DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

(Form Revision Date 9/20/02)

RCRA Corrective Action
Environmental Indicator (EI) RCRA Info code (CA725)
Current Human Exposures Under Control

Facility Name: **Equistar Chemicals, LP**
Facility Address: **3400 Anamosa Road, Clinton, Iowa, 52732**
Facility EPA ID #: **IAD045372836**

DETERMINATION RESULT: YES (on 11/22/2006)

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   X If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Equistar Chemicals, LP (Equistar) formerly known as Chemplex, Norchem, Enron, USI Chemicals and Quantum Chemical Corporation is located on a 275-acre parcel of land at 3400 Anamosa Road, Clinton, Iowa (see Figure 1). The facility was built in 1967 and began production of high- and low-density polyethylene in 1968. Manufacturing and engineering activities occur primarily on the northern portion of the facility, and treatment, storage, and transport transfer activities occur primarily on the southern portion of the facility. From 1968 to 1984, the facility was operated by Chemplex Company, which was jointly owned by the Getty Chemical and ACC Chemical Companies. In 1984, Chemplex merged with Northern Petrochemical, and the name of the company was changed to Norchem. This company was purchased by National Distillers and Chemical Corporation in 1986. In 1987, Norchem changed its name to Enron, which later changed its name to USI Chemicals Company. In late 1987, the name of the company was changed to Quantum Chemical Corporation and remained so until Equistar assumed ownership in 1998.

The Equistar facility is located west of the Camanche and Clinton communities in a predominantly agricultural area between U.S. Highway 30 and Hawkeye Road. The former PCS Nitrogen Facility, a former fertilizer manufacturing plant previously known as Hawkeye Chemical and Arcadian, is located southeast of the Equistar facility on the south side of Hawkeye Road. The Lawrence Todtz Farm Site is located approximately 1 mile south of the facility. The residences surrounding the facility are served by private drinking water wells (EPA 2004).

The Chemplex Company Superfund Site (Chemplex Site) is located on a portion of the Equistar facility. The site was identified as a potentially uncontrolled hazardous waste site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and was proposed for the National Priorities List (NPL) in 1984. The Chemplex Site was later withdrawn from consideration for the NPL under the RCRA deferral policy in 1991 and is being addressed as a Superfund Alternative site. A number of AOCs at the Chemplex Site were identified from historic waste disposal practices and previous investigations. The contaminants of concern at the site are chlorinated hydrocarbons, benzene, toluene, ethylbenzene, and xylenes; and polynuclear aromatic hydrocarbons (PAH). The site is being managed as two operable units (OU). Chemplex OU#1 (Well 106 Area) addresses the groundwater at the site. The groundwater extraction and treatment remedy, which includes a point of compliance (POC) boundary, was selected in the 1989 Record of Decision (ROD) and has been operating since May 1994. Chemplex OU#2 addressed the contaminated soils and wastes at the site (landfill area). The remedy for OU#2, selected in the 1993

ROD, was capping and soil vapor extraction (SVE). Construction of the cap and SVE system for OU#2 was completed in 1998. The SVE system ceased operation in 2003 because it met the shutoff criteria established in the Consent Decree (EPA 2004).

The EPA conducted a five-year review of the Chemplex Site in 2004. The review concluded that the remedy selected and implemented for the two OUs is protective of human health and the environment. EPA determined that, although the groundwater contaminant plume extends to downgradient property, the plume was well defined and no one was currently drinking groundwater from the site that contained concentrations greater than those established by the Safe Drinking Water Act. Developing a plan to address contamination beyond the POC was a followup item identified from the 2004 five-year review (EPA 2004).

A Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA), including a visual site inspection (VSI), was performed by a U.S. Environmental Protection Agency (EPA) contractor at the facility in 1989. Solid Waste Management Units (SWMUs) and areas of concern (AOCs) were identified at the facility as a result of the RFA, see Figure 2. They are described below (Jacobs Engineering Group Inc. [Jacobs] 1989, Terracon 1993). A RCRA Facility Investigation (RFI) was performed during spring and summer 1991 according to a RFI Workplan approved by EPA, with supplemental sampling conducted in fall 1991. Terracon's Interim RFI Report was dated December 6, 1991, revised December 13, 1991, and submitted by Equistar on December 16, 1991. Supplementary results were presented in a report dated March 9, 1992. The Draft RFI Report was approved in a certified letter from the EPA dated March 3, 1992. The EPA requested that Equistar prepare an interim Corrective Measures Study (CMS). A CMS was conducted, and a Final CMS Report was submitted to EPA on July 29, 1993 (Terracon 1993). The Final CMS report further characterized the "Cold Lime Pond Area" (lime pond portion of SWMU 1 and an upgradient portion of SWMU 8) and the "Active Sludge Storage Area" (combined portions of SMWUs 9 and 6), also specified as combined SWMUs 2 and 3 in the 1991 RFI Workplan (Terracon 1993).

SWMUs and AOCs identified at Equistar, as defined in the RFI Work Plan (Terracon 1990), are SWMU 1 Wastewater Treatment Plant; SWMU 2 Tertiary Polishing Basin; SWMU 3 Surface Impoundment; SWMU 4 Former Surface Impoundment; SWMU 5 Former Surface Impoundment; SWMU 6 Inactive Landfarm; SWMU 7 Former Waste Pile; SWMU 8 Previous Basin; SWMU 9 Present Waste Pile; SWMU 10 Former Containerized Storage Area; SWMU 11 Present Hazardous Waste Container Storage Area; SWMUs 12a, 12b, and 12c, Satellite Accumulation Areas; SWMU 13, Residual Oil Tank; SWMU 14 Elementary Neutralization Tank; SWMU 15, Bulk Oil Tank Area; SWMUs 16a, 16b, 16c, and 16d, Surface Water Collection Ponds and Drainage; AOC A, Polychlorinated biphenyl (PCB) Transformers; AOC B, Asbestos Piping; AOC C, Scrap Metal Yard; and AOC E, Various Past Leaks or Spills, refer to Figure 2.

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in the RCRA Info national database ONLY as long as they remain true (i.e., RCRA Info status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria [e.g., Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to any user of a public water system under the Safe Drinking Water Act] from releases subject to RCRA Corrective Action (from SWMUs, RUs, or AOCs)?

Media	Yes	No	?	Rationale/Key Contaminants
Groundwater	X			See below for explanation
Surface Soil (e.g., <2 ft)	X			See below for explanation
Subsurface Soil (e.g., >2 ft)	X			See below for explanation
Air (indoors)[2]		X		See below for explanation
Air (outdoors)		X		See below for explanation
Surface Water		X		See below for explanation
Sediment		X		See below for explanation

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

__Y__ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):
A geological cross section of the Equistar facility is shown in Figure 3. In general the unconsolidated overburden sediments beneath the facility consist of a mixture of clay and silt with variable amounts of sand and gravel. This overburden varies in thickness from one to 90 feet with the thinner intervals being in the northern portion of the site. This overburden immediately overlies the Silurian Scotch Grove Formation. The Scotch Grove Formation is composed of an upper and lower unit. The lower unit of the Scotch Grove Formation lies immediately above the Picture Rock Member of the Silurian Hopkinton Formation. The Picture Rock Member which has a relatively low porosity and hydraulic conductivity compared to the rock units immediately above and below it. As a result, the

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggests that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

Picture Rock Member of Hopkinton Formation may be retarding the vertical migration of contaminants to the underlying Farmers Creek and Lower Hopkinton members of the Hopkinton Formation. Beneath the Hopkinton Formation lies the Slurian Blanding Formation which overlies the Ordovician Maquoketa Shale which acts as a regional aquitard. (EPA 2004).

Groundwater

Groundwater occurs in both the overburden and underlying bedrock formations. In general, groundwater flows from the north to the south, with an increasing hydraulic gradient in the southwest and southeast areas near the tributaries. In the vicinity of the tributaries, the flow directions are skewed toward the tributaries, even in the lower bedrock members (EPA 2004).

The September 1990 Consent Decree set performance standards (PS) for groundwater that are required to be attained within a defined area of attainment. The PS and maximum contaminant level (MCL), under the safe drinking water act, for PCE are 5 micrograms per liter [µg/L]. PCE (the primary constituent of concern) along with other chemicals have been detected above their PS and MCLs in several monitoring wells.

Groundwater samples are collected on a regular basis at the facility and were collected most recently in March and December 2005 and May 2006. The groundwater samples collected during the spring (March) 2005 groundwater annual sampling event indicated volatile organic compound (VOC) contamination above the PS and MCL (Erler & Kalinowski, Inc [EKI] 2006). The December 2005 sample event is conducted voluntarily by the PRP (EKI 2006a) as a supplemental effort. Groundwater is collected from a smaller subset of the spring wells. None of the concentrations detected during the December sample effort exceeded a PS. The groundwater samples collected in May 2006 indicated contamination above the PS and MCL (EKI 2006c). The well with the maximum PCE concentration detected during the spring 2006 annual sampling event was MW-115A (Lower Scotch Grove formation) with a concentration of 3,400 µg/L (detected at a secondary dilution factor) (EKI 2006c). Other chemicals detected above their PS and/or MCLs during the May 2006 sampling event are shown in Table 1 with their concentrations and locations. Figures 4a and b show the locations of monitoring wells with maximum concentrations at the facility.

TABLE 1
COMPOUNDS DETECTED IN GROUNDWATER EXCEEDING
THEIR RESPECTIVE MAXIMUM CONTAMINANT LEVELS (MCL)

Contaminants	Well Number with maximum concentration	Maximum Detected Concentrations (µg/L)	Performance Standard (ug/L)	Maximum Contaminant Level (µg/L)
Benzene	EW-19a	9.7	1.0	5.0
1,1-Dichloroethene	MW-82B	100	7.0	7.0
cis-1,2-Dichloroethene	EW-19a	2,300 D	70.0	70.0
Trichloroethene	MW-115A	280	3.0	5.0
Tetrachloroethene (PCE)	MW-115A	3,400 D	5.0	5.0
Methylene Chloride	MW-115A	7.1	5.0	5.0
Vinyl Chloride	EW-19a	520 D	0.015	2.0

Notes:
µg/L Micrograms per liter
D Analyte concentration was determined at a secondary dilution factor

Polynuclear aromatic hydrocarbons (PAHs) were not detected above their PS in groundwater during the March 2005 or May 2006 sample events. Metals were analyzed in groundwater during the March 2005 sample event. Arsenic was the only metal detected above its PS of 0.03 ug/L, at a maximum concentration of 23.5 ug/L in Well LF-6.

Soil (Surface and Subsurface)
Overburden soils at the facility generally are composed of loess material, a clayey silt to lean clay; and below the loess, a highly variable glacial till less permeable than the clayey silt or lean clay. The overburden varies in thickness from 1 to 90 feet with the thinner parts in the northern portion of the facility (EPA 2004).

Soil has been impacted by contaminants at the Equistar facility. Investigations at the facility including soil sampling in sludge storage areas in 1985 and the 1989 RFA VSI, as well as the CMS sampling conducted from October 1992 through February 1993 have indicated contaminant releases to the soil in the areas around SWMUs 1, 2, 3, 4, 6, 7, 8, and 9 (as defined in the 1989 RFA). Several constituents of concern have been detected in these areas. The RFI identified two SWMU areas that required further evaluation in the CMS, the cold lime pond and sludge handling area. These are areas with soil concentrations above risk based levels. Refer to Attachment 1, results of soil analysis at contaminated SWMUs (Terracon 1993). The Cold Lime Ponds Area (SWMUs 1 and 8) contained benzo(a)anthracene at a concentration of 15 milligrams per kilogram (mg/kg) above its risk-based concentration of 2.9 mg/kg (IDNR 1999). Soil beneath the Active Sludge Storage Area (SWMUs 6 and 9) contained chrysene at 4.2 mg/kg, well below its risk-based concentration of 290 mg/kg (IDNR 1999). However, the sludge actively managed in the area (placed to dry before off site management) was determined to be just above risk based concentrations for industrial use, i.e., just above the 10^{-6} level, that is, one increased case of cancer in one million. As part of the final remedy for SWMU 6/9, a cap was installed above the soil in the sludge storage area, with the purpose of prohibiting future sludge drying operations from further contaminating the underlying soil. The sludge handling area remained an active unit until the operation was discontinued in 2002. Visible sludge was removed from the area at that time, but the cap and berms remain in place. Although visible sludge was removed, there may be remnants above and/or mixed into the cap. If so, and contamination remains in the area, the worst case concentrations would be that in the sludge or just above the 10^{-6} carcinogenic risk level.

The sewer line system was also investigated at the facility. Soil samples were collected from the fill around the sewer lines for chemical analysis. Results of the investigation were reported in the Process Sewer Investigation Report, dated May 3, 1996. Benzo[a]anthracene, benzo[a]pyrene, and benzene were detected in soil around the sewer lines at concentrations exceeding risk based criteria.

Indoor Air

The primary contaminants detected in soil during investigation of SWMUs were polynuclear aromatic hydrocarbons (PAHs). These compounds have also been detected in site groundwater, although not to the extent that chlorinated hydrocarbons have been detected. PAHs are still produced as a byproduct of the facility's industrial processes. Because this facility remains an industrial setting and PAHs are currently produced in small amounts; exposure to these compounds inside the buildings is considered to be covered by the facility's OSHA program.

Chlorinated solvents (e.g., PCE) were used previously at the facility, but are no longer used. PCE and other chlorinated VOCs have contaminated groundwater throughout the facility. The exact extent near occupied buildings on the north portion of the facility is not monitored on an ongoing basis. Therefore, the exact extent of exposure to volatiles in these buildings was unknown. As a result, EPA completed an investigation in 2006 of the chlorinated VOC indoor air concentrations (Booze Allen Hamilton, BAH 2006). A subset of facility buildings was selected to best represent the potential for exposure to indoor air contamination resulting from groundwater contamination. For example, buildings were selected that are occupied on a regular basis, had basements (most buildings are slab-on-grade), and located throughout the facility. Sampling canisters were left in the approximate breathing zone, where possible, of twelve different sampling locations to collect indoor air samples over a 24-hour period. In addition, 2

outdoor air samples were collected to evaluate ambient background. All air samples were sent for off site analysis for the following chlorinated volatile organic compounds (VOCs): 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, PCE, TCE, and vinyl chloride. To represent worst case conditions, one sample container was placed at ground level next to a sump in a basement of the laboratory building. None of the analyzed VOCs were detected in any indoor or outdoor air sample, and all detection limits were below the corresponding 1×10^{-4} preliminary remediation goal (PRG) calculated for indoor air by EPA Region 9. As such, indoor air was determined to not be contaminated.

Outdoor Air

Because indoor air was determined to not be contaminated, it is assumed that outdoor air will not be an issue as VOCs do not have the capability to accumulate in the absence of a confining structure.

Surface Water

Two unnamed tributaries to Rock Creek bound both the eastern and western portion of the facility and flow south, draining into Rock Creek approximately 2,200 feet south of the plant. The tributaries are not used for any purpose such as recreational or water supply as they are intermittent and with limited access since they are on the facility property. Below the confluence of these unnamed tributaries, Rock Creek flows to the east and then to the south. Approximately 1.5 miles southeast of the facility, Rock Creek flows adjacent to some local lakes. During high water conditions, the creek and lakes are hydraulically connected through a culvert. Rock Creek eventually discharges to the Mississippi River approximately 2 miles south of the facility (EPA 2004).

Historical VOC results: A surface water sample collected in 1994 from the western tributary exceeded the PS for benzene, PCE, TCE, and vinyl chloride. Since annual monitoring of the western tributary began in 1996, surface water has not exceeded a PS for any VOC parameter. Historical results of detected VOCs are summarized in Table 7 of the March 2005 sampling report (EKI 2006). Regular monitoring of the eastern tributary has not been conducted. In response to request by EPA monitoring of the eastern tributary and Rock Creek was conducted in 2004 and 2005.

Recent VOC results: **October 2004** Samples were collected in October 2004 from the western tributary, the eastern tributary, and Rock Creek (EKI 2005). The only VOC detected in October 2004 was 1,2,4-trichlorobenzene at a concentration of 0.5 ug/L in the sample from Rock Creek, well below the MCL of 70 ug/L. **March 2005** Surface water samples were collected from four locations during the March 2005 sample event: western tributary, eastern tributary, just downstream from where the west tributary joins Rock Creek, and just downstream from where the east tributary joins Rock Creek. Only one chlorinated organic compound was detected during the spring 2005 sample event, in the surface water sample from the western tributary, 1,1,2-trichloro-1,2,2-trifluoroethane, at a very low concentration of 0.18 ug/L. This compound does not have an MCL, and has not been considered a site related compound. **December 2005** Surface water samples were collected for VOC analysis in December 2005 from the eastern tributary and from Rock Creek directly downgradient from where it joins with the western tributary. VOCs were not detected in either sample. **March 2006** Most recently, surface water samples were collected in March 2006; six from Rock Creek and one from the west tributary (EKI 2006b) for VOC analysis. Acetone was the only VOC detected, a common laboratory contaminant. Acetone is not considered a site related compound and does not have a PS. **May 2006** A surface water sample was collected from the west tributary in May 2006 as part of the regular annual sampling event. VOCs were not detected in this sample.

Recent PAH/metal results: Results of PAH analysis collected since 2004 were reviewed. **July 2004** The PAHs anthracene (at 0.11 ug/L), benzo[a]anthracene (at 0.015 ug/L), and benzo[k]fluoranthene (at 0.043 ug/L) were detected in surface water from the western tributary in July 2004. These compounds do not have an MCL, but the MCL for benzo[a]pyrene is 0.2 ug/L. The Region 9 Preliminary Remediation Goal (PRG) for tap water is 1,800 ug/L for anthracene; 0.92 ug/L for benzo[a]anthracene, and 0.92 ug/L for benzo[k]fluoranthene. The detected

concentrations are below these PRG values. **March 2005** A surface water sample was collected from the western tributary for PAH analysis during the March 2005 sample event (EKI 2005). Two PAHs were detected, benzo[g,h,i]perylene, and benzo[k]fluoranthene, at levels of 0.0317 and 0.0212 ug/L, respectively, both below the MCL of benzo[a]pyrene. Benzo[g,h,i]perylene does not have a PRG for tap water, the detected concentration of benzo[k]fluoranthene was below the PRG of 0.92 ug/L. One sample was collected from the east tributary for metals analysis. Of antimony, arsenic and barium, only barium was detected at 30.2 ug/L well below the PS/MCL of 2,000 ug/L. **May 2006** A surface water sample and duplicate were collected from the west tributary in May 2006 as part of the regular annual sampling event. Only one of these samples had any PAHs detected; the duplicate had acenaphthene at 1.54 ug/L, well below the tap water PRG of 370 ug/L.

In summary, surface water leaving the facility does not contain contaminant concentrations that would cause a health concern.

Sediment

Sediment sampling had not been done since original investigations in the early 1990s. Therefore, EPA requested that the facility conduct sediment sampling. This sampling was completed in March 2006 (EKI 2006b). Seven sediment samples were collected and analyzed for VOCs and PAHs; five from the western tributary, two from the eastern tributary.

VOCs in sediment: The only VOCs detected were acetone and methylene chloride. Acetone was only detected in one sediment sample at a concentration of 4.2 micrograms per kilogram (ug/kg), below the quantitation limit of 5 ug/kg. Acetone is not considered site related, is a common laboratory contaminant and does not have a PS. The Region 9 PRG for residential soil is 14,000 millgrams per kilogram (mg/kg) and the migration to groundwater pathway PRG is 800 ug/kg. Methylene chloride was detected below the quantitation limit of 5 microgram per kilogram (ug/kg), at concentrations ranging from 0.27 to 0.64 ug/kg. Although not directly comparable to sediment results, the PRG for methylene chloride calculated by EPA Region 9 for residential soil use is 9.1 mg/kg. The most conservative methylene chloride PRG for the soil matrix is the soil screening level for migration to groundwater of 1 ug/kg. The concentrations detected in sediment did not exceed this value. Methylene chloride is a common laboratory contaminant; therefore, it is possible the detection in sediment resulted from laboratory or field contamination. Methylene chloride has not been detected in surface water samples, therefore, if the detection in sediment is not a result of laboratory or field contamination, it does not appear to be creating a problem in surface water, which is more likely accessible than sediment.

SVOCs in sediment: The following table summarizes detections of SVOCs in sediment.

Compound	Maximum Concentration mg/kg	Location of Max Sample # East/West Tributary	PRG Region 9 Soil Residential (mg/kg)	PRG Region 9 Migration to GW mg/kg DAF = 1
Acenaphthylene	0.057	SED-EPA-5 West	NA	NA
Anthracene	0.0091	SED-EPA-5 West	22,000	590
Benzylbutylphthalate	0.032	SED-EPA-3 West	12,000	810
Di-n-butylphthalate	0.017	SED-EPA-3 West	6,100	270
Fluoranthene	0.016	SED-EPA-5 West	2,300	210
Fluorene	0.012	SED-EPA-5 West	2,700	28
Phenanthrene	0.033	SED-EPA-5 West	NA	NA
Pyrene	0.027	SED-EPA-5 West	2,300	210

NA–not available; mg/kg–milligrams per kilogram; DAF–Dilution attenuation factor

The PAH with the most conservative PRG values is benzo[a]pyrene with a residential soil PRG of 0.062 mg/kg and a migration to GW PRG of 0.4 mg/kg. The detected PAH concentrations are well below the most conservative PRG values. The only PAH detected in sediment that was also recently detected in surface water is anthracene. Anthracene in surface water was well below the PRG for tap water. In summary, although PAHs were detected in sediment, the concentrations are not above risk based levels.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table **Potential Human Receptors (Under Current Conditions)**							
"Contaminated" Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food[3]
Groundwater	Yes	Yes	No	No	No	No	No
Soil (surface, e.g., <2 ft)	No	Yes	No	Yes	No	No	No
Soil (subsurface e.g., >2 ft)	No	Yes	No	Yes	No	No	No
~~Air (indoors)~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~
~~Air (outdoors)~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~
~~Surface Water~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~
~~Sediment~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~	~~_____~~

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

__X__ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

[3]Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Rationale and Reference(s):

Groundwater:
Residents: Private residences adjacent to the facility have in the past had wells screened in the shallow, overburden aquifer. However, except for the Munck property, these wells were plugged and abandoned (EKI 2000). The Munck well is sampled on a regular basis for contaminants. There are residents with private wells located to the south of the facility; however, they are beyond the current extent of the VOC plume. No nearby irrigation wells are in use (EKI 2000).

Workers: Groundwater is provided from five deep supply wells at the facility for industrial and potable use. Production Well 2 was determined to be compromised due to the presence of PCE above drinking water standards. Since that time, Well 2 has been abandoned and replaced with Well 7. Because PCE detections in Well 2 resulted in PCE detections in facility potable water, the facility disconnected water fountains and marked access points (e.g., faucets) with warnings not to drink the water. In addition, the facility began to provide an off site source of drinking water to facility workers. Since this time, Well 2 has been abandoned and a new Well 7 installed that does not have PCE contamination. The facility continues to provide drinking water in bottles and coolers throughout the facility. Although people generally drink water from this off-site source, it is possible for them to have access to groundwater through faucets, therefore, a potential exposure to groundwater exists.

Soil:
Soil at the facility has been contaminated. The facility is fully fenced, therefore, there is no soil access for residents or trespassers of any type. Because contamination is present, exposure to surface soil or subsurface soil, by workers or construction workers is possible.

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

_____ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

X____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):
Groundwater - Residents: Groundwater is currently not a complete significant exposure pathway for the residential population.

Private residences adjacent to the facility have had wells screened in the shallow, overburden aquifer. However, except for the Munck property, these wells were plugged and abandoned (EKI 2000). The Munck well is sampled annually as part of the PME plan. 2004 Results (EKI 2004) - PCE was detected in the Munck residence well at 0.27 ug/L, below the MCL of 5 ug/L. PCE was not detected in a sample collected in September 2004. No other VOCs were detected in either the July or September 2004 samples. PAHs were detected in the Munck residence well at 0.18 ug/L for anthracene, 0.031 ug/L for benzo(b)fluoranthene, and 0.050 ug/L for benzo(k)fluoranthene. These compounds do not have an MCL, but the MCL for benzo(a)pyrene is 0.2 ug/L. The Region 9 PRG for tap water for these compounds are 1,800 ug/L for anthracene, 0.092 ug/L for benzo[b]fluoranthene, and 0.92 ug/L for benzo[k]fluoranthene. The detected concentrations are below the respective tap water PRG. The recently installed machine well at the Munck residence was sampled in July 2004 and no VOCs were detected. 2005 Results (EKI 2006) - VOCs were not detected in the Munck well in the sample collected in March 2005. PAHs were also not detected. 2006 Results (EKI 2006c)– VOCs were not detected in the Munck well in the sample collected in May 2006. PAHs were also not detected.

[4]If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

There are residents with private wells located to the south of the facility; however, they are beyond the current extent of the VOC plume.

Therefore, no residents near the facility are currently drinking groundwater that contains concentrations greater than those established by the Safe Drinking Water Act (EPA 2004) or established by Region 9 for a PRG. EPA will continue to monitor the concentrations of facility related contaminants in groundwater.

Groundwater - Workers: Exposure of workers to groundwater contamination is not occurring at significant levels.

Groundwater is provided from five deep supply wells at the facility for industrial and potable use. Production Wells 1, 3, 4, 6, and 7 are currently used to provide this water. Up until 2006, Production Well 2 was used to provide groundwater at the facility. Due to detection of site related contamination, this well was replaced in 2006 by Production Well 7. Production Wells 1, 2, 4, and 6, have been monitored on an annual basis as part of the PME. Production Well 3 was not monitored on a regular basis due to its location north of the areas of groundwater contamination. However, a sample was collected from Well 3 and Well 7 in 2006 for analysis to evaluate contamination. Because Well 2 is no longer in use and has been abandoned, results from this well are not discussed in this evaluation.

Analytical results of groundwater from Production wells 1, 4, and 6 were presented in the 2004, 2005, and 2006 annual sample reports (EKI 2004, EKI 2006, EKI 2006c). 2004 - Wells 1, 4, and 6 did not have any VOCs detected. 2005–Wells 1, 4, and 6 did not have any VOCs detected. The PAH benzo[k]fluoranthene was detected in Well 4, at a concentration of 0.0259 ug/L. The Region 9 PRG for this compound, 0.92 ug/L, was not exceeded. 2006–VOCs were not detected in Wells 1 and 6. PCE was detected in the Well 4 sample at a concentration of 0.96 ug/L, below the PS and MCL. PCE was also detected in the field and trip blanks for the 2006 annual sample event, at concentrations up to 0.25 ug/L (EKI 2006c). A sample was collected from Well 3 in 2006 for VOC analysis and no VOCs were detected (EKI 2006b).

After installation in 2006, a sample of groundwater was collected from Production Well 7 and analyzed for an extended list of parameters to evaluate water quality. The results are part of a July 20 email, see Attachment 2. No organic compounds, including PCE, were detected in the sample from Well 7, with detection limits well below the MCL. Inorganic compounds were all below the MCL and secondary MCL (SMCL) values, except for iron. Iron does not have an MCL, but does have an SMCL of 0.3 mg/L. Iron was detected at a concentration of 0.51 mg/L. SMCLs are intended primarily for aesthetic use of water and are not considered to be health related.

The facility has been collecting samples from a sink in the laboratory building (Room 120) on a regular basis since 2003 to monitor contaminant concentrations in the facility potable water supply resulting from Production Well 2, see Attachment 2, email dated July 20, 2006. Table 1 (compiled by EPA, but attached to the email) shows results of room 120 since Production Well 2 went off line in May 2006. While Well 2 was online, the tap water and Production Well 2 showed detections of PCE. PCE has not been detected in facility tap water since Well 2 went off line.

SUMMARY Since Well 2 has gone off line, the only contaminants detected in a production well were PCE (a one time detection) and benzo[k]fluoranthene in Well 4 at levels below the MCL or Region 9 PRG for tap water. The tap water sample from room 120 has been non detect for PCE. EPA will continue to monitor the detection of contaminants in facility production wells.

Soil:
With the exception of construction/maintenance around facility sewer lines, significant exposure to contamination in soil is not likely occurring at the facility as explained below.

Soil at the facility has been contaminated. Because the facility is fully fenced, exposure potential would exist only for workers or construction workers. Investigations have been done of soil under both CERCLA and RCRA programs.

CERCLA: The ROD issued for the CERCLA soil investigation, Operating Unit 2 (OU2), in 1993 included groundwater suppression, capping, and a SVE system for the Landfill area; establishment of vegetative covers in other areas of the site (SWMUs associated with sludge storage); and institutional controls in all areas. SWMUs are marked with signs stating that the soil should not be disturbed. The baseline risk assessment for the OU2 soils and wastes concluded that no unacceptable carcinogenic or noncarcinogenic risks were posed by exposure to the on-site soils. Essentially, the potential noncarcinogenic risks were determined in the acceptable range and the potential carcinogenic risks were determined less than the excess lifetime cancer risk of 10^{-4}, which EPA considers acceptable (EPA 2004).

As part of the CERCLA program, a "Notice of Environmental Cleanup, Access Easement and Restrictive Covenants" was filed with the Clinton County Office of Recorder on August 21, 2001 that imposes a restriction that the plant property is prohibited from any use other than commercial or industrial.

RCRA: The RCRA Facility Investigation (RFI) determined that two SWMUs required additional evaluation in the Corrective Measures Study (CMS), the sludge handling area and cold lime ponds. In addition, EPA requested additional evaluation of the facility sewer system. The CMS determined that exposure at the cold lime ponds was within acceptable limits.

During the RFI, it was determined that soil beneath the Active Sludge Storage Area (SWMUs 6 and 9) contained chrysene at 4.2 mg/kg, well below its risk-based concentration of 290 mg/kg (IDNR 1999). However, the sludge actively managed in the area (placed to dry before off site management) was determined to be just above risk based concentrations for industrial use, i.e., just above the 10^{-6} level, that is, one increased case of cancer in one million. As part of the final remedy for SWMU 6/9, a cap was installed above the soil in the sludge storage area, with the purpose of prohibiting future sludge drying operations from further contaminating the underlying soil. The sludge handling area remained an active unit until the operation was discontinued in 2002. Visible sludge was removed from the area at that time, but the cap and berms remain in place. Although visible sludge was removed, there may be remnants above and/or mixed into the cap. If so, and contamination remains in the area, the worst case concentrations would be that in the sludge or just above the 10^{-6} carcinogenic risk level. EPA prefers the carcinogenic risk to be below the 10^{-6} level, but will consider risk values between 10^{-6} and 10^{-4} acceptable if site conditions warrant, such as continued industrial use with limited exposure potential. Combining the discontinued operations in the area (minimizing exposure potential) and signs marking the SWMU area, with continued industrial site use, the existence of a restrictive covenant (protecting against future exposures), and low potential for exceedance of risk-based levels; significant exposure to contamination in soil at this location by workers is not likely occurring.

According to facility personnel, there are no current or future plans for significant general construction at the facility, other than the Rail Line construction project, which is located off of the facility to the east, and would not encounter soil contamination.

Investigation of the facility sewer system has been done to evaluate contamination in soils around the facility sewer lines. Results of investigation of the sewer line are presented in the Process Sewer Investigation Report (Terracon 1996) and the Supplemental Process Sewer Investigation Report (Terracon 2004). A summary of maximum detected concentrations compared to Region 9 PRGs shows that soil concentrations around sewer lines exceed industrial levels for benzene, benzo[a]anthracene, and benzo[a]pyrene. However, the facility production area, where the sewer lines are located, is mostly paved, concrete, or gravel. If the ground cover and soil around the sewer lines were disturbed during construction/maintenance, it could result in a significant exposure.

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)

Parameter	Maximum Concentration ug/kg	Region 9 PRG Industrial Soil ug/kg	Region 9 PRG residential soil ug/kg
Benzene	17,000	1,400	640
Benzo[a]anthracene	2,980	2,100	620
Chrysene	3,420	210,000	62,000
Benzo[a]pyrene	3,300	210	62

5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

X If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be "unacceptable") - continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

_____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):

The remaining exposure pathway to evaluate for acceptability is exposure to construction workers during maintenance or construction around sewer lines. According to facility personnel, sewer line maintenance does not occur often, but is possible. Two projects have occurred in the past three years. There are no current requirements for sewer line maintenance; therefore, no current exposure exists for this pathway.

Any sewer maintenance would require an excavation permit at the facility. All excavation permits must go through the environmental engineer for review prior to beginning work. The environmental engineer is familiar with the RCRA investigations done at the facility and would notify the facility industrial hygienist if an excavation area was contaminated. The IH does air monitoring and requires personal protective equipment in areas showing contamination to control exposure to the workers such that it would be within acceptable limits.

6. Check the appropriate RCRA Info status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

__X__ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the Equistar Chemicals facility, EPA ID # IAD045372836, located at 3400 Anamosa Road, Clinton, Iowa, under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

_____ NO - "Current Human Exposures" are NOT "Under Control."

_____ IN - More information is needed to make a determination.

Completed by Original Signed _____ Date November 22, 2006
(signature)
Mary Grisolano
Project Manager, RCRA Corrective Action & Permits Branch
EPA Region 7

Supervisor Original Signed_____ Date November 22, 2006
Lynn Slugantz
Branch Chief, RCRA Corrective Action & Permits Branch
EPA Region 7

Locations where References may be found:

EPA Region 7 Headquarters
RCRA Files
901 North 5th Street
Kansas City, Kansas 66101

Contact telephone and e-mail numbers

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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

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FIGURES

ATTACHMENT 1

RESULTS OF 1993 SOIL SAMPLING ACTIVITIES
AT CONTAMINATED SOLID WASTE MANAGEMENT UNITS

ATTACHMENT 2

JULY 20, 2006, EMAIL GROUNDWATER AND TAP WATER ANALYTICAL RESULTS