QUARTERLY REPORT
FOR THE
ROCKY FLATS GROUNDWATER PLUME
TREATMENT SYSTEMS

April through June 2001

June 30, 2001

1/15

DOCUMENT CLASSIFICATION
REVIEW WAIVER PER
CLASSIFICATION OFFICE

TABLE OF CONTENTS

TABLES

FIGURES

GRAPHS

ACRONYM LIST

DOE	Department of Energy
gpm	gallons per minute
ITS	Interceptor Trench System
HRC™	Hydrogen Release Compound™
msl	mean sea level

mg/l	milligrams per liter
OU	Operable Unit
pCi/l	picoCuries per liter
PU&D	Property Utilization and Disposal
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
SCFA	DOE Subsurface Contaminant Focus Area
ug/l	micrograms per liter
VOCs	volatile organic compounds

1.0 INTRODUCTION

This quarterly report describes the activities and available performance monitoring data for the five groundwater collection and treatment systems at the Rocky Flats Environmental Technology Site (RFETS) However, as required by the respective decision documents, most of these systems are now sampled semi-annually Therefore, this report will only contain information for plume treatment systems where more frequent samples are collected For this quarter, data are presented for the Solar Ponds Plume System and the PU&D Yard Plume Treatability Study

Available data for all five groundwater collection and treatment systems will be included in the Annual Report prepared at the end of each calendar year This report will include the reactive barriers installed for the Mound Site Plume, the East Trenches Plume and the Solar Ponds Plume, the Operable Unit (OU) 1 – 881 Hillside system and the OU7 – Present Landfill Seep collection system

1.1 Site Events

Higher than average precipitation fell this quarter with resulting heavier flows at the plume treatment systems The historic mean for the amount of precipitation typically received from March through May is 5 5 inches During the same period this year, 6 5 inches of precipitation were received June precipitation data are not yet available March precipitation this year was 1 36 inches, similar to the historic mean of 1 27 inches April precipitation this year was 1 95 inches, slightly higher than the historic mean for April of 1 56 inches May precipitation this year amounted to 3 19 inches, slightly higher than the May historic mean of 2 68 inches

2.0 SOLAR PONDS PLUME TREATMENT SYSTEM

The Solar Ponds groundwater plume contains low-levels of nitrate and uranium, generally attributed to storage and evaporation of radioactive and hazardous liquid wastes in the Solar Evaporation Ponds from 1953 to 1986 These ponds were drained and the sludge removed by 1995 Six interceptor trenches were installed in 1971 to de-water the hillside north and downgradient of the ponds The original six trenches were abandoned in place and the Interceptor Trench System (ITS) was installed in 1981 The ITS was replaced with the installation of a 1,100-foot long collection system and passive treatment cell containing iron and wood chips Installation was completed in September 1999 and the components of the system are shown on Figure 1 This system intercepts the water previously collected by the now defunct ITS

The original system design placed the treatment cell adjacent to North Walnut Creek With this design, water intercepted by the collection trench would flow by gravity to the treatment cell without detention in the collection trench Because Preble's Meadow Jumping Mouse (a Federally Listed Threatened Species) is present at this optimal location for a flow-through treatment cell, the location of the treatment cell was moved 400 feet upgradient to a location immediately adjacent to the collection trench As a result, the collection trench for this system must hold approximately 11 feet of groundwater to develop sufficient hydraulic head for the groundwater to flow into the treatment cell

Maintenance requirements consist of water level monitoring and sample collection Based on information from other similar systems, the media does not require raking or other maintenance It is expected that media replacement will be required 10 years after installation

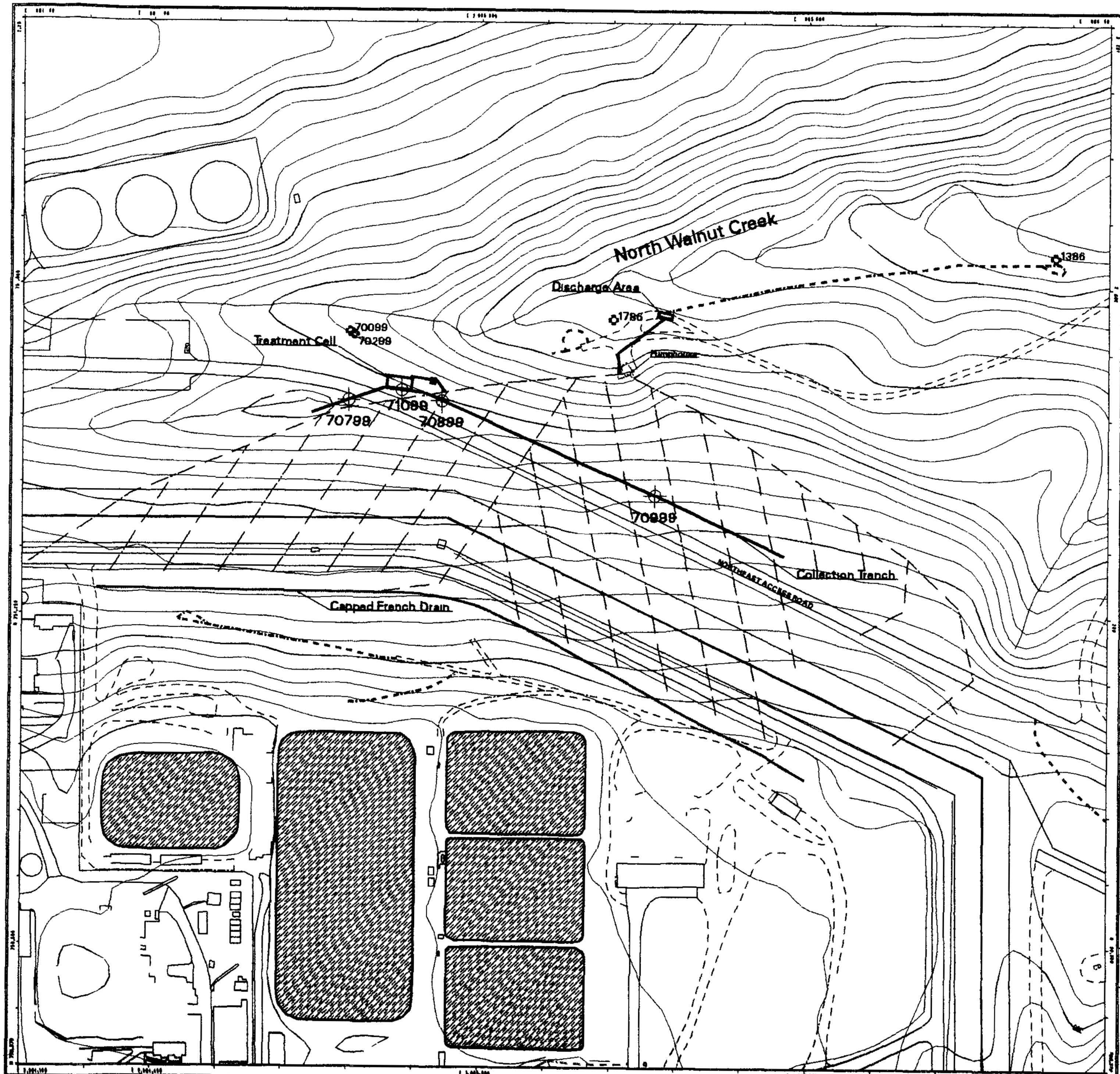

Figure 1
Solar Ponds Plume Treatment System Locations

EXPLANATION

- ITS
- In Trench Piezometer Location
- Monitoring Well

Standard Map Features

- Buildings and other structures
- Solar Evaporation Ponds (SEP)
- Lakes and ponds
- Streams, ditches or other drainage features
- Fences and other barriers
- Contour (5-Foot)
- Paved roads
- Dirt roads

Scale = 1 : 3080
1 inch represents approximately 257 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: DynCorp — THE ART OF TECHNOLOGY

Prepared for: KAISER-HILL

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5

2.1 Project Status

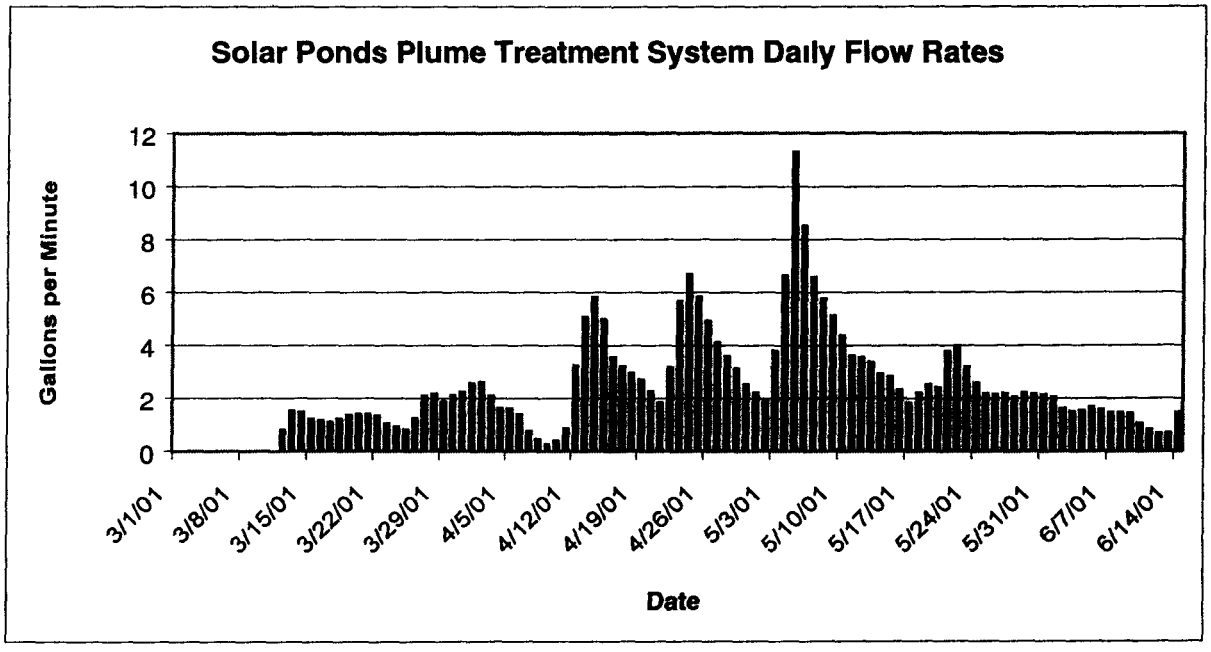
The Solar Ponds Plume system is currently collecting groundwater containing nitrate and uranium from the Solar Ponds Plume However, some untreated groundwater is also reaching surface water at the discharge gallery resulting in higher nitrate and uranium levels in North Walnut Creek than were observed prior to system installation

Surface water quality continues to be well below applicable standards of 10 pCi/l uranium and 100 mg/l nitrate specified in the Solar Ponds Plume Decision Document (DOE 1999) The 100 mg/l nitrate standard is a temporary modification of the underlying stream standard of 10 mg/l nitrate in North Walnut Creek (DOE 1999)

2.2 Treatment Effectiveness

Treatment system flow and volume of water are measured and recorded automatically The average daily flow rates for the period March through June 14, 2001 are shown below in Graph 1 The flow rate for this quarter ranged from 0 26 to 11 28 gallons per minute with the higher flow rates closely associated with precipitation events As of June 14, 2001, 421,697 gallons of water have been treated since system installation Of this volume, 357,645 gallons were treated from March 6 to June 14, 2001

Graph 1 Solar Ponds Plume Treatment System Flow Volume, March through June 2001



Water levels within the collection trench are monitored monthly at locations shown on Figure 1 Water levels for the last two quarters are provided in Table 1 and indicate a rise in water levels within the collection trench over the last quarter

Table 1 Solar Ponds Plume Collection Trench Piezometer Water Levels (in feet below top of casing)

Piezometer	1/3/01	2/5/01	3/5/01	4/5/01	5/1/01	6/1/01
70799	Dry	NM	Dry	14 87	13 7	13 88
70899	Dry	Dry	18 11	16 75	15 41	15 54
70999	Dry	Dry	Dry	20 8	20 15	20 25
71099	21 24	21 06	18 49	17 13	15 92	16 07

NM – not measured

Downgradient wells are also monitored monthly and the last two quarters of data are provided in Table 2 Water levels in colluvial well (70099) fluctuated from 5875 to 5877 feet above mean sea level (msl) Water levels in the bedrock well (70299) fluctuated one foot from 5876 to 5877 feet above msl The wells were sampled about one week before the May water levels were measured, and the volume of groundwater removed for the analytical samples is the most likely result of the slightly lower water levels measured at this time

Water levels in well 1786, located adjacent to the discharge gallery, increased from 5864 to 5865 feet above msl During this period, water levels in well 1386 remained constant at 5837 feet above msl

Table 2 Depth to Groundwater in Solar Ponds System Wells (in elevation above msl)

Well	1/3/01	2/5/01	3/5/01	4/5/01	5/1-5/01	6/1/01
70099	5877	5875	5875	5876	5875	5876
70299	5877	5877	5877	5877	5876	5877
1386	5837	5837	5837	5837	5837	5837
1786	5864	5864	5864	5864	5865	5865

2.2.1 Treatment System Monitoring

Monthly samples are collected from the treatment system influent, effluent and discharge gallery (Figure 1) Because of the increased flow through the treatment cell this quarter, additional samples were collected to verify that the treatment cell was continuing to function at the higher flow volumes Even with the higher flow rates observed this quarter, the effluent concentrations continue to be much lower than predicted Available nitrate and uranium concentrations are provided in Table 3, including the six consecutive sampling events from this quarter Except for the May 8th effluent nitrate concentration of 5 3 mg/l, all effluent nitrate and uranium values are close to zero

Table 3 Solar Ponds Plume Treatment System Analytical Results

	SPP Influent		SPP Effluent		SPP Discharge Gallery	
Collection date	Nitrate in mg/l	Total Uranium in pCi/l	Nitrate in mg/l	Total Uranium in pCi/l	Nitrate in mg/l	Total Uranium in pCi/l
28-Oct-99	130	20 93	-	-	-	-
30-Nov-99	140	20 59	-	-	-	-
28/30-Dec-99	170	23 53	-	-	280	37 44
27-Jan-00	160	27 63	-	-	-	-
29-Feb-00	140	24 66	-	-	-	-
24/27-Mar-00	48	28 3	<0 05	-	240	45 2
25-Apr-00	140	24 99	<0 05*	0 96	283*	34 96*
22-May-00	115	23 05	<0 05 to 0 1*	0 24*	188*	-
29-Jun-00	130	21 72	-	-	294*	28 84
18-Jul-00	140	19 67	<0 05 to 1 1*	0 233	217*	26 17
17-Aug-00	130	26 03	16	0 061	246*	36 91
25-Sep-00	140	24 51	<0 05*	0 03	203*	19 62
Oct-00	110	25 46	<0 05	0 02	200	23 95
30-Nov-00	130	23 27	-	-	200	35 47
27-Dec-00	150	24 68	-	-	220	33 38
30-Jan-01	140	25 06	-	-	130	25 66
26-Feb-01	150	26 44	-	-	140	24 51
19-Mar-01	120	25 58	0 07	0 15	110	28 84
13-Apr-01	140	24 43	<0 05	0 003	120	20 20
25-Apr-01	130	24 58	<0 05	0 05	130	28 55
3-May-01	110	24 82	0 13	0 091	150	24 79
8-May-01	150	23 66	5 3	0 11	140	26 60
23-May-01	130	nr	<0 05	nr	180	nr

* average concentration for month
\- not sampled
nr not received

The discharge gallery appears to be discharging groundwater that is bypassing the treatment cell Recent concentrations observed at this location are similar to the concentrations at the influent In addition, the discharge gallery is located within the zone-of-sacrifice for this plume, the pre-existing downgradient part of the plume that has nitrate concentrations consistently above 500 mg/l This downgradient part of the plume also contributes to the higher nitrate and uranium concentrations at the discharge gallery that are elevated above the treatment system effluent

Prior to December 2000, the discharge gallery contaminant concentrations were significantly higher than the concentrations observed in the collection trench Nitrate concentrations observed at the discharge gallery sharply declined in January and February During the last quarter, the influent and discharge gallery samples analytical data remained in the same range The discharge gallery sample nitrate concentrations are still lower than the greater than 200 mg/l concentrations observed in 1999 and 2000, but the concentrations fluctuate over a greater range than the influent While the concentrations continue to be monitored, it appears that the high concentration portion of the plume immediately adjacent to the discharge gallery is no longer contributing significant levels of additional contamination The latest nitrate concentration of 180 mg/l on May 23rd was

8

observed following 3 inches of rain This may indicate that nitrate in the soils is being flushed into solution

2.2.2 Downgradient Water Quality

GS13 and Pond A-3 are monitored monthly to verify that nitrate concentrations at both locations are below the temporary stream standard of 100 mg/l The nitrate and uranium concentrations are provided in Table 4 and verify that the existing stream standards continue to be met

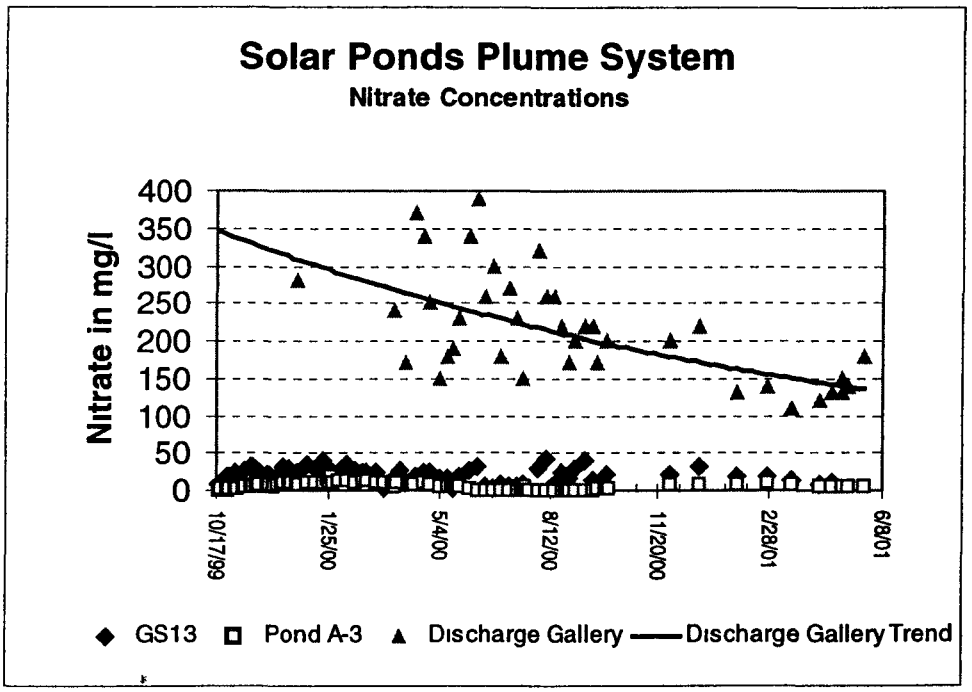
Table 4 Downgradient Water Quality

	GS 13		Pond A-3
Collection date	Nitrate in mg/l	Total Uranium in pCi/l	Nitrate in mg/l
October 99*	17 9	5 59	1 14
November 99*	24 11	6 41	5 04
December 99*	23 67	7 99	8 37
January 00*	32	6 75	14 13
February 00*	26 6	7 57	13 2
March 00*	16 65	5 15	9 26
April 00*	18 65	5 59	8 33
May 00*	13 18	7 1	4 88
June 00*	15 12	3 27	1 11
July 00*	6 5	3 23	1 51
August 00*	24 26	4 13	1 12
September 00*	22 8	3 77	1 23
October 00*	21	5 49	2 48
30-Nov-00	22	9 18	7 1
27-Dec-00	33	9 81	8 8
30-Jan-01	20	9 15	7 9
26-Feb-01	18	8 85	11
19-Mar-01	13	5 89	8 2
13-Apr-01	7 8	2 999	4 1
25-Apr-01	10	2 936	5 4
3-May-01	2 9	1 328	4 5
8-May-01	12	4 08	5 3
23-May-01	15	nr	5 6
Standards	100	10	100

* Average monthly concentrations
nr results not received

Graph 2 below displays all available nitrate data since installation of the Solar Ponds Plume system along with concentrations observed at the discharge gallery The graph also shows the decreasing trend in discharge gallery nitrate concentrations

Graph 2 Nitrate Concentrations at the Solar Ponds Plume Treatment System



GS13 is the performance monitoring location for the Solar Ponds Plume System (DOE 1999) and is located in North Walnut Creek immediately downgradient of the Solar Ponds Plume Since January 2001, the nitrate concentrations have been at or below 20 mg/l but fluctuate depending upon precipitation and other factors For this quarter, the average nitrate concentration ranged from 2 9 to 15 mg/l with an average concentration of 9 5 mg/l nitrate

At Pond A-3, located downstream of GS13, nitrate concentrations have been steadily declining since March 2000 and are now generally below 10 mg/l Nitrate concentrations this reporting period ranged from 4 1 to 5 6 mg/l nitrate with an average concentration of 5 0 mg/l

Phytoremediation and higher flow rates in North Walnut Creek may account for the lower nitrate concentrations observed during June and July 2000 Water leaving the discharge gallery flows along an abandoned dirt road that is now reclaimed by volunteer native vegetation As expected, standing water at the discharge gallery supports rushes and cattails while the saturated soils support foxtail grass and barnyard grass Wetland plants in general are known to have relatively high nitrate uptake rates In the fall and winter months, seasonal die-back of the vegetation, combined with decreased flow in North Walnut Creek, apparently causes nitrate levels to increase slightly at GS13

The Pond A-4 Outfall (GS-11) is a RFCA Point of Compliance for uranium Samples are collected during the Pond A-4 discharge events and usually contain 3 to 4 pCi/L total uranium, well below the stream standard of 10 pCi/L The most recent Pond A-4 discharge was May 6 through May 21, 2001, uranium data from the composite samples are shown in Table 5

10

Table 5 Recent Uranium Activities at the Pond A-4 Point-of-Compliance (pCi/l)

Start Date	U-233, 234	U-235	U-238	Total Uranium
5/6/01	1 54	0 068	1 55	3 158
5/8/01	1 66	0 056	1 37	3 086
5/10/01	1 83	0 107	1 72	3 657
5/13/01	2 04	0 032	1 88	3 952

Analytical samples are collected quarterly, where possible, from the two downgradient wells Data from these wells are provided in Table 6 The bedrock well (70299) consistently contains sufficient water for sampling while the adjacent colluvial well (70099) sometimes does not The bedrock contact is lower at the bedrock well, possibly indicating a preferential groundwater flow path Fractured claystone is present in the bedrock well and these fractures apparently contain more water than the colluvium in this area

Table 6 Solar Ponds Plume Downgradient Well Analytical Results

Well	Date	Nitrate/Nitrite (mg/l)	Uranium-233,-234 (pCi/l)	Uranium-235 (pCi/l)	Uranium-238 (pCi/l)	Total Uranium (pCi/l)
70099 Alluvial	6/6/00	0 87	117	5 04	84 6	206 64
	10/26/00	2 2	79	2	58	139
	1/23/01	2 4	115	3 69	81 9	200 59
	4/20/01	1 9	96	3 5	68	167 5
70299 Bedrock	8/24/99	2 1	5 17	0 18	2 98	8 33
	10/26/99	0 1	11 17	0 55	10 70	22 42
	6/2/00	0 05	5 46	0 32	3 85	9 63
	10/26/00	0 05	7 8	0 16	5 3	13 26
	1/22/01	0 25	9 01	0 22	5 98	15 21
	4/20/01	0 66	6 6	0 22	4	10 82
1786	5/11/99	410	33 79	1 13	27 40	62 32
	5/4/00	560	41 7	1 56	29	72 26
	11/8/00	630	36	1 1	26	63 1
	1/23/01	570	36 7	1 3	26 9	64 9
	4/17/01	620	38 2	1 79	28 4	68 39
1386	5/18/99	0 06	6 68	0 31	5 79	12 78
	5/4/00	0 05	8 65	0 33	7 47	16 45
	10/26/00	0 23	8 7	0 33	7 3	16 33
	1/23/01	0 1	9 91	0 58	7 96	18 45
	4/16/01	0 05	12 3	0 41	9 92	22 63

The nitrate observed concentrations are lower than anticipated in both wells The uranium activity in the colluvial well (70099) is higher than the upgradient part of the Solar Ponds Plume (DOE 1999) and elsewhere in the collection and treatment system (Table 3) The uranium activity at 70099 is also much higher than in the adjacent bedrock well This order of magnitude difference probably indicates that this well intersects naturally occurring uranium-rich cobbles or other native material

Well 1786 is located adjacent to the discharge gallery within the zone-of sacrifice for the Solar Ponds Plume, the downgradient part that was not intended to be treated The high concentrations present at this location confirm that the Solar Ponds Plume extended to North Walnut Creek prior

to installation of the Solar Ponds Plume System Of note, nitrate concentrations at this location appear to increase with increased precipitation and a resulting rise in groundwater elevations (see Table 2) The increased nitrate concentrations in the well may be at least partly the cause of the increased nitrate concentrations at the discharge gallery observed during the same general timeframe (see Table 3) Well 1386 is near GS13 and is located outside of the plume extent

2.3 Conclusions and Planned Changes

Recent data verify that the treatment cell is performing as designed, even during this period of high water flows During drier periods, water levels in the collection trench fluctuate rather than holding constant at 11 feet suggesting that water is bypassing the treatment system Water quality in North Walnut Creek continues to be well below applicable standards for nitrate and uranium even with bypass of the treatment system

Water levels within the collection trench and nearby wells will continue to be monitored on a monthly basis Monitoring will continue at GS13, Pond A-3, and the treatment system influent, effluent and discharge gallery to measure system performance and the impact to surface water Results for this reporting period reinforce the seasonal effects experienced in system performance, with normal treatment during fall and winter and treatment augmented by phytoremediation during the spring and summer At this time, the Site plans to continue to monitor the system through fiscal year 2001 to document seasonal impacts and to determine if other actions are required to continue to meet surface water standards

3.0 PU&D Yard Plume Treatability Study

A plume of volatile organic compound (VOC) contaminated groundwater is derived from a contaminant source located in the Property Utilization and Disposal Yard (PU&D Yard) at RFETS Investigation results indicate that subsurface VOC contamination is present in only a few locations and that the primary contaminant is tetrachloroethene (Kaiser-Hill 2001)

A treatability study is in progress to evaluate the effectiveness of Hydrogen Release Compound™ (HRC™) for enhancing natural attenuation of the VOCs in the groundwater and soil at the PU&D Yard Plume HRC™ is a proprietary, environmentally safe, food quality, polylactate ester formulated for slow release of lactic acid upon hydration The HRC™ is expected to stimulate rapid degradation of chlorinated VOCs found in groundwater and soil at this location by making low concentrations of hydrogen available to the resident microbes to use for dechlorination The HRC™ is expected to be a one-time application According to the manufacturer (Regenesis), the material is expected to stimulate contaminant degradation for approximately one year

The product has been used at other sites to stimulate rapid degradation of chlorinated VOC contaminants in groundwater and soil This study will evaluate the effectiveness of HRC™ in the low flow groundwater regimes common at RFETS (Kaiser-Hill 2001) This project is a cooperative effort between RFETS and the Department of Energy (DOE) Subsurface Contaminant Focus Area (SCFA) and funding is provided by DOE SCFA

3.1 Project Events

The study is located in the most highly contaminated portion of the PU&D Yard Plume and within the source area (Figure 2) A monitoring well (30900) was previously installed in this area

12

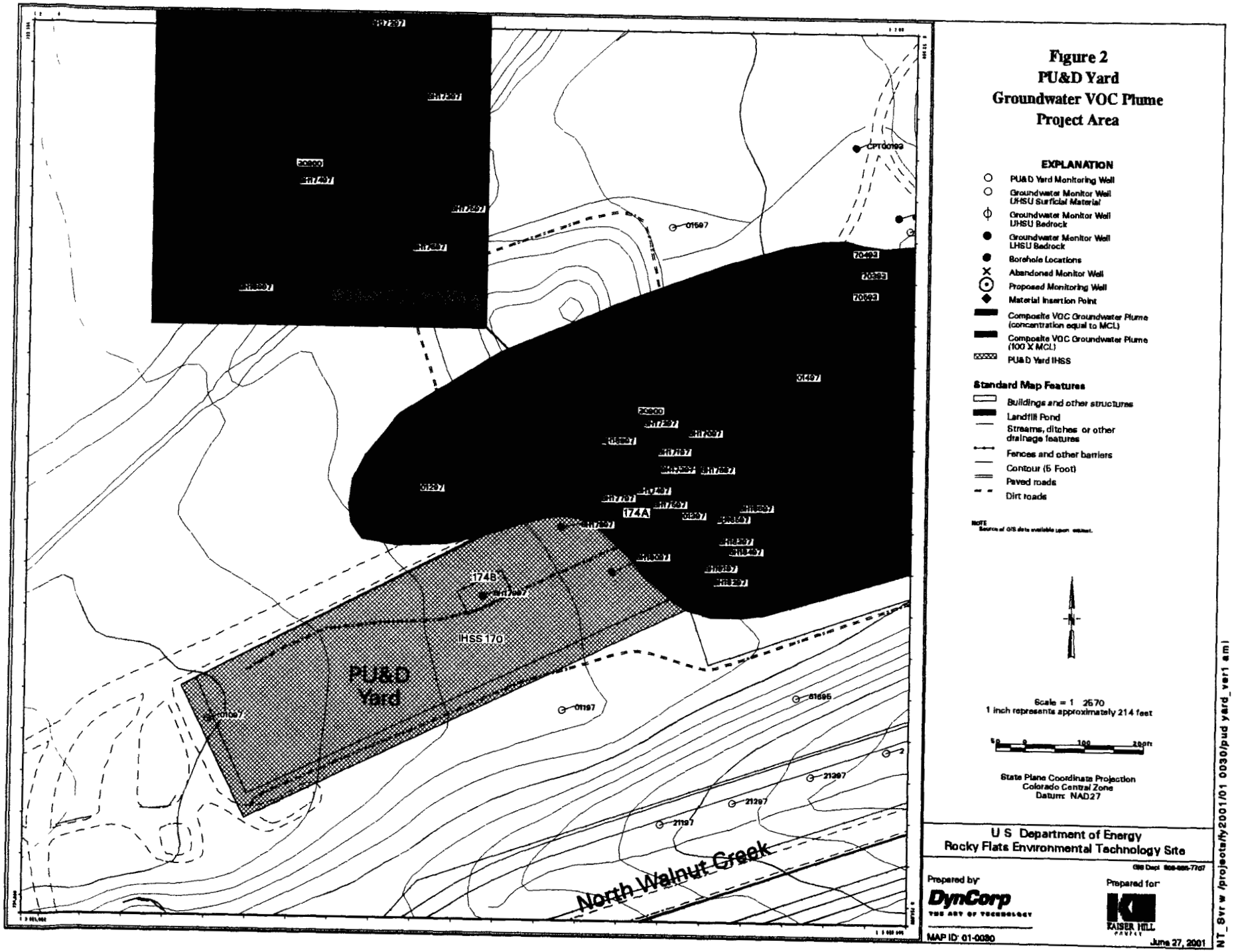


Figure 2
PU&D Yard
Groundwater VOC Plume
Project Area

EXPLANATION

- PU&D Yard Monitoring Well
- Groundwater Monitor Well UHSU Surficial Material
- Groundwater Monitor Well UHSU Bedrock
- Groundwater Monitor Well LHSU Bedrock
- Borehole Locations
- Abandoned Monitor Well
- Proposed Monitoring Well
- Material Insertion Point
- Composite VOC Groundwater Plume (concentration equal to MCL)
- Composite VOC Groundwater Plume (100 X MCL)
- PU&D Yard IHSS

Standard Map Features

- Buildings and other structures
- Landfill Pond
- Streams, ditches or other drainage features
- Fences and other barriers
- Contour (5 Foot)
- Paved roads
- Dirt roads

NOTE
Source of GIS data available upon request.

N

Scale = 1 : 2670
1 inch represents approximately 214 feet

50 0 100 200ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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GIS Dept 303-966-7707

Prepared by
DynCorp
THE ART OF TECHNOLOGY

Prepared for
KAISER HILL COMPANY

MAP ID: 01-0030

June 27, 2001

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immediately adjacent to borehole 17497 where the highest concentrations of VOCs in soils were detected An additional monitoring well (31001) was installed slightly downgradient of the source area in January 2001 Baseline samples were collected from these two monitoring wells prior to insertion of the HRC™

Beginning in February 2001, 16 material insertion points were used to place over 800 pounds of HRC™ into the subsurface These material insertion points are located within the source area of the plume immediately surrounding borehole 17497 Insertion of the HRC™ was completed on March 1, 2001 Sufficient groundwater was present at southwest corner of the insertion grid (MIP3) to collect a groundwater sample prior to insertion of the HRC™

Subsurface conditions were allowed to stabilize for two months, then monthly sampling was initiated April 30, 2001

3.2 Preliminary Results

Results from the initial baseline samples and the first monthly samples were received this quarter and are reported below For completeness, the previous sample from the pre-existing monitoring well (30900) in the source area is also included In addition, results from the one time only groundwater sample from MIP3 are also shown below

Table 7 Preliminary Treatability Study Results

Location	Sample Date	Tetrachloroethene (ug/l)	Trichloroethene (ug/l)	Carbon Tetrachloride (ug/l)	Cis 1,2 Dichloroethene (ug/l)
MIP3	2/20/01	4 9	ND	ND	ND
30900	10/20/00	96	7 4	ND	53 1
	1/17/01	120	7	ND	78
	4/30/01	180	11	ND	110
31001	1/30/01	18	5 5	ND	1 2
	4/30/01	130	20	ND	52
Groundwater Tier I Action Levels		500	500	500	700
Groundwater Tier II Action Levels		5	5	5	7

ND - not detected

As shown by the data in Table 7, concentrations of tetrachloroethene, trichloroethene and cis 1,2 dichloroethene increased after insertion of the HRC™ According to Regenesis (the HRC™ manufacturer), approximately 70% to 80% of project sites see an initial increase in chlorinated compound concentrations before a downward trend is observed This is due to disturbance to the aquifer during the HRC application process and to development of biosurfactants, both of which facilitate the desorption of contamination from soil particles, thus temporarily increasing dissolved contaminant concentrations before the contaminants are degraded The increased concentrations are anticipated to continue for one or two months before a decreasing trend is observed

Also of interest, the highest concentration of tetrachloroethene observed for the PU&D Yard groundwater plume was collected from borehole 17497 during drilling operations to collect subsurface soil samples The tetrachloroethene concentration of 1,700 ug/l from this sample is one order of magnitude higher than in subsequent samples collected at this location This may indicate that the PU&D Yard Plume has already naturally degraded below Tier 1 Action Levels,

or that groundwater collected from monitoring wells provides a more representative groundwater sample than groundwater samples collected during drilling operations

3.2 Conclusions and Work Planned

The planned monthly sampling for the treatability study will continue and results will be presented in the next Quarterly Plume Report

4.0 REFERENCES

DOE, 1999, *Final Solar Ponds Plume Decision Document*, RF/RMRS-98-286 UN, June

Kaiser-Hill, 2001, PU&D Yard Plume Enhanced Natural Attenuation Treatability Study Work Plan, PRO-1256-PU&DPLUME-WP, January