United States Environmental Protection Agency

July 12, 2007

MEMORANDUM

SUBJECT: **Ecological Risk And Fate Assessment for Proxitane®WW-12 Microbiocide Label Amendment to Add Disinfection of Sewage and Wastewater Effluent**

PC Codes: 000595 (hydrogen peroxide), 063201 (ethaneperoxoic acid)
DP Barcodes: D334873, D334954

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THRU: **Norm Cook, Chief** 7/13/07
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TO: **Marshall Swindell – RM-33**
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I. INTRODUCTION

The Risk Assessment and Science Support Branch (RASSB) has reviewed Solvay Chemicals Inc. request to add disinfection of sewage and wastewater effluent to the Proxitane WW-12 label (EPA Reg. No. 68660-1). Proxitane WW-12 contains 12% peroxyacetic acid (PAA) and 18.5% hydrogen peroxide as active ingredients. The proposed use directions recommend use to treat sewage and wastewater effluent associated with public and private wastewater treatment plants. Proxitane WW-12 is applied by itself or with UV light as a dosage of 0.5 to 10 ppm PAA. The label specifies that the maximum discharge amount cannot exceed 1.0 ppm PAA. Ecotoxicity studies using Proxitane WW-12 or for products having similar concentrations of the ai's were submitted or referenced. COREMIX and PRIZM/EXAMS models were used by the registrant to predict concentrations of Proxitane WW-12 in effluents.

Use of Proxitane WW-12 is not expected to result in adverse acute or chronic risk to terrestrial birds, mammals, or plants; or to aquatic species under typical use conditions due to rapid dissipation and mixing of effluents with water. Toxicity to endangered or threatened freshwater and estuarine/marine invertebrates is indicated in the maximum residue scenario. However, the Agency does not expect significant impacts beyond the initial mixing zone. An endangered species determination is not made at this time. An avian acute oral toxicity study is outstanding.

ECOTOXICITY (See Appendix 1 attached for the ecotoxicity data summary)

A. Acute Ecotoxicity Studies:

TERRESTRIAL SPECIES:

<u>Birds and Mammals</u>:
One acute avian toxicity study was cited. The toxicity value LD50 of 750 ppm using 15% PAA is considered to be "Practically Non-toxic" to the Bobwhite quail. This study is supplemental and does not fulfill the guideline requirement 850.2100. Avian toxicity studies cited were either not available or are believed to be invalid (see Appendix A for details).

<u>Plants</u>:
A Tier II seedling emergence non-target plant toxicity study was conducted on rice (*Oryza sativa*). This study is acceptable and fulfills the guideline requirement for 850.4225.

<u>Invertebrates</u>:
An acute non-target honeybee study is not required for the proposed uses.

AQUATIC SPECIES:

Studies submitted or referenced by the registrant were either not available or not useful. However, aquatic animal studies for another hydrogen peroxide plus PAA product with slightly greater concentrations of active ingredients as Proxitane WW-12 are available. These studies are cited in the bibliography and in Appendix A.

<u>Freshwater Fish</u>:
Three acute freshwater fish toxicity studies are available. All three studies test

15% PAA and 22% hydrogen peroxide. The test species are rainbow trout, bluegill sunfish, and fathead minnow. Two studies were highly toxic and one was moderately toxic. The most sensitive species was the rainbow trout **LC50 = 0.72 mg/L** (MRID 46696001). These studies are acceptable and fulfill the guideline requirement for freshwater fish acute toxicity tests. The product label must state: "This pesticide is toxic to fish."

Estuarine/Marine Fish:
One acute toxicity estuarine/marine fish toxicity test is available using 15% PAA and 22% hydrogen peroxide. The test chemical was moderately toxic to the inland silverside. The estuarine/marine fish toxicity endpoint is greater than the most sensitive freshwater fish endpoint. Therefore, the rainbow trout endpoint will be used in the risk assessment.

Freshwater Invertebrates:
One acute freshwater invertebrate toxicity test is available for the *Daphnia magna* using 15% PAA and 22% hydrogen peroxide. The test chemical was highly toxic to *Daphnia magna* (**LC50 = 0.57 mg/L**). The product label must state: "This pesticide is toxic to aquatic invertebrates."

Estuarine/Marine Invertebrates:
Two estuarine/marine invertebrate toxicity tests are available for the Mysid shrimp and the Bay mussel using 15% PAA and 22% hydrogen peroxide. The test chemical was highly toxic to both species, the most sensitive being the Bay mussel (**LC50 = 0.49 mg/L**). The product label must state: "This pesticide is toxic to shrimp, clams, and oysters."

Aquatic Plants:
Aquatic plant toxicity data are available for 5 plant species: green algae, blue-green cyanobacteria, freshwater diatom, marine diatom, and a floating aquatic macrophyte. All tests were with Proxitane WW-12 (12% PAA and 18.5% hydrogen peroxide) except for the green algae which was tested with Vigor-Ox having 5% PAA only. Green algae was the most sensitive plant tested having an **EC50 value of 0.18 mg/L**. Proxitane- -WW-12 was also highly toxic to the freshwater diatom (EC50 = 0.56 mg/L). **The most sensitive aquatic plant is the green algae**. A confirmatory study for green algae MRID 4669601 is available and must be cited. Otherwise study 850.5400 for *Selenastrum capricornutum* must be repeated using Proxitane WW-12.

B. **Chronic Aquatic Ecotoxicity Studies:**

Freshwater Chronic Fish and Invertebrates:
One chronic 21 day study is available for the *Daphnia magna* using 5% PAA, 15.4% hydrogen peroxide, and 23.9% acetic acid (MRID 46833608). The

NOAEC was 0.34 mg/L and the LOAEC was 1.10 mg/L.

Estuarine/Marine Fish and Invertebrates:
No studies are available.

IV. ESTMATED ENVIRONMENTAL CONCENTRATIONS (EECs)

A. EECs – TERRESTRIAL

Terrestrial EECs were not calculated since it is anticipated that exposures and risks for terrestrial animals (birds and mammals) to Proxitane WW-12 use should be minimal, and any incidental exposure would be practically non-toxic on an acute basis. Terrestrial plants are also not expected to be at risk. A confirmatory avian toxicity study is outstanding.

B. EECs – AQUATIC

Modeling Results

1. EXAMS

Table 1 shows the maximum and mean estimated environmental concentrations of PAA in water. The concentrations are directly correlated to the stream flow and dilution factor.

Table 1. Estimated Environmental Concentrations from EXAMS run.

Stream Flow	Dilution	Maximum (ppb)	Mean (ppb)
7Q10	24:1	30	18
Mean	135:1	7	6

Table 2 shows the Estimated Environmental concentrations of the PAA in discharged water by CORMIX model. Depending on the stream flow and dilution factor, the concentration of the PAA decreases with distance for reaching a certain concentration (i.e. 0.15 mg/L). These results could be used for the endangered species assessment.

2. CORMIX

Table 2. CORMIX inputs and results for 1 ppm discharge

Scenario	1B	3B	5B[a]	6B[a]	7B	8	10	12
CORMIX 3= Worst Case; 2= moderate/large	3	3	2	2	3	2	2	3
Stream flow (MDL)[b]	126	27	126	510	126	5110	908	908
SDF (stream dilution factor)	33	71	33	135	33	135	24	24
Distance to reach 0.15 mg/L	88 m	18 m	1.5 m	0 m	320 m	1.7 m	12 m	38 m
Distance to reach 0.067 mg/L	180 m	41 m	15 m	1 m	636 m	10 m	61 m	210 m

a Scenarios 5B and 6B are for submerged multiple diffusers, with a Manning's n (roughness coefficient) greater than those for the other scenarios. Scenario 5B uses the same stream velocity as the other scenarios (5 cm/sec, 0.1 mph), but scenario 6B uses faster velocity (0.24 m/sec, 0.55 mph).

b MDL = million liters/day

V. RISK QUOTIENTS (RQs) AND LEVELS OF CONCERN (LOCs)

A. OVERVIEW

Exposure and Risk to Nontarget Terrestrial Animals and Aquatic Organisms

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The means of this integration is called the quotient method. Risk quotients (RQs) are calculated by dividing exposure estimates by acute and chronic ecotoxicity values.

RQ = EXPOSURE/TOXICITY

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are used by OPP to analyze potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories: (1) **acute** -- potential for acute risk to non-target organisms which may warrant regulatory action in addition to restricted use classification, (2) **acute restricted use** -- the potential for acute risk to non-target organisms, but may be mitigated through restricted use classification, (3) **acute endangered species** - endangered species may be adversely affected by use, (4) **chronic risk** - the potential for chronic risk may warrant regulatory action, endangered species may potentially be affected through chronic exposure, (5) **non-endangered plant risk** – potential for effects in non-target plants, and (6) **endangered plant risk** – potential for effects in endangered plants. Currently, AD does not perform assessments for chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to birds or mammals.

The ecotoxicity test values (measurement endpoints) used in the acute and chronic risk quotients are derived from required studies. Examples of ecotoxicity values derived from short-term laboratory studies that assess acute effects are: (1) LC_{50} (fish and birds), (2) LD_{50} (birds and mammals), (3) EC_{50} (aquatic plants and aquatic invertebrates) and (4) EC_{25} (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are: (1) LOAEC (birds, fish, and aquatic invertebrates), and (2) NOAEC (birds, fish and aquatic invertebrates). For birds and mammals, the NOAEC generally is used as the ecotoxicity test value in assessing chronic effects, although other values may be used when justified. However, the NOAEC is used if the measurement endpoint is production of offspring or survival.

Risk presumptions and the corresponding RQs and LOCs are tabulated below.

Table 3. Risk Presumption Categories

Risk Presumption for Terrestrial Animals	**LOC**
Acute: Potential for acute risk for all non-target organisms	>0.5
Acute Restricted Use: Potential for acute risk for all non-target organisms, but may be mitigated through restricted use classification	>0.2
Acute Endangered Species: endangered species may be adversely affected by use	>0.1
Chronic Risk: potential for chronic risk may warrant regulatory action	>1

Risk Presumption for Aquatic Organisms	LOC
Acute: Potential for acute risk for all non-target organisms	>0.5
Acute Restricted Use: Potential for acute risk for all non-target organisms, but may be mitigated through restricted use classification	>0.1
Acute Endangered Species: endangered species may be adversely affected by use	>0.05
Chronic Risk: potential for chronic risk may warrant regulatory action	>1
Risk Presumption for Terrestrial and Aquatic Plants	**LOC**
Potential for risk for all non-endangered and endangered plants	>1

B. RQs – TERRESTRIAL

Terrestrial RQs were not calculated since RASSB believes that exposures and risks for terrestrial animals (birds and mammals) to Proxitane WW-12 during use for wastewater effluent treatments should be minimal. Terrestrial non-target plants are not expected to be adversely impacted if exposed to incidental spray drift or from treated effluents along river banks or shore lines.

C. RQs – AQUATIC

Ecotoxicity Values – Acute

The most sensitive species and endpoints are:

Species	Endpoint (EC/LC50)
Rainbow trout =	720 ppb
Daphnia magna =	570 ppb
Bay mussel =	490 ppb
Green algae =	180 ppb

Ecotoxicity Values – Chronic

The most sensitive species and endpoints are:

Species	Endpoint (NOAEC)
Daphnia magna =	340 ppb
Green algae =	120 ppb

Estimated Environmental Concentrations – EECs

Using the EXAMS model estimates of a low flow stream (7Q10) and a median stream flow the 7Q10 stream gave a maximum concentration of 30 ppb and a mean concentration of 18 ppb. The typical – average – median stream estimates were 7 ppb for maximum and 6 ppb for the median concentration.

Table 4. Risk Quotients for Acute Aquatic Organisms Exposed to 2 stream flow levels

EC/LC 50 Values	**7Q10 – 30 ppb** Maximum conc.	**7Q10 - 18 ppb** Mean conc.	**Median – 7 ppb** Maximum conc.	**Median – 6ppb** Mean conc.
Fresh wtr. Fish – 720 ppb	0.042	0.025	0.009	0.008
Fresh wtr. Invert. – 570 ppb	**0.053**	0.032	0.012	0.011
Mussel – 490 ppb	**0.061**	0.037	0.014	0.012
Green algae* – 180 ppb	0.167	0.100	0.039	0.033

* Most sensitive aquatic species in available acute exposure studies.

Levels of Concern (LOC's) are: 0.5 aquatic animals, 0.05 endangered/threatened aquatic animals, 1.0 aquatic plants. Exceedances are in **BOLD**.

Based on Table 4 above, acute LOCs for endangered or threatened aquatic invertebrates are exceeded only for the lowest flow stream scenario and the highest predicted concentration of effluent. RQs for the most sensitive species, green algae, may change depending on testing with higher concentrations of PAA and hydrogen peroxide. The non-target plant risk assessment is incomplete due to the outstanding green algae study.

Table 5. Risk Quotients for Chronic Aquatic Organisms Exposed to 2 stream flow levels

NOAEC Values	7Q10 – 30 ppb Maximum conc.	7Q10 - 18 ppb Mean conc.	Median – 7 ppb Maximum conc.	Median – 6ppb Mean conc.
Fresh wtr. Invert. – 340 ppb	0.088	0.053	0.021	0.050
Green algae* – 120 ppb	0.250	0.150	0.058	0.050

* Most sensitive aquatic species in available studies.

Levels of Concern (LOC's) are: 1.0 aquatic animals, 1.0 aquatic plants. Exceedances are in **BOLD**.

Based on Table 5 above, chronic LOCs for aquatic organisms were not exceeded for either stream flow scenario. The green algae study must be repeated.

Based on environmental fate data, PAA is a more potent oxidant and disinfectant than hydrogen peroxide. PAA decomposes to acetic acid, hydrogen peroxide, oxygen, and water. Water reactions include spontaneous decomposition, hydrolysis, and transition-metal-catalyzed decomposition. A pH range of 5.5 to 8.2 results mostly in spontaneous decomposition to acetic acid and oxygen. By-products from PAA treated river water were mostly carboxylic acids. Carboxylic acids are formed via oxidation of natural organic matter in water by PAA. No halogen containing disinfection by-products (DBPs) have been observed, however, some low levels of aldehydes can form when PAA interacts with amino acids, phenols, and other aromatic substances. In primary effluents, close to 100% of PAA is consumed within 120 minutes and approximately 30% of PAA was consumed in secondary effluent in Canadian studies (Kitis, 2004).

This review will focus on PAA residues in sewage treatment effluent given that hydrogen peroxide is reduced to degradates much more quickly that PAA.

VI. LISTED SPECIES AND CRITICAL HABITAT REVIEW

Section 7 of the Endangered Species Act, 16 U.S.C. Section 1536(a)(2), requires all federal agencies to consult with the National Marine Fisheries Service (NMFS) for marine and anadromous listed species, or the United States Fish and Wildlife Services (FWS) for listed wildlife and freshwater organisms, if they are proposing an "action" that may affect listed species or their designated habitat. Each federal agency is required under the Act to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. To jeopardize the continued existence of a listed species means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of the species." **50 C.F.R. ' 402.02**.

To facilitate compliance with the requirements of the Endangered Species Act subsection (a)(2) the Environmental Protection Agency, Office of Pesticide Programs has established procedures to evaluate whether a proposed registration action may directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of any listed species (U.S. EPA 2004). After the Agency's screening-level risk assessment is performed, if any of the Agency's Listed Species LOC Criteria are exceeded for either direct or indirect effects, a determination is made to identify if any listed or candidate species may co-occur in the area of the proposed pesticide use. If determined that listed or candidate species may be present in the proposed use areas, further biological assessment is undertaken. The extent to which listed species may be at risk then determines the need for the development of a more comprehensive consultation package as required by the Endangered Species Act.

This preliminary assessment indicates that there is potential for Proxitane WW-12 effluents to overlap with listed species and that a more refined assessment is warranted, to include direct, indirect and habitat effects. The more refined assessment should involve clear delineation of the action area associated with proposed use of Proxitane WW-12 and best available information on the temporal and spatial co-location of listed aquatic invertebrate species with respect to the action area. This analysis has not been conducted for this assessment. An endangered species effect determination will not be made at this time.

VII. SUMMARY

In summary, RASSB concludes that, based on the available information and data as discussed above, Proxitane WW-12 effluents are not expected to be acutely toxic to terrestrial or aquatic animals or plants from typical use. The acute organism risk assessment is incomplete due to a missing avian acute oral toxicity study, however, direct exposure to birds is not expected to be significant from the proposed use. Aquatic invertebrate (freshwater and estuarine/marine) endangered or threatened species may be at risk during times of low stream flow and maximum discharge. However, based on CORMIX estimates, species located beyond the initial mixing zone are not expected to be impacted.

Chronic impacts are not expected to occur to aquatic animals or plants exposed to effluent due to rapid dissipation and dilution of any remaining residues. A more refined assessment can be made upon receipt of the outstanding avian toxicity study.

VIII. ADDITIONAL DATA NEEDED TO REFINE THE ASSESSMENT

850.2100 – Avian Acute Oral Toxicity using Proxitane WW-12.

The registrant must cite Persan and Fennosan PPA studies to support Proxitane WW-12 registration (see Appendix A, Table 1, attached).

IX. LABEL ISSUES:

Proxitane WW-12 labels must have the following hazard statement: "This pesticide is toxic to fish, aquatic invertebrates, shrimp, clams, and oysters."

REFERENCES

Cohen, S. Z, Quingli Ma, and J. Iam. 2006. Estimates of Peracetic Acid Concentrations and Potential Impacts in Surface Water Using the EXAMS and CORMIX Models. Solvay Chemicals, inc. Houston, Texas.

Kitis, M. 2004. Disinfection of Wastewater With Peracetic Acid: a Review. Environmental International, Vol. 30: 47-55.

MRID 46696001 – Block, D. 2004. "Aquatic Toxicity Testing Results for Perasan (An Equilibrium Mixture of 15% Peracetic Acid and 22% Hydrogen Peroxide): Acute and Chronic Freshwater Fish, Invertebrate, and Algal Bioassays." Project number: BES2004PAAF. Unpublished study prepared by Block Environmental Services, Inc. 34p.

MRID 46696002 – Block, D. 2005. "Aquatic Toxicity Testing Results for Perasan (An Equilibrium Mixture of 15% Peracetic Acid and 22% Hydrogen Peroxide): Acute and Chronic Marine Fish, Invertebrate, and Algal Bioassays." Project number: BES2004PAAF. Unpublished study prepared by Block Environmental Services, Inc. 32p.

MRID 46833608 - Wetton, P. 2000. "Fennosan PAA: Daphnia magna Reproduction Test." Project Number: 663/007. Unpublished study prepared by Safepharm Laboratories, Ltd. 79p.

Appendix A.

Table 1. Summary of Ecotoxicity Studies in support of Proxitane WW-12, – 07/12/07

Study/Species	**MRID Number**	**Study Results**	**Status of Study**
Birds			
Avian Acute Oral – 15% ethaneperoxoic acid **850.2100**/71-1 Bobwhite quail	40580517	No DER available. Avian studies cited by the registrant on page 6 of 45 (MRID 46966601): 00153754, 00153753, 00153755, 40580517 believed to be invalid (Divosan Forte, Reg. No. 875-107). P3-Oxonia studies cited, Reg. No. 53263-9 were not found.	Cited by registrant. No study submitted, no DER available. Reported results: LD50 = 750 ppm
Freshwater Aquatic Fish			
Acute Freshwater Fish- 15%PAA, 22%HPeroxide **850.1075**/72-1c Rainbow trout (Oneorhyn*chus mykiss*)	40580515 Terrell, 1987b, Table 15, page 39 of JACC No.40, Jan, 2001.	No DER available.	Cited by registrant. No study submitted, no DER available. Reported results: LD50 = 0.90 ppm PAA
Acute Freshwater Fish 15%PAA, 22%HPeroxide **850.1075**/72-1a Bluegill sunfish (Lep*omis macrochirus*)	40580515 Terrell, 1987b, Table 15, page 39 of JACC No.40, Jan, 2001.	No DER available.	Cited by registrant. No study submitted, no DER available. Reported results: LD50 = 3.30 ppm PAA
Acute Freshwater Fish- 15%PAA, 22%HPeroxide **850.1075**/72-1c Rainbow trout (Oneorhyn*chus mykiss*)	46696001	LC50 = 0.72 mg/L NOAEC = 0.20 mg/L **MUST COMPENSATE TO USE!**	CORE – Highly toxic PERASAN (Reg.No. 63838-2) – DER available per Perclean Ocean review.
Acute Freshwater Fish- 15%PAA, 22%HPeroxide **850.1075**/72-1c Fathead Minnow (*Pimephales promelas*)	46696001	LD50 = 0.99 mg/L NOAEC = 0.71 mg/L **MUST COMPENSATE TO USE!**	CORE – Highly toxic PERASAN (Reg.No. 63838-2) – DER available per Perclean Ocean review.
Acute Freshwater Fish- 15%PAA, 22%HPeroxide **850.1075**/72-1c Bluegill sunfish (Lep*omis macrochirus*)	46696001	LD50 = 1.21 mg/L NOAEC = 0.78 mg/L **MUST COMPENSATE TO USE!**	CORE – Moderately toxic PERASAN (Reg.No. 63838-2) – DER available per Perclean Ocean review.
Freshwater Aquatic Invertebrates			
Acute Freshwater Invert. 15%PAA, 22%HPeroxide -	40580516 Terrell, 1987a, Table 15, page 38	No DER available.	Cited by registrant. No study submitted. No DER available.

850.1010/72-2 (*Daphnia magna*)	of JACC No.40, Jan, 2001.		Reported results:LC50=0.69 mg/L
Acute Freshwater Invert.- 15%PAA, 22%HPeroxide **850.1010**/72-2 (*Daphnia magna*)	46696001	LC50 = 0.57 mg/L NOAEC = 0.40 mg/L **MUST COMPENSATE TO USE!**	CORE – Highly toxic PERASAN – (Reg.No. 63838-2) DER available per Perclean Ocean review.
Estuarine/Marine Aquatic Animals			
Acute Estuarine/Marine Invert. 15%PAA, 22%HPeroxide **850.1035** Mysid shrimp (*Mysidopsis bahia)*	46696002 ✓	LC50 = 0.65 mg/L NOAEC = 0.29 mg/L **MUST COMPENSATE TO USE!**	Supplemental - Highly toxic PERASAN – (Reg.No. 63838-2) DER available per Perclean Ocean review.
Acute Estuarine/Marine Invert. 15%PAA, 22%HPeroxide **850.1055** Bay Mussel (*Mytilus edulis)*	46696002 ✓	LC50 = 0.49 mg/L NOAEC = 0.20 mg/L Not a guideline species. **MUST COMPENSATE TO USE!**	CORE – Highly toxic PERASAN – (Reg.No. 63838-2) DER available per Perclean Ocean review.
Acute Estuarine/Marine Invert. 12.5%PAA, 19%HPeroxide, 18%HOAc **850.1055** Bay Mussel (*Mytilus edulis)*	Fairhurst, 1987 – Table 15, page 38 of JACC No.40, Jan, 2001.	No DER available. Not a guideline species.	Cited by registrant. No study submitted (Fairhurst, 1987). No DER available. Reported results: LC50= 0.27 mg/L as PAA, NOAEC = 0.13 mg/L as PAA
Acute Estuarine/Marine Invert. 12.5%PAA, 19%HPeroxide, 18%HOAc **850.1025** Pacific Oyster Embryo (*Crassostrea gigas*)	Butler, 1987, Table 15, page 38 of JACC No.40, Jan, 2001.	No DER available. Not a guideline species.	Cited by registrant. No study submitted (Fairhurst, 1987). No DER available. Reported results: LC50= 0.28 mg/L as PAA, NOAEC = 0.13 mg/L as PAA
Acute Estuarine/Marine Fish 15%PAA, 22%Hperoxide **850.1075** Inland Silverside (*Menidia beryllina*)	46696002 ✓	LC50 = 2.17 mg/L NOAEC = 1.73 mg/L **MUST COMPENSATE TO USE!**	Supplemental – Toxic. PERSAN- (Reg.No. 63838-2) DER available per Perclean Ocean Review
Plants			
Rooted Aquatic – Rice Proxitane-WW12, 12%PAA, 18.5%hHPeroxide **850.4225**/123-1 (*Oryza sativa*)	46966608	Seedling Emergence: EC25 = 3400 mg ai/K NOAEC = 2600 mg ai/K	Acceptable (core)

Floating macrophyte Proxitane-WW-12, 12%PAA, 18.5%hHPeroxide **850.4400**/123-2 Duckweed (*Lemna gibba*)	46966604	EC50 = 230 mg/l EC05 = 33 mg/L	Acceptable (core)
Blue-green cyanobacteria Proxitane-WW12, 12%PAA, 18.5%HPeroxide **850.5400**/123-2 (*Anabaena flos-aquae*)	46966606	EC50 = 1.5 mg/L NOAEC = 1.0 mg/L	Acceptable (core)
Green-algae Vigor-Ox, 5%PAA **850.5400**/123-2 (*Selenastrum capricornutum*)	46966609	(5% PAA only) EC50 = 0.18 mg/L NOAEC = 0.12 mg/L	Supplemental Must be repeated using: Peroxitane WW-12 - 12%PAA, 18.5%HPeroxide
Green-algae 15%PAA, 22%Hperoxide **850.5400**/123-2 (*Selenastrum capricornutum*)	46696001	EC50 = 0.44 mg/L **MUST COMPENSATE TO USE!**	Core. DER available PERSAN, Reg. No. 63838-2.
Freshwater diatom Proxitane-WW12, 12%PAA, 18.5%HPeroxide **850.5400**/123-2 (*Navicula pelliculosa*)	46966605	EC50 = 0.56 mg/L NOAEC = 0.10 mg/L	Acceptable (core)
Marine diatom Proxitane-WW12, 12%PAA, 18.5%HPeroxide **850.5400**/123-2 (*Skeletonema costatum*)	46966607	EC50 = 27 mg/L NOAEC = 16 mg/L	Acceptable (core)
Chronic Aquatic Tests			
FishEarlyLifeStage **850.1400**/72-4a Rainbow trout (Oneorhyn*chus mykiss*)			Reserved.
Fish Early Life – TGAI Estuarine/Marine species **850.1400**			Reserved.
Aquatic Invertebrate Life Cycle 21Day 15%PAA, 15.4%HPeroxide, 23.9%AceticAcid **850.1300**/72-4b (*Daphnia magna*)	46833608	NOAEC = 0.34 mg ai/L LOAEC = 1.10 mg ai/L MATC = 0.34 mg ai/L **MUST COMPENSATE TO USE!**	Supplemental Fennosan PPA DER available per Perclean Ocean review.
Mysid shrimp life-cycle TGAI **850.1350**			Reserved.

Appendix B – Estimated Concentrations of Proxitane WW-12 in water

Siroos Mostaghimi, 07/02/07

Background

Solvay Chemicals Inc. has submitted a registration request for Proxitane WW-12 for use in wastewater treatment plants (WWTPs). The active ingredients are peracetic acid (PAA), and hydrogen peroxide. Hydrogen peroxide is already registered for once-though cooling systems and will not be considered in this report. According to the registrant PAA is a non-persistent pesticide that could replace chlorination and other approaches as a disinfectant in many WWTPs. It would be added to the disinfection chamber after primary and/or secondary treatment. PAA is the 'toxicity driver' in Proxitane.

Solvay Chemical Inc. has submitted a study titled "Estimates of the peracetic acid concentrations and potential impacts in surface water using the EXAMS and CORMIX models". The followings are a summary of these data.

A modified version of the EXAMS Georgia pond/stream 'environment' was used. CORMIX model is designed for point-source discharge scenarios.

Wastewater Treatment Plants: Overview and Discharge Characteristics

The EPA's Office of Wastewater Management periodically conducts the Clean Watersheds Needs Survey. Table 1 shows the number and percentages of treatment facilities in operation for year 2000.

Treatment Facilities in Operation in 2000*[a,b]

Existing Flow Range (MGD)	Number of Facilities	% of Facilities	Total Existing Flow (MGD)	% of Flow
0.001 to 0.100	6583	40.5	290	0.83
0.101to 1.000	6462	39.8	2339	6.7
1.001 to 10	2665	16.4	8328	23.8
10 too 100	487	3.0	12741	36.5
100 and higher	46	0.28	11201	32.1
Other[c]	12			

Total	16255		34899	

*Adapted from Clean Watersheds Needs Survey (CWNS), U.S. EPA, www.epa.gov/owm/mtb/cwns/index.htm, visited 7/25/05.

[a] California, Colorado, New York, and South Dakota did not have the resources to complete the updating of these data.

[b] Results presented in this table for American Samoa, Guam, Nevada, Northern Mariana Islands, Puerto Rico, Virgin Islands, and Wyoming are from the 1996 survey because these states and territories did not participate in the CWNS 2000.

[c] Flow data for these facilities were unavailable.

The product to be used in wastewater treatment is Proxitane® WW-12. This product contains 12% PAA, 18.5% hydrogen peroxide, 18% acetic acid, with the balance being water.

PAA degrades rapidly into water, oxygen, acetic acid, and carbon dioxide. Hydrogen peroxide degradation occurs within a few minutes to hours.

The dose required for disinfection and the rate of reaction are dependent upon a number of factors. The prevailing factors include:

1. The type of wastewater treatment plant (biological or physicochemical),
2. Suspended solids, and
3. pH

Therefore, the initial PAA demand of the effluent should be considered when setting a suitable dose level. The initial microbial loading of the effluent will also determine the PAA dose required to comply with national or local standards for wastewater quality after treatment. The effective dose rate can be anywhere between 0.5 ppm and 10 ppm and will be degraded within the disinfection chamber to give a residual of no more than 1 ppm PAA.

The Models:

Flows for the CORMIX runs were 0.1 MGD, 1 MGD, and 10 MGD. Together, these encompass 96.7% of the WWTPs and 31% of the flow, as of the 2000 data. For EXAMS, discharge was input as a function of the stream flow and velocity in order to obtain stream dilution factors of 24:1 and 135:1.

The registration request is for a 1.0 ppm PAA discharge limit. Therefore, 12 scenarios using the 1.0 ppm discharge, and two CORMIX scenarios at 0.5 ppm were run for comparison. The EXAMS scenarios were all run at 1.0 ppm as continuous loads.

CORMIX provides three sub models for three types of point-source discharge. CORMIX1 models submerged single-port discharge. It is considered an interim condition for this assessment relative to the other two sub models, and was therefore not used.

CORMIX2 models discharge with submerged multi-port diffusers. This type of discharge is representative of more modern and larger WWTPs. This sub model was used only for the plants in the two larger flow categories, 1 MGD and 10 MGD. Finally, CORMIX3 models discharge through a single pipe at the surface. This represents the worst case, but it is a worst case that occurs often. In addition, we made the CORMIX3 assessments extra conservative by setting the pipe outlet only 0.3 m from the stream bank. This setting enabled the hypothetical plume to attach itself to the shoreline as it flowed downstream, which minimizes dispersion and dilution.

The following data related to U.S. Publicly Owned Treatment Works (POTWs) were used in this risk assessment. These data are contained within the database used by a Tier I screening model called E-FAST, version 2.0, which is used for assessments under the Toxic Substances Control Act:

Statistics	Receiving Streams	Stream Dilution Factors (SDF)
Harmonic mean	126 MLD	135
7Q10	27 MLD	24

Where:

MLD = million litters/day,
SDF = stream flow divided by the effluent flow for all U.S.
POTWs, 7Q10 = the seven consecutive days of lowest flow in a 10-year period (<1% probability).

Depending on the scenario, two of the following three variables were set to determine the third: WWTP flow, SDF, or stream flow.

EXAMS evaluate the fate, transport, and exposure of synthetic organic chemicals –Pesticides, industrial materials, and leachates from disposal sites. EXAMS contains an Integrated Database Management System (DBMS) specifically designed for storage and management of project databases required by the software. User interaction is provided by a full-featured Command Line Interface (CLI), context-sensitive help menus, an on-line data dictionary and CLI users' guide, and plotting capabilities for review of output data. EXAMS provides 20 output tables that document the input datasets and simulation results summaries for aid in ecological risk assessments. EXAMS provides long-term (steady-state) analysis of chronic chemical discharges, initial-value approaches for study of short-term chemical releases, and full kinetic simulations that allow for monthly variations in mean climatological parameters and alterations of chemical loadings on daily time scales. Results can be analyzed in hourly time steps.

CORMIX (Cornell Mixing Zone Expert System) was developed under several cooperative funding agreements between the U.S. EPA and Cornell University between 1985 and 1995. It is currently a proprietary model. It is a software system for the analysis, prediction, and design of point-source pollutant discharges into diverse water bodies. FORTRAN-based CORMIX makes three-dimensional predictions of an effluent discharge's dilution, decay, and plume trajectory as a function of time. In addition to concentration profiles, CORMIX also analyzes the flow characteristics ("flow classification") and provides advice for improving the discharge design; i.e., engineering advice is provided to help make the system more environmentally desirable. With a graphical user interface, CORMIX is very user friendly. There are three CORMIX subsystems, which are described in III(A)(3) above: CORMIX1, which models submerged single-port discharge (not used in this assessment); CORMIX2, which models submerged multi-port diffusers (more modern); and CORMIX3, which models single-port surface discharge (worst case).

Modeling Results

1. EXAMS

Table 1 shows the maximum and mean estimated environmental concentrations of PAA in water. The concentrations are directly correlated to the stream flow and dilution factor.

Table 1. Estimated Environmental Concentrations from EXAMS run.

Stream Flow	Dilution	Maximum (ppb)	Mean (ppb)
7Q10	24:1	30	18
Mean	135:1	7	6

Table 2 shows the Estimated Environmental concentrations of the PAA in discharged water by CORMIX model. Depending on the stream flow and dilution factor, the concentration of the PAA decreases with distance for reaching a certain concentration (i.e. 0.15 mg/L). These results could be used for the endangered species assessment.

2. CORMIX

Table 2. CORMIX inputs and results for 1 ppm discharge

Scenario	1B	3B	5B[a]	6B[a]	7B	8	10	12
CORMIX 3= Worst Case; 2= moderate/large	3	3	2	2	3	2	2	3
Stream flow (MDL)[b]	126	27	126	510	126	5110	908	908
SDF (stream dilution factor)	33	71	33	135	33	135	24	24
Distance to reach 0.15 mg/L	88 m	18 m	1.5 m	0 m	320 m	1.7 m	12 m	38 m
Distance to reach 0.067 mg/L	180 m	41 m	15 m	1 m	636 m	10 m	61 m	210 m

a Scenarios 5B and 6B are for submerged multiple diffusers, with a Manning's n (roughness coefficient) greater than those for the other scenarios. Scenario 5B uses the same stream velocity as the other scenarios (5 cm/sec, 0.1 mph), but scenario 6B uses faster velocity (0.24 m/sec, 0.55 mph).

b MDL = million liters/day

Reference

Cohen, S. Z, Quingli Ma, and J. lam. 2006. Estimates of Peracetic Acid Concentrations and Potential Impacts in Surface Water Using the EXAMS and CORMIX Models. Solvay Chemicals, inc. Houston, Texas.

File C:\Myfiles\2007 Reports\ Review of the Estimates of Peracetic Acid Concentrations and Potential Impacts in Surface Water using the EXAMS and CORMIX Models.

CC: RASSB Chemical files, Siroos Mostaghimi, RASSB