Statement of Basis

FACILITY:	Denver Federal Center Building 52A
PERMIT NO.:	CO-0034860
PERMITTEE:	General Services Administration
RESPONSIBLE OFFICIAL:	Scott L. Conner Deputy Regional Commissioner
PHONE:	303-236-2858
CONTACT PERSON:	John Kleinschmidt, PG, RG
PERMIT TYPE:	Minor Industrial (Reissue)

Background Information:

The proposed permit is for a discharge from a ground water cleanup activity at Building 52A, Denver Federal Center, Denver, CO. The groundwater contains contaminants released by a former leaking underground storage tank. The tank contained waste solvent and the affected groundwater contains 1,1,1-trichloroethane, trichloroethene, 1,1-dichloroethylene, and 1,1-dichloroethane.

Prior to the reissuance of this NPDES permit in 2007, the groundwater pump and treat remediation system was modified. Prior to 2007, the treatment process included filtration, air stripping, and granular activated carbon (GAC) polishing. The revised treatment system, as it operates today (2013), has additional treatment processes including an ultraviolet oxidation reactor and a small GAC volatile organic compound polishing unit. The purpose of the GAC now is specifically to reduce the concentration of hydrogen peroxide in the treated effluent discharge. Thus, the revised treatment process includes filtration, air stripping, UV oxidation, and granular activated carbon treatment.

Receiving Waters:

The groundwater extracted from the eleven (11) recovery wells is pumped to the treatment system prior to being discharged via Outfall 001 to the storm sewer system entering McIntyre Gulch, a tributary to the South Platte River. The location of the outfall is:

	Latitude	Longitude
Outfall 001	39º43’02”	-105º07’06”

Designated Uses

Since the 1997 issuance of the permit, two changes to water quality standards that have been approved by the Colorado Water Quality Control Commission have an impact on the effluent limits applicable to this discharge. First, drinking water MCLs have been removed from the fish ingestion standard applicable to McIntyre gulch. This was the rationale for applying end-of-pipe effluent limits in previous permits applicable to this discharge. Second, Lakewood Pond, which is 2.5 miles downstream of the outfall, has been added as a drinking water source. Lakewood Pond is a small impoundment on McIntyre Gulch that is located within the Lakewood Country Club. These changes in the water quality standards have one major implication in deriving permit limits in that effluent limits based on drinking water Maximum Contaminant Levels (MCLs) no longer apply at the outfall to McIntyre Gulch. Instead, these MCLs need to be met 2.5 miles downstream where the revised water quality standards for Lakewood Pond include these MCLs.

The change in water quality standards can for McIntyre Gulch and Lakewood Pond effectively move the point of compliance for water quality based effluent limits from the outfall to the point at which these waters enter Lakewood Pond. A change of water quality based effluent limits to meet drinking water MCLs further downstream would not be subject to "anti-backsliding" provisions as this change in water quality standards can be considered a "significant change" under which EPA's water quality based effluent limits can be re-evaluated (See 40 CFR 122.44(l)(1)). However, in evaluating effluent limits to meet MCLs, a more practical approach would be to have these water quality based limits apply at the facility boundary, which is the compliance point for a RCRA consent which applies drinking water MCLs at this point. The rationale for this is that plumes, although estimated to be decreasing in contaminant concentration, still exist at the Federal Center and contribute to contaminant loading through seeps into McIntyre Gulch. Since a RCRA order requires meeting these MCLs at the facility boundary, it would not be prudent for EPA to issue an NPDES permit which could cause or contribute to a violation of that order, effectively providing the discharger with a shield from complying with an order administered through another agency.

Revised water quality standards:

1. COSPUS16c, described as: "All tributaries to the South Platte River, including all lakes, reservoirs and wetlands, from the outlet of Chatfield Reservoir, to a point immediately below the confluence with Big Dry Creek, except for specific listings in the subbasins of the South Platte River, and in Segments 16a, 16b, 16d, 16e, 16f, 16g, 17a, 17b, and 17c."

   Uses: Aquatic Life Warm 2, Recreation E, Agriculture

   Standards for which there are effluent limits in this permit: pH (6.5-9.0)

2. COSPUS22, described as: "Lakes and reservoirs in watersheds tributary to the South Platte River from the outlet of Chatfield Reservoir to a point immediately below the confluence with Big Dry Creek, except for specific listings in the subbasins of the South Platte River, and in Segments 16b, 17a, 17b, 17c, and 23.

   Uses: Aquatic Life Warm 2, Recreation E, **Water Supply**, Agriculture, Fish Ingestion

   Standards for which there are effluent limits in this permit: These are based on the State of Colorado's Water Plus Fish Standards since Segment COSPUS22 has both a Class 2 Aquatic Life and a Water Supply classification:

   Benzene: 2.2 ug/L; 1,1- Dichloroethylene: 7 ug/L; Trichloroethylene (TCE): 5.0ug/L; 1,1,1– Trichloroethane: 200 ug/L; Vinyl Chloride: 0.023 ug/L

Mixing zones could be established for benzene, dichloroethylene, trichloroethylene, trichloroethane, and vinyl chloride such that they meet water quality standards for water supply 2.5 miles downstream. Water quality based effluent limits which incorporate dilution or an attenuation factor (e.g., instream UV degradation) could be used provided that they do not cause a violation of the RCRA order which applies at the facility boundary. However, a mixing zone/degradation factor was not factored into establishing effluent limits for the facility as the technology based effluent limits for these pollutants are the primary driver for retention of the 2007 permit limits. A reopener clause has been added to this permit to allow for a relaxation of the technology based effluent limits. If the permit is re-opened to relax these technology based limits, it may be necessary to re-calculate water quality based effluent limits based on mixing and instream degradation to ensure that water quality standards can be met downstream and to ensure that the permit does not allow for concentrations of pollutants which would violate the RCRA order which applies at the facility boundary.

Technology Based Effluent Limits

Final effluent limits applicable to this facility are based on the more stringent application of both water quality based effluent limits and technology based limits. Since a change in the point of compliance for water quality based effluent limits for the facility could result in a less restrictive water-quality based limit, it is necessary to re-evaluate the technology based limits for this permit.

There are not effluent limitations guidelines promulgated by EPA which address the treatment of chlorinated solvents, so Best Professional Judgment has been used to derive technology based limits for this permit. In doing so, the age of equipment and facilities, processes employed, engineering aspects of various types of control technologies, process changes, and non-water quality environmental impacts have been considered.

The existing system is a pump-and-treat system which employs a four-step process:

1. Filtration
2. Air Stripping
3. Hydrogen peroxide addition/ UV-disinfection
4. Granulated Activated Carbon (GAC) treatment for hydrogen peroxide reduction

Current technologies which are employed at similar facilities referenced in EPA's Treatability Database include:

Note: The following discussion provides background information for each of the technologies used at the FHWA treatment plant. Although the FHWA treatment plant uses each of these general technologies, the exact details or type of technology may be different than the technology type discussed below. For example, the FHWA air stripper system utilizes a different type (venturi vs. packed tower aeration) of air stripper technology.

GAC: Granular activated carbon can achieve high to very high removals of TCE (from 75% up to greater than 99% removal). One study monitored full-scale treatment of a ground water for four months without detectable breakthrough. Another study reported short times to breakthrough but utilized a very high influent TCE concentration (1,000 ug/L). U SEPA has identified granular activated carbon as a Best Available Technology for removal of TCE from drinking water.

Air Stripping: Packed tower aeration can achieve moderate to complete TCE removal (60 to 100%). Air stripping whether it's a packed tower or venturi system as a treatment technology can achieve significant reduction in VOC concentrations, the specifc reduction is generally dependent on the relationship of the size of the system and the contaminant concentrations in the water to be treated. The studies used for the basis of these statements included pilot- and full-scale monitoring of ground waters. One study at very high air-to-water ratios shows complete removal. Another study of twin towers operated in series shows near complete removal of TCE. One study showed overall better performance of hydrophilized packing as compared to non-hydrophilized packing. USEPA has identified packed tower aeration as a Best Available Technology for removal of TCE from drinking water.

Hydrogen Peroxide: The use of hydrogen peroxide in combination with synthesized reactive nanostructured stacked membranes was found to be effective in removing TCE (70 to 80 percent for groundwater and lab water, respectively), according to results of one bench-scale study. It should be noted that the influent contaminant concentration and reaction time were higher than conditions typically experienced in drinking water treatment applications.

UV Irradiation: UV irradiation coupled with hydrogen peroxide can achieve high to very high reductions of TCE in contaminated water (up to greater than 99 percent removal). In most cases, however, this technology may not be feasible for full-scale water treatment due to the high hydrogen peroxide doses and long UV exposure times required.

Removal efficiencies based on each of these technologies varies widely from 10-100% largely based on the fractionation of the pollutants between various phases (e..g, dissolved aqueous vs. DNAPL fractions). Therefore, it is not possible to determine an expected removal efficiency based on the technologies available only. However, it is noted from the research that this system, which employs all four of these technologies in a series, likely diverges from what is standard industry practice through increased duplication and refinement. More standard industry approaches would include a more limited replication of treatment technologies with the most common approach being a combination of air stripping and GAC treatment. (Source: Decision Guide: A Guide for Selecting Remedies for Subsurface Releases of Chlorinated Solvents**;** Sale, T. and C. Newell, ESTCP Project ER-200530)

Given this wide projection of removal efficiencies, the best method for determining technology-based limit is then to determine what is in place at the site and whether it is reasonable to keep the same process in place given age of equipment and non-water quality environmental impacts such as energy requirements.

Determining whether cost-effectiveness would adversely impact operations at the facility may not be appropriate as this is a facility operated by the U.S. government, so direct correlations to profit margin would be difficult at best. However, the case can be made that if the facility has been able to afford the existing treatment system, without fundamentally impacting operations, then it can continue in the same fashion. Therefore, it is necessary to determine whether the existing system is appropriate for its purpose and whether age of equipment or other environmental considerations should be considered.

In comparison to other similar treatment systems, this system may be over-designed for its needs with the additional UV-oxidation treatment step, and this treatment process has been the cause of significant operational costs. While the UV oxidation system is still operational, it has reached or is reaching a point in its life span where continued operation and maintenance can no longer be considered within the context of routine maintenance. Increased continual replacement of UV system components has been an ongoing problem in the treatment system as it has aged. It should also be noted that the UV-oxidation step is highly energy intensive (i.e., non-water quality environmental impact). Costs for operating the UV oxidation unit include power, hydrogen peroxide, routine maintenance, annual lamp change out, periodic lamp and vessel cleaning, alarm troubleshooting and repairs. Including all of these factors, the estimated annual cost for operating the UV oxidation unit is approximately $19,340 per year.

For these reasons, (redundance, life span cost and maintenance, energy intensive), the treatment potential of this system has been evaluated in the absence of the UV-oxidation step. In order to collect data from this system, samples were collected when bypassing the UV-oxidation system. The result was that for the following pollutants measured in the discharge, none were detected in the effluent (i.e., below detection levels). Since the detection level is below the effluent limits for all of the following pollutants, it can be

determined that the existing system without the UV oxidation step can meet existing effluent limits.

The following table show the removal efficiency for selected pollutants when the UV-oxidation step is bypassed:

	Influent Concentration (ug/L)	Effluent Concentration (all non-detect)
1,1-Dichloroethane	73	< 0.22
1,2-Dicholoroethane	0.28	< 0.13
1,1-Dichloroethylene	57	< 0.23
1,1,1-Trichloroethane	150	< 0.16
Trichloroethene	12	< 0.16
1,1 - Dichloroethylene	80	< 2.2
Trichloroethene	12	< 0.16
Methylene Chloride	7.0	< 3.2

The existing system without the UV-oxidation step has been demonstrated to be prudent when considering economic impacts to the facility, the age of equipment and facilities, processes employed, engineering aspects of various types of control technologies, process changes, and non-water quality environmental impacts have been considered. The existing system without the UV-oxidation step has also shown the ability to treat pollutants to the effluent limits in the 2007 permit. Therefore the existing effluent limits have been retained in the 2013 reissuance of this permit.

It should be noted that the effectiveness of the system in meeting existing effluent limits was demonstrated on only one sampling event. Wide fluctuations in pollutant removal efficiency for these types of technologies have been recognized in EPA's treatability database. These fluctuations were related to on-site factors such as varying influent concentrations and pollutant fractionation. Since factors such as influent concentration and plume dynamics will change over time for this system, it is reasonable to expect that pollutant removal efficiencies will change over time as well. Therefore, a re-opener clause has been added to Part 4.15.4 of the permit:

4.15.4. Re-evaluation of Technology-Based Effluent Limits: Performance data demonstrate that the treatment system, while being properly operated and maintained, cannot meet technology-based effluent limits as predicted by the Best Professional Judgment (BPJ) analysis for this permit.

Technology based effluent limits were employed based on the effectiveness of the existing system in treating pollutants. If it is shown over time, that the existing system without the UV-oxidation step, while being properly operated and maintained, cannot meet these effluent limits, the permit can be reopened with the modification of these effluent limits. This modification would result in lower permit effluent limits based on the metrics specific to the system in place (e.g., percent pollutant removal of the highest influent concentration). In doing so, it will be necessary to demonstrate that these revised

limits can still meet water quality standards when accounting for dilution and breakdown in the environment.

Effluent Limitations for Outfall 001

	30-Day Average	7-Day Average	Daily Maximum
(b) Flow, mgd	0.029	n/a	0.043
(b) Total Suspended Solids, mg/L	n/a	n/a	30
(b) Oil and Grease, mg/L	n/a	n/a	10
(c) BTEX, ug/L	n/a	n/a	100
(c) Benzene, ug/L	n/a	n/a	5.0
(d) 1,1- Dichloroethane, ug/L	n/a	n/a	700
(d) 1,1 - Dichloroethylene, ug/L	n/a	n/a	7.0
(d) Trichloroethylene (TCE), ug/L	n/a	n/a	5.0
(d) 1,1,1 – Trichloroethane, ug/L	n/a	n/a	200
(c) Vinyl Chloride, ug/L	n/a	n/a	2.0
(e) There shall be no acute toxicity in the discharge (LC_{50}>100%)			
(a) The pH of the discharge shall not be less than 6.5 and shall not be greater than 9.0 at any time			
(a) Temperature of the discharge shall maintain a normal pattern of diurnal and seasonal fluctuations with no abrupt changes and shall have no increase in temperature of a magnitude, rate, and duration deemed deleterious to the resident aquatic life			

(a) pH and temperature limits are based on the standards provided at 5CCR 1002-38

(b) TSS and Oil and Grease limits are based on requirements for all dischargers as stated in Colorado Regulation No. 62, Regulations for Effluent Limitations. The daily max TSS limit of 30 mg/L correlates with the 7-day average limitation as provided in Colorado Regulation No. 62. 7-day and 30-day average limits were not provided as the frequency of sampling is not sufficient to provide for averaging of multiple samples. The flow limitation is based on the pump rates for the recovery wells.

(c) Limits for organics are based on Best Professional Judgment (BPJ) using estimated pollutant concentrations for the air stripping technology and as presented in EPA's Model NPDES Permit for Discharges Resulting From The Cleanup of Gasoline Released From Underground Storage Tanks, USEPA, 1989.

(d) Limits for the chlorinated volatile organic compounds, TCE, 1,1,1-trichloroethane, and , 1-1-dichloroethylene are based on human health criteria or drinking water criteria under Colorado Regulation No. 31. The limitation for 1,1-dichloroethane is based on a State of Colorado Groundwater Equivalent Standard for human health risk.

(e) Whole Effluent Toxicity (WET) limitations will apply to the discharge for both fathead minnows and Ceriodaphnia dubia.

Monitoring Requirements:

The monitoring requirements for Outfall 001 are to be completed by the permittee and are presented below. Monitoring frequency has been changed to quarterly for all constituents in this permit. The 2007 permit contained the following language: "After one year, if all tests for a given parameter meet discharge limits, the monthly sampling frequency will be changed to quarterly for all parameters for which there were not exceedances of permit limits for twelve (12) consecutive tests." There were no exceedances of permit limits recorded for this permit for all of the following parameters, and the pollutant of concern (H202) causing WET failures early on was causing issues, so monthly sampling frequency has been changed to biennial (once every two years). Reduced frequency of WET testing is appropriate based on data showing a low variability in influent concentrations and a continuous decrease in influent concentration as a result of the pollutant plume diminishing significantly over time.

	Frequency	Sample Type
(a) Total Flow, mgd	Daily	Instantaneous
Total Suspended Solids, mg/L	Quarterly	Grab
Total Phosphorus, mg/L	Quarterly	Grab
Benzene, ug/L	Quarterly	Grab
BTEX, ug/L	Quarterly	Grab
1,1-Dichloroethane, ug/L	Quarterly	Grab
1,1-Dichloroethylene, ug/L	Quarterly	Grab
Trichloroethylene (TCE), ug/L	Quarterly	Grab
1,1,1-Trichloroethane, ug/L	Quarterly	Grab
Vinyl Chloride, ug/L	Quarterly	Grab
pH, s.u.	Quarterly	Grab
Temperature (c)	Quarterly	Grab
(b) Oil and Grease, visual	Quarterly	Visual
Whole Effluent Toxicity, acute LC_{50}	Biennial	Grab

(a) Flow measurements of effluent volume should be made in a manner that the permittee can affirmatively demonstrate that representative values are being obtained. The average flow rate (in million gallons per day) during the reporting period and the maximum flow rate observed (in million gallons per day) shall be reported.

(b) The frequency for oil and grease inspection has been changed to quarterly to coincide with monitoring for other constituents and because a sheen has never been observed in several years of data and is thus not likely to be detected. If a visible sheen is detected, a grab sample shall be taken and analyzed immediately. The concentration of oil and grease shall not exceed 10mg/L in any sample.

Endangered Species

No species that are federally-listed as endangered or threatened ("listed") under the Endangered Species Act (ESA) have been found or are expected to be present at the Denver Federal Center. According to the U.S. Fish & Wildlife Service there is no critical habitat designated on or near DFC. Therefore, EPA finds that this permit is not likely to adversely affect any of the species listed by the US Fish and Wildlife Service under the Endangered Species Act.

Historic Properties

Discharges and discharge-related activities would not affect a property that is listed or is eligible for listing on the National Register of Historic Places as maintained by the Secretary of the Interior. The U.S. Government purchased what is the DFC property in the early 1940s, and developed it into the Denver Ordnance Plant. Other buildings were built after the war was over. Currently, most of the buildings constructed on the DFC have been renovated, thus making them ineligible for National Historic designation. Only two buildings have maintained enough structural and physical integrity to meet the criteria for consideration for National Register designation: the original Office of Civil Defense Building adjacent to Building 50, and Building 710. Both of these buildings are underground. EPA does not anticipate any impacts on historic properties or cultural resources because this permit is a renewal and will not be associated with any new ground disturbance or significant changes to the volume or point of discharge.

Public Notice and Response to Comments

This permit was public noticed on August 31, 2013 in the Denver Post. No comments were received during the public notice period.

Miscellaneous

The effective date and the expiration date of the permit will be determined at the time of permit issuance. The intention is to renew the permit for a period of approximately five years, but not to exceed 5 years.

Permit drafted by Greg Davis, 8P-W-WW, January 14, 2013
Permit reviewed by Robert Shankland, SEE, 8P-W-WW, January 21, 2013