, (where there was visual evidence that the wood waste had been swept or shoveled offsite by PG&E employees). It is my opinion that PG&E’s handling, storage, transportation and/or disposal of treated wood wastes at the Facilities, by itself, results in the accumulation and discharges of high levels of pentachlorophenol, dioxins and furans, conditions that may present an imminent and substantial endangerment to human health and the environment.

77. ERF's observations of the physical layout of the Facilities and their storm drain systems and information provided by PG&E concerning the same, plus modeling analysis performed by Dr. Parker, establish that during rainfall events, the Facilities' storm drain systems regularly convey very large volumes of storm water runoff from the Facilities into Humboldt and San Francisco Bays. Storm water runoff from the Myrtle, West 14th St., and Clawiter Facilities are diluted somewhat before this

runoff reaches Humboldt or San Francisco Bays, but storm water from the Oakport Facility flows undiluted straight into San Francisco Bay. Even when diluted, the concentrations of dioxins and furans in storm water runoff from the Myrtle, West 14th St., and Clawiter Facilities exceed by vast magnitudes the benchmark values published by expert regulatory agencies concerning the levels of dioxins and furans that these agencies consider to pose risks. Additionally, the undiluted concentrations of dioxins and furans in storm water runoff from the Oakport Facility similarly exceed these benchmark values by vast magnitudes. Thus, by regularly transporting very large volumes of storm water from the Facilities shown to be contaminated with dioxins and furans above regulatory agency benchmark values into Humboldt and San Francisco Bays, I conclude that PG&E is creating an imminent and substantial endangerment to the health of persons and the environment and causing pollutants to accumulate to dangerous levels in the San Francisco and Humboldt Bay environments.

78. I further conclude that PG&E's storm water discharges from the Facilities pose an imminent and substantial endangerment to the health of persons and the environment because the storm water discharges also transport contaminated sediments from the Facilities into Humboldt and San Francisco Bays. ERF's samples of sediments on the Facilities show that they are heavily contaminated with dioxins and furans. The sediments sampled were also found within storm water flow pathways and thus inevitably will be entrained in storm water flows and carried off-site where they will be deposited into the sediments of Humboldt and San Francisco Bays. Corroboration of this risk is notably to be found in the OAKOUTSED-1 sample collected at the edge of San Francisco Bay right directly at the point where the Oakport Facility discharges storm water from an outfall. Dioxins and furans in this sediment sample were ten times above background and well above the ecological and human health risk benchmark levels set by expert regulatory agencies. This sample demonstrates that discharges from the Oakport Facility have caused pollutants to accumulate to dangerous levels in the San Francisco Bay environment.

79. I also conclude that motor vehicle traffic on and off the Facilities would tend to track the contaminated sediments found at the Facilities and transport these contaminants off-site where storm water runoff would tend to transport them into storm drains and other drainage pathways where they

would tend to end up in Humboldt and San Francisco Bays--further contributing to the endangerment risks identified above.

80. While dioxins and furans pose the most significant environmental threat at the Facilities, SWAPE's sampling data further establishes that storm water runoff and the sediment transported by the runoff from at least the Oakport and Clawiter Facilities also transports other heavy metal pollutants (arsenic, copper and zinc from the Oakport Facility and copper and lead from the Clawiter Facility) into Humboldt and San Francisco Bays at levels that significantly exceed expert regulatory agency benchmark values and thus pose significant environmental risk.

81. In evaluating ERF's samples of storm water runoff and sediments from the Facilities, I have considered SWAPE's samples to be conservative, i.e., if anything, to under estimate the levels of pollutants in PG&E's storm water runoff. SWAPE gathered its sediment and storm water samples during the latter part of runoff events or shortly after the runoff events. A significant amount of dioxin/furans, pentachlorophenol and metal pollutants (including sediments) would likely have already migrated off-site during the of storm water runoff near the commencement of the storm event; it is well known that first flush flows of storm water runoff tend to have the highest concentration of pollutants. For this reason, the sample concentrations presented in the SWAPE analyses may actually underestimate the volume and mass of dioxins and furans, pentachlorophenol and heavy metals present in storm water runoff and sediments at the Facilities resulting in an underestimation of the volume of pollutants entering the receiving waters.

82. In evaluating the risks posed by the environmental contamination being caused by PG&E's activities at its Facilities, it is important to take into account that dioxins, furans, and heavy metals degrade very slowly and some dioxin and furans congeners can degrade into even more toxic byproducts. Thus, the contaminants released from the Facilities will persist for a very long time in the environment, where they will add to existing contamination sources as an ongoing source of toxicity to organisms that can uptake dioxins and other pollutants into their tissues. Various lower trophic level receptors (life lower on the food chain such as marine worms, snails, and bivalves like mussels and oysters that serve as a food source for upper trophic life) and upper trophic level receptors (life higher on

the food chain) in the receiving waters of Humboldt and San Francisco Bays are at substantial risk of being further harmed by the added exposure to dioxins and furans and other pollutants posed by PG&E's release of pollutants from the Facilities. Furthermore, there is substantial risk that predator fish (such as striped bass and salmonid species such as salmon and steelhead), marine mammals, aquatic dependent predator bird species such as pelicans, heron, and egrets), and humans that consume shellfish and fish taken from these waters will have added levels of harmful dioxins and other pollutants added to their tissues. Notably, dioxins and furans are well known to bioaccumulate and biomagnify, i.e. to persist in the tissues of animals for long periods of time once they are absorbed and to continue to accumulate to higher levels in organisms higher up the food chain.

83. In evaluating whether the levels of dioxins in storm water discharges from the Facilities present an imminent and substantial endangerment to human health and the environment, I have also considered the findings and effluent limitations in the National Pollutant Discharge Elimination System (NPDES) permit issued by the California Regional Water Quality Control Board, San Francisco Bay Region ("Regional Board") to the Chevron refinery in Richmond, California. The Chevron Richmond refinery discharges wastewater to San Francisco Bay. The Richmond refinery NPDES permit Fact Sheet indicates that EPA has directed, and the Regional Board has agreed, that effluent limits on the levels of dioxins discharged from given facilities should be expressed using the World Health Organization TEQ methodology, the same methodology I have used to calculate the dioxins levels in samples from the Facilities. Chevron Products Company Richmond Refinery, Regional Board Order No. R2-2011-0049 (NPDES No. CA0005134) at F-34 (attached as Exhibit L). The Regional Board found that due to elevated levels of dioxins in the wastewater discharged by the Richmond refinery, that the Richmond refinery NPDES permit necessarily had to include limits on discharges of dioxins to try to protect the water quality of San Francisco Bay and the aquatic species that utilize San Francisco Bay. (Exhibit L at F-34, 35.) The Regional Board further found that because San Francisco Bay is already impaired for dioxins, it was impermissible to allow the Richmond refinery a "dilution credit," i.e. impermissible to conclude that the refinery's wastewater could contain higher levels of dioxins than is healthy for aquatic species because it will be diluted once it enters San Francisco Bay. Instead, to protect the Bay, the levels

of dioxins in the refinery's wastewater could be no higher than what species can tolerate without any dilution. (Exhibit L at F-30.) The Richmond refinery NPDES permit sets effluent limitations of 1.4×10^{-8} ug/liter(.014 pg/L) monthly average levels of dioxins and 2.8×10^{-8} ug/liter (.028 pg/L) maximum daily levels of dioxins. *Id*. at 13. The levels of dioxins in the storm water from the PG&E Facilities are many times higher than these permit limits. For example, the storm water flowing from the Oakport site directly into San Francisco Bay was found to contain 110 pg/L. That is 3,928 times higher than the Chevron Refinery NPDES daily maximum limit, and 7,857 times the monthly average limit. This comparison further corroborates my opinion that these discharges pose substantial risks to the aquatic wildlife of San Francisco Bay-- and Humboldt Bay as well given that the latter water body is also already impaired by excessive dioxins pollution and like San Francisco Bay has shellfish, fish, aquatic bird and marine mammal populations that are vulnerable to dioxins pollution.

84. Finally, in qualitatively assessing the risk posed by PG&E's release of pollutants from the Facilities, it is important to recognize that while the dioxin and furans discussed in this report alone pose substantial risks to the environment and human health, these pollutants can interact with other pollutants present in the environment from other sources and/or released from the Facilities (such as pentachlorophenol) to create additive risk. Given the substantial pollution of Humboldt and San Francisco Bays that already exists (and is reflected by, for example, the California State Water Resources Control Board and the U.S. Environmental Protection Agency identifying these waters as impaired water bodies due to excessive pollution by several pollutants), it is my opinion that the dioxin and furan releases from the Facilities are interacting with releases of other pollutants to create substantial additive environmental and human health risks.

85. There are numerous, strong lines of evidence to support my conclusion that PG&E's handling and storage of waste pentachlorophenol (PCP) wood treatment chemicals, and Treated Wood Wastes, at the Facilities, are the source of PCP, dioxins (PCDDs) and furans (PCDFs) in storm water and sediments flowing off the Facilities into Humboldt and San Francisco Bays.

1. It is notoriously known that PCP contains dioxins and furans, and that storm water running off sites where PCP-treated products and PCP-contaminated wastes are stored will

contain dioxins. The relationship between PCP and dioxins has been known for a long time. Among the many sources of this widely-known information, in a 1988 report, the California State Water Resources Control Board reported on the analysis of commercial PCP products and their findings of high concentrations of dioxin and furan congeners in the PCP. Another example is a 2005 report of a study conducted by the Oregon State University, Utility Pole Research Cooperative. That study evaluated the preservative migration from PCP-treated utility poles in storage yards. The study found that PCP solubilization and migration in rainfall runoff is "relatively predictable" that "increased rainfall was associated with an overall increase in total penta migration, but the runoff concentrations did not vary. These results suggest that migration from the poles is a function of water contact with the pole and penta solubility in the rainwater."

Methods for controlling the migration of PCP, dioxins and furans from utility pole storage areas are also well established. For example the McFarland Cascade Pole and Lumber Company, a supplier of PG&E's PCP-treated utility poles, collects storm water from its PCP-treated pole storage area and routes the storm water to a treatment system. The system is described in detail in the ("Fact Sheet for NPDES Permit WA0037953 (McFarland Cascade Pole and Lumber Company)". The storm water flows through catch basins equipped with inserts and/or hay bales to control floating and settleable solids. The storm water then flows to a four-compartment oil/water separator which removes sinking solids, oils and greases. From the final chamber of the separator, storm water is pumped through mixed-media filters consisting of layers of gravel, sand and garnet that remove fine solids from the storm water. After going through the mixed-media filters, the water passes through two granular activated carbon (GAC) adsorption units where dissolved contaminants in the storm water adsorb into the activated carbon media. The effectiveness of the treatment system "depends upon the contact time between the stormwater and the activated carbon media." The removal of sediments from the water, and the emphasis on the activated carbon filtration are two critical components of removing dioxins from contaminated storm water. This is because dioxins are highly sorbed to biological and sediment matrices. PG&E does not employ such storm water pollution prevention measures at the Facilities--which alone is evidence that storm water runoff from the Facilities is likely to contain dioxins and furans. Because PG&E does not employ any comparable treatment to its storm water discharges, the dioxins and furans reasonably predicted to be transported in storm water runoff from the utility poles will inevitably remain in the storm water discharges from the Facilities.

2. The samples collected at the Facilities by Matt Hagemann for ERF showed extremely consistent results. ERF's sampling found comparable levels of PCP, dioxins and furans present in the storm water and sediment samples from each geographically unique facility. This corroborates that that it is reasonable to hypothesize that dioxins and furans in the samples are due to comparable factors at the Facilities, the presence of wastes oils from pentachlorophenol treated utility poles and TWW, and are not an artifact of sampling errors.

3. ERF's sampling shows that the levels of PCP, dioxins and furans, in both storm water and sediments, are highest in the areas where PCP-treated utility poles and Treated Wood Wastes are handled, stored or disposed of. The gradient of contaminant levels shows that these are the source areas of the waste pollutants.

4. There is a strong correlation between PCP levels and dioxin/furan levels in the ERF samples collected on and off-site of the Facilities. That is, the sampling generally found that higher PCP levels in the water and sediment sample corresponded with higher dioxin/furan levels.

5. The dioxin/furan congener profile ("fingerprint") of each of the samples collected at the Facilities, as well as the samples collected off-site at two of the facilities' discharge locations, is consistent with the profile for dioxins/furans associated with pentachlorophenol. The dioxin/furan congener profiles for the environmental samples (surface water/soils/sediments) collected at the Facilities also match the congener profile of a wipe sample collected from the surface of one of PG&E's PCP-treated utility poles stored at the Oakport Facility. Again, this is concrete evidence that PCP is the source of the dioxins and furans found on and around the Facilities. The attached Exhibit M shows: 1) a comparison of the

technical PCP congener profile (Clevery et. Al., 1997), with the OAKWIPE-1 sample collected at the Oakport Facility, 2) a comparison of PCP to Forest fire emissions. 3) an illustration of the comparison of Oak Wipe-1 to emissions from unleaded gasoline emissions and 4) an illustration of the comparison of Oak Wipe-1 to diesel truck emissions. It is my opinion that the congener profile comparisons for the samples collected at the Facilities, when looking at both the percentages of the 2,3,7,8 congeners in relation to each other, and also looking at the 2,3,7,8 congeners in relation to total PCDDs/PCDFs, clearly support the conclusion that the source of the dioxins/furans is PCP. The weight-of-evidence including, 1) the fact that the PCP was found on-site and migrating from the site in water and sediment samples, 2) the PCP and PCDDs/PCDFs found in the Oak Wipe-1 sample, and 3) the similarity of the congener signatures is compelling evidence that the PCP, PCDDs and PCDFs found in all of the ERF samples originates from the waste wood treatment oils and Treated Wood Wastes stored and handled at the PG&E Facilities. In addition, none of the PG&E experts have provided any evidence that the PCP found on-site is not originating from PG&E activities and the storage of treated poles.

6. ERF's investigations at the Facilities resulted in strong visual evidence (observations, photographs and videos) that stormwater runoff that flowed from from the utility pole and Treated Wood Waste storage areas into the storm water conveyance systems contained oily sheens. Visible sheens in stormwater runoff is indicative of waste oil that is being picked up and transported in storm water. Given that the stormwater runoff in issue was originating from areas where PG&E was storing wood treated with PCP oil mixtures, the oil causing the sheens in this stormwater was almost certainly PCP oil. A risk assessor following the standards of the risk assessment profession and relevant guidance from the United States Environmental Protection Agency would conclude that the practice of allowing stormwater containing oily sheens to runoff from areas where PCP-treated wood is being stored and then to discharge such stormwater in nearby waters without any treatment potentially poses risks of contaminating the environment with dioxins. A risk assessor adhering to the standards of the profession would follow EPA guidance for risk assessment (U.S. EPA, Ecological Risk Assessment Guidance for

Superfund: Process for Designing and Conducting Ecological Risk Assessments, June 1997, EPA 540-R-97-006) ("EPA Ecological Risk Assessment Guidance ") before concluding that such a discharge posed no risk. In keeping with the EPA Ecological Risk Assessment Guidance, a risk assessor being duly professional would not adopt a "no further action" conclusion, i.e., a conclusion that no further investigation was warranted and environmental risks could be ruled out, without storm water samples showing an absence of contamination in the storm water runoff. Notably, the EPA Ecological Risk Assessment Guidance stresses that a risk assessor must exercise great caution in reaching a no further action conclusion and only do so based on specific evidence warranting such a conclusion:

> At the screening level, it is important to minimize the chances of concluding that there is no risk when in fact a risk exists. Thus, for exposure and toxicity parameters for which site-specific information is lacking, assumed values should consistently be biased in the direction of overestimating risk. This ensures that sites that might pose an ecological risk are studied further. Without this bias, a screening evaluation could not provide a defensible conclusion that negligible ecological risk exists or that certain contaminants and exposure pathways can be eliminated from consideration.

EPA Ecological Risk Assessment Guidance at 1-2.

It was in keeping with the EPA Ecological Risk Assessment Guidance and the standards of the ecological risk assessment profession for ERF to take samples of storm water on the Facilities and running off the Facilities and sediments in the pathway of storm water flows at the Facilities to further assess the risk that dioxins and furans are being transported from the PCP treated wood stored at the Facilities into the environment via the pathway of storm water flows. See, e.g., EPA Ecological Risk Assessment Guidance at 1-2.

86. ERF corroborated the hypothesis that oil sheens in storm water flows at the Facilities are indicative of the likely presence of elevated PCP, dioxins and furans in its taking of samples of storm

water flows at the Facilities. ERF's storm water samples where heavy sheen was present showed the highest levels of PCP, dioxins and furans. See, Matt Hagemann Report; Hayward Facility photos and videos (Plt's Bates 000205 – 000535, VIDEO0005.3gp, VIDEO0006.3gp, VIDEO0007.3gp); Myrtle Ave. facility photos and videos (Plt's Bates 000536 - 000698 ,DSCN1929.MOV and DSCN7449.AVI); Oakport Facility photos and video (Plt's Bates 000699 – 001122) and West 14th Street Facility photos and video (Plt's Bates 001126 – 001330, DSCN1925.MOV, DSCN1926.MOV, DSCN1927.MOV).

87. In my opinion, in order to abate the imminent and substantial endangerment these Facilities pose to human health and the San Francisco and Humboldt Bay environments, further site and off-site characterization should be conducted to fully characterize the lateral and vertical extent of pentachlorophenol, dioxins and furans contamination on the Facilities and the extent of off-site lateral and vertical migration of these contaminants from the Facilities. This characterization work should include substantial additional sampling of storm water runoff from the Facilities and sampling of soils and sediments at and near the Facilities for levels of pentachlorophenol dioxins and furans. It is also my opinion that a survey of the affected receptors in San Francisco and Humboldt Bays should be conducted. Specifically, studies should be performed to assess the exposures to the affected receptors to pentachlorophenol, dioxins and furans originating at the Facilities, and a full human health and ecological risk assessment should be completed for these facilities. The studies would include observing and identifying likely pathways of exposure to pollutants originating at the Facilities to specific species in the receiving environment, and taking tissue samples from organisms in the pathways to test hypotheses concerning likely exposures.

88. PG&E should implement short-term and long-term remedial measures. Short-term remedial measures should include commonly employed and feasible means to reduce the levels of polluted runoff in storm water. In my opinion, the following measures would likely decrease the pollutant levels on and being discharged from the Facilities:

1) Overhead coverage or other methods to prevent storm water from contacting treated wood wastes, stacks of freshly treated utility poles and other sources of PCP, dioxins and

furans, as well as area containment, such as impermeable berms in the areas where freshly-treated poles and treated wood wastes are handled and stored;

2) Avoiding stockpiling of utility poles at the Facilities by purchasing them on an as needed basis and conveying them to the field within a few days of storing them at the Facilities;

3) mandating in contracts with utility pole suppliers that utility poles purchased by PG&E that are treated with pentachlorophenol be treated in a fashion that minimizes or eliminates the dripping of pentachlorophenol from the utility poles and requiring utility pole suppliers to employ post treatment fixation to diminish the incidence of utility poles dripping pentachlorophenol;

4) Instituting new measures for sawing up utility poles or other treated wood waste whereby PG&E only saws up treated wood waste in either indoor locations or outdoor locations that are paved. PG&E should place plastic tarps underneath treated wood waste to be sawed up in any outdoor location to collect sawdust from sawing operations. PG&E should vacuum and/or otherwise clean the plastic tarps after sawing operations to remove any sawdust or debris that falls on the plastic tarps and ensure that sawdust or debris collected from the tarps is placed within containers for proper offsite disposal. Following thorough cleaning, PG&E should also reuse the plastic tarps to minimize waste generation. PG&E should not saw up treated wood waste in any outdoor location while it is raining or when on site winds exceed 10 mph;

5) Before the first forecasted storm event of the rainy season, inspecting all storm drain inlets at the Facilities. During this inspection, PG&E should clean as needed each drain inlet using a vacuum or other effective cleaning device/method in order to remove dusts and solids that have entered the storm drain inlets;

6) Cleaning out sediments collected in the drain inlets at the Facilities following each storm event and properly dispose of any dust, sediment, or other pollutants removed from storm drain inlets or catch basins;

7) Inspecting the drain inlets at the Facilities during the wet season at least weekly, and on the day of or prior to any forecasted storm event that may result in discharge from the Facilities, and checking that the drain inlets are not in a condition that would materially impair their efficacy;

8) Covering the inlets at the Facilities for the entirety of the summer dry months with a metal plate or some other solid material that will prevent dust and solids from collecting in the drain inlets;

9) Adopting and implementing site sweeping and cleaning plans for each Facility. These plans would specify: (i) sweeping and cleaning should be designed to minimize tracking and other dispersal of pollutants on paved areas of the Facilities, (ii) areas where mechanical sweeping is feasible, areas where manual sweeping only is feasible, areas where sweeping is not feasible (such as under material that is not reasonably movable), areas where daily sweeping is likely needed during the rainy season, areas where less frequent sweeping is likely to be adequate, some provision for some more limited dry weather sweeping and cleaning to keep pollutant accumulation down (and prevent dust from blowing into areas hard to clean later where storm water in the rainy season is likely to reach), (iii) triggers for more frequent ad hoc sweeping or cleaning such as visual accumulation of dust or debris, (iv) that regenerative sweepers or vacuum systems should be employed to sweep all areas where sweeping by machine, as opposed to manual sweeping, is feasible, (v), at least annually, conduct a thorough inspection of each Facility and to the extent warranted by this inspection perform additional comprehensive site cleaning as needed to keep levels of contaminated dust down (vi) no discharge of any waste fluids or solid wastes generated in site cleaning to storm drain inlets or waterways, and (vii) collecting and disposing of all wastes generated during Facility cleaning and sweeping in a manner that complies with all local, state, and federal laws;

10) Repairing or replacing all cracking pavement and concrete/asphalt berms on the Facilities. PG&E should routinely inspect paved areas and implement additional repairs

or replacement of pavement on an as needed basis to ensure that pollutants are not deposited in cracks and later re-suspended in storm water runoff and/or that storm water flow does not leave the Facilities in other than designated flow paths;

11) Maintaining structural devices for storm water management at the Facilities in good operating condition during the wet season and shall promptly repair any damaged or degraded structural devices; and

12) Conducting training for all appropriate employees to explain how to implement measures designed to reduce pollutants in storm water runoff from the Facilities; and

13) Monitoring storm water discharges for PCP, dioxins and furans to ensure the efficacy of the remedial measures and to determine the need for additional or different measures.

89. Long-term remedial measures should include such site and off-site cleanup work shown by the additional assessment work described above as warranted and appropriate to reduce pentachlorophenol, dioxins and furans loadings to levels below regulatory agency benchmark values – and thus address the imminent and substantial endangerment posed by the Facilities' release of contaminants.

Executed on April 16, 2014 in Canyon, Texas

William J. Rogers

EXHIBIT 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 12 2014

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

MEMORANDUM

SUBJECT: Ninth Circuit Court of Appeals Decision in Ecological Rights Foundation v. Pacific Gas and Electric Company Regarding the RCRA Definition of Solid Waste

FROM: for Susan Shinkman, Director
Office of Civil Enforcement

Rafael DeLeon, Acting Director
Office of Site Remediation Enforcement

TO: Regional Counsels
Regional Enforcement Division Directors
RCRA Enforcement Managers
RCRA Division Directors

This memorandum highlights issues raised by the decision in *Ecological Rights Foundation v. Pacific Gas and Electric*, 713 F.3d 502 (9th Cir. 2013) (*ERF*). The Office of Enforcement and Compliance Assurance (OECA) believes this decision relied on a problematic analysis of when a material may be a solid waste under the Resource Conservation and Recovery Act (RCRA). OECA is concerned that defendants in RCRA citizen suits and EPA enforcement actions may attempt to use this decision to narrow the definition of solid waste under RCRA. OECA therefore requests that the regions contact us if you suspect similar issues may arise in any future enforcement actions, citizen suits, or imminent and substantial endangerment actions under RCRA. In developing this memo, OECA conferred with the Office of Resource Conservation and Recovery and the Office of General Counsel.

The Ecological Rights Foundation (ERF) sued Pacific Gas and Electric and Pacific Bell Telephone Company, alleging that pressure-treated utility poles used and maintained by the defendants discharged wood preservative chemicals into waters of the United States in violation of the Clean Water Act (CWA). ERF argued that the discharged material constituted a solid waste that may present an imminent and substantial endangerment to human health or the environment under RCRA. The utility poles are pressure treated with an oil-pentachlorophenol (PCP) wood preservative mixture that is toxic, a probable human carcinogen, and an EPA registered, restricted-use pesticide under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

The defendants filed a motion to dismiss, arguing under the CWA, that discharges of storm water from the utility poles are neither a "point source discharge" nor "associated with industrial activity." They also argued that wood preservative that escapes from utility poles is not a "solid waste" under RCRA. The district court agreed, granting defendants' motion to dismiss both counts.[1]

The Ninth Circuit affirmed the lower court's decision to dismiss both the CWA and RCRA claims.[2] With respect to the RCRA claim, the court concluded that wood preservative that escapes from utility poles through normal weathering while those poles are in use is not automatically a "solid waste" under RCRA, because wood preservative "that is washed or blown away from utility poles by natural means, as an expected consequence of the preservative's intended use, has not been 'discarded.'" The court limited its holding, indicating that because the plaintiff did not allege "dangerous accumulations" of PCP, the court was not addressing whether escaping wood preservative could be a "solid waste" in that circumstance.

The statutory definition of solid waste under RCRA establishes the jurisdictional threshold for EPA's authority to regulate hazardous waste and also for the exercise of EPA's information gathering, corrective action, and enforcement authorities under RCRA sections 3004, 3007, 3008, 3013, and 7003. The section 7002 imminent and substantial endangerment provision at issue in the *ERF* decision contains the same language as EPA's authority under section 7003.

This memorandum is limited to EPA's view on the court's decision that the wood preservative alleged by plaintiff to be escaping from utility poles is not a solid waste under RCRA. EPA is not opining on whether the other elements of a RCRA section 7002 cause of action were met in this case, nor is EPA suggesting that the wood preservative escaping from poles in use is subject to EPA's hazardous waste regulations.

Analysis of Decision

The Ninth Circuit's decision in this case turned on the second element of a RCRA imminent and substantial endangerment claim under section 7002 (which has similar language to section 7003) – whether the material released into the environment was a solid waste. We believe the court made two fundamental errors in its analysis that led to the incorrect finding that the PCP released into the environment from utility poles is not a solid waste. First, the court incorrectly concluded that because the leaking, dripping or escaping of PCP to the environment by natural causes or human activity was an "expected consequence" of the PCP's intended use, it was not automatically a discarded material under RCRA's statutory definition of solid waste. Second, the court suggested that its conclusion may have been different if the plaintiff had alleged that the PCP releases had resulted in "dangerous accumulations" of

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[1] The district court held that PCP leaking from the poles due to natural means is not the type of discharge that is covered by RCRA section 7002. *See* 803 F. Supp. 2d, 1056, 1065 (N.D. Cal. 2011). The district court noted that ERF had not alleged any conduct by defendant resulting in discharge and that passive leaking from containers was not disposal. The district court's conclusion conflicts with the statutory language and the position the United States has taken in several actions under RCRA section 7003, but the Ninth Circuit did not rely on the district court's analysis in its decision.

[2] The Ninth Circuit also addressed two claims brought under the CWA's citizen suit enforcement provision. *See* 33 U.S.C. § 1365. The Plaintiff argued that the defendants had violated the CWA by discharging pollutants from point sources into waters of the United States without a permit. The court concluded that stormwater discharges from utility poles did not require a permit under the CWA because stormwater discharges from the poles are not associated with industrial activity, per EPA's regulations, and because the utility poles are not point sources. EPA agrees with the court that EPA has not defined stormwater discharges associated with industrial activity to include discharges from utility poles. *See ERF,* 713 F.3d at 515. Nothing in the decision limits EPA's authority to address these stormwater discharges in the future, if the Agency decides it is appropriate. With respect to the point source issue, the court acknowledged that it would normally defer to EPA, but that EPA has not spoken directly to whether utility poles are point sources. *Id.* at 509. Though we do not necessarily agree with the court's conclusion that utility poles are not point sources, this memorandum does not address this issue because we believe the court's decision acknowledges that the Agency remains free to interpret the term "point source" as appropriate.

the chemical. The court's approach improperly conflates when a material becomes a solid waste with the analysis necessary to determine when circumstances may present an endangerment. The court's decision also misinterpreted the Second Circuit's holding in *Connecticut Coastal Fisherman's Ass'n v. Remington Arms Co.*, 989 F.2d 1305, 1314-15 (2d Cir. 1993), and incorrectly construed and applied EPA regulations and guidance on when a product released to the environment may be a solid waste.

1. Releases that are "expected consequences" of a product's intended use may be "discard" of a "solid waste" under RCRA.

A product released to the environment as part of its intended purpose is not immediately a solid waste under RCRA, but may become a solid waste if left in the environment long enough. However, the court erred in holding that a product released into the environment as an "expected consequence" of the product's intended use is likewise not a solid waste. The court held that "wood preservative that is washed or blown away from utility poles by natural means, as an expected consequence of the preservative's intended use, has not been 'discarded.'" *ERF*, 713F.3d at 516. The court cited for support a Second Circuit decision which held that pesticides sprayed for the intended purpose of reaching and killing mosquitoes and their larvae were not discarded. *No Spray Coalition, Inc. v. New York*, 252 F.3d 148 (2d Cir. 2001). In analyzing the issue, the Second Circuit stated that "material is not discarded until after it has served its intended purpose." *Id.*

EPA agrees with the Second Circuit's statement that a material is not discarded so long as it is serving its intended purpose. However, PCP applied to utility poles can be distinguished from land-applied pesticides, such as those that were addressed by the Second Circuit. While land-applied pesticides may serve their intended purpose when dispersed into the environment, the Ninth Circuit noted in this case that the purpose of PCP applied to utility poles is to protect the poles. EPA believes that PCP ceases to serve this purpose at some point after it leaves the poles and is dispersed into the environment.[3] Despite noting that the PCP's purpose was to preserve the poles, the Ninth Circuit held that because dispersal into the environment is an expected consequence of this use, the PCP was not discarded.

The court did not define what it meant by "expected consequences." A broad reading of this language would represent a significant expansion of the Second Circuit's holding and could have unintended ramifications for the RCRA program. For example, with respect to the residue from spilled products, EPA's longstanding position is that absent a bona fide intent to recycle, such residue is a solid waste because the product has been abandoned.[4] The Ninth Circuit's opinion could have the unintended consequence of undermining EPA's established legal position because spills and leaks could be argued to be "expected consequences" of using products and there may be little room to distinguish PCP use on utility poles – where a product in use leaks material to the environment – from the spill scenarios upon which the Agency has opined. This decision could not only undermine EPA's use of Section 7003 but also its authority to ensure adequate cleanup at RCRA regulated facilities.

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[3] While the court noted that leaking, dripping or spilling PCP that comes to land in the soil immediately adjacent to the poles may still be serving its intended purpose of preserving the poles, EPA does not agree that this conclusion can be made without further factual development. *ERF*, F.3d at 515-16. First, the use of PCP in surrounding soils to preserve poles is not a registered use of the preservative under FIFRA. Second, it is not clear whether or to what extent leaked PCP may still be acting as a preservative and whether, at some point, the PCP is either rendered chemically inert (or diluted) or has moved too far away from the pole to accomplish this purpose.

[4] Land Disposal Restrictions for Third Scheduled Wastes, 55 Fed. Reg. 22,520, 22,671 (June 1, 1990).

2. Maintaining a distinction between the definition of solid waste and a potential endangerment.

It is well settled that a prima facie case for an imminent and substantial endangerment suit requires three elements: (1) the person (e.g., defendant) is contributing to or has contributed to the handling, storage, treatment, transportation or disposal (2) of a solid or hazardous waste (3) that may present an imminent and substantial endangerment to human health or the environment.[5] *See* 42 U.S.C. §6972(a)(1)(B) and § 6973(a). The only question to be answered in establishing the second element is whether the material has been "discarded" and thus meets the statutory definition of solid waste set forth in RCRA section 1004(27).

In purporting to limit its holding on "discard" to the facts of this case, the court improperly suggested that it might have reached a different conclusion had plaintiffs alleged "dangerous accumulations" of PCP. *ERF*, 713 F.3d at 518. The court's analysis was improper because the quantity of material and how toxic or dangerous it is has no bearing on the simple question of whether it has been "discarded." Once the "discard" element has been established, an evaluation of quantity, toxicity, or danger of the material is appropriate for an endangerment determination.[6] By conflating the two statutory elements, the court seems to have established a heightened standard for demonstrating whether a substance is a solid waste. This conclusion has no basis in the statutory language or existing case law.

In fact, the United States successfully advocated its position on this issue before the Second Circuit, when it argued that spent lead ammunition could become a solid waste at some point in time, if left to accumulate in the environment after serving its intended purpose. United States as Amicus Curiae at 25, *Conn. Coastal Fishermen's Ass'n v. Remington Arms Co., Inc.*, 989 F.2d 1305 (2d Cir. 1993) (Dockets 92-7191, 91-7193) ("the literal meaning of 'discarded' certainly can encompass shot and targets released into the environment and left to accumulate long after serving their intended purpose"). The Second Circuit adopted this position in its holding. *See Conn. Coastal Fishermen's Ass'n,* 989 F.2d at 1314-15. Neither the United States' brief nor the Second Circuit's decision referred to the amount or toxicity of the spent ammunition in analyzing whether it had been discarded, but instead focused on whether it was left to accumulate after serving its intended purpose.

3. The court's reliance on EPA's regulatory treatment of materials was incorrect in this case.

The court also looked to EPA's regulatory treatment of other materials for support, but this reliance was misplaced. *ERF*, 713 F.3d at 517. The court repeatedly erred by looking to EPA statements on what materials are exempt from *regulation* as solid or hazardous waste under RCRA rather than focusing on what materials fall within the broader statutory definition that applies to actions under RCRA sections 7002 and 7003.[7] EPA has consistently stated, both in its rulemakings and in guidance, that the statutory

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[5] The Ninth Circuit incorrectly states that the prima facie case under RCRA requires (1) the defendant has been or is a generator or transporter of solid or hazardous waste, or is or has been an operator of a solid or hazardous waste treatment, storage or disposal facility; (2) the defendant has "contributed" or "is contributing to" the handling, storage, treatment, transportation, or disposal of solid or hazardous waste; and, (3) the solid or hazardous waste in question may present an imminent and substantial endangerment to health or the environment, *ERF*, 713 F.3d at 514 (citing 42 U.S.C. Section 6972(a)(1)(B); *Prisco v. A&D Carting Corp.,* 168 F.3d 593, 608 (2d Cir.1999).

[6] "Dangerous accumulation" also appears on its face to present a more stringent standard than "may present an imminent and substantial endangerment." *See Price v. U.S. Navy*, 39 F.3d 1011, 1019 (9th Cir. 1994) (actual harm need not be shown).

[7] RCRA section 1004(27) defines "solid waste" to include "discarded material," whereas the regulatory definition at 40 C.F.R. § 261.2 narrows the term by defining "discarded material" as material that is abandoned, recycled, inherently waste-like or a military munition as those terms are further defined in the RCRA Subtitle C regulations. EPA and the courts have clearly stated that the two definitions apply for different purposes. The regulatory definition of solid waste is intended to apply only for

definition of solid waste is broader than the regulatory definition, and that the broader statutory definition is relevant for RCRA section 7003.[8] This position is consistent with Congressional intent.[9] The United States has also successfully advocated this position in litigation.[10]

The court also looked to EPA's hazardous waste listings of various types of PCP wastes as evidence of how PCP is governed by RCRA's statutory authorities. The court noted that four specific PCP-containing wastes were listed hazardous wastes and concluded that, because neither PCP in use nor soil contaminated with PCP is listed, it must not fall under the statutory definition of solid waste. This conclusion was erroneous because, logically, the absence of a regulatory hazardous waste listing is not determinative of what is covered by the regulatory or statutory definition of solid waste. The court also cited to a June 19, 1987 document describing the status of PCP wastes. "Regulatory Status of Various Types of Pentachlorophenol Wastes," RCRA Online No. 11256 (June 19, 1987). However, this document clearly states that it only addresses the scope of the hazardous waste listings.

The court also misinterpreted and took out of context statements by EPA regarding munitions and lead-based paint and failed to acknowledge more relevant statements that run counter to its decision, which actually support the proposition that the material is a solid waste for purposes of RCRA sections 7002 and 7003. For example, EPA's military munitions rule specifically states that munitions are solid wastes for purposes of RCRA sections 7002 and 7003 when munitions land off-range and are not promptly rendered safe and/or retrieved. *See* 40 C.F.R. § 266.202(d); 62 Fed. Reg. 6632 (analogizing this situation to a spill that goes unaddressed). Spent lead ammunition can be a solid waste under RCRA's statutory definition at private firing ranges although such ammunition is not subject to Subtitle C regulation. *See e.g., Conn. Coastal Fishermen's Ass'n*, 989 F.2d at 1314-15.

The court in *ERF* cited to EPA regulations and guidance on the regulation and disposition of lead-based paint wastes, noting that EPA regulates lead-based paint wastes generated and disposed of during renovation "but not lead-based paint that falls from houses through ordinary wear and tear." The court, however, again confused EPA's regulatory definition of solid waste with the statutory definition. In the memo cited by the court, EPA specifically states that although lead-based paint waste is exempt from the

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purposes of implementing RCRA Subtitle C. *See* 40 C.F.R. § 261.1(a), *see U.S. v Valentine*, 856 F. Supp 621, 627 (D.Wyo. 1994) and *Conn. Coastal*, 989 F.2d. 1314, 1315. The RCRA Subtitle C regulations govern the treatment, transportation, storage and disposal of regulated hazardous waste. The broader statutory definition, on the other hand, applies in other circumstances, such as for purposes of the imminent and substantial endangerment authorities in sections 7002 and 7003. A regulated solid waste is necessarily a solid waste under the statute -- the reverse is not true.

[8] *See* 40 C.F.R. § 261.1(b)(2) (stating that EPA may use RCRA section 7003 authority if the EPA has reason to believe that the material may be a "solid waste" and a "hazardous waste" as those terms are defined in the statute); 45 Fed. Reg. 33,084, 33,090 (May 19, 1980) ("unlike [sections 3002 through 3005 and 3010], Congress did not confine the operations of Sections 3007 and 7003 to 'hazardous wastes *identified or listed under this subtitle.*'"); 50 Fed. Reg. 614, 627 (Jan. 4, 1985) (stating that the statutory definitions of solid and hazardous waste would apply under RCRA sections 3007, 3013 and 7003).

[9] *See* H.R. Rep. 98-198 at 47 (EPA's authority under RCRA sections 3007 and 7003 includes all wastes that meet the statutory definition of hazardous waste).

[10] *See, e.g., U.S. v. Valentine*, 856 F. Supp. 621, 627 (D. Wyo. 1994) (*citing* 40 C.F.R. § 261.1 (b)(2)); *Military Toxics Project v. Envtl. Prot. Agency*, 146 F.3d 948 (D.C. Cir. 1998) and *Conn. Coastal Fishermen's Ass'n*, 989 F.2d at 1314-15. As the United States stated in its brief to the Second Circuit in the *Connecticut Coastal* case, "EPA applies a broader definition of solid waste for remedial purposes than for regulatory purposes in order to preserve the widest possible latitude for imminent threats to the public and the environment and to limit RCRA's prospective regulatory requirements to waste management activities that warrant comprehensive regulation from time of generation until final disposition." United States as Amicus Curiae at 23, *Conn. Coastal Fishermen's Ass'n v. Remington Arms Co., Inc.*, 989 F.2d 1305 (2d Cir. 1993) (Dockets 92-7191, 91-7193).

regulatory requirements under the household waste exclusion, this exclusion "does not affect EPA's ability to reach those wastes under its statutory authorities, such as RCRA § 3007 (inspection) and § 7003 (imminent hazard)." *See* "Applicability of the Household Waste Exclusion to Lead-Contaminated Soil" (March 7, 1995) and "Regulatory Status of Waste Generated by Contractors and Residents from Lead-Based Paint Activities Conducted in Households," at 3, *available at* http://www.epa.gov/lead/fslbp.html (Aug. 2000). EPA's regulations clearly exclude household waste from the definition of hazardous waste, but not from the definition of solid waste. *See* 40 C.F.R. § 261.4(b).

The court noted the potential broad implications if it found that leaking wood preservative constitutes a solid waste under RCRA, citing lead paint that naturally chips away from houses as an example of something that would also fall within RCRA's jurisdiction. Not only were the court's concerns misplaced, the court also misstated EPA's authority over lead-based paint. In fact, EPA has asserted its RCRA statutory authority over lead-based paint that falls from houses through ordinary wear and tear. EPA has issued two RCRA section 7003 orders to abate imminent and substantial endangerments from lead-based paint.[11] One order addressed the presence of lead-based paint which was in a deteriorating condition – it was chipping, peeling, and/or flaking – in 20 residential units on the property. Another order addressed the presence of lead dust in a commercial property from sandblasting activity during renovation.

As to pesticides, the Ninth Circuit found persuasive that EPA, under FIFRA, approved the use of PCP for preserving utility poles. The court erred in relying on EPA's approval of the use of PCP as a wood preservative as support for its conclusion that the material cannot be solid waste. Approval under the FIFRA registration process, which evaluates risks associated with use of pesticides does not answer the question of whether the material has been "discarded" and is thus a solid waste under RCRA's statutory definition.[12] Risk is not relevant with respect to the solid waste question, which is simply whether the material has been discarded. In fact, EPA has given notice that pesticides approved for use under FIFRA may be subject to RCRA at some point,[13] and the Agency's interpretation is that pesticides can become "discarded" for purposes of section 1004(27) under circumstances where they no longer serve their intended purpose.

Finally, in upholding the district court's refusal to grant the plaintiff's request for leave to amend the complaint, the court improperly suggested that a material is not a solid waste if its release was caused by human intervention, if that intervention is also an expected consequence of intended use (e.g., drilling into the utility poles). *ERF*, 713 F.3d at 520. Like many of the court's other statements, this conclusion could significantly broaden the concept of intended use. EPA does not agree that human intervention that may be part of a material's use can never result in the material becoming discarded and thus a solid waste under the statute. Referring back to our earlier example of product spills, if human intervention is a

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[11] *See* Unilateral Administrative Orders (UAO) issued to 17th Street Revocable Trust, John R. Redmond, New 4775 Huron L.L.C. and Argyle Properties, RCRA 3-2000-0001TH (April 8, 2002) regarding residential property in the District of Columbia, and UAO to Group I Management and M275, LLC (September 5, 2001) about a commercial property in Fall River, Massachusetts.

[12] EPA's approval of PCP was for use in the poles themselves, not the adjacent soil or areas beyond the utility poles. *See, e.g.* Letter from Jacqueline McFarlane, Office of Chemical Safety and Pollution Prevention, to Dr. Hubert R. O'Neal (March 15, 2012), *available at* http://www.epa.gov/pesticides/chem_search/ppls/061483-00003-20120315.pdf.

[13] *See, e.g.*, Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristic Revisions, 55 Fed. Reg. 11798, 11839 (March 1990) ("...the mandates of FIFRA and RCRA are different. EPA has previously stated that even if it were determined that certain ground *uses* of treated wood did not pose unreasonable risks, wood *wastes* might still be regulated under RCRA Subtitle C").

regular part of a product's use, yet results in a spill of the product, EPA would consider that spill to be discarded product and thus a solid waste under the statute. Furthermore, EPA has used its RCRA section 7003 authority to address similar human activity when lead-based paint is released through contractor renovation work. As stated earlier, however, a finding that a material is a solid waste under RCRA's statutory definition does not trigger RCRA regulatory obligations.

Legal Impact of the Decision

We are not aware of any other court that followed a similar rationale and found that the release of a chemical product that is no longer serving its intended purpose is not a "solid waste" so long as that release (1) is a "natural expected consequence" of its intended use, or (2) does not result in a dangerous accumulation of the material. Because the court neither defined "expected consequence" nor properly applied the holding of *Connecticut Coastal* (by suggesting that there may have been a different result if the plaintiff alleged a "dangerous accumulation" of PCP), the *ERF* decision appears to set a higher bar for establishing the presence of solid wastes under RCRA than currently exists under established case law and thus could limit EPA and citizen's use of RCRA Sections 7002 and 7003.

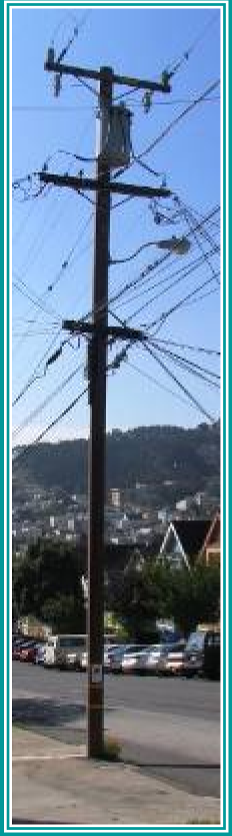
EPA's Position and Path Forward

When deciding whether a material such as the PCP in the instant matter is a solid waste, the court should have focused solely on whether the PCP was discarded. EPA agrees with the court that PCP applied to utility poles is not a waste since it is used for its intended purpose. However, EPA has also consistently stated its position that materials originally used for their intended purpose can become solid wastes under the RCRA statutory definition in certain circumstances such as where the material is no longer serving its intended purpose, is not able to serve its intended purpose, or cannot be reasonably recycled or used for other purposes.

We are seeking opportunities to address these issues in federal court in future judicial actions. We therefore request that you monitor the federal court docket in your region and alert OECA when a case or controversy could affect the analysis regarding the definition of solid waste. Please contact Leslie Oif at Oif.Leslie@epa.gov or 202-564-2291 in OCE or Mary Godwin at Godwin.Mary@epa.gov or 202-564-5114 in OSRE if you have any questions about this memo or have identified a case where this issue might be raised.

cc:

Barnes Johnson, OSWER
Mary Kay Lynch, OGC
John Michaud, OGC



Environmentally Friendly

FRP Composite Power Poles and Crossarms

U.S. Environmental Protection Agency
Washington, DC

August 18, 2008
Presented by: Bob Guilliams

Creative Pultrusions Inc.

POWERTRUSION PRODUCTS

20th Century Electric Distribution Poles

POWERTRUSION PRODUCTS

Creative Pultrusions Inc.

Wood poles dominated the Electric Distribution Systems in the US in the 20th Century for 3 reasons:

1) They were plentiful.
2) First growth was strong.
3) There were few alternate materials

POWERTRUSION PRODUCTS

Pesticides & Preservatives were needed

Formosan termites destroy wooden poles in Hawaii

Pole shell thickness is getting smaller

Creative Pultrusions Inc.

FRP Composite Advantage

POWERTRUSION PRODUCTS

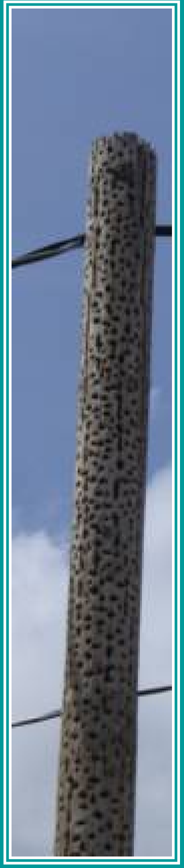
60 foot class
2 wood pole
Oahu
Northshore

Shell thickness approx. 3/8" to ½"

Creative Pultrusions Inc.

Woodpeckers destroy wood poles

POWERTRUSION PRODUCTS



Creative Pultrusions Inc.

PG&E has installed an average of 30,000 wood poles per year for over 60 years.

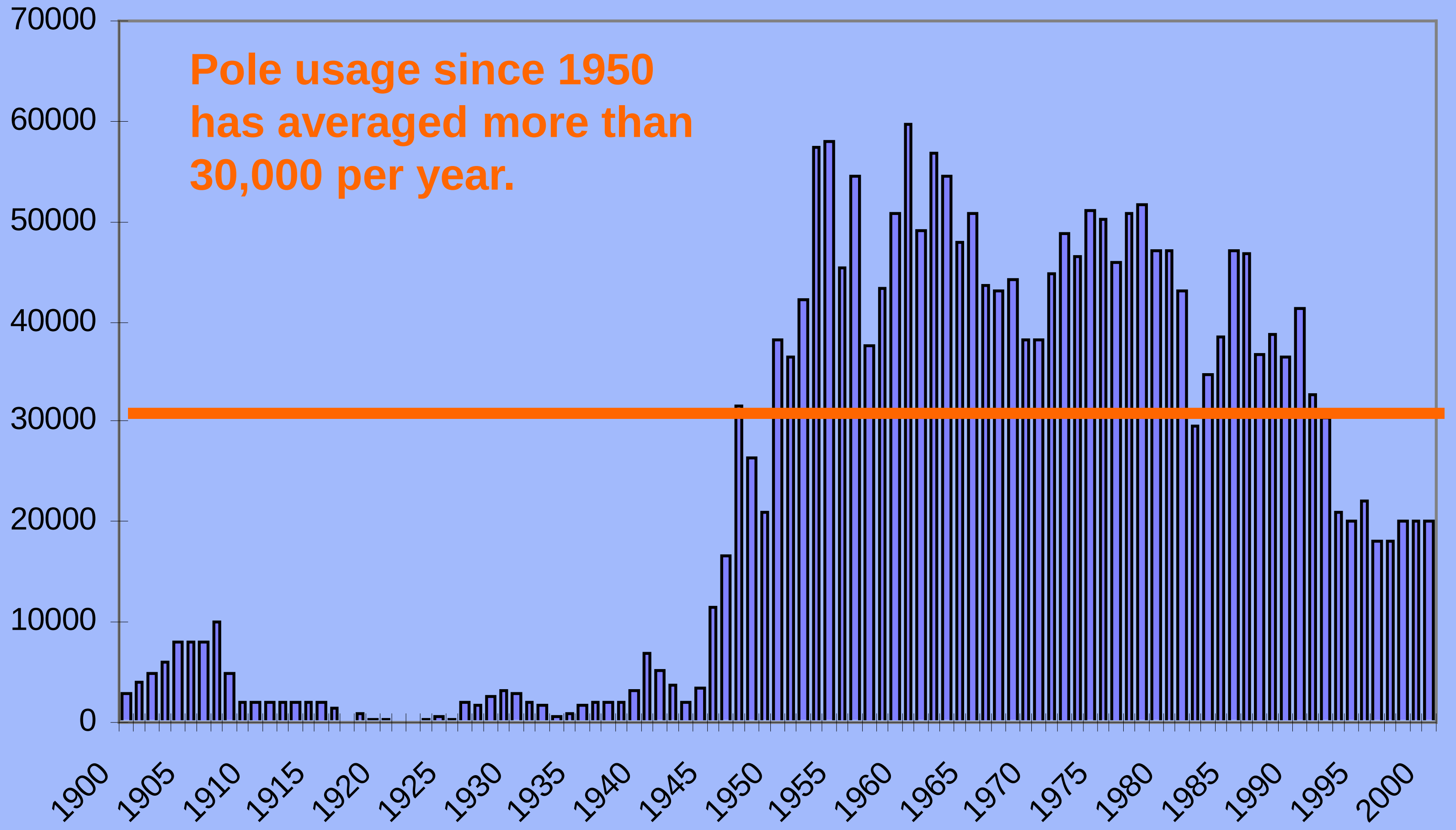


FIGURE 5B-1 Pacific Gas and Electric Company Approximation of PG&E wood pole inventory by date installed.

Creative Pultrusions Inc.

…"PG&E estimates it will save more than $6 million in avoided wood pole purchasing costs over the next 80 years."

POWERTRUSION PRODUCTS

…"PG&E expects each fiberglass pole used to replace 160 wood poles (2 poles per year over 80 years) if the current woodpecker damage rate remains unchanged."

Creative Pultrusions Inc.

To encourage the reuse of wood poles and at the same time to limit a utility's potential liability with respect to poles' reuse, many utilities distribute waiver forms and disclosure information. PP&L developed a "Beneficial Use of Treated Wood" form to track the number of poles given away by line workers. This one-page form, which discussed proper uses for the poles, also acted as a receipt and release to guard against liability. As part of its employee incentive award program, which rewarded employees for achieving operational, safety, and environmental goals, PP&L provided bonuses to line workers for each pole donated or reused. In 1994, PP&L saved $400,000 in avoided disposal costs by finding new uses for its wood poles.

In addition to finding reuse opportunities for wood poles, ComEd is searching for ways to extend the life of its poles. ComEd replaces between 18,000 and 20,000 wood poles each year. Many of these poles are taken down due to public service improvements, such as road widening, rather than deterioration. Although these poles still have considerable life remaining, they have lost some of the preservative at the ground line that would protect them from deterioration. In the past, these poles were disposed of and replaced with new poles. To help remedy the problem of lost preservative, ComEd is placing sodium-fluoride impregnated bandages around the bases of removed poles. This bandage helps reestablish the protective barrier around the pole and extend its life. ComEd is currently using the "pole bandage" on approximately 3 percent of its removed poles, leading to an annual savings of nearly $92,000.

Wood Pole Alternatives

In certain climates and geographical locations, wood poles have limitations. For this reason, many utilities are testing or expanding the use of poles made of more resistant materials, such as fiberglass and concrete.

Pacific Gas & Electric (PG&E) discovered that many of its wood poles lasted only 6 months in areas heavily populated with woodpeckers. To find an alternative, PG&E experimented with fiberglass poles. Fiberglass poles are guaranteed by the manufacturer to last for 80 years. PG&E expects each fiberglass pole used to replace 160 wood poles (2 poles per year over 80 years) if the current woodpecker damage rate remains unchanged. To date, PG&E has installed approximately 100 fiberglass poles, conserving 16,000 wood poles. Even at a cost of $900 per fiberglass pole, over twice the cost of a $400 wood pole, PG&E estimates it will save more than $6 million in avoided wood pole purchasing costs over the next 80 years.

In Florida, wood poles are often damaged by hurricanes. FPC and Florida Power & Light (FP&L) both have begun to replace their wood poles with more hurricane-resistant concrete poles. Just like wood poles, however, concrete poles become a waste management challenge when their useful life is over.

FPC took advantage of a local opportunity to donate its used concrete poles and other concrete debris to Pinellas County's artificial reef program, one of the largest in the country. Since the program began, more than 240 tons of retired poles have been used to create a habitat for many species of fish that now call these artificial reefs in the Gulf of Mexico their home.

Cost-Effective Porcelain Reuse

Porcelain bushings and insulators are often used on utility poles to insulate electric currents. As with the poles themselves, there are numerous reuse opportunities for these porcelain items. When utility poles are taken down, utilities can grind the bushings and insulators for use in road aggregate, ice melt, and outdoor tiling. Since 1993, Northern States Power has recovered nearly 400 tons of porcelain for these purposes. The utility also donates some of its insulators to a local artist who uses them to create sculptures.

Several utilities, however, find it labor intensive to process and grind the porcelain in order to make it economically viable in the marketplace. BGE, which recovered nearly 270 tons of porcelain in 1995, is sending its insulators and bushings to an outside vendor for processing. The vendor employs handicapped individuals to strip any metal remaining on the insulators and bushings (selling it for scrap) and then grinds the porcelain for aggregate. This program not only helps BGE avoid porcelain disposal cost, but also provides BGE with a small percentage of profits made by the outside vendor.

Porcelain processing costs can be avoided altogether by reusing intact bushings and insulators. For example, PG&E tries to reuse its insulators. In addition, the utility lists unusable insulators with a state materials exchange. This way, the utility avoids both disposal costs and porcelain processing costs and, hopefully, finds someone who is interested in the material.

PG&E Environmental policy

POWERTRUSION PRODUCTS

WasteWi$e Partner Profile

Pacific Gas and Electric (PG&E)

Fuel source: Natural gas, hydro power, nuclear, and geothermal.

Facilities: PG&E operates 1,500 facilities.

Generating capacity: 102 billion kilowatt hours.

Service area: PG&E's service area covers 75,000 square miles.

Customers: Approximately 4,463,000.

Employees: Approximately 22,000.

Environmental policy: PG&E's environmental policy states that "PG&E is committed to a clean, healthy environment. We will provide our customers with safe, reliable, and responsive utility service in an environmentally sensitive and responsible manner. We believe that sound environmental policy contributes to our competitive strength and benefits our customers, shareholders, and employees by contributing to the overall well-being and economic health of the communities we serve."

Innovative Waste Reduction Activities

Education and Measurement

Life cycle cost-analysis. For 1997, PG&E is conducting a facility-scale life cycle cost-analysis (LCCA) at a medium-sized customer service center in Contra Costa County. The assessment is examining all material inputs and solid waste stream outputs with the goal of using LCCA techniques to reduce waste disposal costs.

Solid waste consulting. PG&E works with some of its customers on paper recycling and was also one of seven founding members of the Recycled Paper Coalition, a voluntary effort to reduce waste by purchasing recycled content paper …
corporate paper recycling.

Employee education. PG&E's E…
Statement and other environm…
now included throughout the …
riculum training. In 1995, m…
employees attended these c…

Environmental report. PG&…
rate environmental report …
distributed to the Board o…
employees, and external …

Measurement. PG&E is …
collect baseline data o…
company plans to red…
10 percent in 1997 …
developing managem…

Generating St…

Transformer remar…
a dedicated facilit…
and recycling pro…
nearly 30,000 tr…
8,000 were rem…
vice. Nearly 20…
tons of metals …
disposal costs …

Poles. PG&E experimented … to damage caused by woodpeckers. … poles last only 6 months due to woodpecker damage, fiberglass poles are guaranteed to last for 80 years. PG&E expects that each fiberglass pole used will replace 160 wood poles (2 poles per year over 80 years). To date, PG&E has installed approximately 100 fiberglass poles, potentially conserving 16,000 wood poles. Given that wood poles cost $400 each and fiberglass poles cost $900 each, PG&E could potentially save more than $6,000,000 in avoided purchasing costs over 80 years. When fiberglass poles meet the company's performance requirements, PG&E will regularly use them wherever woodpecker

Environmental policy: PG&E's environmental policy states that "PG&E is committed to a clean, healthy environment. We will provide our customers with safe, reliable, and responsive utility service in an environmentally sensitive and responsible manner. We believe that sound environmental policy contributes to our competitive strength and benefits our customers, shareholders, and employees by contributing to the overall well-being and economic health of the communities we serve."

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PG&E Fiberglass Pole Specification

POWERTRUSION PRODUCTS

…"The life expectancy of a new wood pole in the same location is less than 15 years, due to woodpecker damage, high pole decay or being in a termite area."

1. Design Criteria

Fiberglass poles are an option to continued use of wood poles and can be set anywhere economical to do so. However, because the material cost of fiberglass poles is higher than wood, discretion should be used to limit use to locations providing a short payback period. For example:

- The life expectancy of a new wood pole in the same location is less than 15 years, due to woodpecker damage, high pole decay or being in a termite area.
- Equipment poles or poles with high future changeout costs. (Example: When the fiberglass pole material cost is less than 25% of total pole replacement cost).
- Inaccessible areas or locations requiring the pole to be set by hand or helicopter, where the labor savings of the lighter fiberglass pole will offset the higher material cost.

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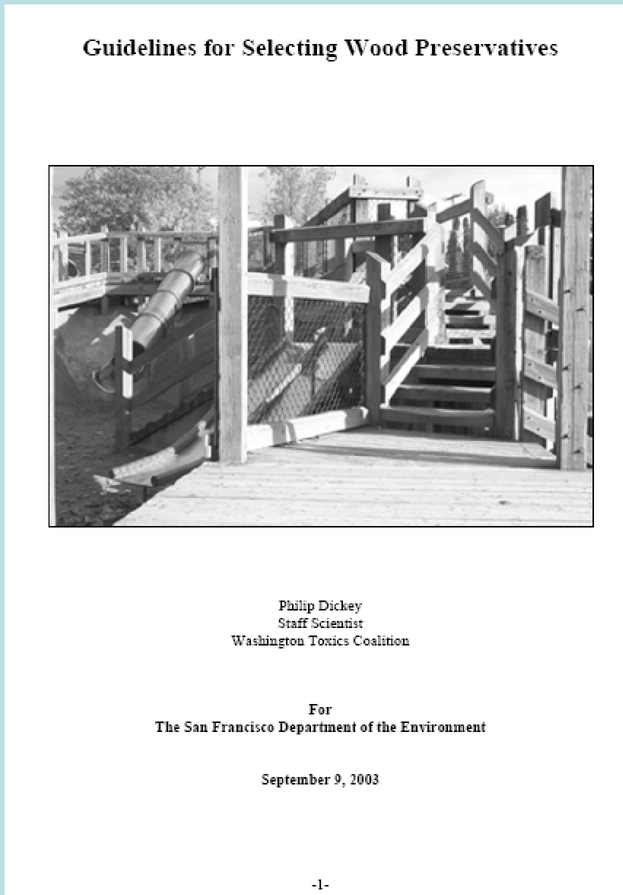
San Francisco City & County Wood Pole Policy



Guidelines for Selecting Wood Preservatives

Philip Dickey
Staff Scientist
Washington Toxics Coalition

For
The San Francisco Department of the Environment

September 9, 2003

-1-

Urges …"all utility pole owners to take steps to protect public health and the environment from wood preservatives in utility poles"

Creative Pultrusions Inc.

City and County of San Francisco Resolution No.004-01-COE Wood Preservatives

…"cover the first five feet above the ground of all existing treated wood poles within 100 feet of elementary schools and parks (and daycare centers if requested to do so)"

Conclusion: Continued use of PCP-treated wood appears to be in conflict with city policy.

Wood Pole Policy

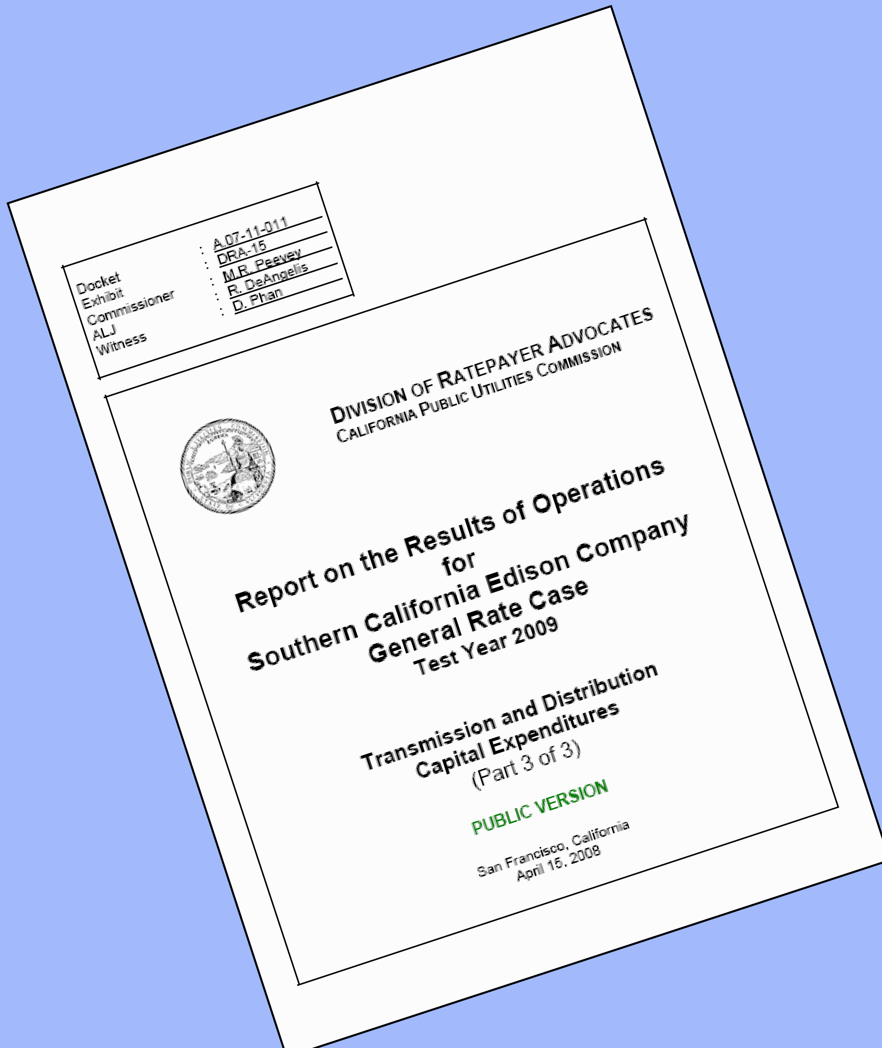
The wood pole policy urges the City and County of San Francisco to "urge PG&E, Pacific Bell, and manufacturers of non-wood utility poles to conduct a feasibility study of alternatives to chemically treated wood utility poles and to urge all utility pole owners to take steps to protect public health and the environment from wood preservatives in utility poles." Although not binding on the private utilities, the resolution also requests that they:

* cover the first five feet above the ground of all existing treated wood poles within 100 feet of elementary schools and parks (and daycare centers if requested to do so)
* report annually on the materials used when poles are replaced.

Conclusion: This policy expresses a clear preference for poles not made of treated wood. In recognition of this policy, it is suggested that before making any selection of wood preservatives for any purpose that the following questions be asked:

* is wood necessary for this project?
* if wood is chosen, is treated wood necessary for this project?

California Public Utilities Commission
Southern California Edison
Test Year 2009 General Rate Case



Docket	: A.07-11-011
Exhibit	: DRA-15
Commissioner	: M.R. Peevey
ALJ	: R. DeAngelis
Witness	: D. Phan

DIVISION OF RATEPAYER ADVOCATES
CALIFORNIA PUBLIC UTILITIES COMMISSION

Report on the Results of Operations
for
Southern California Edison Company
General Rate Case
Test Year 2009

Transmission and Distribution
Capital Expenditures
(Part 3 of 3)

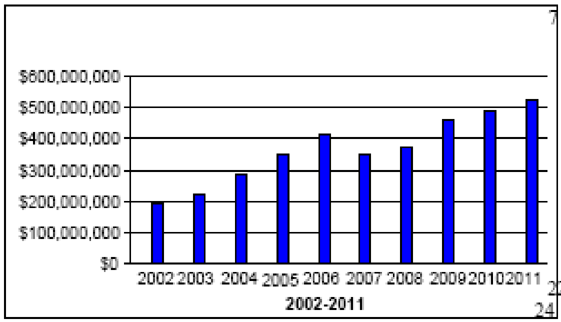
PUBLIC VERSION

San Francisco, California
April 15, 2008

Creative Pultrusions Inc.

California Public Utilities Commission
Southern California Edison
Test Year 2009 General Rate Case

Figure 15-1
Distribution Capital Replacements
2002-2006 Recorded and 2007-2011 Forecast
(In Nominal Dollars)



Source: SCE-3, Vol. 3, Pt. 3, p. 2.

A. Budget Item 480 – Distribution Wood Pole Replacements

SCE requests a total of $505.288 million in capital expenditures to replace distribution wood poles for years 2007-2011.[3] SCE forecasts a replacement rate of 8,630 poles in 2007, 9,673 poles in 2008 and 11,768 poles in 2009. In 2006, SCE replaced 12,059 poles. In 2007, SCE actually replaced 8,961 poles.[4]

DRA reviewed SCE's testimony and workpapers and finds the company's request excessive. DRA recommends the recorded expenditures for 2007, $76.6 million, adjusted for inflation,[5] as the annual funding for 2008 and 2009. DRA's analysis is presented below.

3 SCE-03, Vol.3, Pt. 3, p. 19.

4 SCE's response to DRA-231, Q.1.

5 DRA is using SCE's Distribution Annual Escalation capital composite rates of 2.60% for 2008 and 2.33% for 2009, which DRA accepts as reasonable.

"SCE forecasts a replacement rate of 8830 poles in 2007, 9,673 poles in 2008 and 11,768 poles in 2009."

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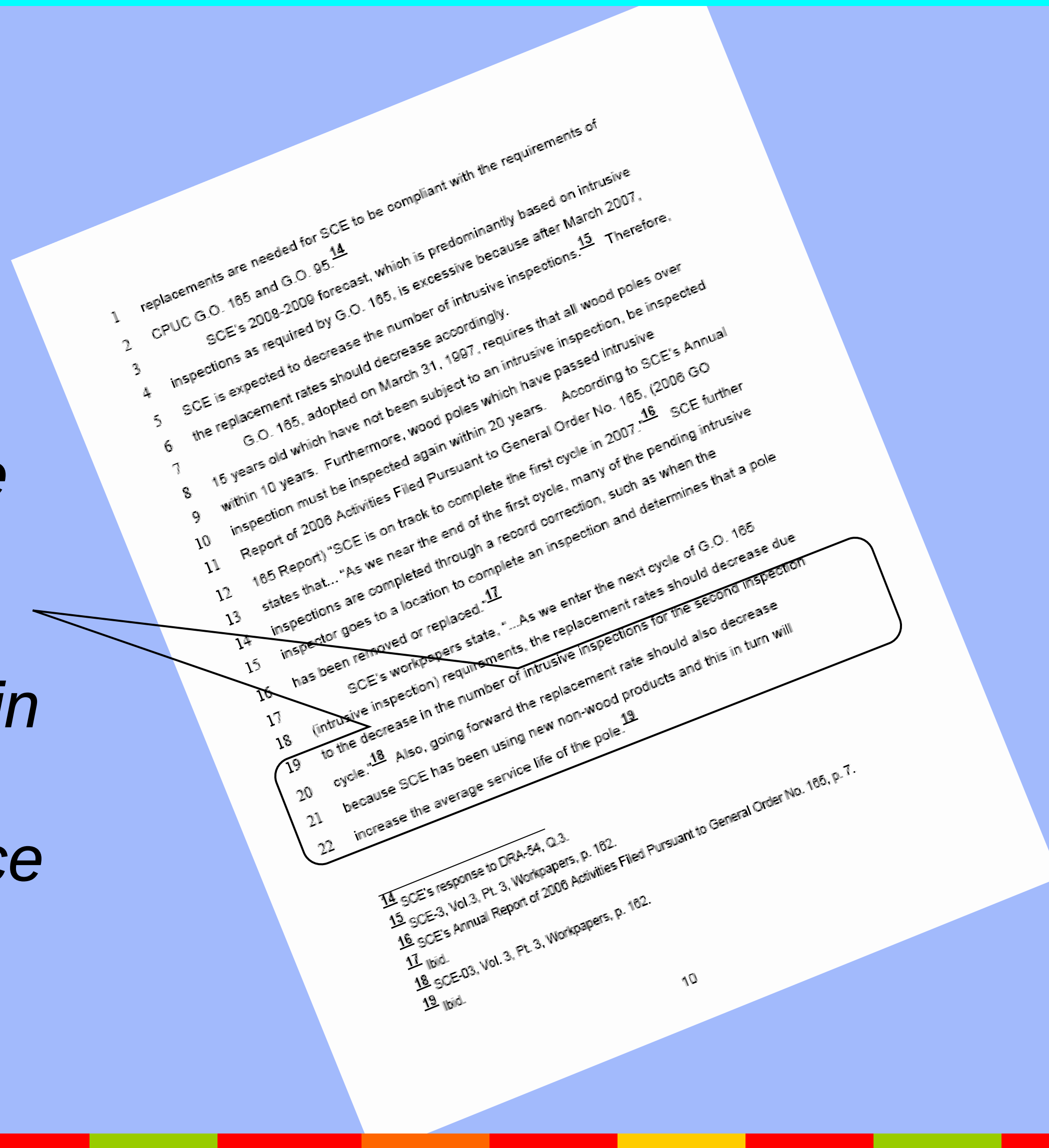
California PUC recognizes that non-wood products will increase the average service life of the pole

…"Also, going forward the replacement rate should also decrease because SCE has been using non-wood products and this in turn will increase the average service life of the pole."



replacements are needed for SCE to be compliant with the requirements of CPUC G.O. 165 and G.O. 95.[14]

SCE's 2008-2009 forecast, which is predominantly based on intrusive inspections as required by G.O. 165, is excessive because after March 2007, SCE is expected to decrease the number of intrusive inspections.[15] Therefore, the replacement rates should decrease accordingly.

G.O. 165, adopted on March 31, 1997, requires that all wood poles over 15 years old which have not been subject to an intrusive inspection, be inspected within 10 years. Furthermore, wood poles which have passed intrusive inspection must be inspected again within 20 years. According to SCE's Annual Report of 2006 Activities Filed Pursuant to General Order No. 165, (2006 GO 165 Report) "SCE is on track to complete the first cycle in 2007."[16] SCE further states that… "As we near the end of the first cycle, many of the pending intrusive inspections are completed through a record correction, such as when the inspector goes to a location to complete an inspection and determines that a pole has been removed or replaced."[17]

SCE's workpapers state, "…As we enter the next cycle of G.O. 165 (intrusive inspection) requirements, the replacement rates should decrease due to the decrease in the number of intrusive inspections for the second inspection cycle."[18] Also, going forward the replacement rate should also decrease because SCE has been using new non-wood products and this in turn will increase the average service life of the pole.[19]

14 SCE's response to DRA-54, Q.3.
15 SCE-3, Vol.3, Pt. 3, Workpapers, p. 162.
16 SCE's Annual Report of 2006 Activities Filed Pursuant to General Order No. 165, p. 7.
17 Ibid.
18 SCE-03, Vol. 3, Pt. 3, Workpapers, p. 162.
19 Ibid.

10

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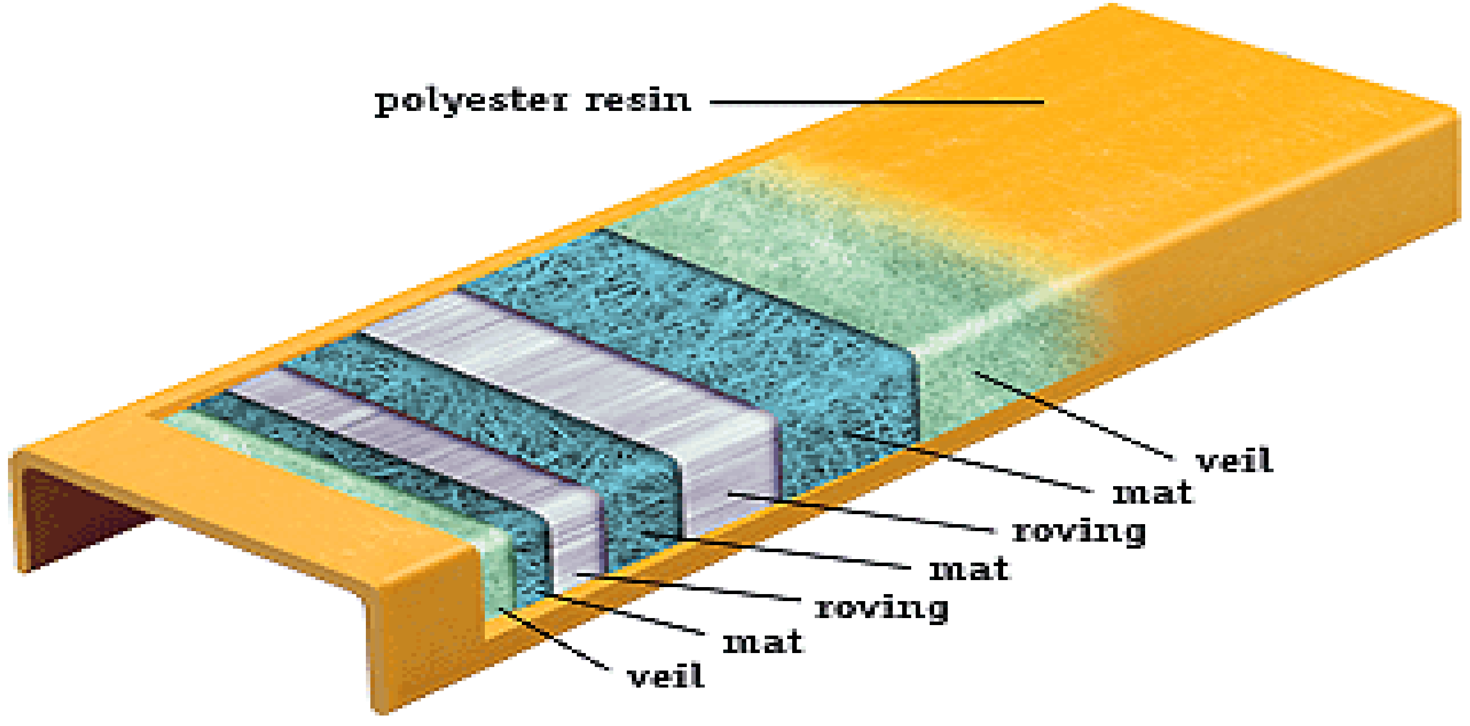
Three primary engineered materials provide alternatives to Chemically-treated wood poles:

1) **Fiberglass**
2) **Steel**
3) **Concrete**

PULTRUSION LAYUP

FRP (**F**iber **R**einforced **P**olymer)



Pultruded Fiberglass Components

Creative Pultrusions Inc.

FRP Composite Advantage

POWERTRUSION PRODUCTS

ü Strength

- q High Strength to Weight Ratio
- q Reliable and Predictable Performance
- q LOW Coefficient of Variation in Test < 5%
- q High E-Modulus – Allows bending without breaking
- q Dimensionally Stable, No creep over time
- q No Separation on ***Catastrophic*** Breaks

ü Lighter

q POLES: 1/3 the weight of Wood:

	FRP	Wood SYP	Wood DF
Class 2 – 35' Pole	322 lbs	1140 lbs	1000 lbs
Class 3 – 40' Pole	368 lbs	1125 lbs	1045 lbs

q Light weight allows for reduced transportation

q Light weight allows for ease of field handling

FRP Composite Advantage

POWERTRUSION PRODUCTS

ü **Lighter**

Helicopter Installation

Creative Pultrusions Inc.

FRP Composite Advantage

POWERTRUSION PRODUCTS

ü Corrosion Resistant

- q Resistance to 300+ chemicals
- q No warp, rot or decay with age
- q Low preventive maintenance
- q Ideal for coastal & caustic applications
- q Unaffected by moisture exposure

Creative Pultrusions Inc.

FRP Composite Advantage

POWERTRUSION PRODUCTS

ü Environmentally Safe

- q No leaching of chemical preservatives
- q Ideal for schoolyards, playgrounds, daycare centers and public areas
- q FRP ideal for crew handling & labor relations

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Distribution Structures

POWERTRUSION PRODUCTS

Pultruded Poles and Crossarms

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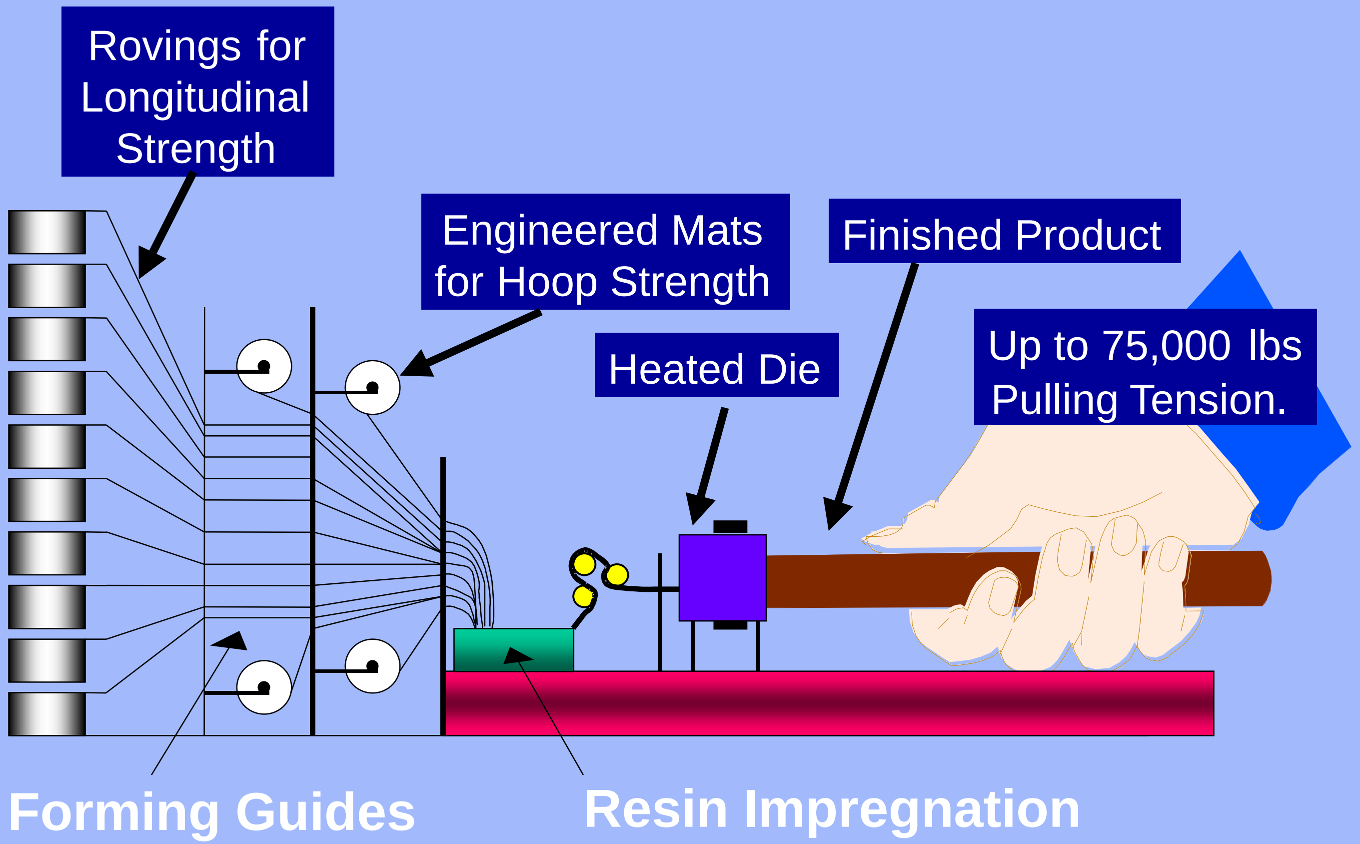
Pultrusion Process

POWERTRUSION PRODUCTS

FIBER REINFORCED POLYMER Composite



Creative Pultrusions Inc.

Powertrusion Products

Manufactured by Creative Pultrusions, Inc.

214 Industrial Lane

Alum Bank, PA 15521

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www.powertrusion.com

Use of Pentachlorophenol-Treated Utility Poles in Residential Areas

Prepared by: The University of Minnesota Consumer Protection Law Clinic
Brian D. Clark
Jennifer M. Ertel
Anne H. Taff

December 1, 2008

Table of Contents

I. Introduction to Pentachlorophenol

Pentachlorophenol, commonly known as "penta" or PCP, is a man-made substance commonly used in the United States as a wood preservative.[i] Penta belongs to a class of chemicals known as chlorinated phenols.[ii] These chemicals are "biocides," or substances which are toxic to living organisms. [iii] Penta treatment protects substances from degradation by killing the insects, bacteria, fungi, marine life and other organisms that come into contact with it.[iv] Penta's toxic properties make it an excellent pesticide, and can greatly extend the useful life of the substances to which it is applied.[v] However, those same toxic properties also make it dangerous for the environment as a whole, including humans.[vi]

In the United States, penta is a registered pesticide under the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA) and regulated by the Environmental Protection Agency (EPA). Currently, EPA prohibits indoor residential uses of penta and has licensed the chemical for use in commercial / industrial settings only.[vii] Penta is used primarily to treat wood utility poles.[viii] Penta treatment greatly extends the useful life of utility poles from approximately seven years for an untreated pole to an average of 30 years for a penta-treated pole.[ix] Ancillary uses include treatment of railroad ties, wharf pilings, fences, shingles, walkways, building components, porches, flooring, and laminated beams.[x] Additionally, penta may be used in agricultural settings for treating wood used as fencerows, hedgerows and agricultural buildings.[xi]

Penta was developed in 1931, and for more than 50 years was largely unregulated.[xii] Due to its effectiveness, penta quickly became one of the most widely-used pesticides in the United States.[xiii] By 1947, nearly 3,200 metric tons of penta were reported to have been used in the U.S. by the commercial wood preserving industry.[xiv] Prior to use restrictions enacted by EPA in the 1980s, 79% of penta produced in the U.S. was used in commercial wood preservation.[xv] Penta was also used as an herbicide, in leather and rope treatments, as a cooling agent in tower water, and in paper mills.[xvi] Consumer wood preservation accounted for as much as 10% of penta usage.[xvii]

In 1984, EPA cancelled all residential uses of penta after studies showed that it posed significant risks to human health.[xviii] The United States Department of Agriculture has warned that penta "should never be used inside . . . for any reason."[xix] Since then, the purchase and use of penta in the U.S has not been available to the general public.[xx] However, penta continues to be present in backyards and neighborhoods across the country due to its widespread use as a preservative in utility poles. Utility pole treatments account for more than 90% of penta usage in this country.[xxi] There are approximately 60 million utility-owned wood poles in service across the U.S. which have been treated with wood preservatives.[xxii] Approximately 36 million of these poles have been treated with penta.[xxiii] Of the remainder, the vast majority of poles are treated with similarly toxic chemicals like creosote and chromated copper arsenate,[xxiv] which pose the same kinds of environmental risks as penta but are beyond the scope of this discussion.[xxv]

Penta is a petroleum-based preservative, and as a result has a very sharp characteristic phenolic (acidic) smell when hot but very little odor at room temperature.[xxvi] Pure penta exists in two forms: As colorless crystals and as a sodium salt that dissolves in water.[xxvii] Humans are generally exposed to technical-grade penta, which is around 86% pure and typically contains two micro-contaminants, hexachlorobenzin (HBC) and dioxin.[xxviii] As discussed in the next section, these contaminants are just as, if not more, toxic than pure penta itself. For this reason, penta is banned in 26 countries including Austria, Belize, Benin, Columbia, Costa Rica, Denmark, Dominican Republic, Egypt, Germany, Guatemala, Hong Kong, India, Indonesia, Italy, Jamaica, South Korea, Liechtenstein, Luxembourg, Malaysia, Moldova, Netherlands, New Zealand, Nicaragua, Norway, Panama, Paraguay, Switzerland, Sweden, Taiwan, Yemen[xxix]

II. Human Exposure & Effects

Penta is classified by EPA as a probable human carcinogen. It is part of a class of chemicals known as "persistent bioaccumulative toxins," or PBTs.[xxx] As the name suggests, PBTs are toxic, persist in the environment and build up over time in food chains. [xxxi] PBTs pose serious risks to human health and ecosystems.[xxxii] The biggest concerns about PBTs are that they transfer easily among air, water, and land, and span boundaries of programs, geography, and generations.[xxxiii] Penta is considered "highly hazardous" by the World Health Organization.[xxxiv]

Technical-grade penta, which is the kind used in commercial wood preservation, is contaminated with several carcinogenic toxins that are byproducts of the manufacturing process. Such toxins include hexachlorobenzene (HCB) and dioxins / furans.[xxxv] HCB and dioxins / furans rank with the most toxic chemicals ever created and are classified as "persistent organic pollutants" by the United Nations Environment Programme. HCB and dioxins / furans have been banned in the United State since the 1960s; however, these chemicals continue to enter the environment as byproducts of the manufacturing of other substances, such as penta.[xxxvi] Because HCB and dioxins / furans are inextricably linked with penta of a technical grade, references to the exposure risks and health effects of penta are intended to be understood as the risks and effects of all three substances acting in concert, unless otherwise noted.

A. Exposure

Human exposure to penta occurs in a number of ways. As a result of its past widespread use as a pesticide, penta is found in all environmental media, in varying amounts.[xxxvii] Penta has been detected in surface waters and sediments, rainwater, drinking water, aquatic organisms, soil, and food, as well as in human milk, tissue and urine. Releases to the environment are decreasing as a result of falling consumption and changing use methods.[xxxviii] However, penta is still released to surface waters from the atmosphere by wet deposition, from soil by run off and leaching[xxxix], and from manufacturing and processing facilities.[xl] Penta is released directly into the atmosphere via volatilization from treated wood products and during production.[xli] Releases to the soil can be by leaching from treated wood products, atmospheric deposition in precipitation (such as rain and snow), spills at industrial facilities and at hazardous waste sites.[xlii] In addition, a number of other chemicals, including hexachlorobenzene (HCB), pentachlorobenzene, and benzene hexachloride isomers, are known to be metabolized to penta.[xliii]

According to EPA, penta may be released to the environment as a result of its manufacture, storage, transport, or use as an industrial wood preservative for utility poles, cross arms, and fenceposts, and other items.[xliv] Other former uses that may have lead to its release include the manufacture of sodium pentachlorophenolate and minor uses as a fungicide, bactericide, algicide, and herbicide for crops, leathers and textiles.[xlv] EPA's Toxic Chemical Release Inventory shows that from1987 to 1993, penta releases to land and water totaled nearly 100,000 lbs. Although EPA has restricted consumer penta usage significantly, it has done little to curb the production of penta for commercial use. A survey of the wood preservation industry reveals that approximately 29.6 million gallons of penta were consumed for wood treatment in the U.S. in 2004 alone.[xlvi]

Two studies demonstrate the ubiquity of penta in the environment. In the 1980s, the National Center for Health Statistics, working in connection with EPA, conducted the Second Health and Nutrition Examination Survey. This survey sampled approximately 28,000 people representing a cross-section of the nation. Penta was found in the urine of 79 percent of those sampled.[xlvii] In 1989, urine samples from 197 Arkansas children were analyzed for a variety of chlorinated phenols, including penta.[xlviii] Half of the children lived in a community with a chemical manufacturing plant, while the control group had no such chemical plant in their community.[xlix] Penta was found in 100 percent of the children tested, with higher traces noted in the children living in close proximity to the plant.[l]

Further evidence indicates that penta is present at significantly elevated levels in water around treated sources. Environment Canada conducted a study to determine the occurrence of chlorophenols, including penta, in utility and railway rights-of-way ditches in British Columbia.[li] Although penta was not detected in control samples taken from pristine watersheds and parklands, penta was found at high levels in utility and railway ditches where poles and ties had been treated with the chemical.[lii] Concentrations of penta averaged 1060 mg/kg at the base of poles.[liii] This concentration greatly exceeds EPA's Minimum Risk Level for dermal and oral exposure to penta. The study found that the level of penta in the soil and water was inversely related to the distance from the penta treated wood in the ditches.[liv]

As a follow up, Environment Canada conducted a study to determine whether dioxins / furans were leaching out of penta-treated utility poles and railroad ties. Samples of treated wood were collected to confirm the source of dioxins / furans.[lv] As in the first study, no dioxins / furans were found in the control samples.[lvi] Significantly elevated levels of dioxin / furans were found not only in the poles and ties themselves, but in the area directly adjacent to the treated wood.[lvii] The study concluded that the principle source of dioxins and furans in railway and utility right-of-way ditch water was associated with the chlorophenols such as penta used for the preservation of wooden ties and poles. Dioxins and furans from these right-of-way wooden structures not only contaminated ditch water but were also transported away from the point source of contamination, as is illustrated by the high levels of dioxins and furans found in water 13 feet downstream of ditches adjacent to utility poles.[lviii]

In 1988, Bell Canada conducted a study to determine whether soil and groundwater in its storage yards were contaminated by penta and / or another wood preservative, chromated copper arsenate (CCA). In Quebec, where the company uses mostly penta-treated poles, the clean-up criteria, or levels determined acceptable, were exceeded by factors as high as 100 at 10 out of 14 sites. Another Canadian study measured the amount of penta leaching out of a pile of 15 Douglas Fir poles under natural rainfall conditions in British Columbia. The level of penta released from these poles was relatively constant throughout the study period of four months, ranging from 1.57-2.85 mg/L rainfall. The Maximum Contaminant Level set by EPA for penta in drinkable water is 0.001 mg/L. Health effects are noted at levels exceeding this amount.[lix] An in-depth discussion of health effects follows this section.

The evidence also reveals widespread penta contamination in the ground around treated sources. A study conducted by the Electric Power Research Institute (EPRI) measured soil adjacent to utility poles in service. EPRI found levels of penta in the soil around the poles as high as 100 mg/kg, or 100 parts per million. EPRI also evaluated the leaching of penta into lower depths of soil around 168 in-service wood utility poles and found that penta residues were relatively constant to 48 inches; maximum levels were above 500 mg/kg. In addition, significant levels of dioxin were measured in soil samples taken from around penta-treated poles, with detectable levels of dioxin found 20 centimeters from the poles.

Studies confirm that inhalation of airborne penta has been found to be one of the most common routes of exposure in humans.[lx] Air samples at penta production facilities confirm the presence of airborne penta, in some cases at levels that exceed EPA's acceptable standards.[lxi]

Exposure to airborne penta is not limited to occupational settings. In one recent study of 120 homes, penta was detected in air 58% of the time and in dust 86% of the time. [lxii] The study concludes that these numbers "point to ubiquitous and continuous exposures to PCP in homes."[lxiii]

In excess of three million utility poles are removed from service each year.[lxiv] The question of disposal and reuse of penta-treated poles, which is essentially unregulated, raises serious questions about risk factors that extend beyond use and storage. At the end of its lifespan, a wooden utility pole is typically disposed of in one of three ways: deposited in a landfill, incinerated, or re-cycled for other uses. In each option, the release of the chemical preservatives into the environment is a concern.[lxv]

Most utility poles are currently disposed of in landfills.[lxvi] Though the preservatives are known to leach into the soil, most preservative-treated wood is not considered hazardous waste at the federal level, and therefore not subject to the Resource Conservation and Recovery Act.[lxvii] Treated wood poles are also burned for their energy value in co-generation facilities permitted for burning treated wood, in hazardous waste incinerators, and in the fireplaces and wood stoves of scavengers.[lxviii] Burning of penta-treated wood releases dioxins into the air.[lxix] While this represents an out-of-pocket savings for the utility industry in the short-term, it represents a real hazard to communities with associated long-term cleanup costs. The Electrical Power Research Institute estimates that "by avoiding the hazardous waste designation, the utility industry saved $15 billion between 1989 and 1993."[lxx]

In a survey conducted by Beyond Pesticides/NCAMP in 1999, utility companies indicated that it is standard practice for poles taken out of service to be given away to the public. These poles are then handled by uninformed people, which results in exposure to hazards not calculated by EPA. The poles or remilled lumber find their way into the public domain as construction material, fencing, garden ties and other uses. At least one company recycles poles for reuse by shaving them down, recovering wood preservative from the shavings, retreating them as smaller poles, and selling the processed shavings for filler for asphalt shingles.

B. Effects[lxxi]

Penta gets into the body via a number of routes, including inhalation of contaminated air, inhalation exposure to penta that has volatilized from treated wood surfaces, oral ingestion of contaminated groundwater used as a source of drinking water, oral ingestion of contaminated food, and dermal contact with contaminated soils or wood products treated with the compound. Although comprehensive studies as to penta's effects on the human body have yet to be conducted, significant anecdotal evidence indicates that penta has a decidedly detrimental effect on human health and wellness.

Adverse health effects have been observed in humans and experimental animals following short- and long-term exposure to penta via all identified exposure routes (inhalation, oral and dermal). Reports of inhalation and dermal exposure in humans and oral exposure studies in animals make up the bulk of the available toxicity data. There are about 50 known cases of penta poisoning, 20 of which resulted in death. The exact dose required to produce illness in humans is not known. It is a short jump from the "no effect" level to the "lethal" dose of penta. For example, at a dose of 80 milligrams per kilogram, no experimental animals died. At a dose of 100 milligrams, 83% died and at 110 milligrams, 100% died.

Several negative health effects been reported for inhalation and dermal exposure to penta in the short term at non-acute concentrations. The most common effects of inhalation of airborne penta include local irritation of the nose, throat and eyes. Common effects of dermal exposure include irritation, contact dermatitis, or, more rarely, allergic disorders such as diffuse urticaria (intense itching). Exposure to penta over a long period of time, or to acute concentrations of the chemical in the short or long term, has been shown to negatively affect several body functions. Observed effects include symptoms like tachycardia, increased respiratory rate, labored breathing, profuse sweating, fever and metabolic acidosis. The liver, thyroid, immune system, reproductive system, and the developing organism are the primary targets of penta toxicity. In addition, exposure to penta is also associated with carcinogenic, renal, and neurological effects.

A number of case reports describe liver effects in individuals exposed to technical grade penta either occupationally or in the home via inhalation and / or dermal contact. The types of hepatic effects noted in the case reports include enlarged liver, jaundice, centrilobular degeneration, and elevated serum biliary acid concentrations. Liver enlargement was also observed in newborns exposed for a short time via contaminated diapers and bed linen in a hospital nursery. Animal studies have confirmed the identification of the liver as one of the primary targets of penta toxicity. Increased liver weights, increased serum enzymes, and histological alterations (centrilobular hepatocellular hypertrophy and vacuolization, necroses, degeneration, and periportal fibrosis) have been observed in rats and mice exposed to pure and technical-grade penta.

Immunological effects have been reported in humans exposed via inhalation and / or dermal contact with penta and in animals following oral exposure. A number of immunological effects (e.g., activated T-cells, autoimmunity, immunosuppression, B-cell dysregulation) have been reported in families living in penta-treated log homes and male factory workers involved in brushing technical-grade penta onto wood strips. A number of animal studies indicate that oral exposure to technical-grade penta affects a wide range of immune functions, such as humoral and cellular immunity, susceptibility to tumor induction and complement activity.

Developmental effects have been observed in the children of male sawmill workers exposed to a mixture of sodium salts of penta and tetrachlorophenol. Although other chemicals, in particular CDDs, may have contributed to the occurrence of these effects, animal studies provide strong evidence that penta is a developmental toxicant following oral exposure. Developmental effects are frequently observed at doses that cause decreases in maternal body weight gain. However, decreases in fetal or pup body weight have been observed at doses that do not result in maternal toxicity. Increases in fetal and neonatal mortality, and soft tissue and skeletal malformations and variation, and decreases in offspring growth have been observed in rats and sheep.

No studies were found that adequately assessed the reproductive toxicity of penta in humans. A possible association between penta exposure and reproductive effects was found in women exposed to technical-grade penta from outgassing wood panels treated with a wood preservative containing penta; however, study limitations, particularly lack of exposure characterization and possible exposure to other chemicals, preclude using these studies to establish a causal relationship. A number of animal studies provide evidence that the reproductive system is a sensitive target of pentachlorophenol toxicity. A decrease in fertility was observed in first generation rats administered penta in a two-generation study. Several studies have reported alterations in reproductive tissues. The observed effects include decreased testes weight and focal and multifocal mononuclear cell infiltrate in the epididymis in first generation rats, focal degeneration of the seminiferous tubules in sheep, and increased severity of uterine and oviduct cysts in sheep and mink. Histological alterations were not observed in rats orally exposed to pure or technical-grade penta for an intermediate or chronic duration.

There is some evidence that penta may negatively interfere with the endocrine system and disrupt normal hormone activity. Hormones are chemicals made by the body that help control the body's functions. They are present in minute quantities, meaning even minor changes in hormone levels can have drastic effects on the human body. Certain other chemicals may be mistaken for hormones by the body and disrupt the systems controlled by the hormones. In particular, some chemicals are mistaken for the female hormone estrogen. These estrogen mimics interfere with the reproductive system, causing infertility, malformed sexual organs, and cancer of sensitive organs. Penta has also been shown to affect the endocrine system, and is considered an endocrine disruptor. Exposure to penta may result in adverse reproductive effects that are associated with changes in the endocrine gland function and immunological dysfunction. A number of women with histories of spontaneous abortion, unexplained infertility and menstrual disorders had elevated levels of penta in their blood.

Severe poisoning and death have occurred as a result of intensive penta exposure. Acute poisoning occurs with systemic absorption that can occur by any route of sufficient dosage. Most occupational poisonings occur through dermal contact. Hyperthermia, muscle spasm, tremor, labored breathing, and chest tightness indicate serious poisoning. Exposure may also cause abdominal pain, vomiting, restlessness, and mental confusion. Tachycardia and increased respiratory rate are usually apparent. Other commonly reported signs and symptoms of systemic poisoning include profuse sweating, weakness, dizziness, anorexia, and intense thirst. Several infant deaths occurred in a nursery where a diaper rinse containing penta had been used.

Children are likely to be exposed to penta by the same routes as adults. In addition, small children are generally more likely than adults to have significant contact with soil and have less concern with hygiene than adults. The data are inadequate to assess whether children are more susceptible than adults to the toxicity of penta; however, EPA has determined that contact with soil contaminated with penta poses an unacceptable cancer risk to children. Likewise, outdoor residential contact with industry pressure-treated wood products (e.g. utility poles, fencing, porches, shingles, steps and decks) leads to cancer in children with at levels considered to be an "unacceptable risk." EPA also finds, "Residues of penta in drinking water (when considered along with exposure from food and residential uses) pose an unacceptable risk to children."

III. Environmental Impact[lxxii]

Most wood treated with penta solutions will "bleed", or move from the interior to the surface of the wood. About 48% of penta will eventually end up in terrestrial soil; about 45% will end up in aquatic sediments; about 5.3% will end up in water; and about 1.4% will end up in air. After reaching soil, penta is broken down by sunlight and bacteria, and can leave the upper soil layer by evaporation and leaching into groundwater. Pentachlorophenol is moderately persistent in water. The dioxin contaminants are extremely stable and resistant to degradation.

Penta may be taken up by plants from soil. In mammals, it may accumulate in the liver, kidneys, plasma protein, brain, spleen, and fat, until it is excreted unchanged in the urine. Penta is not expected to concentrate as it moves up the food chain, but the dioxin and HCB contaminants in penta products do bioconcentrate and bioaccumulate in the environment. Most of these contaminants found in an ecological system will be in animal fat. Dioxin contaminants may concentrate to 100,000 times the environmental level.

Acute ecological effects include the death of animals, birds, or fish, and death or reduced growth rate in plants. Penta may kill or defoliate plants and reduce germination of seeds. Penta has high acute toxicity to aquatic life, which increases as the pH of the water decreases. Chronic ecological effects of penta include reduced lifespan, reproductive problems, lower fertility, and changes in appearance or behavior. Cattle and other farm animals have ingested penta by chewing and licking outdoor wood structures, or from being housed in wooden pens that were treated with penta, causing sickness and death in some animals. In late 1976, about 100 Michigan dairy farms had herd health problems due to contact with penta-treated wood. Penta and contaminants were detected in the milk of two herds.

Penta has high chronic toxicity to aquatic life. Penta is chronically highly toxic to cold and warm water fish and moderately toxic to other freshwater and marine organisms. Concentrations detected in rivers, streams, or surface water systems have been generally below lethal levels. Lethal levels have been exceeded during accidental spills. HBC is slightly toxic to fish, which bioaccumulates rapidly in aquatic organism. Fish are the most sensitive organisms to the dioxin contaminants in penta, as concentrations in parts per quadrillion to parts per trillion are acutely toxic to freshwater fish. Available data also indicate that the dioxins are extremely toxic to both birds and mammals.

A more thorough review of how penta impacts human health and wellness as well the environmental overall is hamstrung by a lack of comprehensive research in this area. Serious questions remain as to the short and long term effects of penta exposure in both occupational and residential settings. Evidence indicates that penta pose appreciable risks to the liver, immune system, reproductive system, and endocrine system, respiratory system and dermis, and can in extreme cases result in death. Those employed as penta manufacturers, distributors and applicators face increased risk due to long term routine exposure. Additionally, children appear to be more sensitive to penta than adults, yet are at increased risk due to a greater likelihood of contact with penta-treated wood and soil, and less concern with hygiene. Systematic, targeted research on penta would help to shed light on these concerns, and provide EPA with a rational basis for its decision to reregister or cancel penta's license.

IV. Alternatives[lxxiii]

In today's market there are several alternatives to take the place of penta's primary usage as a preservative treatment for wood utility poles. These alternatives include more environmentally-friendly wood preservatives that do not contain the toxic chemicals found in penta and similar pesticides (creosote, chromated copper arsenate), such as copper napthenate and alkaline copper quaternary, as well as wood substitutes that do not require preservative treatments, such as concrete, steel, fiberglass reinforced composites and underground cables. The benefits and downsides of each alternative are discussed below. The following factors are considered: durability, lifespan, toxicity, availability and cost, both monetary and environmental.

In the case of treated wood, the utility industry expects 40 to 50 years of service due to the effectiveness of penta as a pesticide (although several additional wood treatments are needed to reach). Wood is highly durable but structural problems due to woodpecker damage have been reported. Also, wood poles are prone to break rather than buckle when struck by vehicles, which poses more danger for vehicle occupants and means the pole will be out of service until a replacement can be brought. The average cost of a penta-treated utility pole is $199. However, the poles require maintenance throughout their lifespan, including re-treatment, resulting in additional costs. Finally, penta raises a host of environmental and human health concerns, as detailed in the preceding sections.

A. Copper Napthenate

Copper naphthenate is an EPA-registered, non-restricted use wood preservative. It is approved for pressure treating of lumber and timber, wood utility poles, foundation piling, and posts. Copper naphthenate has several environmental advantages over conventional wood preservatives. EPA does not regulate copper naphthenate waste as hazardous nor emissions from treating plants as air pollutants. Copper naphthenate-treated wood poles can be disposed in a landfill. The main disadvantage of copper naphthenate is that it is not approved for salt water use, and can leave an oily residue on the wood. Leaching and migration of copper in soil and aquatic systems can be an issue when disposing copper naphthenate-treated wood because aquatic environments are sensitive to copper. However, copper naphthenate is approved for full exposure to above ground, ground contact, and freshwater applications. Copper naphthenate-treated wood is highly durable and not subject to corrosion. Copper naphthenate prices were between $1 and $2 per gallon in 2002. This translates to a cost of a copper naphthenate-treated Southern Pine wood pole of $200.

B. Alkaline Copper Quaternary (ACQ)

ACQ does not contain any restricted use pesticides and is an EPA-registered biocide. It is approved for full exposure to above ground, ground contact, and freshwater applications. Like copper naphthenate, ACQ is not recommended for use in saltwater. ACQ-treated wood poles can be disposed in a landfill but are not suitable for recycling into lumber because the practice is not considered economically feasible. ACQ has been successfully used in Europe, Japan, New Zealand, and Australia for the last 15 years. In the United States, ACQ is already being offered as an alternative to penta and other toxic preservative for some residential uses. ACQ-treated wood costs about 10% to 50% or more than penta-treated wood, depending on the type of wood.

EPRI estimates that ACQ-treated Southern Pine wood pole costs between $203 and $212 per pole.

C. Steel

Steel poles are considered to be the most viable alternative to wood. There are several advantages of steel poles as compared to chemically-treated poles. Steel poles can be designed and fabricated to any height and strength because steel has uniform material strength throughout. Steel offers more durability against severe weather conditions. It is not susceptible to damages caused by woodpeckers, insects, or fire and requires less maintenance. Steel distribution poles, which are also called "thin-walled steel," are becoming more accepted in the utility industry. Thin-walled steel poles have an expected service life of 80 years if they are not damaged. Another advantage of steel poles is that they buckle under overloads instead of breaking. While the steel pole has to be removed after it buckles, the potential advantage of buckling (without breakage) is that electricity may continue to flow until an outage can be managed during pole replacement.

Steel poles is that they are often made from recycled materials, and weigh approximately 30-50% less than comparable wood poles, which means less freight cost. The installation method of steel poles is similar to treated wood and can be up to 30% less expensive because they are lighter and easier to handle. However, more careful handling is required in transportation and installation to avoid cracks, chips, or dents in the poles. There is no need to re-tighten hardware later due to pole shrinkage, as there is with wood poles. Corrosion can be a problem with steel poles, primarily below the ground line; however, there are several types of finishes that are available with steel that remedy this problem. Another issue is that corrosion may also be present on the inside surface.

At cost of $215-$260 per pole, steel poles cost more to produce than treated wood poles. However, the reuse rate of steel poles is staggering - almost 100%. This is because steel is an easily recyclable material. Over 70 million tons of steel is recycled in a given year, and the steel industry estimates that two of every three pounds of new steel is produced from old steel.

There are environmental costs to producing steel that are not present with wood. The primary concerns are with the metal-contaminated dust and sludge that are byproducts of heating steel in a furnace. Recently heightened environmental standards have spurned cleaner steel operations, which provide ways to reduce these byrpoducts. The dust contaminants are tied to use of chlorinated lubricants in the heating operations, which could be eliminated. The sludge is non-toxic and can be processed at municipal water treatment facilities. One study indicates that treated wood poles may have lower process energy requirements and create less air pollution and carbon dioxide emissions than steel poles; however steel poles do not have the leaching problems present in pesticide-treated wood. The study concludes that it is hard to compare the two environmental costs, and that further study is needed to address the issue.

D. Fiberglass-Reinforced Composite (FRC)

FRC refers to polymer resin poles with glass, Kevlar, ceramic, or carbon fibers added for strength. These poles are much more durable and lightweight than wood poles, and are easier to transport and install. Lifespan for FRC poles is a minimum of 40 years, with an average as high as 80 years. FRC poles are actually more reliable than wood with respect to bending loads because their physical properties are less variable. The surface of FRC-treated poles must be carefully protected during transportation and installation. In-service FRC failures have been reported in rare instances, caused by ultraviolet radiation, de-lamination of fiberglass layers, overloading, or vehicle impacts. FRC is a relatively new material, and there are no in-depth industry studies of its environmental impact. FRC poles do not have the leaching problems associated with pesticide-treated wood. At $450 per pole, FRC poles are among the more expensive alternatives to wood, but due to the durability and consistency of the material, it is expected that FRC poles incur much lower maintenance costs than do wood poles. Currently there are a limited number of producers of FRC poles in the United States, though demand is expected to increase if pesticide treatments are restricted.

E. Concrete

Like steel and FRC, concrete poles are engineered structures and therefore have much less variance in physical characteristics than wood poles. They are impervious to UV degradation, fungi, insects, and woodpeckers. They do not twist or warp. They stand up well to short duration fires. Concrete poles can last 80-100 years and do not require maintenance because they do not rust or require painting or ground line treating.

The main disadvantages of concrete poles are higher installation and freight costs due to weight. In addition, design and installation to prevent electrocution of handlers is important. Concrete has hygroscopic characteristics, so freeze / thaw cycles can cause degradation. It is also subject to degradation in saltwater regions because saltwater reacts with lime in the cement and neutralizes the bonding. Concrete may also crack, which can be a concern if it exposes steel tendons in spun-cast concrete poles, but overall concrete is more durable than wood.

Concrete poles cost between $350 and $375. These poles are more economical than wood poles in certain applications, such as in areas where a wood pole would require guying (stabilizing poles with wire or ropes attached to the ground) to meet rigidity requirements.

Currently there are a limited number of producers of concrete poles in the United States, though demand is expected to increase if pesticide treatments are restricted.

Leaching of chemicals is not an issue, but concrete poles have an energy-intensive manufacturing process that raises serious environmental concerns. Cement is produced in kilns that often burn hazardous waste. Some of the wastes burned in cement kilns are destroyed, but some are indestructible (heavy metals) and some are transformed into more toxic chemicals like chlorinated benzenes and dioxins. Everything which is not destroyed is released into the environment during the process. Some is released through fugitive emissions from the stacks in gaseous particulate form. Some is reduced to cement kiln dust, which is typically piled on the ground before being taken to conventional landfills. Some is left in the ash, which also goes to landfills. And some becomes part of the cement, which is then slowly released into environment surrounding the installation site. EPA has refused to regulate the disposal of hazardous waste via cement kilns, which makes kiln incineration an attractive, cheap alternative to disposing of hazardous waste in controlled facilities or reducing the production of hazardous wastes.

F. Burying utility lines

Burying utility lines is often considered as an option for aesthetic reasons or in areas with utility or telephone companies are trying to avoid severe weather conditions. Although cost is a major consideration, the burying of lines is currently accompanied by the use of chemical treatments to protect lines from decay and pest problems. In fact the only remaining use of the insecticide chlordane is underground power transformers. This chemical was banned for agricultural uses in the 1970s along with DDT and other organochlorine pesticides and had its remaining uses forbidden, with this exception, in the later 1980s. The use of this and other chemicals buried along rights of ways, over water tables and in sensitive areas, represents a serious threat to environmental protection.

G. Summary of Alternatives

Currently, a number of viable alternatives to pesticide-treated wood exist are available in the United States. While pesticide treatments continue to be the cheapest option from a purely cost-of-production standpoint, alternatives like copper naphthenate, ACQ, steel, fiberglass and concrete are becoming more competitive. Savings in maintenance, longer in service lifespan and salvage value (of steel in particular) levels the cost playing field over the long-term. Cost issues aside, there are compelling environmental reasons for shifting away from the hazardous chemicals used in treating utility poles and moving to alternative pole treatments and materials. Steel and fiberglass appear to be the most environmentally sound, and stronger regulatory measures would go a long way to making these options all the more green. By contrast, there does not appear to be a way to retool pesticides to make them environmentally safe.

V. Conclusion

The studies and materials summarized in this report indicate that penta may cause substantial harm to humans and the environment, either through contact, groundwater contamination or inhalation. There are several reasonable, affordable and significantly less harmful alternatives available to replace penta-treated utility poles.

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[i] ToxFAQs for Pentachlorophenol, Agency for Toxic Substances & Disease Registry, Department of Health and Human Services, CAS#: 87-86-5, Released September 2001, p.1.
[ii] PCP: Product Chemistry, Preliminary Risk Assessment for Pentachlorophenol, Document ID: EPA-HQ-OPP-2004-0402-0004, Released Nov. 19, 2004, p. 1.
[iii] Pentachlorophenol Revised Risk Assessments; Notice of Availability and Solicitation of Risk Reduction Options, Federal Register, April 16, 2008 (Volume 73, Number 74).
[iv] Human Health Issues, Pesticide: Health & Safety, U.S. EPA, http://www.epa.gov/pesticides/health/human.htm.
[v]A Qualitative Economic Impact Assessment of Alternatives to Pentachlorophenol, Preliminary Risk Assessment for Pentachlorophenol, Document ID: EPA-HQ-OPP-2004-0402-0078, Released April 17, 2008, p. 5.
[vi] ToxFAQs for Pentachlorophenol, at 1.

[vii] Pentachlorophenol and its Use as a Wood Preservative, Pesticides: Topical & Chemical Fact Sheets, US EPA, http://www.epa.gov/opp00001/factsheets/chemicals/pentachlorophenol_main.htm.
[viii] A Qualitative Economic Impact Assessment of Alternatives to Pentachlorophenol, at 9.
[ix] Comments from the U.S. Telecom Association, Preliminary Risk Assessment for Pentachlorophenol, Document ID: EPA-HQ-OPP-2004-0402-0044, Released May 31, 2005, p. 6.
[x] PCP: Use Profile, Preliminary Risk Assessment for Pentachlorophenol, Document ID: EPA-HQ-OPP-2004-0402-0004, Released Nov. 19, 2004, p. 2.
[xi] Id.
[xii] Id.
[xiii] Id at 3.
[xiv] Id at 2.
[xv] Id at 3.
[xvi] A Qualitative Economic Impact Assessment of Alternatives to Pentachlorophenol, at 8.
[xvii] Id.
[xviii] Pentachlorophenol Revised Risk Assessments; Notice of Availability and Solicitation of Risk Reduction Options, Federal Register, April 16, 2008 (Volume 73, Number 74).
[xix] Protecting Log Cabins from Decay, General Technical Report FPL-11, U.S.D.A. Forest Service Forest Products Laboratory, Released 1977, p.2.
[xx] Pentachlorophenol Revised Risk Assessments; Notice of Availability and Solicitation of Risk Reduction Options, Federal Register, April 16, 2008 (Volume 73, Number 74).
[xxi] A Qualitative Economic Impact Assessment of Alternatives to Pentachlorophenol, at 9.
[xxii] Id.
[xxiii] Id.
[xxiv] Id.
[xxv] On November 19,2008, EPA reregistered penta as safe for use (i.e. “causes no unreasonable adverse effects on humans or the environment”).[xxv] The EPA re-registration process did not substantially evaluate use of penta in residential areas. Citing this and multiple other problems, several concerned cities and organizations submitted comments on EPA’s research during the reregistration process. These problems include considerable gaps in the understanding of penta’s toxicity, leaching characteristics, post-application residential exposure risks, and behavior in urban environments where the largest density of penta-treated wood exists. (See Appendix A, available upon request.) Such gaps weaken EPA’s risk assessments and suggest that its findings are not based on a true analysis of the risks posed to humans living in urban communities.
[xxvi] Public Health Statement for Pentachlorophenol, Agency for Toxic Substances & Disease Registry, Department of Health and Human Services, CAS#: 87-86-5, Released September 2001.
[xxvii] Id.
[xxviii] Id.
[xxix] Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or Not Approved By Governments, United Nations, Fifth Issue, 1994.
[xxx] Priority PBTs, Persistent Bioaccumulative & Toxic Chemical Program, US EPA, http://www.epa.gov/pbt/pubs/cheminfo.htm
[xxxi] About PBTs, Persistent Bioaccumulative & Toxic Chemical Program, US EPA, http://www.epa.gov/pbt/pubs/aboutpbt.htm.
[xxxii] Id.
[xxxiii] Id.
[xxxiv] Decision Guidance Documents, Pentachlorophenol and Its Salts and Esters, United Nations Environment Programme, Released 1996.
[xxxv] The National Toxicology Program of the National Institutes of Health listed dioxins and furans as a “known human carcinogens” in the Federal Government's Ninth Report on Carcinogens. EPA identifies dioxins and furans as part of a class of persistent bioaccumulative and toxic chemicals. “The term dioxin is commonly used to refer to a family of toxic chemicals that all share a similar chemical structure and a common mechanism of toxic action.”
[xxxvi] Dioxins and Their Effects of Human Health, World Health Organization, Fact sheet N°225, November 2007; Hexachlorobenzene, International Agency for Research on Cancer, Summaries & Evaluations, 2001, p. 493.
[xxxvii] Ecological Effects and Environmental Risk Characterization, Preliminary Risk Assessment, Document ID: EPA-HQ-OPP-2004-0402-0003, Released Nov. 19, 2004.

[xxxviii] Potential for Human Exposure, Toxicological Profile for Pentachlorophenol, Agency for Toxic Substances & Disease Registry, Department of Health and Human Services, CAS#: 87-86-5, p. 1.
[xxxix] Leaching refers to the loss of preservative chemicals from treated wood, usually as a result of contact with water.
[xl] Potential for Human Exposure, Toxicological Profile for Pentachlorophenol, at 1.
[xli] Id.
[xlii] Id.
[xliii] Id.
[xliv] Pentachlorophenol Revised Risk Assessments; Notice of Availability and Solicitation of Risk Reduction Options, Federal Register, April 16, 2008 (Volume 73, Number 74).
[xlv] Id.
[xlvi] Vlosky, 2006
[xlvii] Second Health and Nutrition Examination Survey (NHANES II), National Center for Health Statistics & EPA, 1980.
[xlviii] *Pole Pollution*, Beyond Pesticides, NCAMP, 1999.
[xlix] Id.
[l] Id.
[li] Guidance for Wood Preservation Facilities Reporting to the National Pollutant Release Inventory, Environment Canada, CEPA Environmental Registry, http://www.ec.gc.ca/pdb/NPRI/2002guidance/Wood2002/toc_e.cfm.
[lii] Id.
[liii] Id.
[liv] Id.
[lv] Id.
[lvi] Id.
[lvii] The poles and ties themselves contained about 76.7 mg/kg dioxins and 18.7 mg/kg furans. In railway ties, 13.5 mg/kg dioxins and 2.29 mg/kg furans were found. Dioxins / furans were found in utility and railway ditches at concentrations as high as 2.58 mg/kg and 1.28 mg/kg respectively
[lviii] Id.
[lix] Technical Factsheet on Pentachlorophenol, EPA Ground Water & Drinking Water. EPA has found pentachlorophenol to potentially cause central nervous system effects from short-term exposures at levels above the MCL. Penta has the potential to cause reproductive effects and damage to liver and kidneys from long-term exposure at levels above the MCL. There is some evidence that pentachlorophenol may have the potential to cause cancer from a lifetime exposure at levels above the MCL.
[lx] Fielders *et al.*, 1982.
[lxi] Airborne levels of penta at production and wood-preservation facilities have ranged from several mg/m^3 to more than 300 mg/m^3 in some work areas.
[lxii] Rudel, RA, DE Camann, JD Spengler, LR Korn, and JG Brody, 2004.
[lxiii] Id.
[lxiv] Wood Utility Pole Life Cycle, Environmental Literacy Council, www.enviroliteracy.org/article.php/1311.html.
[lxv] Id.
[lxvi] EPRI, 2002.
[lxvii] Wood Utility Pole Life Cycle, Environmental Literacy Council, www.enviroliteracy.org/article.php/1311.html.
[lxviii] Id.
[lxix] Id.
[lxx] EPRI, 2002.
[lxxi] The following data comes from Health Effects, Toxicological Profile for Pentachlorophenol, Agency for Toxic Substances & Disease Registry, Department of Health and Human Services, CAS#: 87-86-5, Released September 2001.
[lxxii] The following data comes from Potential for Human Exposure, Toxicological Profile for Pentachlorophenol, Agency for Toxic Substances & Disease Registry, Department of Health and Human Services, CAS#: 87-86-5, Released September 2001.
[lxxiii] Information in this section is compiled from A Qualitative Economic Impact Assessment of Alternatives to Pentachlorophenol, Preliminary Risk Assessment, Document ID: EPA-HQ-OPP-2004-0402-0078, US EPA, Released April 17, 2008, and Alternatives to Wood Poles, Beyond Pesticides, Released December 2001.