Stormwater Runoff and Wastewater Discharge Monitoring Program for the UCD/DOE LEHR National Superfund Site

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Presented below is a stormwater runoff and wastewater discharge water quality monitoring program for the UCD – DOE LEHR National Superfund site. This program is designed to comply with State Water Resources Control Board Order No.97-03-DWQ NPDES General Permit No. CAS000001 (General Permit) and Waste Discharge Requirements (WDRs) for Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities.

Surface Water Monitoring Program

The Discharger (University of California, Davis and the Department of Energy) shall sample Putah Creek upstream of the LEHR facility at the current upstream monitoring point (PCU), at the current downstream monitoring point (PCD), and at a new downstream monitoring point where Mace Blvd. crosses Putah Creek (PCM), as well as at surface stormwater runoff discharge points LS-1,LF-1 and LF-3. Samples shall also be taken at the sampling point where UCD's campus wastewater treatment plant treated effluent is discharged to Putah Creek current sampling point (STPO).

The Discharger shall collect LEHR site surface water runoff samples during the first storm of the rainy season which produces significant flow and quarterly thereafter when water is present. At least one storm each season (fall, winter and spring) the Discharger shall collect samples from all Putah Creek stations which are to be analyzed for the monitoring parameters specified in Table 1. Further, aquatic life toxicity testing of the stormwater runoff samples shall be conducted in accord with the requirements set forth in this monitoring program.

The UCD treated wastewater discharges to Putah Creek shall be sampled monthly and analyzed for the parameters listed in Table 1. During the fall, winter and spring, an additional sampling of UCD's wastewater discharges to Putah Creek shall be conducted during anticipated high flow associated with stormwater runoff events. All wastewater treatment plant samples shall also be analyzed for aquatic life toxicity in accord with the procedures set forth in this monitoring program.

At least two Putah Creek samples shall be taken at the Creek sampling locations during each season where during the fall, winter and spring at least one of the samples shall be taken coincident with a rainfall runoff event that is sampled as part of the stormwater runoff from the LEHR site. Putah Creek samples shall be analyzed for the parameters listed in Table 1. Further, the Putah Creek samples shall be analyzed for aquatic life toxicity as set forth in this monitoring program. In addition, Putah Creek fish shall be sampled once each year at the station specified herein to determine whether excessive concentrations of hazardous chemicals have accumulated in the fish tissue.

The dischargers can request a modification of this monitoring program after three years of data collection in accord with this program demonstrates that LEHR site stormwater runoff is not contributing to water quality use impairments of Putah Creek. This monitoring program or limited modifications of it shall remain in effect for at least three years after the LEHR site surface disturbance of soils associated with site remediation has been completed. If at that time, no violations of water quality objectives/criteria have occurred, then the dischargers can request a significant

modification of this monitoring program so long as adequate safeguards are implemented to ensure that the ongoing groundwater remediation programs do not represent a threat to surface water discharges, either through stormwater runoff or occasional discharges to the campus sewerage system.

If adverse impacts are found to the beneficial uses of Putah Creek associated with the campus wastewater discharges, it is the responsibility of the Discharger to convincingly demonstrate that these impacts are not associated with LEHR site activities. It shall be assumed, unless otherwise demonstrated, that both DOE and UCD are Responsible Parties in any adverse impacts to the beneficial uses of Putah Creek.

The Discharger shall submit the surface water monitoring reports in accord with the schedule set forth in this sampling program. The Discharger shall include an evaluation of surface water quality impacts and compliance with the Water Quality Protection Standard and water quality objectives and CVRWQCB Basin Plan requirements, as well as US EPA (1987) (EPA 440/5-86-001) water quality criteria as well as the US EPA (1996) 1995 Updates (EPA 820-B-96-001) (September 1996) and California Toxics Rule criteria (until finalized, released in August 1997) .

The Discharger shall continue to monitor stormwater discharges in accordance with Water Quality Order No. 97-03-DWQ (Discharges of Storm Water Associated with Industrial Activities).

TABLE 1 – SURFACE WATER MONITORING PROGRAM

Parameter	**Units**
Field Parameters	
pH	
Specific Conductance	µmhos/cm
Temperature	C
Turbidity	Turbidity units
Dissolved Oxygen	mg/l
Monitoring Parameters	
Anions/Cations[1]	mg/l
Total Dissolved Solids (TDS)	mg/l
Total Suspended Solids	mg/l
Total Organic Carbon	mg/l
Inorganics[2]	mg/l
Volatile Organic Compounds (EPA Method 8260, Attachment F)	µg/l
Semi-volatile Organic Compounds (EPA Method 8270, Attachment F)	µg/l
Chlorinated Herbicides (EPA Method 8150, Attachment F)	µg/l
Organophosphorus Compounds (EPA Method 8141, Attachment F)	µg/l
Carbamate Pesticides (EPA Method 8321, Attachment F)	µg/l

[1] Anions/Cations: Bicarbonate, Carbonate, Chloride, Nitrate, Sulfate, Calcium, Magnesium, Potassium, and Sodium.

[2] Inorganics (total and dissolved): Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Cyanide, Iron, Lead, Manganese, Mercury, Nickel, Silver, Thallium, Tin, Selenium, Sulfide, Vanadium, and Zinc.

The temperature at which specific conductance values are measured is to be reported.

The analytical methods for total chromium and chromium VI shall have reliable detection limits of less than 1 µg/L. The selenium analytical methods shall be able to reliably measure total selenium at less than 2 µg/L. All other parameters shall be measured using analytical methods that will determine the parameter at concentrations less than the concentrations that would limit the presence of the constituent in the water based on US EPA aquatic life criteria, fish tissue residues considered hazardous by the US EPA for the use of fish as food, or the CVRWQCB Basin Plan objectives, including the narrative objectives.

Biological Monitoring

Toxicity Testing

Toxicity testing shall be conducted on Putah Creek, LEHR site stormwater runoff and UCD wastewater discharge samples. These samples shall be tested using the US EPA standard three species short term chronic toxicity tests (US EPA Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA-600-4-91-002, July, 1994) using both the acute and chronic endpoints. The test organisms shall include fathead minnow larvae (*Pimephales promelas*), zooplankton (*Ceriodaphnia dubia*,) and algae (*Selanastrum capricornutum.*)

Quarterly samples of Putah Creek water and sediments shall be taken for aquatic life toxicity testing at PCU, PCD and PCM. The Putah Creek sediment samples should be taken on the LEHR side of the Creek. Sediment testing shall be conducted using *Hyalella asteca.* (US EPA Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, EPA/600/R-94-024, June, 1994).

If toxicity is found then Toxicity Investigation Evaluations (TIEs) shall be conducted to determine the cause of the toxicity. The discharger shall develop a program to eliminate the toxicity in the discharges to Putah Creek from the LEHR site.

All surface water sample analyses for the organophosphate and carbamate pesticides analytical procedures should, if possible, use 1,500 ml samples evapoconcentrated two to five ml in order to achieve adequate sensitivity for these compounds.

Excessive Bioaccumulation of Hazardous Chemicals

Each early fall, samples consisting of six fish each of uniform size of two dominant types of fish shall be taken from Putah Creek about 2,000 ft upstream, in the vicinity of where the University of California, Davis wastewater treatment plant discharges to Putah Creek and about 1,000 feet downstream of the PCD sampling station, as well as in the vicinity of the PCM sampling station. Edible size fish should be obtained if possible. The fish samples should be composited and analyzed for chlorinated hydrocarbon pesticides, PCBs, dioxins, mercury and lead. The results of these fish tissue analyses shall be compared to DHS fish advisory levels and US EPA guideline values for excessive bioaccumulation of hazardous chemicals. (See Table 2 for US EPA Guideline values)

Organism Assemblage Information

Each fall biological surveys to determine the numbers and dominant types of benthic macroinvertebrates and fish shall be conducted about 1,000 ft upstream and at about 200 ft and 3,000 ft downstream of where Old Davis Road crosses Putah Creek. Standard California Department of Fish and Game (California Stream Bioassessment Procedure [CSBP]) sampling and data analysis techniques shall be used, (Harrington, J.M. 1996. California Stream Bioassessment Procedures – Third Edition. California Department of Fish and Game, Water Pollution Control Laboratory. Rancho Cordova, CA.).

Reporting

The Discharger shall report monitoring data and information as required in the Central Valley Regional Water Quality Control Board's Monitoring and Reporting Program and as required in the Standard Provisions and Reporting Requirements of this Board. Reports which do not comply with the required format will be **REJECTED** and the Discharger shall be deemed to be in non-compliance with the WDRs. In reporting the monitoring data required by this program, the Discharger shall arrange the data in tabular form so that the date, the constituents, the concentrations, and the units are readily discernible. The Discharger shall summarize the data to clearly illustrate compliance with waste discharge requirements, CVRWQCB Basin Plan requirements, the US EPA water quality criteria – 1986, 1995 Updates and the California Toxics Rule (August 1997 and the final CTR) criteria. An appropriate discussion of the monitoring results, including notations of any water quality violations, shall precede the tabular summaries.

The Discharger shall report field and laboratory test results in semi-annual monitoring reports. The Discharger shall submit the semi-annual monitoring reports by **28 February** (Fall report) and **31 August** (Spring report) of each year. The Spring report shall constitute the semi-annual report for data collected between the previous 1 January and 30 June. The Fall report shall constitute the semi-annual report for data collected between 1 July and 31 December of the previous calendar year. The Fall report shall also constitute the annual report for the previous calendar year summarizing data collected over the entire calendar year. The annual report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous twelve months, so as to show historical trends. The Discharger shall report to the Board the results of any monitoring done more frequently than specified herein.

The Discharger shall report method detection limits and practical quantitation limits. The report shall include all method peaks, including those which the Discharger cannot quantify and/or specifically identify.

Table 2. **FDA and US EPA Limits Relevant to the BPTCP** (ng/g wet wt)

Adapted from: CA State Water Resources Control Board, "Final Functional Equivalent Document, Water Quality Control Policy for Guidance on the Development of Regional Toxic Hot Spot Cleanup Plans," CA State Water Resources Control Board, Sacramento, July (1998)

Chemical	FDA Action Level or Tolerance[1] (edible portion)	US EPA Screening Values[2] (edible portion)
Total PCB	2,000[3]	10
Total DDT	5,000	300
Aldrin	300[3,4]	-
Dieldrin	300[3,4]	7
Endrin	300[3,4]	3,000
Heptachlor	300[3,4]	-
Heptachlor epoxide	300[3,4]	10
Lindane	-	80
Chlordane	300	80
Endosulfan	-	20,000
Methoxychlor	-	-
Mirex	-	2,000
Toxaphene	5,000	100
Hexachlorobenzene	-	70
Any other chlorinated hydrocarbon pesticide	-	
Dicofol	-	10,000
Oxyfluorfen	-	800
Dioxins/Dibenzofurans	-	$7x10^{-4}$
Terbufos	-	1,000
Ethion	-	5,000
Disulfoton	-	500
Diazinon 900	-	-
Chlorpyrifos	-	30,000
Carbophenothion	-	1,000
Cadmium	-	10,000
Selenium	-	50,000
Mercury	1,000[3] (as methyl mercury)	600

Table 2 Footnotes

[1] US Food and Drug Administration, "Shellfish Sanitation Interpretation: Action Levels for Chemical and Poisonous Substances" (1984). A tolerance, rather than an action level, has been established for PCB.

[2] US EPA, "Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories," Volume 1, EPA 823-R-93-002, US EPA Office of Water, Washington, D.C. (1993)

[3] Fish and Shellfish

[4] Singly or in Combination for Shellfish

ATTACHMENT E

Constituents included in VOC_{water} (by USEPA Method 8260):

Acetone
Acrylonitrile
Benzene
Bromochloromethane
Bromodichloromethane
Bromoform (Tribromomethane)
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane (Ethyl chloride)
Chloroform (Trichloromethane)
Dibromochloromethane (Chlorodibromomethane)
1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (Ethylene dibromide; EDB)
o-Dichlorobenzene (1,2-Dichlorobenzene)
p-Dichlorobenzene (1,4-Dichlorobenzene)
trans-1,4-Dichloro-2-butene
1,1-Dichloroethane (Ethylidene chloride)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethylene (1,1-Dichloroethene; Vinylidene chloride)
cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)
trans-1,2-Dichloroethylene (trans-l,2-Dichloroethene)
1,2-Dichloropropane (Propylene dichloride)
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene
2-Hexanone (Methyl butyl ketone)
Methyl bromide (Bromomethene)
Methyl chloride (Chloromethane)
Methylene bromide (Dibromomethane)
Methylene chloride (Dichloromethane)
Methyl ethyl ketone (MEK; 2-Butanone)
Methyl iodide (Iodomethane)
4-Methyl-2-pentanone (Methyl isobutylketone)
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene (Tetrachloroethene; Perchloroethylene)
Toluene
1,1,1-Trichloethane (Methylchloroform)
1,1,2-Trichloroethane
Trichloroethylene (Trichloroethene)
Trichlorofluoromethane (CFC-11)
1,2,3-Trichloropropane
Vinyl acetate
Vinyl chloride
Xylenes

ATTACHMENT F

Inorganics (USEPA Method):

Aluminum	6010	Copper	6010	Silver	6010
Antimony	6010	Cyanide	9010	Sulfide	9030
Arsenic	7061	Iron	6010	Thallium	7841
Barium	6010	Lead	7421	Tin	6010
Beryllium	6010	Manganese	6010	Vanadium	6010
Cadmium	6010	Mercury	7470	Zinc	6010
Chromium	6010	Nickel	7520		
Cobalt	6010	Selenium	7741		

Volatile Organics (USEPA Method 8260):

Acetone
Acetonitrile (Methyl cyanide)
Acrolein
Acrylonitrile
Allyl chloride (3-Chloropropene)
Benzene
Bis(2-ethylhexyl) phthalate
Bromochloromethane (Chlorobromomethane)
Bromodichloromethane (Dibromochloromethane)
Bromoform (Tribromomethane)
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane (Ethyl chloride)
Chloroform (Trichloromethane)
Chloroprene
Dibromochloromethane (Chlorodibromomethane)
1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (Ethylene dribromide; EDB)
o-Dichlorobenzene (1,2-Dichlorobenzene)
m-Dichlorobenzene (1,3-Dichlorobenzene)
p-Dichlorobenzene (1,4-Dichlorobenzene)
trans-1,4-Dichloro-2-butene
Dichlorodifluoromethane (CFC 12)
1,1-Dichloroethane (Ethylidene chloride)
1,2-Dichloroethane (Ethylene dichloride)
1,1-Dichloroethylene (1,1-Dichloroethene; Vinylidene chloride)
cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)
trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)
1,2-Dichloropropane (Propylene dichloride)
1,3-Dichloropropane (Trimethylene dichloride)
2,2-Dichloropropane (Isopropylidene chloride)
1,1-Dichloropropene
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene

Volatile Organics (continued):

Hexachlorobutadiene
2-Hexanone (Methyl butyl ketone)
Isobutyl alcohol
Isodrin
Methacrylonitrile
Methyl bromide (Bromomethane)
Methyl chloride (Chloromethane)
Methyl ethyl ketone (MEK; 2-Butanone)
Methyl iodide (Iodomethane)
Methyl methacrylate
4-Methyl-2-pentanone (Methyl isobutyl ketone)
Methylene bromide (Dibromomethane)
Methylene chloride (Dichloromethane)
Naphthalene
Propionitrile (Ethyl cyanide)
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene (Tetrachloroethene; Perchloroethylene; PCE)
Toluene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane, Methylchloroform
1,1,2-Trichloroethane
Trichloroethylene (Trichloroethene; TCE)
Trichlorofluoromethane (CFC-11)
1,2,3-Trichloropropane
Vinyl acetate
Vinyl chloride (Chloroethene)
Xylene (total)

Semivolatile Organics (USEPA Method 8270 - base, neutral, & acid extractables):

Acenaphthene
Acenaphthylene
Acetophenone
2-Acetylaminofluorene (2-AAF)
Aldrin
4-Aminobiphenyl
Anthracene
Benzo[a]anthracene (Benzanthracene)
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Benzo[g,h,i]perylene
Benzo[a]pyrene
Benzyl alcohol
alpha-BHC
beta-BHC
delta-BHC

ATTACHMENT F

Semivolatile Organics (continued):

gamma-BHC (Lindane)
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl) ether (Dichloroethyl ether)
Bis(2-chloro-1-methyethyl) ether (Bis(2-chloroisopropyl) ether; DCIP)
4-Bromophenyl phenyl ether
Butyl benzyl phthalate (Benzyl butyl phthalate)
Chlordane
p-Chloroaniline
Chlorobenzilate
p-Chloro-m-cresol (4-Chloro-3-methylphenol)
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenyl phenyl ether
Chrysene
o-Cresol (2-methylphenol)
m-Cresol (3-methylphenol)
p-Cresol (4-methylphenol)
4,4'-DDD
4,4'-DDE
4,4'-DDT
Diallate
Dibenz[a,h]anthracene
Dibenzofuran
Di-n-butyl phthalate
o-Dichlorobenzene (1,2-Dichlorobenzene)
m-Dichlorobenzene (1,3-Dichlorobenzene)
p-Dichlorobenzene (1,4-Dichlorobenzene)
3,3'-Dichlorobenzidine
2,4-Dichlorophenol
2,6-Dichlorophenol
Dieldrin
Diethyl phthalate
p-(Dimethylamino)azobenzene
7,12-Dimethylbenz[a]anthracene
3,3'-Dimethylbenzidine
2,4-Dimehtylphenol (m-Xylenol)
Dimethyl phthalate
m-Dinitrobenzene
4,6-Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octyl phthalate
Diphenylamine
Endosulfan I
Endosulfan II
Endosulfan sulfate

ATTACHMENT F

Semivolatile Organics (continued):

Endrin
Endrin aldehyde
Ethyl methacrylate
Ethyl methanesulfonate
Famphur
Fluoranthene
Fluorene
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachloropropene
Indeno(1,2,3-c,d)pyrene
Isophorone
Isosafrole
Kepone
Methapyrilene
Methoxychlor
3-Methylcholanthrene
Methyl methanesulfonate
2-Methylnaphthalene
Naphthalene
1,4-Naphthoquinone
1-Naphthylamine
2-Naphthylamine
o-Nitroaniline (2-Nitroaniline)
m-Nitroaniline (3-Nitroaniline)
p-Nitroaniline (4-Nitroaniline)
Nitrobenzene
o-Nitrophenol (2-Nitrophenol)
p-Nitrophenol (4-Nitrophenol)
N-Nitrosodi-n-butylamine (Di-n-butylnitrosamine)
N-Nitrosodiethylamine (Diethylnitrosamine)
N-Nitrosodimethylamine (Dimethylnitrosamine)
N-Nitrosodiphenylamine (Diphenylnitrosamine)
N-Nitrosodipropylamine (N-Nitroso-N-dipropylamine; Di-n-propylnitrosamine)
N-Nitrosomethylethylamine (Methylethylnitrosamine)
N-Nitrosopiperidine
N-Nitrosospyrrolidine
5-Nitro-o-toluidine
Pentachlorobenzene
Pentachloronitrobenzene (PCNB)
Pentachlorophenol
Phenacetin
Phenanthrene

ATTACHMENT F

Semivolatile Organics (continued):

Phenol
p-Phenylenediamine
Polychlorinated biphenyls (PCBs; Aroclors)
Pronamide
Pyrene
Safrole
1,2,4,5-Tetrachlorobenzene
2,3,4,6-Tetrachlorophenol
o-Toluidine
Toxaphene
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
0,0,0-Triethyl phosphorothioate
sym-Trinitrobenzene

Organophosphorus Compounds (USEPA Method 8141):

Azinphosmethyl
Bolstar
Chlorpyrifos
Coumaphos
Def
Demeton-s
Diazinon
Dichlorvos
Dimethoate
Diphenamid
Disulfoton
Ethion
Ethoprop
Fensulfothion
Fenthion
Malathion
Merphos
Methidathion
Methyl Trithion
Mevinphos
Naled
“Parathion, ethyl”
“Parathion, methyl”
Phorate
Phosalone
Phosmet
Prometon
Prowl

ATTACHMENT F

Organophosphorus Compounds (USEPA Method 8141):

Ronnel
Simazine
Trichloronate
Trifluralin

Chlorinated Herbicides (USEPA Method 8150):

2,4-D (2,4-Dichlorophenoxyacetic acid)
Dinoseb (DNBP; 2-sec-Butyl-4,6-dinitrophenol)
Silvex (2,4,5-Trichlorophenoxypropionic acid; 2,4,5-TP)
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)

Carbamate Pesticides (USEPA Method 8321):

Aldicarb
Aminocarb
Barban
Benomyl (Carbendazim)
Bromacil
Carbaryl
Carbofuran
Chloropropham
Chloroxuron
Diuron
Fenuron
Fluometuron
Linuron
Methiocarb
Methomyl
Mexacarbate
Monuron
Neburon
Oxamyl
Propachlor
Propham
Propoxur
Siduron
Tebuthiuron