California Regional Water Quality Control Board
San Francisco Bay Region

Terry Tamminen
Secretary for Environmental Protection

1515 Clay Street, Suite 1400, Oakland, California 94612
(510) 622-2300 • Fax (510) 622-2460
http://www.swrcb.ca.gov/rwqcb2

Arnold Schwarzenegger
Governor

TO: Interested Parties
FROM: Roger Brewer
Toxics Cleanup Division
DATE: November 15, 2004
SUBJECT: Update to November 9, 2004, Memo Regarding ESLs for Naphthalene in Soil and Groundwater Impacted With Diluent

Additional information has been provided to this office regarding the use, chemical makeup and aquatic toxicity of diluent. A summary is provided below. Concentrations of the chemical naphthalene in diluent are likely to be significantly lower than suggested in the November 9, 2004, memo. This information decreases concerns regarding the potential threat posed by naphthalene in releases of diluent. It does not, however, alter the recommendation to test for naphthalene at all sites where significant releases of petroleum-based products (including diluent) or wastes have been identified and comprehensively assess risks to human health and environment.

Concur:

Stephen A. Hill
Toxics Cleanup Division Chief

Use of Diluent

Diluent is not a drilling fluid or additive, as implied in the November 9, 2004, memo. It is a rough distillate of crude oil with a boiling point distribution from approximately 175 to 450 °C. Diluent was used in production piping at the former Guadalupe oil field and other locations in order to reduce the viscosity of crude oil, making the oil easier to pump from one location to another. It contains no additives such as corrosion inhibitors or antifoulant agents. The chemistry of diluent should not be taken as an indicator of the chemistry of drilling fluids, drilling additives, or drilling wastes.

Naphthalene Content of Diluent

Data for "naphthalenes" in diluent presented in the Guadalupe Oil Field report referenced in the November 9, 2004, memo include all chemical members of the alkyl naphthalene family and are not specific to the individual chemical naphthalene (Stratus, 1999). As summarized in Table 1, the mean of 37 analyses of naphthalene concentrations in diluent reported by four separate analytical labs is 157 mg/kg (0.016 weight percent). Note that this is roughly 100 times lower than the range initially suggested in the November 9, 2004, ESL memo. The highest dissolved naphthalene concentration measured in diluent-impacted ground water at the former Guadalupe oil field was reported to be 11 µg/L (Arthur D. Little, 1996), below the most stringent screening level suggested in the September 24, 2004, ESL memo. Based on this information, diluent has a

very low naphthalene concentration and is unlikely to present any incremental health risks associated with naphthalene.

In addition, analyses of 60 crude oils from around the world average 423 mg/kg naphthalene (0.042 weight percent), indicating that crude oil is also typically low in naphthalene (Kerr et al., 2001, Table 2a). As noted before, however, coal tars and other petroleum mixtures associated with manufactured gas plant sites can be very high in naphthalene (may exceed 10 weight %).

Table 1 - Naphthalene in petroleum fuels and oils.

Petroleum Mixture	Range Weight % Naphthalene	Average Weight % Naphthalene
[1]Gasolines	0.15-0.36	0.25
[1]Diesel Fuels (#2)	0.01-0.80	0.26
[1]Kerosene	0.15-0.46	0.31
[1]Jet Fuels	0.25-0.50	0.25
[1]No. 2 Fuel Oil	0.009-0.40	0.22
[1]Lube and Motor Oils	0.00005-0.25	0.059
[2]Diluent	0.0009-0.05	0.016
[3]Crude oil	0.00012-0.37	0.042
[4]Coal Tar	0.07-13.5	3.8

[1]Data from Potter and Simmons, 1998 as reported in the 9/24/04 ESL memo
[2]Arthur D. Little, 1996; Levine-Fricke, 1996; Stratus Consulting, 1999
[3]Kerr et al., 2001
[4]EPRI, 1993

Aquatic Toxicity of Diluent

Bioassay results referenced in the November 9, 2004, memo included a preliminary evaluation of the toxicity of the water-accommodated fraction of diluent in surface water and sediment to a variety of different species. While these early bioassays were useful in comparing relative sensitivity among species, they were of limited utility in developing toxicity benchmarks because their results did not always relate to specific locations at the site, detailed analytical chemistry was not always available, and exposure regimens were not always relevant to exposure in the field (CH2M Hill, 2004). Based on the complexity and variability of the complete aquatic bioassay data set, it is premature to identify a chronic aquatic toxicity criteria for diluent-impacted water, or to make broad comparisons of the aquatic toxicity of diluent and other petroleum mixtures.

Specialty Chemicals

As indicated in the November 9, 2004, memo, a few of the specialty chemicals used at oil and gas processing facilities have elevated naphthalene concentrations. However, the two products for which material safety data sheets were provided in the November 9, 2004, memo (NALCO 5163 and NALCO 5172) are not drilling fluids or typically used as drilling fluid additives. They

have been used at a variety of industrial processing facilities, notably in cooling units. These chemicals are typically added in low volumes to various fluid streams. Consequently, while spills of these raw specialty chemicals may create naphthalene concerns, spills of the fluid streams into which the specialty chemicals are added will pose significantly less concerns.

References:

Arthur D. Little, Inc., 1996, *Evaluation of existing data and supplementary investigation of contamination at the Guadalupe Dunes oil field*: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.

CH2M Hill, 2004, *Site-wide screening-level ecological risk assessment for the Guadalupe oil field*: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.

EPRI, 1993, *Chemical and physical characteristics of tar samples from selected manufactured gas plant (MGP) sites*: Electrical Power Research Institute (May 1993), EPRI TR-102184.

Levine-Fricke, 1996, *Final draft feasibility study to address separate-phase and dissolved phase diluent at the Guadalupe Oil Field, San Luis Obispo County, California*: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.

Lundegard, P. D., and Garcia, G. F., 2001, *Evolving state of ecological risk assessment at the former Guadalupe oil field, California*: Society of Petroleum Engineers, SPE 68341.

Kerr, J. M., McMillen, S. J., Magaw, R. I., Melton, R., and Naughton, G., 2001, *Risk-based soil screening levels for crude oil: the role of polyaromatic hydrocarbons*, in McMillen, S. J., Magaw, R., I., and Carovillano, R. L., eds., Risk-based decision-making for assessing petroleum impacts at exploration and production sites, U.S. Department of Energy, 239p.

Stratus Consulting, Inc., 1999, *Guadalupe oil field NRDA: chemistry and toxicity of diluent, site water, and sediment*: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.

,4N California Regional Water Quality Control Board -
San Francisco Bay Region
Terry Tamminen
Secretaryfor
Environmental
Protection
TO:
FROM:
1515 Clay Street, Suite 1400, Oakland, California 94612
(510) 622-2300 ò Fax (510) 622-2460
http://www.swrcb.ca.gov/rwqcb2
DATE:
SUBJECT:
Arnold Schwarcenegger
Governor
Interested Parties
Roger Brewer
Toxics Cleanup Division
November 15, 2004
Update to November 9, 2004, Memo Regarding ESLs for Naphthalene in Soil and Groundwater Impacted With Diluent
Additional information has been provided to this office regarding the use, chemical makeup and aquatic toxicity of diluent. A summary is provided below. Concentrations of the chemical naphthalene in diluent are likely to be significantly lower than suggested in the November 9, 2004, memo. This information decreases concerns regarding the potential threat posed by naphthalene in releases of diluent. It does not, however, alter the recommendation to test for naphthalene at all sites where significant releases of petroleum-based products (including diluent) or wastes have been identified and comprehensively assess risks to human health and environment.

Concur:
. Hill
Toxics Cleanup Division Chief

Use of Diluent

Diluent is not a drilling fluid or additive, as implied in the November 9, 2004, memo. It is a rough distillate of crude oil with a boiling point distribution from approximately 175 to 450 • C.

Diluent was used in production piping at the former Guadalupe oil field and other locations in order to reduce the viscosity of crude oil, making the oil easier to pump from one location to another. It contains no additives such as corrosion inhibitors or antifoulant agents. The chemistry of diluent should not be taken as an indicator of the chemistry of drilling fluids, drilling additives, or drilling wastes.

Naphthalene Content of Diluent

Data for "naphthalenes" in diluent presented in the Guadalupe Oil Field report referenced in the November 9, 2004, memo include all chemical members of the alkyl naphthalene family and are not specific to the individual chemical naphthalene (Stratus, 1999). As summarized in Table 1, the mean of 37 analyses of naphthalene concentrations in diluent reported by four separate analytical labs is 157 mg/kg (0.016 weight percent). Note that this is roughly 100 times lower than the range initially suggested in the November 9, 2004, ESL memo. The highest dissolved naphthalene concentration measured in diluent-impacted ground water at the former Guadalupe

oil field was reported to be 11 pg/L (Arthur D. Little, 1996), below the most stringent screening
level suggested in the September 24, 2004, ESL memo. Based on this information, diluent has a

very low naphthalene concentration and is unlikely to present any incremental health risks
associated with naphthalene.
In addition, analyses of 60 crude oils from around the world average 423 mg/kg naphthalene
(0.042 weight percent), indicating that crude oil is also typically low in naphthalene (Kerr et al.,
2001, Table 2a). As noted before, however, coal tars and other petroleum mixtures associated
with manufactured gas plant sites can be very high in naphthalene (may exceed 10 weight %).
Table 1 - Naphthalene in etroleum fuels and oils.

	Range Weight %	Average Weight
etroleum Mixture	Naphthalene	Naphthalene
Gasolines	0.15-0.36	0.25
Diesel Fuels #2	0.01-0.80	0.26
Kerosene	0.15-0.46	0.31
Jet Fuels	0.25-0.50	0.25
No. 2 Fuel Oil	0.009-0.40	0.22
Lube and Motor Oils	0.00005-0.25	0.059
Diluent	0.0009-0.05	0.016
Crude oil	0.00012-0.37	0.042
Coal Tar	0.07-13.5	3.8

'Data from Potter and Simmons, 1998 as reported in the 9/24/04 ESL memo
Z Arthur D. Little, 1996; Levine-Fricke, 1996; Stratus Consulting, 1999
3Kerr et al., 2001
4EPRI, 1993
Aquatic Toxicity of Diluent
Bioassay results referenced in the November 9, 2004, memo included a preliminary evaluation of
the toxicity of the water-accommodated fraction of diluent in surface water and sediment to a
variety of different species. While these early bioassays were useful in comparing relative
sensitivity among species, they were of limited utility in developing toxicity benchmarks
because their results did not always relate to specific locations at the site, detailed analytical
chemistry was not always available, and exposure regimens were not always relevant to
exposure in the field (CH2M Hill, 2004). Based on the complexity and variability of the
complete aquatic bioassay data set, it is premature to identify a chronic aquatic toxicity criteria
for diluent-impacted water, or to make broad comparisons of the aquatic toxicity of diluent and
other petroleum mixtures.
Specialty Chemicals
As indicated in the November 9, 2004, memo, a few of the specialty chemicals used at oil and
gas processing facilities have elevated naphthalene concentrations. However, the two products
for which material safety data sheets were provided in the November 9, 2004, memo (NALCO
5163 and NALCO 5172) are not drilling fluids or typically used as drilling fluid additives. They

have been used at a variety of industrial processing facilities,

notably in cooling units. These chemicals are typically added in low volumes to various fluid streams. Consequently, while spills of these raw specialty chemicals may create naphthalene concerns, spills of the fluid streams into which the specialty chemicals are added will pose significantly less concerns.

References:

Arthur D. Little, Inc., 1996, Evaluation of existing data and supplementary investigation of contamination at the Guadalupe Dunes oil field: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.

CH2M Hill, 2004, Site-wide screening-level ecological risk assessment for the Guadalupe oil field: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.

EPRI, 1993, Chemical and physical characteristics of tar samples from selected manufactured gas plant (MGP) sites: Electrical Power Research Institute (May 1993), EPRI TR-102184.

Levine-Fricke, 1996, Final draft feasibility study to address separate phase and dissolved phase diluent at the Guadalupe Oil Field, San Luis Obispo County, California: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S 140.

Lundegard, P. D., and Garcia, G. F., 2001, Evolving state of ecological risk assessment at the former Guadalupe oil field, California: Society of Petroleum Engineers, SPE 68341.

Kerr, J. M., McMillen, S. J., Magaw, R. I., Melton, R., and Naughton, G., 2001, Risk-based soil screening levels for crude oil: the role of polyaromatic hydrocarbons, in McMillen, S. J., Magaw, R., I., and Carovillano, R. L., eds., Risk-based decision-making for assessing petroleum impacts at exploration and production sites, U.S. Department of Energy, 239p.

Stratus Consulting, Inc., 1999, Guadalupe oil field NRDA: chemistry and toxicity of diluent, site water, and sediment: California Environmental Protection Agency, Central Coast Regional Water Quality Control Board, Guadalupe Oil Field, Case No. S140.