NOTICE

All drawings located at the end of the document.

Work Plan Manual for the Startup, Operation, and Maintenance of the IM/IRA for the 881 Hillside Operable Unit No. 1

EG&G ROCKY FLATS

Manual No. 21100-WP

OU 01.5

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Date 3/25/92

ADMIN RECORD

FINAL

WORK PLAN MANUAL FOR THE STARTUP, OPERATION, AND MAINTENANCE OF THE INTERIM MEASURE/INTERIM REMEDIAL ACTION FOR THE 881 HILLSIDE OPERABLE UNIT NO. 1

ROCKY FLATS PLANT

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

February 1992

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EXECUTIVE SUMMARY

The Rocky Flats Plant (RFP) is a U.S. Department of Energy (DOE) facility operated by EG&G Rocky Flats. Since it was started in 1950, the facility has produced plutonium products. As part of the production, waste materials were disposed of onsite at a number of locations. Among those locations were sites along the hillside south and east of Building 881. This area has been designated "881 Hillside" or Operable Unit (OU) 1.

EG&G Rocky Flats has initiated an Interim Measure/Interim Remedial Action (IM/IRA) for OU 1. The IM/IRA for OU 1 includes intercepting the groundwater, removing and treating it, and discharging the treated water to an interceptor ditch. The treatment system comprises an ultraviolet/hydrogen peroxide (UV/H_2O_2) oxidation system, an ion exchange (IX) system, and tanks for storing the treated water before disposal.

This work plan addresses the startup and operation and maintenance (O&M) of the IM/IRA for OU 1. The startup includes the systems operation (SO) test, while O&M includes the systems operation scheduled to occur from April 6, 1992, to December 14, 1992.

The work plan includes the health and safety plan (HSP), the respiratory protection plan, the sampling and analysis plan (SAP), and the systems operation (SO) test plan. An O&M manual has been prepared as a separate document.

The SAP addresses sampling for both the SO test and the systems operation. Sampling during the SO test includes many more samples and analyses than the systems operation sampling does. This is because the purpose of sampling during the SO test is to optimize the UV/H_2O_2 and IX systems, and the purpose of sampling during the systems operation is to monitor the treatment system's performance in meeting treatment goals. To optimize the UV/H_2O_2 and IX systems,

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samples need to be taken at several points and analyzed for several parameters. To monitor the treatment system's performance, only influent and effluent streams will be sampled.

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LIST OF ABBREVIATIONS

AA	atomic absorption
AOP	advanced oxidation process
ARAR	applicable or relevant and appropriate requirements
CBT	computer-based training
CCR	Colorado Code of Regulations
CDH	Colorado Department of Health
CLP	contract laboratory program
CO_2	carbon dioxide
COC	chain of custody
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	carbomolecular sieve
CWA	Clean Water Act
DOE	(U.S.) Department of Energy
DOT	(U.S.) Department of Transportation
DQO	data quality objective
EMD	Environmental Management Department
EPA	(U.S.) Environmental Protection Agency
ER	Environmental Restoration (Program)
gal	gallon
GC/MS	gas chromatography/mass spectroscopy
gpd	gallon per day
gpm	gallon per minute
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
GT	greater than
H_2O_2	hydrogen peroxide
hsl	hazardous substance list
HSP	Health and Safety Plan
IAG	Interagency Agreement
I&C	instrumentation and control
ICP	inductively coupled plasma
IHSS	Individual Hazardous Substance Sites
IM/IRA	Interim Measure/Interim Remedial Action
IX	ion exchange
L	liter
LT	less than
µg	microgram
MCC	motor control center
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mg	milligram
ml	milliliter
MS	matrix spike
MSD	matrix spike duplicate

NaOH	sodium hydroxide
O&M	operation and maintenance
OPS	operating procedures
ORR	Operational Readiness Review
OSA	Operational Safety Analysis
OSHA	Occupational Safety and Health Administration
OU	operable unit
oz	ounce
PARCC	precision, accuracy, representativeness, completeness, comparability
pCi	picocurie
PLC	programmable logic controller
ppm	part per million
PSI	Peroxidation Systems, Inc.
QA	quality assurance
QAA	Quality Assurance Addendum
QAPP	Quality Assurance Project Plan
QC	quality control
RAD	radiation
RCRA	Resource Recovery and Conservation Act
R&D	research and development
RFEDS	Rocky Flats Environmental Data System
RFI	RCRA facility investigation
RFP	Rocky Flats Plant
RI	remedial investigation
rpm	revolution per minute
RPP	respiratory protection plan
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SO	systems operation
SOP	standard operating procedure
TBC	to be considered
TDS	total dissolved solids
TSD	treatment, storage, and disposal
µg	microgram
UV	ultraviolet
UV/H_2O_2	ultraviolet/hydrogen peroxide
VOA	volatile organic analysis
WQC	water quality criteria
WQCC	Water Quality Control Commission

Section 1

Introduction

1.0 INTRODUCTION

This work plan is provided to describe the 881 Hillside Operable Unit (OU 1) groundwater treatment facility constructed at the Rocky Flats Plant (RFP). It describes the purpose, features, operation, and testing of the treatment processes and equipment. It also establishes guidelines for evaluating the treatment facility operations and process efficiency and provides detailed procedures for testing and operating the treatment processes and equipment.

The work plan consists of individual sections that present the project background, provide detailed descriptions of the individual project tasks, describe the project management function, establish the schedule for completing each task, and present quality assurance requirements. The work plan also contains four appendices. Appendix A contains a site-specific health and safety plan (HSP) that is intended to provide the operating personnel with guidelines and instructions for working around the equipment in a safe manner. It defines safety practices for operating equipment and collecting and handling samples that are consistent with Rocky Flats Plant established procedures. Appendix B presents the respiratory protection plan.

Appendix C is the sampling and analysis plan (SAP). Its main purpose is to instruct the operators in collecting samples of groundwater and effluent from the various process units as well as air samples from tanks and degasifier. It establishes procedures for sample handling and tracking. It presents the historical groundwater data that have been collected from wells and sumps in the 881 Hillside area and shows the treatment of the 881 Hillside groundwater. The SAP also defines the number of samples, sampling frequency, sampling locations, analyses required for each, and references the analytical procedures to be used.

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Appendix D contains the systems operation (SO) test plan. The SO test plan provides a description of the test equipment and the treatment processes installed to treat the 881 Hillside groundwater. It also describes the test objectives and provides detailed instructions for completing system tests. It establishes procedures whereby the collected data will be managed, interpreted, evaluated, and presented. The SO test plan also establishes procedures for handling and disposing of residuals that are generated during the tests. It describes the format for the test report and discusses the SO test schedule.

The Draft Operation and Maintenance (O&M) Manual is provided under a separate cover. The O&M manual contains manufacturers' manuals that were supplied with the process equipment, parts lists, and installing and operating instructions supplied with each item of equipment and accessory. It also includes detailed instructions for operating the treatment system.

Section 2

Background

2.0 BACKGROUND

The Rocky Flats Plant is a contractor-operated facility of the U.S. Department of Energy (DOE) located in Golden, Colorado. It is presently operated by EG&G Rocky Flats. Since it was started up in 1950, it has produced plutonium products for the Department of Defense. During its period of operation from the 1950s to the 1980s, waste materials were disposed of onsite at a number of locations. Among those locations were sites along the hillside south and east of Building 881. This area has been given the designation "881 Hillside."

This section provides background on the RFP site, specifically the 881 Hillside OU 1. Information is also provided on the contaminants of concern that have resulted in the DOE decision to undertake an Interim Measure/Interim Remedial Action (IM/IRA) at OU 1.

IM/IRAs are typically used as a vehicle for contaminant migration abatement and/or risk reduction. However, use of the IM/IRA to gain site-specific remedial information to support final action is also justification for conduct of an IM/IRA. For example, the EPA Office of Solid Waste and Emergency Response (OSWER) Directive guidance for groundwater remedial actions states (EPA, 1989): "Response measures may be implemented to prevent further migration of contaminants if they will prevent the situation from getting worse, initiate risk reduction, and/or the operation of such a system would provide information useful to the design of the final remedy."

The IM/IRA at OU 1 consists of treating the groundwater from the 881 Hillside area for the removal of volatile organic chemicals, heavy metals, dissolved solids, and selected radionuclides. A brief description of the treatment system is also provided.

2.1 881 Hillside Area Description

The 881 Hillside Area is located at the southeast corner of the RFP (see Figure 2-1). Based on the past operations knowledge, 12 distinct sites, or Resource Conservation and Recovery Act (RCRA) Industrial Hazardous Substance Sites (IHSSs), have been identified as the components of the 881 Hillside area. These IHSSs have contributed volatile organic constituents to the groundwater in the area. Furthermore, the sites are in the proximity of a surface drainage, Woman Creek. The creek routes surface water into Mower Reservoir and Standley Lake located due southeast of the RFP. Water from these bodies is used for direct or indirect human consumption. Due to a potential for impact on human health, the 881 Hillside IHSSs were designated by DOE as high-priority sites for the IM/IRA.

A brief description of each IHSS follows. Figure 2-1 also indicates relative locations of the IHSSs.

1. **Oil Sludge Pit (IHSS 102)**—A small pond located south of Building 881 was used for disposing of oil sludges in late 1950s.

2. **Chemical Burial Site (IHSS 103)**—A small pit was used for disposal of liquid wastes southeast of Building 881 in the early 1960s.

3. **Liquid Dumping (IHSS 104)**—An area east of Building 881 was reportedly used for disposing of unknown liquids before 1969. However, because the results of area drilling in 1987 did not substantiate this disposal, the site probably does not exist, and its location is not shown on the map.

4,5. **No. 6 Fuel Oil Tanks (IHSSs 105.1 and 105.2)**—Two fuel oil tanks are located south of Building 881. They are out of service and filled with concrete.

6. **Outfall Site (IHSS 106)**—An overflow line from the sanitary sewer sump south of Building 881 daylights on the slope below the building.

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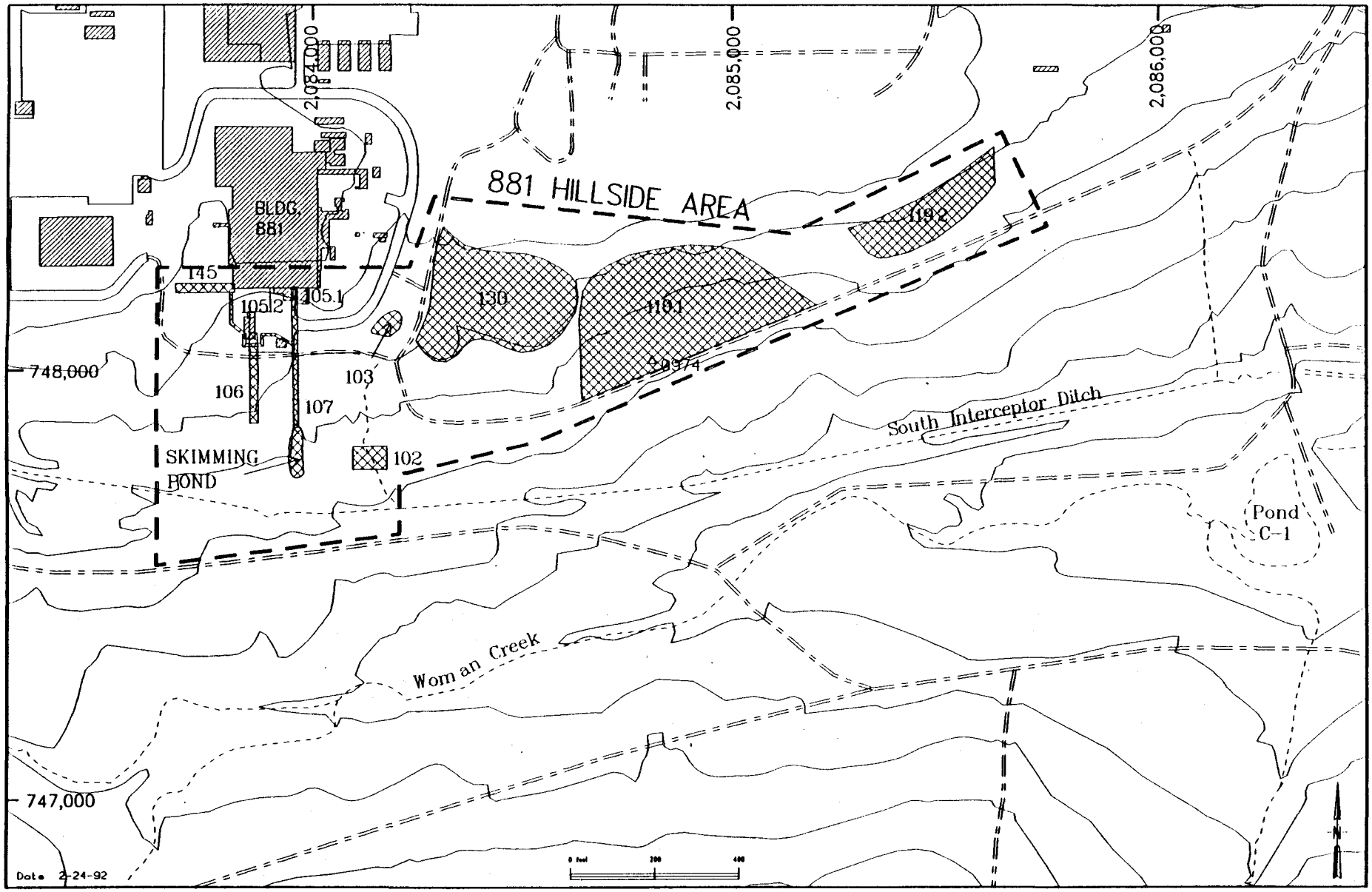

Figure 2-1
881 HILLSIDE AREA SITE MAP

7. **Hillside Oil Leak (IHSS 107)**—Oil was discovered flowing from the Building 881 footing drain in early 1973. Although the source of oil was never positively identified, the oil was collected in a skimming pond and transported offsite. Discharge of water from the footing drain is ongoing.

8,9. **Multiple Solvent Spills (IHSS 119.1 and 119.2)**—Two areas east of Building 881 were used for barrel storage between 1969 and 1972.

10. **Radioactive Site (IHSS 130)**—Soils contaminated with low levels of radionuclides were placed on the hillside east of Building 881 and covered with soil between 1969 and 1972.

11. **Sanitary Sewer Line Leak (IHSS 145)**—The sanitary sewer line leaked on the hillside southwest of Building 881 in early 1981.

12. **Drum Storage Area (IHSS 177)**—Building 885 is currently used for satellite collection and 90-day accumulation of RCRA-regulated wastes. The building will be closed, and soil remediation will be addressed under RCRA Interim Status (6 Colorado Code of Regulations [CCR] 1007-3). Groundwater contamination will be addressed as part of the 881 Hillside Area remedial investigation/feasibility study (RI/FS) performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

2.2 Contaminants of Concern

The groundwater, surface water, soils, and sediments in the 881 Hillside area have been previously characterized in 1987, 1988, and 1989, for the nature and extent of contamination. The groundwater in the 881 Hillside area is primarily alluvial. Presence of organic contamination in the alluvial groundwater has been established. Although inorganic contamination most likely represents the background conditions, this correlation has not been clearly established because of limited data on the background conditions in the vicinity of the site. Surface waters have been found to be free of volatile organic contamination; however, uranium concentrations appear to be elevated with regard

to the estimated background levels. Some chlorinated volatile organic contaminants have been detected in the subsurface soils. But, for the most part, the soils and sediments data were not conclusive because of laboratory- and field-induced contamination was present in the samples. All of the above media are subject to additional investigation as part of the final RCRA facility investigation (RFI)/RI for the 881 Hillside area.

Based on the nature of contamination and potential exposure pathways, the alluvial groundwater at the 881 Hillside area can be divided into three separate categories:

1. The Building 881 footing discharge (IHSS 107); that is, alluvial groundwater potentially discharging to surface water

2. Alluvial groundwater beneath or in the immediate vicinity of the 881 Hillside area characterized by the presence of volatile organic contaminants in several of the groundwater monitoring wells

3. Alluvial groundwater downgradient of the 881 Hillside area, but beyond the limit of volatile organic contamination

Locations sampled in 1987, 1988, and 1989 (Figure 2-2) fall under one of the above three categories of alluvial groundwater. Well location 55-86 (not shown in the figure) located southwest of the RFP and upgradient of all known SWMUs was designated as the background well. The IM/IRA Plan (DOE, January 1990) compared data from all other locations with 55-86 well data to determine whether a well indicated contamination above the background levels. For the purpose of the IM/IRA, if a parameter was analyzed above background level in any well, that parameter was considered a contaminant of concern and was retained for an ARARs evaluation and for the treatability study. The maximum concentrations of the contaminants of concern for each of the three alluvial groundwater categories are indicated in Tables 2-1, 2-2, and 2-3. Potential ARARs are also presented in the tables to identify the parameters that may be important from the viewpoint of meeting the treatment goals.

TABLE 2-1

PARAMETERS DETECTED ABOVE ESTIMATED BACKGROUND LEVELS BUILDING 881 FOOTING DRAIN DISCHARGE (all concentrations in µg/l)

Parameter	Background Value	ARAR Value	Well Data: Maximum Detected	Well Data: Sampling Locations
Tetrachloroethene	5U	5	8	SW45
Total Dissolved Solids	167	400	464	SW45
Chloride	19	250	77	SW45
Nitrate + Nitrite as N	1.5	10	8.5	SW45
Sulfate	27	250	56	SW45
HCO_3 as $CaCO_3$	79	NS	232	SW45
Barium	71	1000	155	SW45
Calcium	33800	NS	85300	SW45
Magnesium	5900	NS	21000	SW45
Mercury	0.2U	2	0.9	SW45
Potassium	800	NS	3800	SW45
Selenium	5U	10	18	SW45
Sodium	13100	NS	46000	SW45
Strontium	150	NS	700	SW45
Zinc	164	2000	600	SW45
Gross Alpha, pci/L	5	15	13.4	SW45
Gross Beta, pci/L	14	50	15.1	SW45
Plutonium 239, 240, pci/L	0.01	15	2.57	SW45
Total Uranium	1.8	40	10.2	SW45

Note: Data summarized from DOE, January 1990. All well locations that exceeded the background levels are indicated, but only the maximum detected concentrations are presented.

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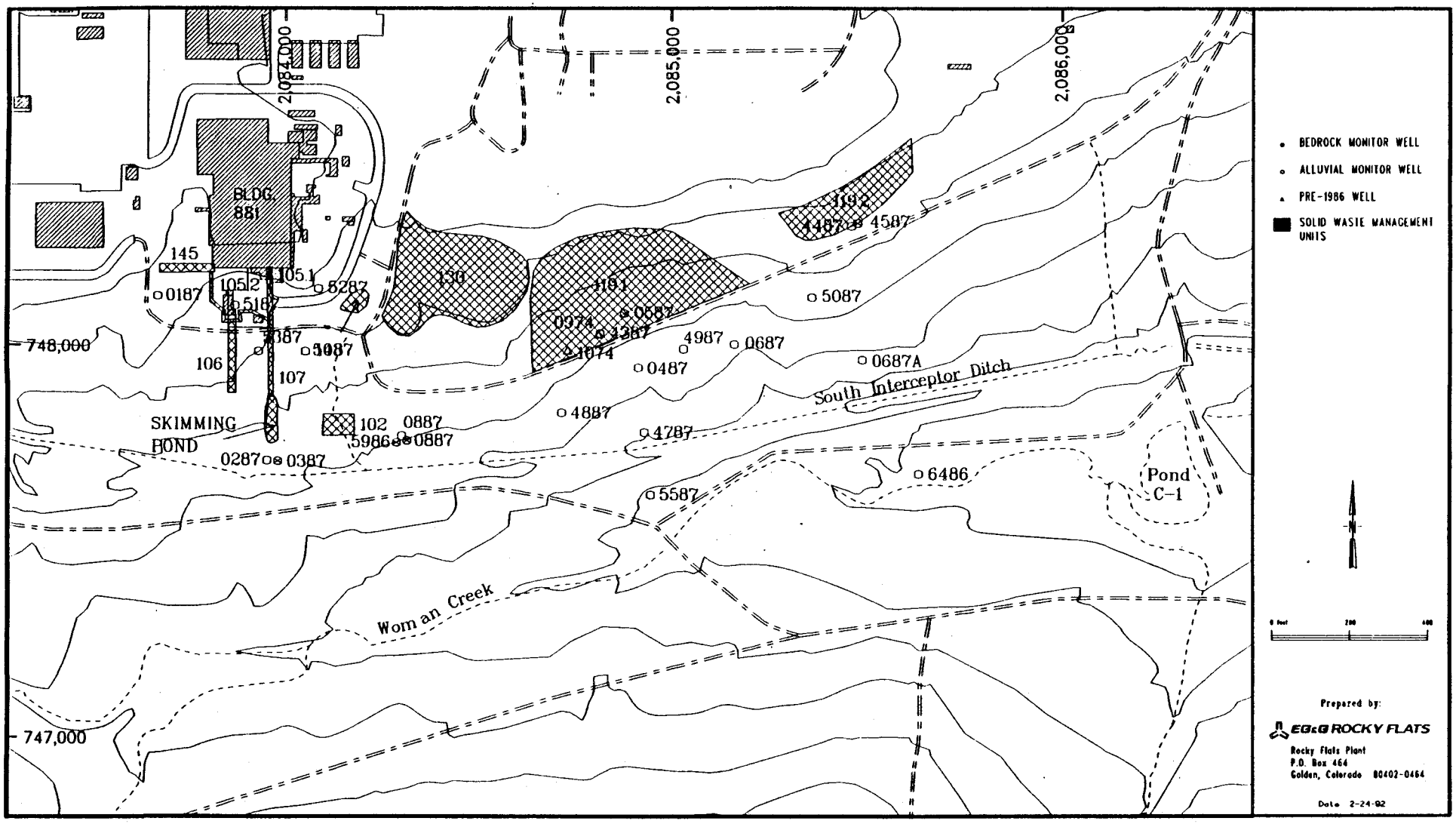

Figure 2-2
WELL LOCATIONS AT THE 881 HILLSIDE AREA

TABLE 2-2

PARAMETERS DETECTED ABOVE ESTIMATED BACKGROUND LEVELS ALLUVIAL WELLS AT THE 881 HILLSIDE (all concentrations in µg/l)

Parameter	Background Value	ARAR Value	Well Data: Maximum Detected	Well Data: Sampling Locations
1,1-Dichloroethene	5U	7	7900J	0974, 4387
1,1-Dichloroethane	5U	NS	180J	0974, 4387
1,2-Dichloroethane	5U	5	17J	0974, 4387
1,1,1-Trichloroethane	5U	200	15000	0974, 1074, 4387
Carbon Tetrachloride	5U	5	2400J	1074, 0487
Trichloroethene	5U	5	11000	0974, 1074, 0487, 4387
1,1,2-Trichloroethane	5U	5	5900J	0974, 1074, 0487, 4387
Antimony	60U	60	80	0974, 1074, 0487, 5287
Barium	71	1000	177	0974, 0487, 0687, 4387, 5287
Calcium	33800	NS	356000	0974, 1074, 0487, 0687, 4387, 5287
Cesium	20U	NS	40J	0487
Chromium	26	50	78	0487
Copper	46	200	952	4387
Iron	162	300	174	0687
Lithium	100U	2500	700	0974
Magnesium	5900	NS	73300	0974, 1074, 0487, 0687, 4387, 5287
Manganese	66	50	959	0487, 0687, 4387, 5287
Mercury	0.2U	2	0.3	0687
Molybdenum	22U	100	26.5	1074, 4387
Nickel	37U	200	864	0487, 0687, 4387, 5287
Potassium	800	NS	12300	0974, 1074, 0487, 0687, 4387, 5287
Selenium	5U	10	3200	0974, 1074, 0487, 0687, 4387
Sodium	13100	NS	342000	0974, 1074, 0487, 0687, 4387, 5287
Strontium	150	NS	2430	0974, 1074, 0487, 0687, 4387, 5287
Vanadium	24	100	30	0487
Zinc	164	2000	2450	1074, 4387, 5287
Total Dissolved Solids	167000	400000	2374000	0974, 1074, 0487, 0687, 4387, 5287
Chloride	19000	250000	458000	0974, 1074, 0487, 0687, 4387, 5287
Nitrate + Nitrite as N	1500	100000	55000	0974, 1074, 0487, 4387
Sulfate	27000	250000	7000000	0974, 1074, 0487, 0687, 4387, 5287
HCO_3 as $CaCO_3$	79000	NS	502000	0974, 1074, 0487, 0687, 4387, 5287
Gross Alpha, pci/L	5	15	319	0974, 1074, 0187, 0487, 0687, 4387, 5287
Gross Beta, pci/L	14	50	286	0974, 0487, 0687, 4387, 5287
Strontium 89, 90, pci/L	1	8	2.1	0487, 0687
Tritium	400	20000	777	0487
Total Uranium	1.8	40	54.6	0974, 1074, 0187, 0487, 0687, 4387, 5287

Note: Data summarized from DOE, January 1990. All well locations that exceeded the background levels are presented, but only the maximum detected concentrations are indicated.

TABLE 2-3

PARAMETERS DETECTED ABOVE ESTIMATED BACKGROUND LEVELS ALLUVIAL WELLS DOWNGRADIENT OF THE 881 HILLSIDE (all concentrations in µg/l)

Parameter	Background Value	ARAR Value	Well Data: Maximum Detected	Well Data: Sampling Locations
Methylene Chloride	5U	5	17B	0287
Acetone	10U	50	19	5587
Tetrachloroethene	5U	5	35J	6486,0287
Aluminum	223	5000	260	6586, 0287
Antimony	60U	60	61.8	6986
Barium	71	1000	311	6486, 6586, 6686, 6986, 0287, 4887
Calcium	33800	NS	299000	6486, 6586, 6686, 6986, 0287, 4887
Copper	46	200	327	4887
Iron	162	300	406.5	6586, 0287
Lead	16	50	24	6586, 6686
Magnesium	5900	NS	95500	6486, 6586, 6686, 6986, 0287, 4887
Manganese	66	50	543.1	6486, 6586, 6686, 0287, 4887
Mercury	0.2U	2	6	6486, 6986, 0287
Molybdenum	22U	100	53.3	6486, 0287, 4887
Nickel	37U	200	1180	6486, 6586, 6686, 6986, 4887
Potassium	800	NS	7000	6486, 6586, 6686, 6986, 0287, 4887
Selenium	5U	10	240	6486, 6986, 4887
Sodium	13100	NS	211000	6486,6586, 6686, 6986, 0287, 4887
Vanadium	24	100	36.8	6486
Zinc	164	2000	2460	4887
Total Dissolved Solids	167000	400000	2081000	6486, 6586, 6686, 6986, 0287, 4887
Chloride	19000	250000	838000	6486, 6586, 6686, 6986, 0287, 4887
Nitrate + Nitrite as N	1500	10000	4290	6986, 0287
Sulfate	27000	250000	270000	6486, 6586, 6686, 6986, 0287, 4887
HCO_3 as $CaCO_3$	79000	NS	401000	6486, 6586, 6686, 6986, 0287, 4887
Gross Alpha, pci/L	5	15	100	6486, 6586, 6686, 6986, 0287, 4887
Gross Beta, pci/L	14	50	254	6986, 0287
Strontium 89, 90, pci/L	1	8	5.6	6586, 6986, 0287
Plutonium 239, 240, pci/L	0.01	15	0.211	0287
Tritium	400	20000	510	6986
Total Uranium	1.8	40	19	6486, 6586, 6986, 0287, 4887

Note: Data summarized from DOE, January 1990. All well locations that exceeded the background levels are presented, but only the maximum detected concentrations are indicated.

2.3 Treatment Goals/ARARs

This section presents a summary of the potential ARARs associated with the 881 Hillside alluvial groundwater. At this time, the treatment goals for the IM/IRA are the potential ARARs. The potential ARARs or to-be-considered (TBC) requirements are based on contaminants detected in the 881 Hillside area samples, and the following current federal and state health and environmental statutes and regulations:

- Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs)
- Clean Water Act (CWA) water quality criteria (WQC)
- RCRA Subpart F Groundwater Concentration Limits (40 CFR 264.94)
- Colorado Department of Health (CDH) surface water standards for Woman Creek and Walnut Creek (5 CCR 1002-8, Section 3.8.0, amended February 15, 1990)
- CDH Water Quality Control Commission (WQCC) statewide and classified groundwater area standards (5 CCR 1002-8, Section 3.11)

2.4 IM/IRA Treatment System Description

The alluvial groundwater from the 881 Hillside area will be collected from three locations:

1. The Building 881 footing drain.
2. A new recovery well, installed southeast of Building 891, expected to represent the 881 Hillside wells that are the most contaminated wells (Table 2-2).

3. A new french drain, installed parallel to and near the bottom of the slope, expected to collect the 881 Hillside alluvial water that is beyond the current contamination plume. The water from the french drain is expected to represent the downgradient wells (Table 2-3).

For the IM/IRA, the influent holding tanks will receive the waters from the above three locations before feeding to the treatment system located in the new Building 891. In addition, the water from the Building 891 floor drain sump will also be pumped to the influent tanks. Data in Tables 2-1, 2-2 and 2-3 represent worst-case conditions or the highest concentration levels found. The actual concentration of the composite stream in all likelihood will be lower than the maximum concentrations presented in these tables.

Based on the detected contaminants of concern, DOE performed a comparative cost and performance analysis to select the optimum treatment alternative (IM/IRA Plan, DOE, January 1990). The analysis indicated oxidation of organic contaminants followed by ion-exchange polishing of inorganic contaminants as the most suited treatment option for the 881 Hillside alluvial groundwater. Specifically, an ultraviolet/hydrogen peroxide (UV/H_2O_2) system was selected for oxidation of organics, and a four-column series ion-exchange treatment system was selected for removing uranium, heavy metals, and demineralization or reducing total dissolved solids.

The treatment system configuration is presented in Figure 2-3. In summary, the combined alluvial water from the three 881 Hillside collection locations and the Building 891 sump will be fed to the UV/H_2O_2 oxidation system. Effluent from the oxidation system will be passed in series through a strong-base anion-exchange column for removing uranium, a weak-acid cation exchange column for reducing heavy metals, and finally a strong-acid cation exchange column followed by a weak-base anion exchange column for reducing total dissolved solids. The release of carbon dioxide from the carbonate/bicarbonate minerals achieved in the second ion exchange column (weak-acid cation-exchange) will necessitate degassing of the effluent before further ion exchange treatment. Treated effluent from the final ion exchange column will be pumped to the effluent holding tanks for eventual disposal.

The total flow of groundwater to the treatment system will be about 10 gallons per minute (gpm) (approximately 14,400 gallons per day [gpd]). The treatment system is designed to operate 10 hours per day at a rate of 30 gpm. Actual flow rates will depend on groundwater recovery from the three sources.

Various sampling points along the treatment system will be sampled and analyzed for contaminants of concern. The sampling frequency will depend on the specific objective, such as performance evaluation or monitoring. Appendix B addresses such items as sampling objectives, rationale, and methods.

Section 3

Task Description

3.0 TASK DESCRIPTION

This section describes the tasks that comprise startup and operation and maintenance (O&M) of the OU 1 IM/IRA. Specifically, the tasks address startup and O&M of the groundwater recovery and treatment system.

3.1 TASK 1—WORK PLAN PREPARATION

The first task is preparation of this work plan. The HSP, the SAP, and the SO test plan are appended to the work plan. A QAA, supplied by EG&G Rocky Flats, is also incorporated into this work plan in Section 6, "Quality Assurance Addendum." The O&M manual is under a separate cover.

3.2 TASK 2—TRAINING OF SUBCONTRACTOR OPERATIONS PERSONNEL

A minimum of 1 to 2 weeks will be spent on training subcontractor personnel. The onsite personnel will receive the following training:

- Daily health and safety meetings on each day in which operations work is performed.

- The operations supervisor will have a minimum of 8 hours of Occupational Health and Safety Administration (OSHA) hazardous waste supervisory training and 40 hours of OSHA training required for working with hazardous materials. The operations supervisor will be accessible during periods of treatment system operation. This person will also be responsible for the daily health and safety meeting.

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- Radiation safety training for Environmental Management.
- Respirator fitting and training.
- Employees who potentially might work in confined spaces will undergo confined space training.
- OSHA 24-hour on-the-job training.
- Resource Conservation and Recovery Act (RCRA) Hazard Communication training.
- The RCRA Computer Based Training (CBT) Course.
- Fork Lift Safety Training, as applicable.
- In addition, onsite personnel will have already received 40 hours of the OSHA training required for working with hazardous materials (OSHA 29CFR 1910.120), including annual 8-hour refresher courses.

On the first day of system operation, a site-specific health and safety meeting will be held onsite. The EG&G Rocky Flats project manager will be present to ensure that training, as well as health and safety issues, have been covered and documented. The meeting will address the HSP, the QAA, SOPs, and other health and safety issues. Operations personnel will have reviewed these materials before this meeting and will be prepared to sign off on them. Training documentation will be submitted to the EG&G Rocky Flats project manager and will also be maintained by the subcontractor on the work site.

Operational personnel will be trained with all aspects of operation of the groundwater recovery and treatment system through hands-on training. This includes, but is not limited to, all emergency

procedures, all safety practices, the location and use of safety equipment, appropriate RFP rules and procedures, cleaning and maintenance practices, sampling, and residual handling.

3.3 TASK 3—PREPARATION FOR INITIAL OPERATIONAL READINESS REVIEW

An Operational Readiness Review (ORR) will be prepared. This will include the following tasks:

- A Respiratory Protection Plan (RPP) that has been included in Appendix B
- Statements of qualifications on personnel working on the project will be provided. EG&G Rocky Flats will qualify personnel in accordance with EMD procedure 3-21000-ADM-02.02.
- Copies of the O&M manual (with drawings), the work plan, the HSP, the SAP, and current SOPs will be onsite. Site personnel will be familiar with the content of these documents and know their location.
- Soft copies (3.5-inch computer disks) of submitted work will be supplied to the EG&G Rocky Flats project manager.
- Calibration of gauges, instruments, etc. A calibration notebook will be maintained onsite with annual calibration certificates, checklists, etc.

3.4 TASK 4—SYSTEMS OPERATION TEST

Limited performance testing will be performed as part of the SO test on the treatment system in accordance with the SO test plan, as described in Appendix D. This test will consist of testing the performance of the groundwater treatment system in removing contaminants. Clean water hydrostatic pressure testing of process equipment will be performed by ET LaForte as part of the SO test before this performance test. EG&G Rocky Flats personnel from Environmental Management,

Facilities Inspection, Environmental Operations, Construction Coordination, and vendor representatives will be present to monitor these tests.

3.5 TASK 5—OPERATION OF GROUNDWATER TREATMENT SYSTEM TO TREAT EXCAVATION WATER

During the excavation of the french drain, water will be recovered due to dewatering and runoff collection. This water will be stored until needed and will be treated after initiating the SO test. This activity will be coordinated with the SO testing, and the excavation water could be a source of water for the performance test mentioned in Section 3.4.

3.6 TASK 6—SYSTEMS OPERATION TEST ON TOTAL SYSTEM

An SO test will be performed on the total system. This test will continue the performance test initiated as part of Task 4; however, this part of the testing will be performed on actual groundwater recovered. This test also includes SO testing of the recovery system with the exception of pressure testing. In particular, the pump system and the controls, valving, and instrumentation associated with groundwater recovery will be tested. Pressure testing of the buried lines connecting the recovery system to the treatment system will not be included in this task.

3.7 TASK 7—INTERIM OPERATION OF GROUNDWATER RECOVERY AND TREATMENT SYSTEM

After completion of the SO test on April 3, 1992, as detailed in the Inter-Agency Agreement (IAG), the groundwater recovery and treatment system will be operated on a routine basis beginning April 6, 1992, and ending December 14, 1992. During this time, two operations personnel will be present at all times when the system is operating or when work is being performed. The normal operating schedule will be 10 hours per day, 7 days per week, except for EG&G Rocky Flats Plant holidays. Actual flow rates will depend on groundwater recovery.

3.8 TASK 8—SYSTEMS OPERATION TEST REPORT

Upon receiving the analytical results from the SO test, the Systems Operation Test Report will be prepared covering all systems tests performed, including the clean water hydrostatic tests. This task will be performed concurrently with the routine operation of the groundwater recovery and treatment system. Test descriptions and test data of the previously performed clean water hydrostatic tests will be supplied by EG&G Rocky Flats.

3.9 TASK 9—PREPARATION OF OPERATIONS DOCUMENTS

The HSP, the SAP, and the O&M manual will be revised to reflect information derived from the SO tests. After receiving comments from EG&G Rocky Flats, the documents will be finalized. The following describes the subtasks associated with this task.

3.9.1 Subtask 9.1—Operation and Maintenance Manual

The purpose of the O&M manual is to provide guidance to operations, maintenance, and engineering personnel. The revised O&M manual will contain the following information:

- Revisions of items in Appendix D, as appropriate. These items will be incorporated into a comprehensive and integrated O&M manual for the entire system including groundwater recovery.
- All general and site-specific SOPs.
- Trouble shooting guidance.
- Equipment cleaning and maintenance procedures.
- Operational information.

- Resin loading/unloading.
- Daily startup and shutdown procedures.
- Spare parts inventory.

3.9.2 Subtask 9.2—Standard Operating Procedures

Procedures regarding maintenance, operations, cleaning, and daily startup and shutdown will be prepared as part of the O&M manual. SOPs will be provided by EG&G Rocky Flats for inclusion in the O&M manual.

3.9.3 Subtask 9.3—Operational Safety Analysis

An Operational Safety Analysis (OSA) for each process unit or piece of equipment will also be prepared to identify real/potential safety hazards and to establish safety practices. The OSA will be written to meet the requirements outlined in the Rocky Flats Health and Safety Practices (HSP) Manual, 1991. The applicable OSA will be incorporated into the SOPs whenever possible.

3.10 TASK 10—IDENTIFICATION AND IMPLEMENTATION OF MINOR PROCESS MODIFICATIONS

During the preparation of the draft SO Test Report, an investigation of possible modifications in procedures, plans, equipment, and operating parameters to improve operating efficiency, cost efficiency, safety, and environmental impact of the treatment system will be initiated.

Although implementation of these modifications will not include any construction nor major optimization studies, minor changes in equipment operation and operating parameters to "fine tune" the operation of the groundwater recovery and treatment system will be implemented.

Limited SO testing will be performed at this time to meet internal RFP standards and policies. The system will be checked to make sure it is operational to include correcting minor imperfections detected during Tasks 4, 6, and 8 and confirming that the system meets the standards set forward by EG&G Waste Operations.

3.11 TASK 11—TRAINING OF EG&G ROCKY FLATS ENVIRONMENTAL OPERATIONS PERSONNEL

After the operations documents are finalized and accepted, EG&G Rocky Flats personnel will be trained to operate and maintain the treatment facility. Site-specific safety training will be provided for EG&G Rocky Flats personnel. This training includes emergency procedures, safety practices, the location and use of safety equipment, cleaning and maintenance practices, sampling, and residual handling practices.

3.12 TASK 12—PREPARATION FOR FINAL OPERATIONAL READINESS REVIEW

The subcontractor will assist EG&G Rocky Flats Environmental Operations in preparing for a second Operational Readiness Review. This task will be similar in nature to Task 3.

Section 4

Project Management

4.0 PROJECT MANAGEMENT

Figure 4-1 presents the organization for the testing and operation of the 881 Hillside OU 1 groundwater treatment facility. The organizational chart includes staff from EG&G Rocky Flats, IT Corporation, and CH2M HILL and shows the interaction between the various personnel. A more detailed chart for the IM/IRA is shown in Section 6.

The following includes descriptions and responsibilities of key positions:

- OU 1 Project Manager–EG&G Rocky Flats. The OU 1 project manager is responsible for the environmental restoration activities for OU 1.

- QA Officer–EG&G Rocky Flats. The QA officer is responsible for the implementation of QA activities.

- OU 1 IM/IRA Project Manager–EG&G Rocky Flats. The OU 1 IM/IRA project manager is responsible for the OU 1 IM/IRA.

- SO Testing Project Manager–EG&G Rocky Flats. The project manager is responsible for SO testing of the groundwater recovery and treatment system for the OU 1 IM/IRA.

- IM/IRA Operations Manager–EG&G Rocky Flats. The IM/IRA operations manager is responsible for operating the groundwater recovery and treatment system for the OU 1 IM/IRA.

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		APPROVED BY	Pat L.	2-27-92		

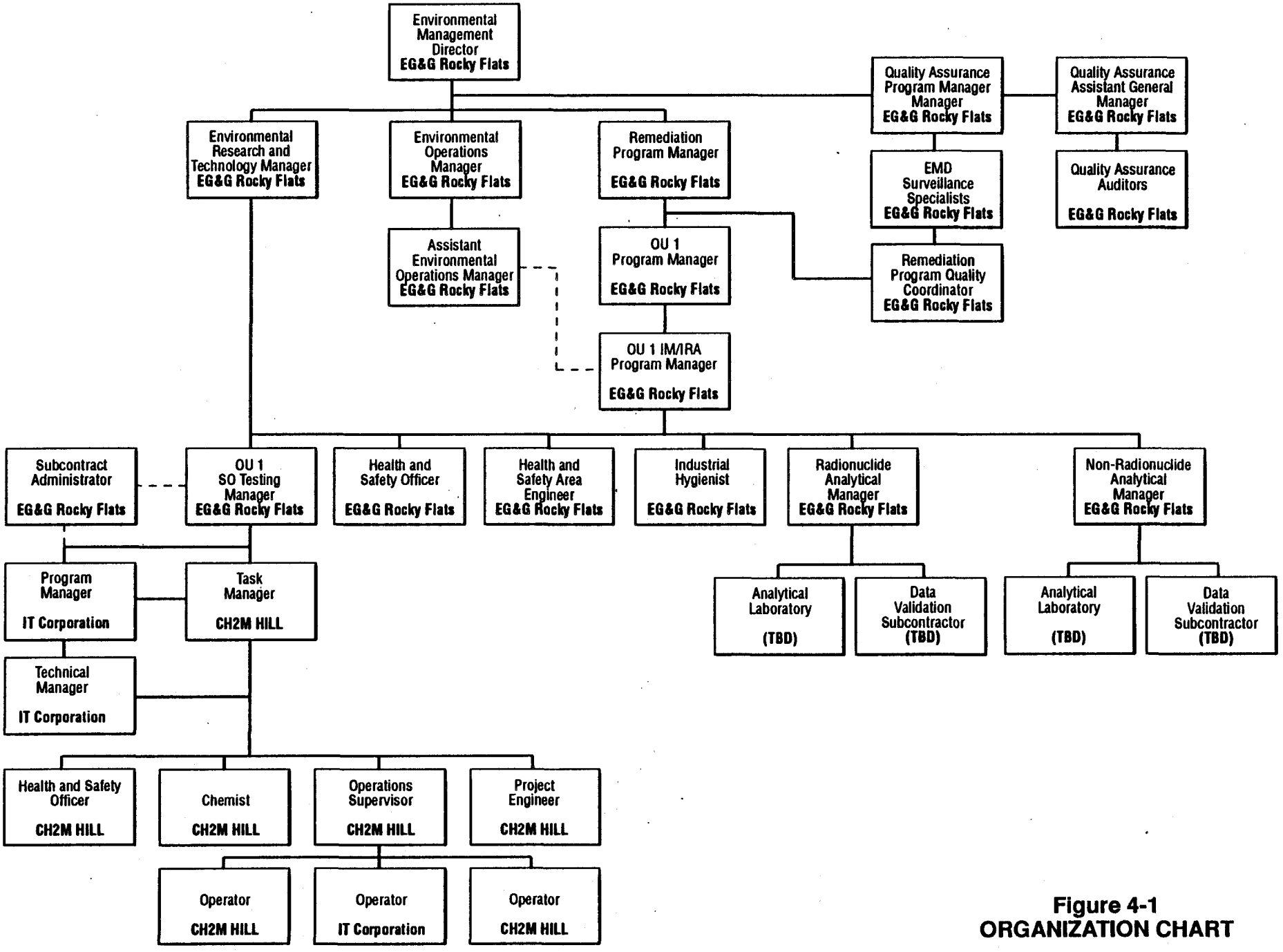

Figure 4-1
ORGANIZATION CHART

- Health and Safety Area Engineer–EG&G Rocky Flats. The health and safety area engineer is responsible for reviewing the OU 1 IM/IRA health and safety plan and overseeing implementation of it.

- Radionuclide Analytical Manager–EG&G Rocky Flats. The radionuclide analytical manager is responsible for the radionuclide analyses of OU 1 IM/IRA samples.

- Non-Radionuclide Analytical Manager–EG&G Rocky Flats. The non-radionuclide analytical manager is responsible for all other analyses of OU 1 IM/IRA samples.

- Industrial Hygienist–EG&G Rocky Flats. The industrial hygienist is responsible for the implementation of the health and safety plan for RFP employees.

- Subcontractor Administrator–EG&G Rocky Flats. The contracting officer is responsible for the funding aspects of the OU 1 IM/IRA.

- Program Manager–IT Corporation. The program manager is responsible for contractor work and meeting the schedule and budget and handles both administrative issues that are not resolved at the task manager level.

- Technical Manager–IT Corporation. The technical manager is responsible for the technical issues that are not resolved at the task manager level.

- Task Manager–CH2M HILL. The task manager is responsible for the day-to-day project activities and technical work.

- Project Engineer–CH2M HILL. The project engineer prepares work plans, conducts the SO test, and evaluates data.

- Chemist–CH2M HILL. The chemist prepares the SAP and monitors the implementation of the plan.

- Health and Safety Officer–CH2M HILL. The health and safety officer prepares the HSP and oversees its implementation.

- Operations–CH2M HILL. Operations staff operates the treatment plant, implements the O&M manual, and conducts the SO tests under the direction of the task manager.

Section 5

Schedule

5.0 SCHEDULE

The schedule for completing the tasks described in Section 3.0, Task Description, is presented in Figure 5-1. The Interagency Agreement (IAG) specifies IM/IRA construction completion by March 2, 1992. Therefore, the SO testing is scheduled to start on March 2, 1992, and will be completed on April 3. Treatment system operation is scheduled to start April 6, 1992, and will continue through December 14, 1992. Treatment system operation will be conducted on a 10 hour-per-day schedule, 7 days per week as previously described.

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Schedule Name: Rocky Flats Plant
881 Hillside OU No. 1
As of Date : 13-Feb-92

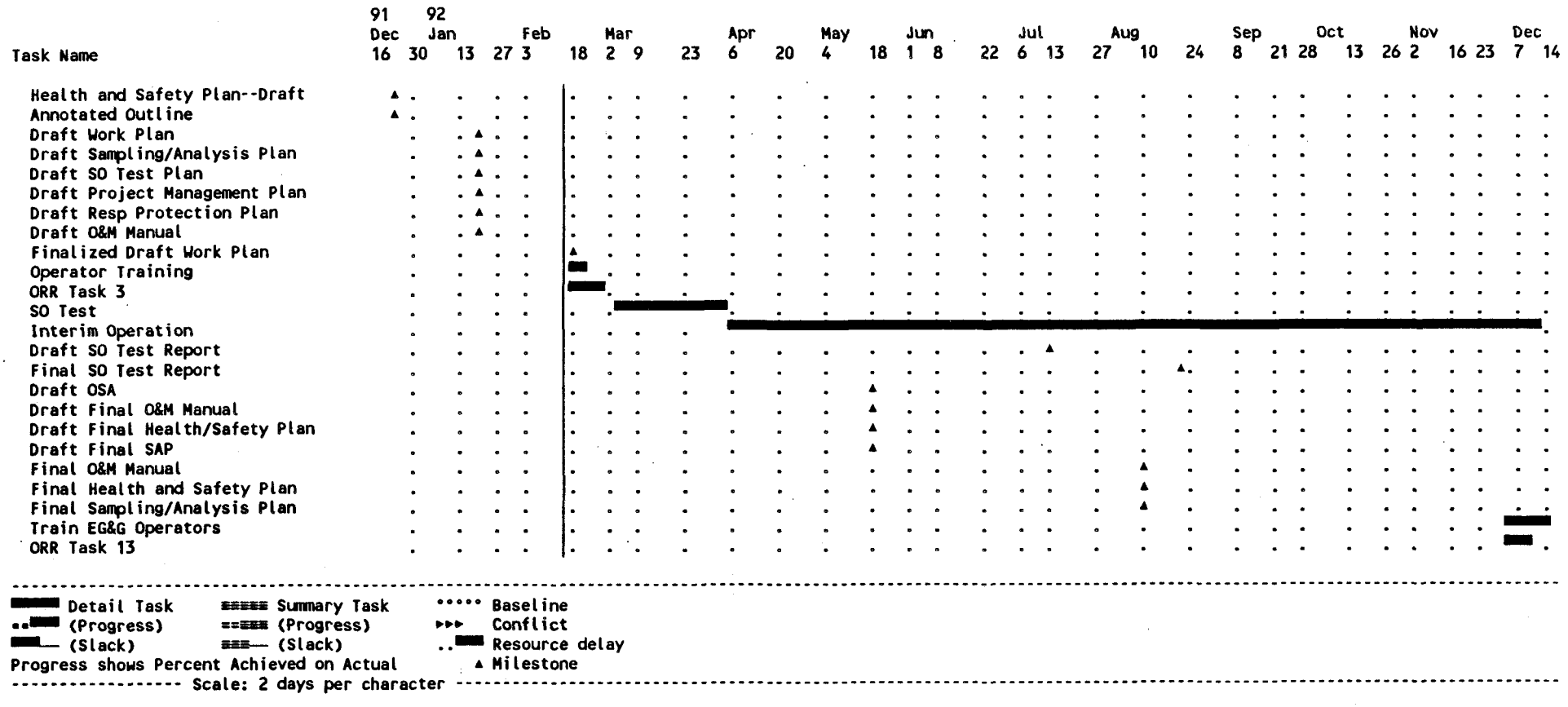

Figure 5-1
PROJECT SCHEDULE

Section 6

Quality Assurance Addendum

SECTION 6

QUALITY ASSURANCE ADDENDUM

QAA 1.5

to the

ROCKY FLATS SITE-WIDE QUALITY ASSURANCE PROJECT PLAN FOR CERCLA RI/FS AND RCRA RFI/CMS ACTIVITIES

for the

OPERATION AND MAINTENANCE OF THE 881 HILLSIDE (OPERABLE UNIT NO. 1) INTERIM MEASURE/INTERIM REMEDIAL ACTION WORK PLAN

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

DRAFT

TITLE: Quality Assurance Addendum

Approved By: MC Burmeister 3/3/92
Name (Date)

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INTRODUCTION AND SCOPE

This Quality Assurance Addendum (QAA) supplements the "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA Remedial Investigation/Feasibility Studies and RCRA Facility Investigations/Corrective Measures Studies Activities" (QAPjP), and establishes the specific quality assurance (QA) controls applicable to the operation and testing activities described in the Work Plan for the Operation and Maintenance of the Interim Measure/Interim remedial Action for the 881 Hillside Operable Unit No. 1 (referred to herein as the OU1 IM/IRA WP).

The interim measure/interim remedial action (IM/IRA) for Operable Unit No. 1 (OU1) includes intercepting alluvial groundwater beneath and just down gradient from the 881 Hillside, routing it to a water treatment system, treating the groundwater, an then discharging it to the Rocky Flats Plant (RFP) South Interceptor Ditch (see Figure C-2 of Appendix C to the OU1 IM/IRA WP). The OU1 IM/IRA groundwater treatment system consists of an ultraviolet/hydrogen peroxide (UV/H_2O_2) process and an ion exchange process. The (UV/H_2O_2) process is intended to reduce concentration of organics, through destruction of organic constituents, while the ion exchange process in intended to remove inorganics and radionuclides.

The groundwaters of concern that will be collected and routed to the OU1 IM/IRA treatment system include discharge water from the Building 881 footing drain, alluvial groundwater beneath 881 Hillside, and alluvial groundwater immediately downgradient of the 881 Hillside area. Water will be collected via a footing drain sump at Building 881, an alluvial recovery well southeast of the newly constructed Building 891, and a french drain recently installed parallel to and near the bottom of the 881 Hillside slope.

6.1.0 ORGANIZATION AND RESPONSIBILITIES

The overall organization of EG&G Rocky Flats, the Environmental Management Department (EMD), and specific divisions involved in Environmental Restoration (ER) Program activities, including IM/IRAs, is shown and described in detail in Section No. 1.0 of the QAPjP.

Subcontractors will be tasked by EG&G Rocky Flats to implement the operation and testing activities outlined in the OU1 IM/IRA WP. The specific EMD personnel who will interface with the Subcontractors and will provide technical direction are described in Section 4 and illustrated in Figure 4-1 of the OU1 IM/IRA WP.

6.2.0 QUALITY ASSURANCE PROGRAM

The QAPjP was written to address QA controls and requirements for implementing Interagency Agreement (IAG) related activities. The content of the QAPjP was driven by Department of Energy (DOE) Order 5400.1, which requires DOE organizations to develop QA programs for environmental monitoring and surveillance programs; DOE RFP Standard Operating Procedure (SOP) 5700.6B, which require a QA Program to be implemented for all RFP activities; and the Interagency Agreement (IAG) for the RFP, which requires a QA Project Plan to be developed for remediation program activities addressed by the IAG. DOE QA programs are required to incorporate the quality criteria of American Society of Mechanical Engineers (ASME) NQA-1, Quality Assurance Requirements for Nuclear Facilities, where the IAG requires the QA Project Plan to include the 16 elements of Environmental Protection Agency (EPA) QAMS/005/80, Interim Guidelines and

Specifications for Preparing Quality Assurance Project Plans. The 18-criteria format of NQA-1 was selected as the basis for both the QAPjP and subsequent QAAs with the applicable elements of QAMS/005/80 incorporated where appropriate. Figure 2-1 of the QAPjP illustrates where the 16 elements of QAMS/005/80 are integrated into the QAPjP and also into this QAA. Section 2.0 of the QAPjP also identifies other DOE Orders and QA requirements documents to which the QAPjP and this QAA are responsive.

The controls and requirements addressed in the QAPjP are applicable to systems operation and testing activities described in the OU1 IM/IRA WP, unless specified otherwise in this QAA. Where site-wide QA controls and actions are applicable to the OU1 IM/IRA activities, the applicable section of the QAPjP is referenced. Many of the QA requirements identified in the QAPjP are

addressed in the OU1 IM/IRA WP. Those sections of the OU1 IM/IRA WP are addressed where appropriate.

6.2.1 Training

All EMD and subcontractor personnel performing operation and testing activities addressed in the OU1 IM/IRA WP shall complete the minimum training requirements specified in Section 2.0 of the QAPjP and Section 3.2 of the OU1 IM/IRA WP. In addition, all personnel performing activities in accordance with the Standard Operating Procedures (SOPs) specified in the OU1 IM/IRA WP and this QAA shall receive documented training on the QAPjP, this QAA, and training specified in the applicable SOPs prior to performing the work. Personnel qualifications for those EM Department and subcontractor personnel shall be documented and verified at the Operational Readiness Review.

6.2.2 Quality Assurance Reports to Management

A QA summary report will be prepared annually or at the conclusion of these activities (whichever is more frequent) by the EMD Quality Assurance Project Manager (QAPM) or designee. This report will include a summary of field operation and laboratory inspections, surveillance, and audits and a report on data verification/validation results.

6.3.0 DESIGN CONTROL AND CONTROL OF SCIENTIFIC INVESTIGATIONS

6.3.1 Design Control

The OU1 IM/IRA WP describes the 881 Hillside groundwater treatment facility constructed at the Rocky Flats Plant (RFP). It describes the purpose, features, operation, and testing of the treatment processes and equipment. It also establishes guidelines for evaluating the treatment facility operations and process efficiency and provides detailed procedures for testing and operating the

treatment processes and equipment. As such, it is considered the design control document for the OU1 groundwater IM/IRA.

6.3.2 Data Quality Objectives

Data quality objective (DQOs) are qualitative and quantitative descriptions of the uncertainty that decision makers are willing to accept in environmental measurement data. This uncertainty is used to specify the quality of the measurement data. The quality of measurement data is typically expressed in terms of precision, accuracy, representativeness, comparability, and completeness (referred to as PARCC parameters).

Appendix B, Sampling and Analysis Plan, of the OU1 IM/IRA WP describes the development of DQOs for the testing and operation phases of the 881 Hillside groundwater treatment system. The development of DQOs for testing and operation generally follows the three stage process for developing DQOs presented in Appendix A of the QAPjP.

The objective of the treatment system testing phase is to obtain analytical data from pre-treatment (influent) and post-treatment (effluent) water samples to determine optimum operating conditions for the (UV/H_2O_2) oxidation and ion-exchange treatment processes. During this system testing phase effluent samples will be collected from all four ion-exchange columns to determine optimum operating conditions. The specific objectives, data needs, analytical level (previously identified as the DQO Level in Appendix C of the OU1 IM/IRA WP) for each suite of parameters, and data use is summarized in Table C-1 of the OU1 IM/IRA WP.

The objective of the treatment system operation phase, which is also the primary objective of the 881 Hillside IM/IRA, is to obtain analytical data from influent and effluent water samples in order to evaluate the effectiveness of the (UV/H_2O_2) oxidation and ion-exchange treatment technologies in removing organics, heavy metals, radionuclides and total dissolved solids from 881 Hillside alluvial groundwater. The treatment goals for the treatment system are the ARAR values identified in Table 2-1, 2-2, and 2-3 of Section 2.0 of the OU1 IM/IRA WP. During the operation phase of the

treatment system effluent samples from only two of the ion-exchange columns need to be collected for analysis. The specific objectives, data needs, analytical levels, and data uses for operation of the treatment system are summarized in Table C-2 of the OU1 IM/IRA WP.

The definitions and methods of calculating PARCC parameters, which are used as measures of data quality, are provided in Appendix A of the QAPjP. PARCC parameter goals are established prior to initiating investigations in order to assist decision makers in determining if DQOs for measurement data have been met.

PARCC parameter goals for measurement data (which for this IM/IRA is the influent and effluent analytical data) are established so that they are appropriate to the analytical level of the data (i.e., the higher the analytical level, the higher the PARCC parameter goal, which in turn means that the decision makers will have more confidence in the quality of their data). Analytical level III was identified in Tables C-1 and C-2 as the appropriate analytical levels for radionuclides, uranium, anions, and TDS. Analytical level IV was identified as the appropriate level for volatile organics (VOCs) and metals.

Analytical level III data typically require analysis of environmental samples according to EPA methods or equivalent alternatives. Analytical level IV data require analysis of environmental samples by EPA approved methods and adherence to quality control (QC) requirements that are specified by the EPA Contract Laboratory Program (CLP). EG&G Rocky Flats has committed to following EPA CLP protocol in laboratory analysis of all environmental samples associated with the RFP ER Program. Therefore, EPA CLP QC protocol will be adhered to in the analysis of samples required to produce the analytical level III measurement data.

Goals for precision and accuracy of the OU1 IM/IRA measurement data have been selected based on historical precision and accuracy measures of the analytical methods selected. These precision and accuracy objectives are restated in this QAA in Table 6-2, which is included at the end of this QAA. The goal for completeness is 100 percent, with a minimum acceptable of 90 percent.

Comparability and Representativeness are qualitative statements describing data quality and are discussed in Appendix C of the OU1 IM/IRA WP.

6.3.3 Sampling Locations and Sampling Procedures

The sampling strategy, including sampling locations and sampling frequency, for the treatment system testing and operation phases is described in Section C.3 of Appendix C of the OU1 IM/IRA WP. Sampling and analysis during system testing and initial operation will be more frequent than during regular system operation because of the need to determine and assure optimum operating conditions for the treatment system.

Sampling points for both the testing and operation phases will be located in the system piping just before the (UV/H_2O_2) unit (influent sample) and just after the (UV/H_2O_2) unit and each of the four ion-exchange columns (effluent samples). Samples will consist of grab samples collected during each test run after the system has reached steady-state operation (a minimum of 1-hour). Preliminary sampling locations, sampling frequencies and analytical suites required for systems testing samples are summarized in Table C-3 of the OU1 IM/IRA WP. Since sampling and analysis during the testing phase will be conducted more frequently and is considered experimental j((i.e., used to adjust system operation), actual sampling and analysis will be document by the operations contractor in a Field logbook. In addition to field logbooks, scientific notebooks will be kept in accordance to Administrative Procedure 3-21000-ADM-05.12.

Influent and effluent testing samples will be collected according to a slightly modified version of EMD Operating Procedure (OPS) 5-21000-OPS-SW.07, Collection of Tapwater Samples. The steps for purging described in SW.07 are not applicable for the collection of the treatment system samples because water will be constantly moving through the system lines, negating the need for purging. Requirements for sample containers, preservatives, and holding times for influent and effluent testing samples are consistent with those listed in SW.07 (which are consistent with requirements specified in 5-21000-OPS-FO.13 and the QAPjP).

During the operation phase only the influent to the treatment system and the effluent from it will be sampled and analyzed. The sampling location for the influent will be the same as the one used to collect testing phase influent samples (i.e., just before the (UV/H_2O_2) unit. The effluent sampling location will be situated on the transfer line following the effluent holding tanks.

Samples collected during system operation will be collected in the same manner as system testing samples (i.e., the modified version of SW.07). System operation samples that are sent to the analytical laboratory for analysis will consist of a composite of the individual grab samples. Composting of individual grab samples for the operation phase is being considered. A procedure will be developed to describe the compositing of these individual grab samples. The sample container, preservative, and holding time requirements for these samples shall also be consistent with those specified in SW.07.

The collection of all testing and operation phase samples shall be documented on an OU1 IM/IRA Water Sampling Log Sheet (Figure 6-1), which identifies the sample collection point, the sample number that identifies the sample as an influent or effluent sample for operation phase samples or the sample collection point and hours after start-up for the testing phase samples, the date and time each sample was collected, and the sampler. A Document Change Notice (DCN) to revise SW.07 will be submitted. Field Sampling will also be in accordance to SW.07 since the influent line and the groundwater recovery system have sample ports. No other field measurements are planned at this time.

All testing and operation phase samples will be handled and packaged for shipment to the analytical laboratory according to EMD OPS 5-21000-OPS-FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples. Water Sample Log Sheets will be controlled and submitted to EG&G on a weekly basis according to 5-21000-OPS-FO.02, Field Document Control.

U.S. Department Of Energy - Rocky Flats Plant | Form SW.7C

ROCKY FLATS PLANT
ENVIRONMENTAL MANAGEMENT PROGRAM
GROUND/SURFACE WATER TREATMENT SYSTEM SAMPLING LOG SHEET

Operable Unit No.:		Date:	
Treatment System:		Time:	
Project Number:		Sampler's Name:	
Sample Location:			
Sample Number:		Sample Type: (Circle One)	
Reason For Sampling:		Grab	Composite
Sample Volume:		Purge Time:	

FIELD MEASUREMENTS

Time	Temp (Celsius)	pH	Conductance (microS/cm)	Water Description

OBSERVATIONS

Figure 6-1
EXAMPLE OF SAMPLING LOG SHEET

DRAWN BY Douville 02/26/92 | CHECKED BY Part L. 2-27-92 | APPROVED BY Part L 2-27-92 | DRAWING NUMBER RF1

6.3.4 Analytical Procedures

The analytical strategy for the testing and operation phases of the OU1 IM/IRA is described in Section C.3 of Appendix C of the OU1 IM/IRA WP. The contaminants of concern for this IM/IRA include any parameter that has been detected with concentrations at or above background. These parameters are listed in Table 2-1, 2-2, and 2-3 of the OU1 IM/IRA WP.

The methods of analysis for each parameter are those specified in Parts A and B of the RFP General Radiochemistry and Routine Analytical Services Protocol (GRRASP). These specific methods are included in Table 6-2 at the end of this QAA.

6.3.5 Equipment Decontamination

It is expected that water samples will be collected directly into sample containers without the need for additional sampling equipment. As a result, equipment decontamination is not anticipated. However, if the need for equipment decontamination arises, it will be done according to 5-21000-OPS-FO.03, General Equipment Decontamination.

6.3.6 Air Quality

Off gas samples will be collected from a degassifier installed in the systems treatment train. The degassifier is installed following the weak-acid cation-exchange column. The degassifier is intended to remove CO_2 and other off gases by purging the water stream with air. During the testing phase, off gas samples will be collected from the degassifier and the ion exchange surge tank at the same time as water sample collection. The air sampling frequency for the operation phase has not yet been determined. Air samples will be analyzed for CO_2 and VOCs. The method of analysis has not yet been determined.

6.3.7 Quality Control Samples

To assure the quality of the sampling techniques, collection and/or preparation of field quality control (QC) samples are incorporated into the sampling scheme. QC samples and collection frequencies for both the testing and operations phase are shown in Table 6-1.

6.3.7.1 Objectives for Field QC Samples

Equipment rinsate blanks are considered acceptable (with no need for data qualification) if the concentration of analytes of interest is less than three times the required detection limit for each analyte as specified in Table 6-2. Field duplicate samples will agree within 30 percent relative percent difference for aqueous samples.

Trip blanks and field preservation blanks (for organics and inorganics, respectively) indicate possible field contamination when analytes are detected above the minimum detection limits presented in Table 6-2. The EG&G Laboratory Analysis Task Leader or laboratory validation contractor (Figure 6-1) will be responsible for verifying these criteria and shall be responsible for checking to see if the criteria are met and for qualifying data.

TABLE 6-1

QC SAMPLE COLLECTION FREQUENCY

QC Sample	Frequency
Duplicate	1 in 20
Field Preservation Blanks[1]	1 sample per shipping container (or a minimum of 1 per 20 samples)
Trip Blank[2]	1 in 20[3]
Equipment Rinsate Blank	Not Applicable

[1]For samples to be analyzed for inorganics and radionuclides.

[2]For samples to be analyzed for volatile organics only.

[3]A trip blank shall not be used for radiochemistry samples because radionuclide samples are less likely to be contaminated from direct exposure to air than are samples of volatile organics.

6.3.7.2 Laboratory QC

Laboratory QC procedures are used to provide measures of internal consistency of analytical and storage procedures. The laboratory contractor will submit written procedures to the EG&G Laboratory Analysis Task Leader for approval. The interlaboratory procedures shall be consistent with or equivalent to EPA-CLP QC procedures. The laboratory procedures must cover the following

areas in sufficient detail, and reflect actual operating conditions in effect during analysis of EG&G RFP samples:

- Sample receipt and log-in
- Sample storage and security
- Facility security
- Sample tracking (from receipt to sample disposition)
- Sample analysis method references
- Data reduction, verification, and reporting
- Document control (including submitting documents to EG&G)
- Data package assembly (see Section III.A of the GRRASP)
- Qualifications of personnel and resumes
- Preparation of standards
- Equipment maintenance and calibration
- List of instrumentation and equipment (including date purchased, date installed, model number, manufacturer, and service contracts, if any)
- Instrument detection limits
- Acceptance criteria for non-CLP analyses
- Laboratory QC checks applicable to each analytical method

Laboratory QC techniques to ensure consistency and validity of analytical results (including detecting potential laboratory contamination of samples) include using reagent blanks, field blanks, internal standard reference materials, laboratory replicates, and field duplicates. The laboratory contractor will follow the standard evaluation guidelines and QC procedures, including frequency of QC checks, that are applicable to the particular type of analytical method being used as specified in the Parts A and B of the GRRASP. All results will be forwarded to the laboratory analysis task leader and validation contractor (Figure 4-1) for review and verification. These requirements are further stipulated in the GRRASP.

6.3.8 Quality Assurance Monitoring

To assure overall quality of each IAG deliverable required by this activity, a Readiness Review will be conducted under the direction of the EM Department QAPM prior to system start-up and testing. The Readiness Review will determine if all prerequisites for the IM/IRA have been met. The Readiness Review will address work prerequisites contained in this QAA, the QAPjP, the EMD OPS referenced in this QAA, the RFP Site Health and Safety Plan, the IAG, and other applicable RFP, local, State, and Federal regulations. Any deficiencies noted during the Readiness Review will be noted in a Corrective Action Report (CAR), which will be processed as outlined in Section No. 16.0 of the QAPjP.

In addition to readiness reviews, oversight inspections will be conducted of the testing, sampling, and operating activities described in the OU1 IM/IRA WP by EMD personnel independent of the work being done under the direction of the Remediation Programs Division (RPD) Quality Coordinator. Any nonconformances or significant conditions adverse to quality will be noted during these inspections, and Nonconformance Reports (NCRs) and CARs will be issued and processed as outlined in Sections 15.0 and 16.0 of the QAPjP. In addition to these inspections, surveillance and audits will be conducted by independent personnel outside the RPD as outlined in Section 18.0 of this QAA.

6.3.9 Data Reduction, Validation, and Reporting

3.9.1 Analytical Reporting Turnaround Times

Analytical reporting turnaround times are as specified in Table 3-1 of the QAPjP.

6.3.9.2 Data Validation

Guidelines used to evaluate analytical data are referenced in subsection 3.4.2 of Section No. 3.0 of the QAPjP. The laboratory validation process is also illustrated in Figure 3-1 of Section No. 3 of

the QAPjP. Field data validation will be performed as specified in subsection 3.4.2 of Section No. 3.0 of the QAPjP. The DQOs for validating the OU1 IM/IRA measurement data are presented in Table 6-2. The process of sample collection, QA verification, sample transfer (chain-of-custody), sample analysis and data validation is illustrated in Figure 8-1 of Section No. 8 of the QAPjP. The standards and criteria used to determine the validity and usability of RFP ER program data are described in subsection 3.7 of Section No. 3.0 of the QAPjP.

6.3.9.3 Data Reduction

Reduction of field and laboratory data shall comply with the data reduction functions summarized in subsection 3.4.1 of Section No. 3.0 of the QAPjP. Laboratory data reduction will comply with the data deliverable requirements specified in the GRRASP. The reduced data will be used in the data validation process to verify that the sampling and laboratory controls and DQOs for measurement of data have been met.

6.3.9.4 Data Reporting

Depending on the data validation process, data are flagged as either "valid," "acceptable with qualifications," or "rejected." the results of the data validation shall be reported in EM Department Data Assessment Summary reports. The usability of data (the criteria of which is also described in subsection 3.3.7 of Section No. 3.0 of the QAPjP) shall also be addressed by the IM/IRA Project Manager.

6.4.0 PROCUREMENT DOCUMENT CONTROL

Subcontractors will perform the system testing and operation activities described in the OU1 IM/IRA WP. The Subcontractors will be required to implement all requirements contained in the OU1 IM/IRA WP, the QAPjP, this QAA, and all applicable EMD OPS referenced in these documents. Analytical services will also be contracted for analysis of water and air samples. Appropriate requirements from the QAPjP, this QAA, and Parts A and B of the GRRASP shall be

passed on to any organizations performing these analyses. Subcontractors may also be utilized to validate analytical data packages. Applicable requirements from the QAPjP and this QAA shall be transmitted to the validation Contractor.

The implementing Subcontractors will be required to provide the materials necessary for performing the work described in the OU1 IM/IRA WP. Subcontractors may be required to submit a QA Program that meets the applicable requirements of the QAPjP and this QAA.

6.5.0 INSTRUCTIONS, PROCEDURES, AND DRAWINGS

The OU1 IM/IRA WP and Appendices describe the system testing and operation activities to be performed. The plan will be reviewed and approved in accordance with the requirements for instructions, procedures, and drawings outlined in Section No. 5.0 of the QAPjP.

Applicable EMD OPS approved for use are identified and referenced in this QAA. Additional quality-affecting procedures proposed for use and identified here will be developed and approved as required by Section 5.0 of the QAPjP prior to performing the affected activity.

Procedure Change Notices (PCNs) (referred to as a Procedure Deviation Notice in Rev.0 of Section No. 5.0 of the QAPjP) will be prepared for changes to approved EMD OPS.

6.6.0 DOCUMENT CONTROL

The following documents will be controlled in accordance with the document control requirements of Section No. 6.0 of the QAPjP:

- "Work Plan for the Operation and Maintenance of the Interim Measure/Interim Remedial Action for the 881 hillside Operable Unit No. 1"

- "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA Remedial Investigations/Feasibility Studies and RCRA Facilities Investigations/Corrective Measures Studies Activities" (QAPjP);
- This QAA;
- All EMD OPS referenced in this QAA.

6.7.0 CONTROL OF PURCHASED ITEMS AND SERVICES

Subcontractors that provide services to support the OU1 IM/IRA will be selected and evaluated as outlined in Section No. 7.0 of the QAPjP. This includes pre-award evaluation/audit of proposed Subcontractors as well as periodic audit of the acceptability of Contractor performance during the life of the contract. Such audits shall be performed at least annually or once during the life of the project, whichever is more frequent. Also see Section No. 18.0 of the QAPjP.

6.8.0 IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA

6.8.1 Sample Containers/Preservation

Appropriate volumes, containers, preservation requirements, and holding times for testing and operation phase testing samples are presented in 5-21000-OPS-SW.07 and 5-21000-OPS-FO.13.

6.8.2 Sample Identification

The OU1 IM/IRA water treatment water samples will be identified as described in Section C.5.2.1 of Appendix C of the OU1 IM/IRA WP. Samples collected during the system testing phase will be identified with a code the designates the unit process, influent or effluent, the hour since system start-up, and a sequential number indicating the analytical suite the sample was collected for. Samples collected during the system operation phase will be identified as influent or effluent, the date of sample collection, and a sequential number indicating the analytical suite the sample was collected for.

6.8.3 Chain-of-Custody

Sample chain-of-custody will be maintained through the application of 5-21000-OPS-FO.13, Containerizing, Preserving, Handling, and Shipping of Samples, and as illustrated in Figure 8-1 of Section No. 8.0 of the QAPjP.

6.9.0 CONTROL OF PROCESSES

The overall process of collecting samples, performing analysis, and entering the data into a database is considered a process that requires control. The process is controlled through a series of written procedures that govern and document the work activities. The process is illustrated diagrammatically in Section 8.0 of the QAPjP.

6.10.0 INSPECTION

The OU1 IM/IRA water treatment facility consists of a recovery well, a french drain, and Building 881 drain (all of which are collection areas for 881 Hillside alluvial groundwater), flow equalization tanks, a (UV/H_2O_2) treatment unit, an ion exchange system consisting of four columns, a degassifier, an ion exchange regeneration system, treatment effluent storage tanks, and a neutralization tank. Inspections of the materials, construction, and installation of each of these independent units were addressed in other QAAs covering Phase I and II OU1 IM/IRA treatment facility construction. As was mentioned previously, oversight inspections will be conducted by EMD personnel independent of the IM/IRA to verify compliance with the testing, sampling, and operation requirements specified in the OU1 IM/IRA WP and this QAA. These oversight inspections will be documented in Inspection Reports. Inspection checklists will be used during the inspections to document what was inspected and inspection findings. Inspection checklists will be attached to inspection reports.

6.11.0 TEST CONTROL

Appendix D of the OU1 IM/IRA WP describes the systems operation testing planned for the OU1 IM/IRA treatment facility. Each of the treatment system components (identified in the previous section) were tested during Phase I and II construction.

System operation testing described in Appendix D includes testing of the equipment to confirm that each item functions as intended at the design conditions, to verify that each process provides the intended treatment, and total system testing to establish that all of the component systems function as designed. Hydrostatic and leak detection testing will be conducted before the system tests are initiated. System tests will be conducted on the following: the groundwater collection and pumping system, influent transfer pumps, the (UV/H_2O_2) process, the ion exchange inlet pump, the intermediate ion-exchange pump, the ion-exchange system—including the degassifier and the ion-exchange regeneration system. System tests are described in Section D.6 of Appendix D.

6.12.0 CONTROL OF MEASURING AND TEST EQUIPMENT (M&TE)

Instrument calibration and maintenance for the treatment system will be performed as described in Section D.6.1 of Appendix D.

Laboratory analyses will be performed by contracted laboratories in accordance with the analytical protocols specified in Parts A and B of the GRRASP. The equipment used to analyze environmental samples shall be calibrated, maintained, and controlled in accordance with the requirements contained in the specific analytical protocols used.

6.13.0 HANDLING, STORAGE, AND SHIPPING

Samples shall be packaged, transported, and stored in accordance with 5-21000-OPS-FO.13. Maximum sample holding times, sample preservative, sample volumes, and sample containers are specified in 5-21000-OPS-SW.07 and 5-21000-OPS-FO.13.

6.14.0 STATUS OF INSPECTION, TEST, AND OPERATIONS

The requirements for the identification of inspection, test, and operating status the treatment system components and instruments shall be implemented as specified in Section No. 14.0 of the QAPjP.

6.15.0 CONTROL OF NONCONFORMANCES

The requirements for the identification, control, evaluation, and disposition of nonconforming items, samples, and data will be implemented as specified in Section No. 15.0 of the QAPjP. Nonconformances identified by contractor(s) shall be submitted to EG&G for processing as outlined in the QAPjP.

6.16.0 CORRECTIVE ACTION

The requirements for the identification, documentation, and verification of corrective actions for conditions adverse to quality will be implemented as outlined in Section No. 16.0 of the QAPjP. Conditions adverse to quality identified by the implementing contractor shall be documented and submitted to EG&G for processing as outlined in the QAPjP.

6.17.0 QUALITY ASSURANCE RECORDS

Sampling records will be processed in accordance with the 5-21000-OPS-FO.02, Field Document Control. QA records to be generated during system testing and operation include, but are not limited to:

- Scientific Notebooks
- Field Logs (e.g., sample collection logs)
- Instrument Calibration Records
- Sample Collection and Chain-of-Custody Records
- Work Plan/Sampling and Analysis Plan
- QAPjP/QAA
- Audit/Surveillance/Inspection/Test Reports
- Nonconformance Reports
- Corrective Action Documentation
- Data Validation Results
- Analytical Results
- Procurement/Contracting Documentation
- Training/Qualification Records
- Inspection and Testing Records

6.18.0 QUALITY VERIFICATION

The requirements for the verification of quality shall be implemented as specified in Section No. 18.0 of the QAPjP. Surveillance of contractors providing system testing, operation, sampling, and analytical support services shall be performed at least annually or once during the life of the project, whichever is more frequent.

6.19.0 SOFTWARE CONTROL

The requirements for the control of software shall be implemented as specified in Section 19.0 of the QAPjP. Only database software is anticipated to be used for the OU1 IM/IRA WP activities. The EMD OPS applicable to the use of the database storing environmental data is 5-21000-OPS-FO.14, Data Management.

TABLE 6-2

Analytical Methods, Detection Limits, and Data Quality Objectives

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	GW	Required Detection Limits Water	Precision Objective	Accuracy Objective
INDICATORS					
Total Suspended Solids	EPA 160.2[a]	X[e]	10 mg/L	20%RPD[f]	80-120% LCS Recovery
Total Dissolved Solids	EPA 160.1[a]	X[f]	5 mg/L	20%RPD[f]	80-120% LCS Recovery
pH	EPA 150.1[a]	X[f]	0.1 pH units	NA	±0.05 pH units
INORGANICS					
Target Analyte List - Metals					
Aluminum	EPA CLP SOW[c]		200 ug/L[b]	**	***
Antimony	EPA CLP SOW[c]		60		
Barium	EPA CLP SOW[c]		200		
Calcium	EPA CLP SOW[c]		5000		
Chromium	EPA CLP SOW[c]		10		
Copper	EPA CLP SOW[c]		25		
Iron	EPA CLP SOW[c]		100		
Lead (GFAA)	EPA CLP SOW[c]		3		
Magnesium	EPA CLP SOW[c]		5000		
Manganese	EPA CLP SOW[c]		15		
Mercury (CVAA)	EPA CLP SOW[c]		0.2		
Nickel	EPA CLP SOW[c]		40		
Potassium	EPA CLP SOW[c]		5000		
Selenium (GFAA)	EPA CLP SOW[c]		5		
Sodium	EPA CLP SOW[c]		5000		
Thallium (GFAA)	EPA CLP SOW[c]		10		
Vanadium	EPA CLP SOW[c]		50		
Zinc	EPA CLP SOW[c]		20		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	GW	Required Detection Limits Water	Precision Objective	Accuracy Objective
Other Metals		X[f]			
Molybdenum	EPA CLP SOW[b] (ICAP)		8 ug/L[i]	**	***
Cesium	EPA CLP SOW[b]		1000		
Strontium	EPA CLP SOW[b]		200		
Lithium	EPA CLP SOW[b]		100		
ANIONS					
Carbonate	EPA 310.1[a]	X[u]	10 mg/L	Same as metals	Same as metals
Chloride	EPA 325.2[a]	X[u]	5		
Sulfate	EPA 375.4[a]	X[u]	5		
Nitrate as N	EPA 353.2[d] or 353.3[e]	X[u]	1		
Target Compound List - Volatiles		X[u]			
1,1-Dichloroethene	EPA CLP SOW[c]		5 mg/L	**	***
1,1-Dichororethane	EPA CLP SOW[c]		5		
1,2-Dichloroethane	EPA CLP SOW[c]		1		
1,1,1-Trichoroethane	EPA CLP SOW[c]		5		
Carbon Tetrachloride	EPA CLP SOW[c]		5		
Trichloroethene	EPA CLP SOW[c]		5		
1,1,2-Trichloroethane	EPA CLP SOW[c]		5		
Tetrachloroethene	EPA CLP SOW[c]		5		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	GW	Required Detection Limits Water	Precision Objective	Accuracy Objective
RADIONUCLIDES					
Gross Alpha	f,g,h,i,k,l,m,n	X'	2 pCi/L	**	***
Gross Beta	f,g,h,i,k,l,m,n	"	4		
Total Uranium	f,h,i,m,n	X'	0.6		
Plutonium 239+240	o,p	X'	0.01		
Tritium	f,g,h,m	X"	400		
Strontium 89,90	f,h,i,m		NA		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

** Precision objective = control limits specified in referenced method and/or Data Validation Guidelines.
*** Accuracy objective = control limits specified in referenced method (in GRRASP for radionuclides).
F = Filtered
U = Unfiltered

1. Higher detection limits may only be used in the following circumstance: If the sample concentration exceeds five times the detection limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the required detection limit. This is illustrated in the example below:

   For lead:

   Method in use - ICP
   Instrument Detection Limit (IDL) - 40
   Sample Concentration - 220
   Required Detection Limit (RDL) - 3

   The value of 220 may be reported even though the instrument detection limit is greater than the RDL.

   Note: The specified detection limits are based on a pure water matrix. The detection limits for samples may be considerably higher depending on the sample matrix.

2. If gross alpha > 5 pCi/L, analyze for Radium 226; if Radium 226 > 3 pCi/L, analyze for Radium 228.

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

3. The detection limits presented were calculated using the formula in N.R.C. Regulatory Guide 4.14, Appendix Lower Limit of Detection, pg. 21, and follow:

$$LLD = \frac{4.66\ (BKG/BKG\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)(e^{-\lambda t})(Aliq)}$$

$$MDA = \frac{4.66\ (BKG/Sample\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)e^{-\lambda t}(Aliq)}$$

Where:

LLD = Lower Limit of Detection in pCi per sample unit.
BKG = Instrument Background in counts per minute (CPM).
Eff = Counting efficiency in cpm/disintegration per minute (dpm).
CR = Fractional radiochemical yield.
SR = Fractional radiochemical yield of a known solution.
λ = The radioactive decay constant for the particular radionuclide.
t = The elapsed time between sample collection and counting.
Aliq = Sample volume.
BKG DUR = Background count duration in minutes.

MDA = Minimum Detectable Activity in pCi per sample unit
Sample DUR = sample count duration in minutes

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

a. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version).

b. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version). The specific method to be utilized is at the laboratory's discretion provided it meets the specified detection limit.

c. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, 2/88 (or latest version).

d. Methods are from "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, 1983, unless otherwise indicated.

e. Methods are from "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods," (SW-846, 3rd Ed.), U.S. Environmental Protection Agency.

f. U.S. Environmental Protection Agency, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No. EMSL-LY-0539-1, Las Vegas, NV, U.S. Environmental Protection Agency.

g. American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, D.C., Am. Public Health Association.

h. U.S. Environmental Protection Agency, 1976. Interim Radiochemical Methodology for Drinking Water, Report No. EPA-600/4-75-008. Cincinnati U.S. Environmental Protection Agency.

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m. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," U.S.G.S. Book 5, Chapter A5, 1977.

n. "Acid Dissolution Method for the Analysis of Plutonium in Soil," EPA-600/7-79-081, March 1979, U.S. EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979.

o. "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium, and Americium," by E.H. Essington and B.J. Drennon, Los Alamos National Laboratory, a private communication.

p. "Isolation of Americium from Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories.

q. "Radioactivity in Drinking Water," EPA 570/9-81-002.

r. If the sample or duplicate result is $< 5 \times$ IDL, then the control limit is $\pm$ IDL.

Appendix A

Health and Safety Plan

ROCKY FLATS PLANT WORK PLAN FOR THE STARTUP AND O&M OF THE IM/IRA FOR THE 881 HILLSIDE OU 1	Manual No.: Procedure No.: Effective Date: Organization:	21100-WP OU 01.5 Appendix A 3/3/92 Environmental Management

Appendix A - Health and Safety Plan

Approved by:

M C Rumenila

Project Manager

3/4/92

Date

"REVIEWED FOR CLASSIFICATION

By [illegible] (U)

Date 5 May 92 [illegible]"

HEALTH & SAFETY PLAN

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CH2M HILL SITE SPECIFIC HEALTH AND SAFETY PLAN

Rocky Flats Plant, Building 891, 881 Hillside, OU No. 1
Groundwater Treatment System

This plan will be kept onsite during field activities and will be reviewed and updated as necessary. This plan adopts, by reference, the following:

1. Standards of practice (SOP) contained in the CH2M HILL *Waste Management and Industrial Processes Discipline Health and Safety Manual, Volumes 1 and 2,*
2. Other applicable CH2M HILL SOPs as appropriate
3. IT Corp. Environmental Restoration Project Health and Safety Program Plan
4. EG&G Rocky Flats Plant Environmental Restoration Program Health and Safety Program Plan and Site Health and Safety Plan Workbook
5. EG&G Health and Safety Practices Manual, revised November 14, 1991
6. Operations and Maintenance Manual for the 881 Hillside OU No. 1 Groundwater Treatment System

The Site Safety Coordinator (SSC) is to be familiar with these SOPs and work practices requirements.

The EG&G Health and Safety Practices Manual and the Operations and Maintenance Manual for the 881 Hillside OU No. 1 Groundwater Treatment System shall be kept onsite at all times.

1.0 PROJECT INFORMATION AND DESCRIPTION

CLIENT OR OWNER: Rocky Flats Plant and IT Corp. **PROJECT NO: DEN30181.T1.WP**

TASK MANAGER: Clint Smith/CH2M HILL **OFFICE: DEN**

SITE NAME: Rocky Flats Plant; 881 Hillside OU No. 1
Groundwater treatment system

SITE ADDRESS: Rocky Flats Plant, Golden, Co.

DATE HEALTH AND SAFETY PLAN PREPARED: February 3, 1992

DATE(S) OF INITIAL VISIT: December 2, 1991

DATE(S) OF SITE WORK: March-December, 1992

1.1 SITE ACCESS: Boulder turnpike to Wadsworth, west on Highway 128, south on Highway 93. West entrance to plant on Highway 93. Stop at security entrance.

1.2 SITE SIZE: The RFP site is comprised of approximately 6,550 acres. Administrative and manufacturing buildings are located within the RFP security area of 400 acres. The remaining 6,150 comprise the buffer zone surrounding the RFP complex.

1.3 SITE DESCRIPTION AND HISTORY: The RFP is a government owned, contractor operated facility, which is part of the nationwide nuclear weapons production complex. The RFP has been in operation since 1951. It is currently operated by EG&G Rocky Flats, Inc. The primary mission of RFP is to fabricate nuclear weapon components from plutonium, uranium, and other non-radioactive metals, principally beryllium and stainless steel. Product storage and waste management practices associated with many years of production operations have led to environmental contamination which is being assessed under the direction of the Environmental Restoration Directorate.

This health and safety plan has been prepared for the startup and operation of the 30-gallons per minute (gpm) groundwater recovery and treatment system for the Environmental Restoration Program's Operable Unit Number 1 (OU1) 881 Hillside waste water treatment plant (Building 891). The purpose of the system is to remove dissolved organic contaminants, metals, and selected radionuclides from the groundwater at the Building No. 881 Hillside area. This HSP is for pilot operation to evaluate and demonstrate the treatment process effectiveness for removing the groundwater contaminants and prepare it for long term operation by EG&G. The Rocky Flats Plant is shown in Figure 1-1. The groundwater treatment plant and effluent tanks are shown in Figures 1-2 and 1-3.

Additional background information may be found in Appendix B, Sampling and Analysis Plan of the "Work Plan for the Operation and Maintenance of the Interior Measure/Interim Remedial Action for the 881 Hillside Operable Unit No. 1."

1.4 ASSIGNMENT OF RESPONSIBILITIES FOR KEY PERSONNEL

EG&G Project Manager—Craig Cowdery
CH2M HILL Task Manager—Clint Smith
CH2M HILL Project Engineer, Lead—Karen Wiemelt
CH2M HILL Health and Safety Officer—Jane Stansfield
CH2M HILL Chemist—Kishor Gala
CH2M HILL Project Engineer—Kelly Bledsoe
Site Safety Coordinator and Operations Supervisor: Jim Soutee/OMI
CH2M HILL Program Manager-Joan Miller
IT Technical Manager-Les Osborn

2.0 SAFETY AND HEALTH ASSESSMENT

2.1 DESCRIPTION OF TASKS

This H&SP covers all tasks that are to be performed in the operation and maintenance of the groundwater treatment plant. These tasks include the following:

1) Operation of an ultra-violet/peroxidation groundwater treatment unit (UV/H2O2)
2) Operation of an ion exchange treatment unit

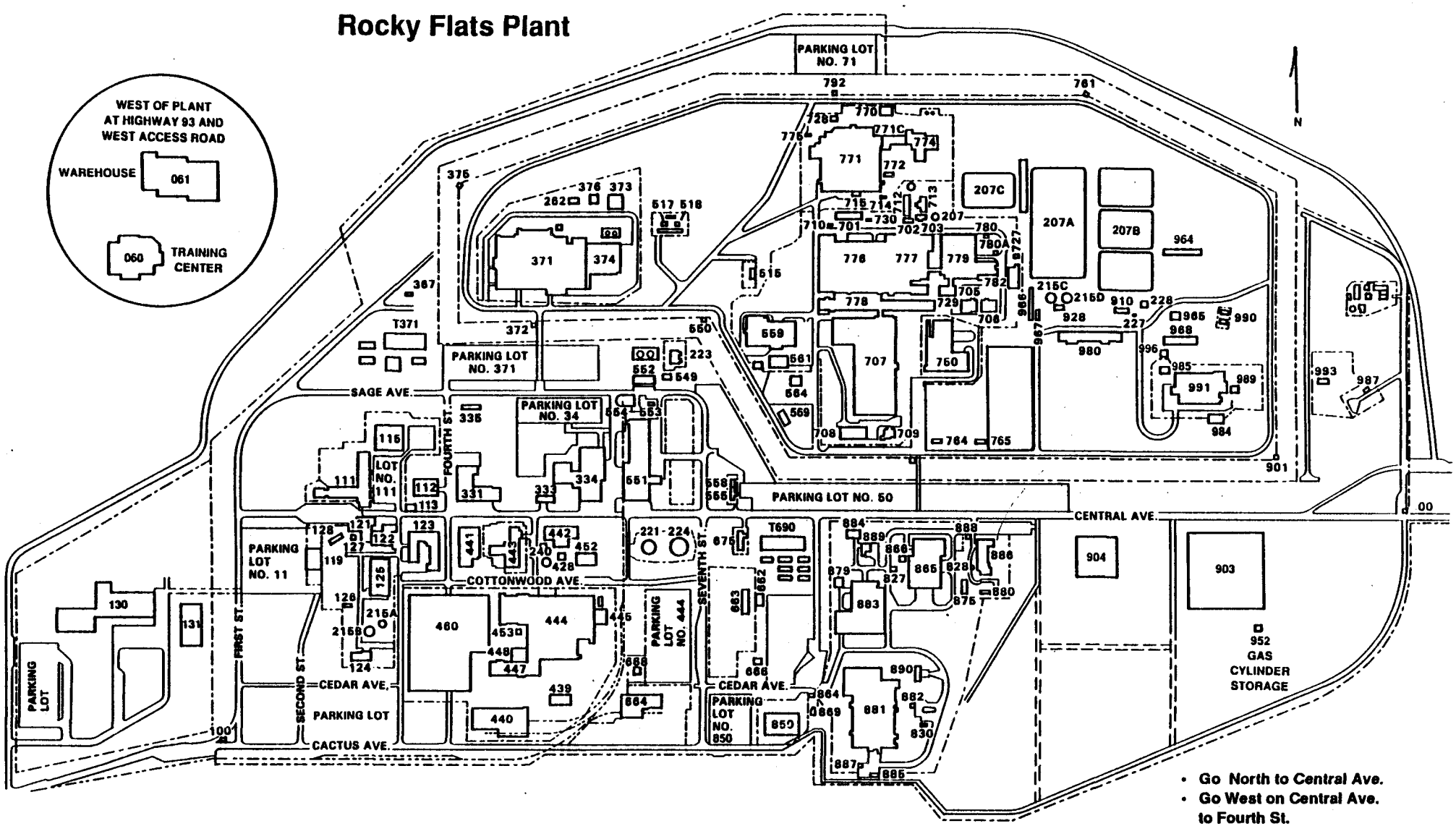
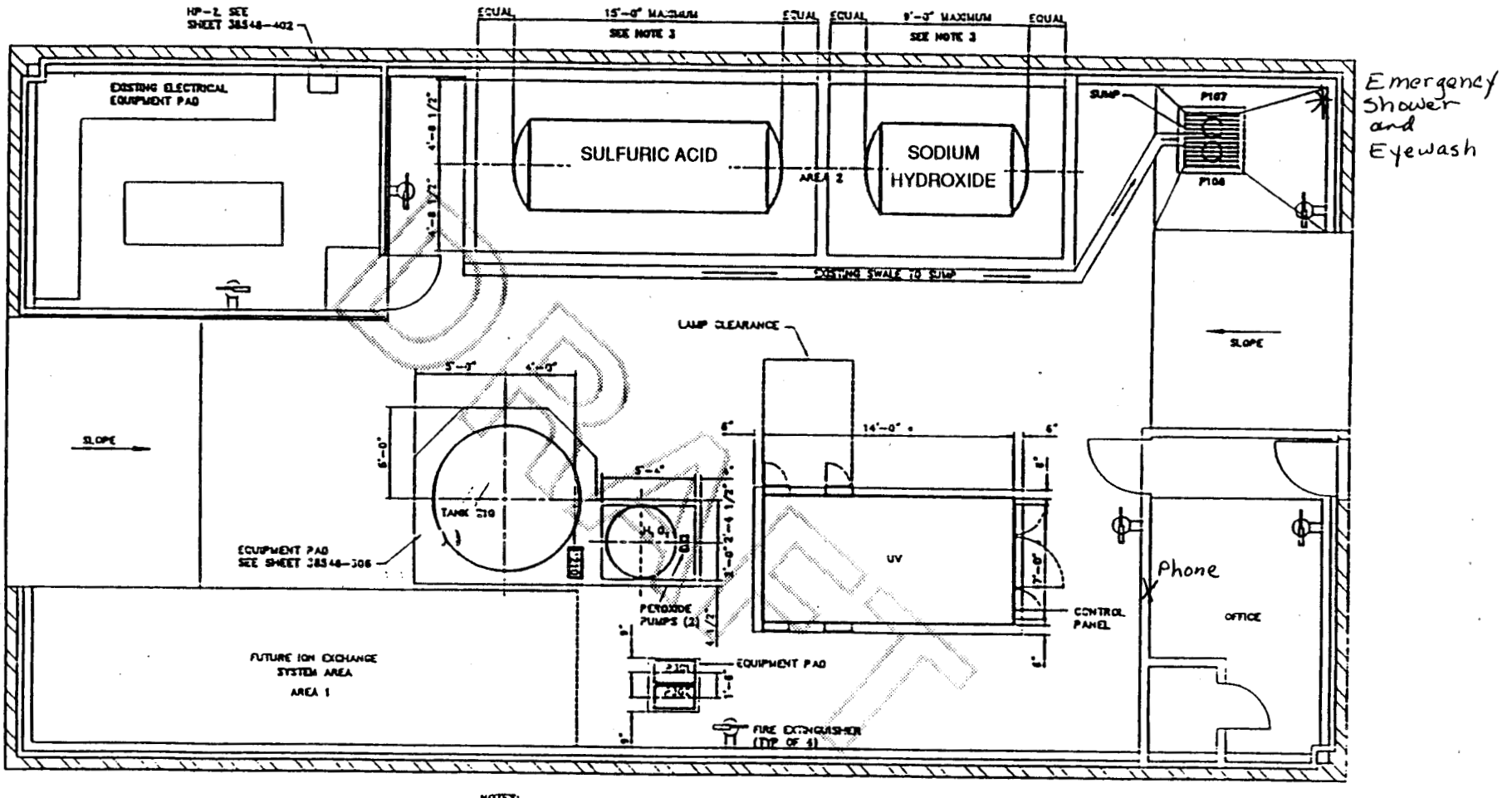


FIGURE 1-1
DIRECTIONS TO MEDICAL CENTER



NOTES:

1. ALL EQUIPMENT TO BE INSTALLED PER MANUFACTURER.
2. SEE DRAWING 38548-306 FOR EQUIPMENT PAD LOCATIONS.
3. * DIMENSIONS TO BE FIELD VERIFIED PRIOR TO INSTALLATION.

BUILDING 891 EQUIPMENT LOCATION PLAN

SCALE: 1/4" = 1'-0"

Figure 1-3

2.1 (continued)

3) Operation of a degasser column
4) Operation of motorized pumping controls to pump untreated groundwater into influent equalization tanks
5) Operation of motorized pumping controls to pump treated groundwater to effluent storage tanks
6) Removal and replacement of filter bags that have captured suspended solids after UV/H2O2 prior to entering the IX unit, and also at the IX regeneration unit
7) Cleaning of UV lamps and changing UV lamp bulbs
8) Regeneration of IX columns
9) Removal and replacement of IX resins
10) Calibration of flow meters and pumps
11) Collecting water samples on a daily or less frequent basis and transferring the samples to an offsite laboratory for analysis
12) Additional specific operations and maintenance items may be added pending receipt of the vendor supplied O&M manuals

2.2 DESCRIPTION OF SYSTEMS OPERATIONS AND PROCESS EQUIPMENT

2.2.1 GROUNDWATER PROCESS EQUIPMENT

The groundwater handling and treatment system consists of groundwater sump pumps, influent equalization/storage tanks, influent transfer pumps, a UV/H_2O_2 oxidation unit, ion exchange surge tank, ion exchange unit, and treated water storage tanks. The purpose of the system is to collect contaminated groundwater at the 881 Hillside area, treat it to remove or destroy the contaminants and discharge the treated water to an infiltration gallery.

Groundwater is collected from a recovery well, Building 891 sump, and french drain. Pumps are installed at each location to transfer the collected groundwater to the influent equalization tanks. There are four pumps at the french drains collection wells, one at the recovery well and two at the Building 891 sump. Influent equalization is provided by two 15,000 gallon tanks located at the south side of Building 891. The tanks are heated and insulated to prevent freezing during cold weather.

Transfer pumps are used to pump the groundwater from the equalization tanks to the UV/H_2O_2 unit located in Building 891. A metering pump is installed to pump 50 percent hydrogen peroxide (H_2O_2) from a 500-gallon storage tank in the building for injection in the UV/H_2O_2 unit inlet line.

The UV/H_2O_2 unit consists of two stainless steel reactor vessels, each containing eight high intensity (high pressure) UV lamps. The lamps are installed inside quartz tubes to prevent direct contact of the water and lamp. The reactors and control panel are mounted on a common skid.

From the UV/H_2O_2 unit, the water flows to the ion exchange (IX) surge tank located at the south side of Building 891. This tank is identical to the groundwater equalization tanks previously described. The water is then pumped from the surge tanks through a bag filter for solids removal to the IX treatment unit. This unit consists of four IX columns connected in series. Each column is designed to remove specific materials so that uranium is removed in the first, metals in the second, and other water quality ions in the third and fourth columns. A degasser column is installed after the second IX column to allow the escape of carbon dioxide or other gases that may otherwise inhibit uniform flow in the downstream columns.

2.2.1 (continued)

After IX treatment, the water is stored in one of three effluent storage tanks. The capacity of each is 300,000 gallons so that up to 3 weeks produced water can be stored. This will allow analyzing the water to determine whether it will require additional treatment before it can be discharged to the infiltration gallery. If additional treatment is required, it can be returned to the treatment system influent or the IX unit.

The IX columns will need to be regenerated periodically. A regeneration system is provided that includes a 2,500-gallon storage tank for sulfuric acid, a 1,250-gallon sodium hydroxide storage tank, and a 15,000-gallon clean water storage tank (for backwash and dilution). A 5,000-gallon capacity neutralization tank is provided to neutralize the IX regenerant before discharge to the waste treatment system or to a tank car for disposal.

Devices for measuring and indicating pressure, temperature, and flow are installed at several locations in the process treatment system. Pressure gages are located at the influent transfer pump discharge, IX pump discharge, neutralization transfer pump discharge, and chemical metering pump discharge. Temperature indicators are located at each equalization tank, UV reactor inlet and outlet, IX surge tank, and clean water storage tank. Flow indicators are installed in the UV/H_2O_2 inlet line, IX outlet line, and IX backwash line. In addition, level indicators are provided for each tank and sump. Most process water analyses will be provided by an offsite laboratory. However, a pH indicator is installed at the neutralization tank and an online radiation meter is installed at the IX unit.

In addition to the UV/H_2O_2 control panel mounted on the UV skid, the main electrical disconnect, motor control center (MCC), and main control panel are installed in the electrical room.

2.2.2 OPERATION OF TREATMENT SYSTEM

The treatment plant will operate 7 days per week, 10 hours per day. In operation, the untreated groundwater will be pumped from the collection areas (recovery well, sump, and french drain collection wells) to the influent equalization tanks. A motorized valve will direct the water to the tank to be filled. When that tank is filled, the treatment plant operator will open the motorized inlet valve to the other tank and close the motorized inlet valve at the full tank. A high-level alarm will sound if the level is allowed to reach the high level set point. Pumping from each sump pumps to the equalization tanks will be intermittent based on the water available in the sumps. Combined flow from all sources is expected to average in the range of 7 to 10 gallons per minute (gpm) over a 24-hour period.

The operator will select the equalization tanks from which to pump groundwater for treatment and will open the motorized valve at that tank discharge. The operator will also select the influent transfer pump to be used and open the appropriate pump suction and discharge valves. The valves at the pumps will be operated manually. The manual valves in the process water line at the UV/H_2O_2 IX units will be opened to allow the water to flow through the treatment system. The surge tank motorized valves will be opened by the operator as will the motorized inlet valve to the selected effluent storage tank.

2.2.2 (continued)

The operator will then start the influent transfer pump and the H_2O_2 feed pump. UV/H_2O_2 unit operation will be initiated in accordance with the UV/H_2O_2 unit O&M Manual provided by the vendor (Peroxidation Systems, Inc.).

When the surge tank water level rises to the operating range, the operator will start the IX feed pump, intermediate IX feed pump, and gasifier air blower. All of the motorized valve and process pump controls will be operated from the main control panel (MCP) in the electrical room.

Flow through the treatment system will be controlled by the speed setting of the influent transfer pump controller. The operator will adjust the flow to 30 gpm or less as indicated on the UV/H_2O_2 inlet flowmeter. The actual treatment system flow rate will be selected by the operator on the basis of equalization tank level.

Certain routine process and system maintenance procedures will be required at varying intervals. These will include removal and replacement of filter bags, cleaning of UV quartz tubes, replacement of UV lamps, regeneration of IX columns, removal and replacement of IX resins, and calibration of flow meters and metering pumps. Additional specific maintenance items are addressed in vendor supplied O&M Manuals.

Water samples will be collected on a daily (or less frequent) basis for analysis by an offsite laboratory. Sample points will include treatment process influent, UV/H_2O_2 unit effluent, IX effluent, and effluent tank water. Samples may also be collected at additional system locations as needed for specific purposes. Examples of these additional samples may include intermediate UV/H_2O_2 samplers (between the two reactors) or neutralization tank effluent.

2.3 SAFETY HAZARDS AND CONTROLS

Hazard	Engineering or Administrative Controls
Electrical Hazards	Refer to Section 15 of EG&G Health and Safety Practices Manual, Electrical Safety
Noise > 85 dBA	Noise protection and monitoring required. Refer to Section 7.06 of EG&G Health and Safety Practices Manual, Hearing Conservation
Lockout/Tagout of energized sources	Refer to Section 2.08 of EG&G Health and Safety Practices Manual, Lockout/Tagout
Build-up of explosive gases	Provide 20 lb A,B,C fire extinguisher and ventilation.
Confined space entry (example, tank cleaning) Tasks requiring confined space entry will be identified pending receipt of vendor's O&M manual	Refer to Section 6.04 of EG&G Health and Safety Practices Manual, Confined Space Entry Checklist and CH2M HILL SOP HS-17 (Attachment 4). All tasks requiring confined space entry shall be identified and the work to be performed shall be in compliance with EG&G, Integrated Work Control Practices (IWCP) program and CH2M HILL and IT procedures. Contact EG&G Project Manager to indicate IWCP.

Hazard	Engineering or Administrative Controls
Gas cylinders	Make certain gas cylinders are properly anchored and chained. Keep cylinders away from ignition sources.
Pressure vessels, systems, and relief devices such as buildup of gasses in degasser column, IX columns, storage tanks, and lines into tanks	Refer to Section 11.03 of EG&G Health and Safety Practices Manual, "Pressure Vessels, Systems, and Relief Devices."
Proper Use and operation of forklift	Refer to Section 9.06 of EG&G Health and Safety Practices Manual, "Powered Industrial Trucks."
Moving vehicles	Back-up alarm required for heavy equipment. Observer remains in contact with operator and signals safe back-up. Personnel to remain outside of turning radius.
Safe storage and handling of materials	Refer to Section 9.00 of EG&G Health and Safety Practices Manual, "Material Handling and Storage."
Industrial Safety hazards due to use of tools, machines, hoisting materials, and accident prevention tags and signs	Refer to Section 12.00 of EG&G Health and Safety Practices Manual, "Industrial Safety."
Back injury	Use proper lifting techniques, or provide mechanical lifting aids.
Ultraviolet radiation damage to eyes and skin	Do not remove blue shields in UV/H202 viewing ports. Wear UV protective safety glasses.

2.4 RADIOLOGICAL HAZARDS AND CONTROLS

Refer to the EG&G Health and Safety Practices Manual section 18, "Radiation Protection" and CH2M HILL *Waste Management and Industrial Processes Discipline Health and Safety Manual, Volume 2* for standards of practice for operating in contaminated areas. An EG&G Radiation Work Permit will be required before plant startup. Plant operators, however, will be conducting their own monitoring. Ken Sablick (Foreman of Radiological Operations) must be contacted to arrange.

Table 2-1

Radioisotope	Radiation Emitted	Half-Life
Tritium-^{3}H	Beta	12.2 years
Uranium ^{238}U	Alpha, beta, gamma	4.5 billion years
Americium-^{241}Am	Alpha, beta, gamma	458 years
Plutonium-^{239}Pu	Alpha, beta, gamma	2.41×10^{4} years

Thermoluminescent (TLDs) dosimeters will be provided to each employee in addition to the TLD's provided by EG&G. The CH2M HILL dosimeters will be worn on the front of the body between the waist and the neck and shall be stored in the Building 891 office when not in use. They shall be collected quarterly, with a new TLD substituted, and sent by CH2M HILL to a laboratory for analysis.

A Ludlum Model 12 count rate meter, with a 43-5 alpha scintillation probe will be used to detect the presence of plutonium and Americium on personnel or equipment that has been in contact with wastewater and must be handled. Smear surveys will be taken on equipment that is handled that has had contact with trapped resins and ion exchanged beds.

In addition, a radiation field survey will be conducted once per month on equipment that may concentrate radionuclides. See air monitoring discussion for specifications.

2.5 HAZARDS POSED BY CHEMICALS BROUGHT ONSITE

Refer to CH2M HILL *Hazard Communication Program Manual* Section 9.07, Written Hazard Communication Program and HSP 7.04, Emergency Shower/Eyewash Requirement from the EG&G Health and Safety Practices Manual. The Site Safety Officer is to request Material Safety Data Sheets (MSDSs) from the client, or vendors for chemicals that treatment plant employees are potentially exposed to. A copy of all MSDS are to be sent to EG&G Industrial Hygiene Department.

Chemical	Location
30 Percent hydrochloric acid—2,500 gallons	Along north wall—large tank—See Figure 1-3
50 Percent Sodium Hydroxide—1,250 gallons	Along north wall—small tank—See Figure 1-3
50 Percent Hydrogen peroxide—500 gallons	Hydrogen peroxide feed tank—See Figure 1-3
Ion Exchange Resins	

TABLE 2-2 HAZARD OF CHEMICALS TO BE BROUGHT ONSITE

Chemical	OSHA PEL or ACGIH TLV	IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
50 Percent Hydrogen Peroxide	1 ppm or 1.4 mg/M^3	75 ppm	Colorless liquid with a sharp odor. Powerful oxidizer.	Skin and eye contact, inhalation, ingestion	Irrigate and wash affected area immediately for at least 15 minutes. Seek medical attention.	Chemical burns to skin and eyes, irritation to nose and mucous membranes of respiratory system.
30 Percent Hydrochloric Acid	5 ppm ceiling	100 ppm	Pungent irritating corrosive	Inhalation, dermal ingestion	Wash with water immediately.	Burns, throat, eyes, and skin.
50 Percent Sodium Hydroxide	2 mg/M^3	250 mg/M^3	VP = O mm odorless	Skin and eye contact ingestion	Wash with water.	Immediate irritation to skin, eyes, and nose.

SECTION 2.6 CHEMICAL HAZARDS POSED BY SITE CONTAMINANTS

Table 2-3 lists the potential chemical hazards, routes of exposures of ground-water contaminants. A complete description of groundwater is found in Appendix B of the "Work Plan for the Operation and Maintenance of the Interim Measure/Interim Remedial Action for the 881 Hillside Operable Unit No. 1."

Table 2-3
Chemical Hazards Posed by Site Contaminants

Contaminant (Synonyms) (Abbreviations)	Max. Detected Concentration µg/l	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	PIP
Acetone	19	1,000 ppm 750 ppm	20,000 ppm	Colorless liquid with a fragrant mint-like odor. Fl. pt. 1.4°F IP: 9.69 eV LEL: 2.6% UEL: 12.8% VP: 266 mm HG (@77°F)	Inhalation Ingestion Contact	Irrigate and wash affected area immediately; artificial respiration; seek medical attention	Eye, nose, and throat irrigation; headaches; dizziness; dermatitis	6.3
1,1-Dichloroethane	180	100 ppm	4,000 ppm	Chloroform-like odor	Inhalation Dermal contact Ingestion	Irrigate and wash affected area, seek medical attention	CNS depression, liver and kidney damage, skin irritation	9.6
1,2-Dichlorethane	17	10 ppm	4,000 ppm	Chloroform-like odor	Inhalation Dermal contact Ingestion	Irrigate and wash affected area, seek medical attention	CNS depression, skin irritation	9.6
1,1-Dichlorethylene (Vinylidene Chloride) (1,1-Dichloroethene) (1,1-DCE)	7,900	1 ppm	Carcinogen	Colorless liquid, mild, sweet odor. LEL: 7.3% UEL: 16%	Inhalation Ingestion Contact	Irrigate and wash affected area immediately; artificial respiration; seek medical attention.	Liver and kidney changes	9.6
Carbon Tetrachloride (Tetrachloroethane)	2,400	10 ppm 5 ppm	Carcinogen	Colorless liquid, sweet odor, not combustible VP: 91 mm Hg	Inhalation Absorption Ingestion Contact	Irrigate and wash affected area immediately; artificial respiration; seek medical attention.	CNS depression, nausea and vomiting, liver and kidney damage, skin irrigation	NA
1,1,1-Trichloroethane (Methyl Chloroform) (1,1,1-TCA)	15,000	350 ppm 350 ppm	1,000 ppm	Colorless liquid, mild sweet odor. LEL: 7% UEL: 16% VP 100 mm Hg	Inhalation Ingestion Contact	Irrigate and wash affected area immediately; artificial respiration; seek medical attention.	Eye and skin irritation, dermatitis, headache, drowsiness	NA

Table 2-3
Chemical Hazards Posed by Site Contaminants

Contaminant (Synonyms) (Abbreviations)	Max. Detected Concentration µg/l	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	PIP
1,1,2-Trichlorethane	5,900	10 ppm	None	Chloroform-like odor	Inhalation Dermal contact Ingestion	Irrigate and wash affected area, seek medical attention	Carcinogen Irritates eyes, nose, throat, cramps, vomiting, diarrhea, affects sleep and appetite	NA
Trichloroethylene (Ethylene Trichloride) (TCE)	5,900	100 ppm 50 ppm	Carcinogen	Colorless liquid, sweet odor. IP: 9.47 eLV LEL: 11% UEL: 41% VP: 58 mm Hg	Inhalation Ingestion Contact	Irrigate and wash affected area immediately; artificial respiration; seek medical attention.	Headache, vertigo, visual disturbance, nausea, eye and skin irritation	9.4
Tetrachloroethylene (Perchloroethylene) (Tetrachloroethene) (Perchlor)	35	100 ppm 50 ppm	Carcinogen	Colorless liquid with sweet odor. Not combustible. IP: 9.32 eV VP: 14 mm Hg	Inhalation Ingestion Contact	Irrigate and wash affected area immediately; artificial respiration; seek medical attention.	Eye, nose, throat irritation; nausea; flush face; vertigo; headache	9.3
Aluminum	260	15 mg/m	NA	Silvery ductile metal	Inhalation	NA	Pulmonary fibrosis, possibly Alzheimer	NA
Antimony	80	0.5 mg/m^3	80 mg/m^3	Silvery white metal	Inhalation Dermal contact	Irrigate and wash affected area, seek medical attention	Irritates eyes, nose, throat, cramps, vomiting, diarrhea, affects sleep and appetite	NA
Barium	311	0.5 mg/m^3	250 mg/m^3	Silver-white, slightly lustrous	Inhalation Ingestion Dermal contact	Irrigate and wash affected area, seek medical attention	Irritates eyes, nose, throat, upper respiratory, GI, muscle spasm, slow pulse, skin burns	NA
Chromium	78	1 mg/m^3	500 mg/m^3	NA	Inhalation Ingestion	Artificial respiration; irrigate and wash affected area, seek medical attention	Corrosive to skin and mucous membranes, carcinogen of the lungs, nasal cavity, stomach, larynx	NA

Table 2-3
Chemical Hazards Posed by Site Contaminants

Contaminant (Synonyms) (Abbreviations)	Max. Detected Concentration µg/l	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	PIP
Copper	952	1 mg/m^3	NA	Reddish in color	Inhalation Ingestion Dermal contact	Artificial respiration; irrigate and wash affected area, seek medical attention	Irritation of eyes and mucous membranes, pharynx; poison by ingestion; metal taste; damage of nervous system, kidneys, and liver	NA
Gross alpha (pCi/l)	319	1.25 rems/year	NA	NA	NA	NA	NA	NA
Gross beta (pCi/l)	286	1.25 rems/year	NA	NA	NA	NA	NA	NA
Iron	406.5	NA	NA	Silvery-white, tenacious, lustrous, ductile metal	Inhalation Ingestion	Artificial respiration; irrigate and wash affected area, seek medical attention	Poison by intraperitoneal route, tissue and lung irritant, and carcinogen	NA
Lead	24	0.15 mg/m^3	NA	Bluish-gray, soft metal	Inhalation Ingestion Dermal contact	Artificial respiration; irrigate and wash affected area; seek medical attention	Carcinogen of lungs and kidneys, affects CNS, GI tract, blood	NA
Lithium	700	NA	NA	Silver-colored light metal	Inhalation Ingestion	Artificial respiration; irrigate and wash affected area, seek medical attention	Reacts with body moisture to cause burns, toxic to CNS	NA
Magnesium	95,500	NA	NA	Hexagonal, silvery-white crystals of metal	Ingestion Inhalation, Dermal contact	Artificial respiration; irrigate and wash affected area, seek medical attention	Poison by ingestion, inhalation can cause metal fume fever, contact to skin has ulcerous results	NA
Manganese	959	5 mg/m^3	10,000 mg/m^3	Silvery or reddish gray solid; brittle	Inhalation Ingestion	Artificial respiration, seek medical attention	Parkinson's, CNS and lung damage, sleepiness, weakness, tremors	NA

Table 2-3
Chemical Hazards Posed by Site Contaminants

Contaminant (Synonyms) (Abbreviations)	Max. Detected Concentration µg/l	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	PIP
Mercury	6	0.1 mg/m^3	28 mg/m^3	Silvery, mobile, odorless liquid	Inhalation Dermal contact Absorption	Irrigate and wash affected area, seek medical attention	Eye and skin irritant, poison by inhalation, cough, tremor, headache, irritability, GI and CNS affected	NA
Molybdenum	53.3	NA	NA	Cubic, silver-white metallic crystals or gray-black powder	Inhalation Ingestion Dermal contact	Irrigate and wash affected area; seek medical attention	Poison by intra-peritoneal and intratracheal routes	NA
Nickel	1,180	1 mg/m^3	CA	Silvery-white, hard, malleable, and ductile metal	Inhalation Ingestion Dermal contact	Irrigate and wash affected area; seek medical attention	Nasal, lung and skin irritant, carcinogenic	NA
Plutonium 239, 240 (pCi/l)	2.57	1.25 rems/year	NA	NA	NA	NA	NA	NA
Potassium	12,300	NA	NA	Soft ductile, silvery-white, very reactive metal	NA	NA	NA	NA
Selenium	3,200	NA	NA	Steel gray, nonmetallic element	NA	NA	NA	NA
Sodium	342,000	NA	NA	Light, soft, ductile, malleable, silver-white metal, highly reactive	Inhalation Ingestion Dermal contact	NA	Reacts with body moisture to cause burns	NA
Strontium 89,90 (pCi/l)	5.6	1.25 rems/year	NA	NA	NA	NA	NA	NA
Strontium	2,430	NA	NA	Silvery-white metal	Ingestion Inhalation	NA	Moderately toxic by ingestion, inhalation	NA
Tritium	777	1.25 rems/year	NA	NA	NA	NA	NA	NA
Total Uranium	54.6	1.25 rems/year	NA	NA	NA	NA	NA	NA
Vanadium	36.8	NA	NA	Bright, white, soft ductile, slightly radioactive metal	NA	NA	Carcinogenic, lung irritant	NA

Table 2-3
Chemical Hazards Posed by Site Contaminants

Contaminant (Synonyms) (Abbreviations)	Max. Detected Concentration µg/l	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	PIP
Zinc	2,460	NA	NA	Bluish-white, lustrous metal	Inhalation Dermal contact	NA	Lung and skin irritant, relatively nontoxic to humans by inhalation	NA

Key:

ACGIH - American Conference of Governmental Industrial Hygienists
C - Ceiling—Concentration shall not be exceeded at any time
CNS - Central Nervous System
Fl. pt. - Flash point—closed cup, unless otherwise noted.
IDLH - Immediately Dangerous to Life and Health—Maximum concentration from which one could escape within 30 minutes without experiencing any irreversible health effects
IP - Ionization potential (eV)
LEL - Lower Explosive Limit
NA - Not available
OSHA - Occupational Safety and Health Administration
PEL - Permissible Exposure Limit—Concentration that nearly all workers may be repeatedly exposed, day after day, without adverse effect. (Based on an 8-hour workday and 40-hour workweek).
PIP - Photoionization potential
PPM - Parts Per Million
TLV - Threshold Limit Value—Concentration that nearly all workers may be repeatedly exposed, day after day, without adverse effect. (Based on an 8-hour workday and 40-hour workweek).
UEL - Upper Explosive Limit
ug/m^3 - micrograms per cubic meter
VP - Vapor Pressure at 68°LF in millimeters (mm) mercury (Hg) unless otherwise noted.

References

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1990 to 1991.

National Institute of Occupational Safety and Health, Pocket Guide to Chemical Hazards, 1985.

Sax, N. Irving and Richard J. Lewis, Sr., Rapid Guide to Hazardous Chemicals in the Workplace. Van Nostrand Reinhold Company, New York, 1986.

2.7 PERSONAL PROTECTIVE EQUIPMENT (PPE) SPECIFICATION[1] (REFERENCE CH2M HILL SOP HS-07 and HS-08)

Task	Level	Body	Foot	Head[2]	Eye	Hand	Respirator	Hearing Protection
1. Operation of UV/H_2O_2	D	Cotton work coveralls	Safety shoes	Hardhat	UV filtering safety glasses with side shields	Leather work gloves	None required	Depends upon results of noise monitoring[3]
2. Filling H_2O_2 feed tank or working with H_2O_2 feed system	D	Tyvek coveralls	Safety shoes	Hardhat	Full face splash shield	PVC or nitrile outer gloves line with latex inner liners	None required	Depends upon the results of noise monitoring
3. Changing UV bulbs in UV/H_2O_2 system	D	Cotton work coveralls	Safety shoes	Hardhat	Safety glasses	Either leather work gloves or line with rubber gloves	None required	Depends upon the results of noise monitoring
4. Operation of IX	D	Cotton work coveralls	Safety shoes	Hardhat	Safety glasses with side shields	Leather work gloves	None required	Depends upon results of noise monitoring
5. Operation of degasser column	D	Cotton work coveralls	Safety shoes	Hardhat	Safety glasses with side shields	Leather work gloves	None required	Depends upon results of noise monitoring
6. Operation of motorized pumps to transfer fluids	D	Cotton work coveralls	Safety shoes	Hardhat	Safety glasses with side shields	Leather work gloves	None required	Depends upon results of noise monitoring
7. Removal and replacement of filter bags	C	Tyvek coveralls	Safety shoes	Hardhat	Safety glasses with side shields	Latex inner glove liners and nitrile outer gloves	APR, full face, MSA Ultratwin or equivalent, cartridges—GMC-H	Depends upon results of noise monitoring
8. Cleaning UV lamps and changing bulbs	D	Tyvek coveralls	Safety shoes	Hardhat	Safety glasses with side shields	Latex inner glove liners and nitrile outer gloves	None required	Depends upon results of noise monitoring
9. Regeneration of IX columns	D	Cotton work coveralls	Safety shoes	Hardhat	Safety glasses with side shields	Leather work gloves	None required	Depends upon results of noise monitoring
10. Removal and replacement of IX resins	D or C	Tyvek coveralls	Safety shoes with latex boot covers	Hardhat	Splash proof goggles	Latex inner glove liners and nitrile outer gloves	APR, full face, MSA Ultratwin or equivalent cartridges—GMC-H	Depends upon results of noise monitoring
11. Calibration of flow meters and pumps	D	Cotton coveralls	Safety shoes	Hardhat	Safety glasses with side shields	None required	None required	Depends upon results of noise monitoring
12. Collecting water samples	D	Cotton coveralls	Safety shoes	Hardhat	Splash proof goggles	Latex inner glove liners and nitrile outer gloves	None required	Depends upon results of noise monitoring

2.7 PERSONAL PROTECTIVE EQUIPMENT (PPE) SPECIFICATION[1] (REFERENCE CH2M HILL SOP HS-07 and HS-08)

Task	Level	Body	Foot	Head[2]	Eye	Hand	Respirator	Hearing Protection
13. Repair or disassembly of process piping or opening of oxidation chamber	D or C	Tyvek coveralls	Safety shows with latex bootcovers	Hardhat	Splash proof goggles	Latex inner glove liners and nitrile outer gloves	May require APR with MSA GMC-H cartridges or equivalent if VOC's > ppm.	Depends upon results of noise monitoring

[1]Modifications: These specifications may change pending receipt of vendor's O&M manuals.
[2]The SSC shall specify hardhat areas.
[3]Noise monitoring will be conducted by contractor.

2.7.1 REASONS TO UPGRADE OR DOWNGRADE LEVEL OF PROTECTION

Upgrade	Downgrade
• Request of individual performing task. • Change in work task that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

2.8 NEW TECHNOLOGIES TO REDUCE EXPOSURES

Many of the operations performed at the groundwater treatment plant are conducted remotely through automated controls. For example, the sulfuric acid and sodium hydroxide are delivered to their storage tanks by automated piping systems, eliminating the need for manual transfers. There will be as little contact as possible with site contaminants.

3.0 SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS

3.1 RESIDUALS HANDLING

Any material that comes into contact with the effluent groundwater or hazardous materials used at the site will be considered hazardous under RCRA and handled appropriately. These materials are called residuals. Residuals will be collected and sorted into four groups:

- Cloth—PPE, chem wipes, gloves
- Glass—Sample bottles
- Dirt—Soil
- Garbage

Garbage is nonhazardous only if it has not come into contact with hazardous waste. All other groups will be stored in labelled drums.

3.2 MATERIALS HANDLING

All drums and containers shall be labelled appropriately. Drum staging areas shall be kept to a minimum number necessary to classify materials safely and prepare them for transport.

3.3 SAFETY REQUIREMENTS FOR OPERATING THE PEROX-PURE SYSTEM (UV/H_2O_2)

See Attachment 4.

3.4 REQUIREMENTS FOR THE ION EXCHANGE SYSTEM MAY BE INCLUDED AS ATTACHMENT 7 AFTER RECEIPT OF VENDOR'S O&M MANUAL.

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4.0 MEDICAL SURVEILLANCE REQUIREMENTS

(REFERENCE CH2M HILL SOP HS-01 AND HS-02, IT Environmental Restoration Project Health and Safety Program Plan, and Rocky Flats Plant Environmental Restoration Health and Safety Program Plan)

4.1 MEDICAL SURVEILLANCE REQUIREMENTS

All employees who work onsite are required to undergo and pass a baseline physical examination which complies with 1910.120(f)(4), or annual follow-up physical (if due). Employees are required to submit certification, with a physician's signature, of medical fitness for duty and whether or not the employee is able to wear respiratory protection. All treatment plant operators must submit and pass a drug/alcohol screening test prior to initiation of field activities. Fitness-for duty documentation will be maintained onsite.

Follow-up medical monitoring may be required after an employee has developed signs or symptoms indicating possible overexposure to hazardous substances, or if an employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation.

5.0 TRAINING REQUIREMENTS

40-hour initial hazardous waste worker training, 3-day site specific training, and 8-hour annual refresher training requirements of OSHA 29CFR1910.120 are required for all operators. In some cases, 24-hour training is acceptable, depending on the nature of the work. This will be decided case by case. Employees designated Site Safety Coordinator, "SSC" have received 8 hours of supervisor training and can serve as site safety coordinator (SSC) for the level of protection indicated. There must be one SSC present during any task performed with the potential for exposure to safety and health hazards. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. There must be one FA-CPR designated employee present during each shift. The "buddy system" requirements of OSHA 29CFR1910.120 are to be met at all times.

In addition, all employees who are classified as operators at the treatment plant will complete a Basic Radiation Safety class, Hazard Communication Training and respiratory protection class, including a quantitative fit test. A separate respiratory protection class need not be attended if 40-hour initial training or annual refreshed training includes respiratory protection. Quantitative fit tests for a full-face respirator are to be scheduled by EG&G. Anyone who operates a fork lift is required to complete a fork lift safety class. All training documentation is to be kept onsite. An initial site-specific safety briefing is to be conducted by the SSC which shall cover the contents of this HSP. Daily safety meetings will be held.

6.0 AIR MONITORING EQUIPMENT SPECIFICATION

Note: Additional recommendations for sampling may be made after receipt of the vendor's O&M manuals.

Instrument	Tasks	Action Levels		Frequency	Calibration
CGI: MSA 360 or equivalent	Tank cleaning any confined space entry	0-10% LEL 10-25% LEL >25% LEL	No expl.[1] hazard Pot.[2] expl. hazard Expl. hazard; evacuate or vent	As specified on IWCP and confined space entry checklist	Daily
0_2 meter: MSA 360 or equivalent	Tank cleaning any confined space entry	> 22.0% O_2 20.9% O_2 < 19.5% O_2	Expl. hazard; evacuate or vent Normal O_2 O_2 def.[3]; vent or use SCBA	As specified on IWCP and confined space entry checklist	Daily
Photoionization Detector (PID): HNu at 11.7 EV probe	When sampling water, changing bag filters, changing or cleaning UV bulbs	0-1 ppm[ab4] 1-5 ppm[ab] 7-5 ppm[ab]	Level D Level C Stop work; re-evaluate	Take background monitor continuously while performing task	Pre and post tasks
Radiation Meter: Ludlum Model; 12 rate meter with a 43.5 alpha scintillation detector probe	Changing bag filters, cleaning or changing UV bulbs	Any positive reading 50 cpm or greater	Decontamination Decontaminate and notify IT Health Physicist	Continuously while performing tasks; monitor personnel and equipment	Daily. Field source check. Monitoring performed by contractor.
Radiation Meter Ludhem Model 2,000 scaler with a Ludlum 43-10 alpha scintillation detector—(use IT's)	To be used for smear samples taken on equipment that has contacted spent filter bags, resins, ion exchange units.	Any 100 cm^2 area that exceeds a count rate equal to 20 dpm shall be decontaminated. Call IT Health Physicist.		Post contact with equipment that has been potentially contaminated with treated or untreated groundwater.	Field source check only. Kept at IT trailer. Performed by operator.
(NaI) Tl scintillation detector with Ludlum μ Roentgen Meter	To be used once per month to perform gamma radiation field surveys. Use IT's.	>3,000μ Roentgen/hr—Call IT Health Physicist.		Once per month	Field source check. Kept at IT trailer. Performed by operator.
Draeger pump and colorimetric indicator tubes	As needed—currently none specified.	Follow instructions.		As needed	None
Sound Level Monitor: Must meet ANS1.S1.4 (1971) type S2A specifications. Set to "A" Network with slow meter response.	Initially at plant startup	>85dB—Conduct noise dosimetry to establish 8-hour TWA.		Only when needed	Pre and post survey performed by operator.

[1]expl = explosion
[2]pot = potential
[3]def = deficient
[4]ab = above background
[5]N/A = not applicable

Note: Personal sampling with passive organic vapor badges may be performed if a problem with organic vapors in air is detected. Currently, this is not a requirement.

Employee Name	Office	Responsibility	SSC/FA-CPR
Jim Soutte	OMI	Supervisor and Site Safety Coordinator	Level (C) SSC; FA-CPR
Steve Moulling	OMI	Operator	
Mike Land	OMI	Operator	
Dean Robb	IT		

6.1 CALIBRATION SPECIFICATION

Instrument	Gas	Span	Reading	Method
PID: HNU, 11.7 ev probe	100 ppm isobutylene	5.0 ± 2.0	68 ppm	1.5 l/m reg T-tubing 0.25 l/m reg direct tubing
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL ± 5 % LEL	1.5 l/m reg direct tubing

7.0 DECONTAMINATION SPECIFICATION (REFERENCE CH2M HILL SOP HS-13)

Personnel	Sample Equipment
• Outer glove removal	• Wash/rinse equipment
• Body suit removal	• Deionized water rinse equipment
• Inner glove removal	
• Respirator removal	
• Wash respirator in sanitizer	
• Rinse in water	
• Hand wash/rinse	
• Face wash/rinse	
• Shower ASAP	
• PPE disposal method: put in designated drums	
• Water disposal method:	

Cotton coveralls will be laundered by EG&G. EG&G showers are available for use. Shower should be taken after changing bag filter. Contractor will wash and sanitize all respirators.

8.0 SPILL CONTAINMENT PROCEDURES

The following tasks or operations have the possibility of a spill:

A. Rupture of an influent or effluent line or valve into any storage or process tanks

B. Resins may spill during removal or replacement of IX resins
C. Collecting water samples

The following materials will be kept onsite to contain small spills (less than 1 pound or 1 pint of a liquid or solid hazardous substance):

Soda ash or lime
Large quantities of water

Small quantities of hydrochloric acid may be neutralized with soda ash or lime and water. Small quantities of hydrogen peroxide and sodium hydroxide may be neutralized with water. Do not flush these down a drain. Vacuum up or scoop up and dispose as hazardous waste. Personnel shall wear neoprene gloves, steel-toed boots, polycoated tyvek, splash proof goggles or a face shield, and full-face APR with GMC-H cartridges when cleaning up a small spill.

In the event of a spill of a liquid hazardous substance that is greater than 1 pint or 1 pound, a solid hazardous substance spill greater than 1 pound, or any gaseous release, notify the site supervisor and the shift superintendent immediately. The shift superintendent will make the appropriate notifications to implement the appropriate responses. Life threatening hazardous material spills or releases are reported by calling 2911. Nonemergency spills are reported by calling 2914. If it can be **safely** accomplished, site personnel can take immediate action to mitigate a spill when it is discovered. Personnel shall only take mitigating action when they are certain of the hazards that exist and are trained to react appropriately. The shift superintendent must be immediately informed of the spill. If a hazardous substance spill poses no greater risk than those experienced during normal duties, the employee may be instructed to clean up the spill. EG&G Industrial Safety, Industrial Hygiene, Radiological Engineering, Radiological Operations, or other applicable departments shall be available for additional instruction on how to handle minor spills. All operating areas within the plant that contain tanks or processes where spills may occur have sloped floors that lead to a drain and sump pump where the spilled contents are neutralized and treated. Tanks and process areas are diked.

9.0 CONFINED SPACE ENTRY

Confined space entry requires compliance to EG&G HSP 6.04 and the IWCP program. The confined space entry checklist, or its equivalent, shall be followed and completed each time a task identified as a confined space entry is performed. The EG&G IWCP area coordinator is to be contacted prior to plant startup.

10.0 WORK PROCEDURES

10.1 WORK PRACTICES (May be changed pending receipt of Vendor's O&M Manual)

- No smoking, except in designated areas.
- No spark or ignition sources.
- SSC to establish areas for eating, drinking, smoking.
- No facial hair that would interfere with respirator fit if Level C.

10.2 SITE CONTROL MEASURES

- Site safety coordinator (SSC) to conduct site safety briefing before starting field activities, or as tasks and site conditions change. Daily safety briefings must be held.
- SSC records safety briefing attendance in logbook, and documents topics discussed.
- Post OSHA job site poster in a central and conspicuous location at the site.
- Establish decontamination procedures, including respirator decontamination procedures, and test.
- Discuss access (entry and exit) from plant.
- Chemicals to be stored in proper containers.
- MSDSs are available for onsite chemicals employees may be potentially exposed to during operations.
- Establish onsite communications.
- Establish "buddy" system.
- Establish procedures for disposal of material generated onsite.
- Air monitoring conducted by SSC in appropriate level of protection.
- SSC to conduct periodic inspections of work practices to determine effectiveness of this plan. Deficiencies to be noted, reported to project health and safety officer and corrected.
- Site safety briefing topics: general discussion of health and safety plan; site specific hazards; PPE requirements; equipment; special procedures; emergencies, spill cleanups.

11.0 EMERGENCY RESPONSE PLAN (REFERENCE CH2M HILL SOP HS-12)

11.1 PRE-EMERGENCY PLANNING

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with the facility and local emergency service providers as appropriate.

- Coordinate preplanning with RFP Fire Department and Emergency Preparedness.
- All visitors will be briefed on the Health and Safety Plan.
- All visitors and personnel will participate in a building indoctrination.
- Locate nearest telephone to the site and inspect onsite communications.
- Locate chemical, safety, radiological, biological hazards.
- Confirm and post emergency telephone numbers and route to hospital and Medical Building 122.
- Post site map marked with location of emergency equipment and supplies.
- Review emergency response plan for applicability to any changed site conditions, alterations in onsite operations, or personnel availability.
- Evaluate capabilities of local response teams.
- Where appropriate and acceptable to the client, inform emergency room/ambulance service and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside.
- Inventory and check site emergency equipment and supplies.
- Review emergency procedures for personnel injury, exposures, fires, explosions, chemical and vapor releases with field personnel.
- Locate onsite emergency equipment and supplies of clean water.
- Verify local emergency contacts, hospital routes, evacuation routes, and assembly points.
- Drive route to hospital.

11.1 (continued)

- Review names of onsite personnel trained in first aid and CPR.
- Review notification procedures for contacting CH2M HILL's medical consultant and team member's occupational physician.
- Rehearse the emergency response plan once prior to site activities.
- Brief new workers on the emergency response plan.

11.2 EMERGENCY EQUIPMENT AND SUPPLIES

The SSC marks the locations of emergency equipment on the site map, phone, evacuation routes, assembly areas, and direction of north and posts the map in the office.

- 20-lb ABC fire extinguisher
- Industrial first aid kit
- Facility emergency equipment
- 15-minute eye wash station that complies with EG&G HSP 7.04 requirements
- Emergency shower that complies with EG&G HSP 7.04 requirements

11.3 EMERGENCY MEDICAL TREATMENT

- The SSC will assume charge during a medical emergency until the ambulance arrives, or the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR.
- Call the ambulance and hospital at extension 2911.
- Determine if decontamination will make injury worse. Yes--seek medical treatment immediately.
- Make certain that injured person is accompanied to emergency room.
- Notify the Project Manager of the injury, EG&G Project Manager.
- Notify the CH2M HILL District Health and Safety Manager and CH2M HILL Project Manager.
- Notify the injured person's human resources department (CH2M HILL, OMI, IT).
- Prepare an incident report. Submit this to the Corporate Director Health and Safety (WDC) and Corporate Human Resources Department (DEN) within 48 hours.

11.4 EVACUATION

- Evacuation routes will be designated by SSC prior to beginning of work.
- Onsite and offsite assembly points will be designated prior to beginning of work.
- Personnel will exit the exclusion zone and assemble at the onsite assembly point upon hearing the emergency signal for evacuation of the exclusion zone.
- Personnel will assemble at the offsite point upon hearing the emergency signal for a site evacuation.
- The SSC and a "buddy" will remain onsite after the site has been evacuated (if safe to do so) to assist local responders and advise them of the nature and location of the incident.
- SSC accounts for all personnel in the onsite assembly zone.
- A person designated by the SSC (prior to work) will account for personnel at the offsite assembly area.
- The SSC is to write up the incident as soon as possible after it occurs, and submit a report to the Corporate Director Health and Safety.

11.5 EVACUATION ROUTES AND ASSEMBLY POINTS

Obtain Rocky Flats Plant Evacuation Plan.

11.6 EVACUATION SIGNALS

All personnel shall call 966-7541 to listen to a recording of RFP alarm signals and the significance of each. **Verbal warning—evacuate WWTP.**

11.7 FIRE RESPONSE PROCEDURES

In all cases, the Fire Department shall be notified at ext. 2911.

- Small, localized fires shall be handled using the appropriate fire extinguishers, by trained personnel only, to bring the occurrence under control.
- Uncontrolled fires shall be handled by the fire department, workers should use the manual fire telephone station, or call ext. 2911, then evacuate the area.
- If the fire releases potentially toxic gases, all persons in the immediate vicinity shall be evacuated upwind. The fire department shall then be informed of the toxic gases.

12.0 EMERGENCY RESPONSE TELEPHONE NUMBERS

SITE ADDRESS: **Phone:**

Police: **Phone:** 2911
Address: Rocky Flats Plant

Fire: **Phone:** 2911
Address: Rocky Flats Plant

Ambulance: **Phone:** 2911
Address: Rocky Flats Plant

Hospital: Rocky Flats Plant Medical Building **Phone:** 2911
Address: Building 122

Route To Hospital: (Refer to map Figure 1.1)

12.1 GOVERNMENT AGENCIES INVOLVED IN PROJECT

Federal: Department of Energy
Environmental Protection Agency

State: Colorado Department of Health

13.0 KEY PERSONNEL AND EMERGENCY CONTACTS

EG&G Project Manager Name: Craig Cowdery Phone: 966-5944	**CH2M HILL Task Manager** Name: Clint Smith Phone: 771-0900, ext. 2601
IT Health and Safety Liaison EG&G Name: Dina Sassone Phone: 966-5875	**EG&G Environmental Restoration Health and Safety Officer** Name: Dennis Smith Phone: 966-5958
CH2M HILL Project Health and Safety Officer Name: Jane Stansfield/DEN Phone: 771-0900 ext. 2383	**EG&G Health and Safety Officer** Name: Jeff VanMeighem Phone: 966-5810
CH2M HILL Radiation Health Manager (RHM) Name: George Stephens/ORO Phone: 615/483-9032	**Site Safety Coordinator (SSC)** Name: Jim Soutee/CH2M HILL Home Phone: 429-5465
IT Technical Manager Name: Les Osborn/IT Phone: 793-5200	**CH2M HILL Regional Manager** Name: Doyle Tinkey Phone: 771-0900
IT Radiation Safety Officer Name: Brian Rothman Phone: 793-5200	**CH2M HILL Regional Human Resources Department** Name: Nancy Orr/DEN Phone: 771-0900
IT Health and Safety Officer Name: Tammy Bernardi Phone: 793-5200	**Corporate Human Resources Department** Name: Beth Brown/DEN Phone: 303/771-0952
CH2M HILL Corporate Director Health and Safety Name: Marty Mathamel/WDC Phone: 703/471-1441	If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured. Notification **must** be made within 24 hours of the injury.
CH2M HILL Medical Consultant Dr. Kenneth Chase Washington Occupational Health Associates 202/463-6698 (8 AM to 5 PM EST) 202/463-6440 (after hours answering service; physician will return call within 30 minutes)	**Occupational Physician (Local)** Name: Dr. Rupert Burtan Phone: 758-1482

14.0 PLAN APPROVAL	
The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if these conditions change.	
PLAN WRITTEN BY: Jane Stansfield/CH2M HILL	**DATE:** February 14, 1992
PLAN APPROVED BY:	**DATE:**
14.1 PLAN AMENDMENTS	
DATE: CHANGES MADE BY:	
CHANGES TO PLAN:	
APPROVED:	**DATE:**
14.2 PLAN AMENDMENTS	
DATE: CHANGES MADE BY:	
CHANGES TO PLAN:	
APPROVED:	**DATE:**

15.0 ATTACHMENTS TO PLAN

Attachment 1: Employee signoff
Attachment 2: Form 533
Attachment 3: Applicable MSDSs
Attachment 4: Safety Requirements for Operating the Perox-Pure System (UV/H_2O_2.)

ATTACHMENT 1

EMPLOYEE SIGNOFF

The employees listed below have been provided a copy of this health and safety plan, have read and understood it, and agree to abide by its provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE / DATE

ATTACHMENT 2

FORM 533
RECORD OF HAZARDOUS WASTE FIELD ACTIVITY

SITE NAME:
SITE SAFETY COORDINATOR:
PROJECT NUMBER:
RECORD OF ACTIVITIES FOR (DATES):

EMPLOYEE NAME / NUMBER	TOTAL DAYS ONSITE	DAYS IN LEVEL B	DAYS IN LEVEL C	DAYS IN LEVEL D	DAYS AS SSC LEVEL B	DAYS AS SSC LEVEL C	DAYS AS SSC LEVEL D	ACTIVITIES PERFORMED

Attachment 3
Applicable MSDSs

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN ST., SCHENECTADY, NY 12303 USA (518) 377-8854

MSDS # 3A
SODIUM HYDROXIDE
50% LIQUID
Revision A
Issued: October, 1977
Revised: August, 1985

From Genium's MSDS Collection, to be used as a reference.

SECTION 1. MATERIAL IDENTIFICATION

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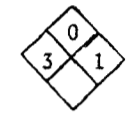
MATERIAL NAME: SODIUM HYDROXIDE, 50% LIQUID
OTHER DESIGNATIONS: Liquid caustic soda, lye solution, CAS #1310-73-2 (NaOH).
MANUFACTURER: Available from many sources including:
Diamond Shamrock Co., Chlor-Alkali Div.
351 Phelps Court, Box 152300
Irving, TX 75015-2300
(800) 241-3134



SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
SODIUM HYDROXIDE (NaOH)	>48.5	Ceiling Limit: 2 mg/m^3*
TYPICAL IMPURITIES:		
Carbonate (as Na_2CO_3)	<0.25	1% NaOH Soln
Chloride (as NaCl)	<1.15	
Chlorate (as $NaClO_3$)	<0.25	Eye, rabbit: Severe irritation
Sulfate (as Na_2SO_4)	<0.03	
Silica (as SiO_2)	<0.01	
Water	balance	

* Current (1985-86) ACGIH TLV. Current OSHA PEL is 2.0 mg/m^3 averaged over 8 hours.

SECTION 3. PHYSICAL DATA

Boiling point, 1 atm .... ca 140°C
Volatiles (water) 50%
Water Solubility ..... complete
Viscosity @ 20°C, cps ... 50
Specific gravity, 60/60°F ... 1.53
Density, lbs/gal 12.76

APPEARANCE & ODOR: Clear liquid - No odor.

DESCRIPTION: A 50% solution of sodium hydroxide (NaOH) in water.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits in Air	Lower	Upper
None - not combustible	N/A	N/A	N/A	N/A

EXTINGUISHING MEDIA:
Use extinguishing agents suitable for the surrounding fire. Use water spray to cool containers of this material which are involved in a fire situation to help prevent rupture.
Sodium hydroxide will react with metals such as aluminum, tin, and zinc to generate flammable and explosive hydrogen gas.

Firefighters should wear self contained breathing apparatus and full protective gear to prevent contact with this corrosive material.

SECTION 5. REACTIVITY DATA

This material is stable under normal storage conditions in sealed containers. Polymerization will not occur. There are no hazardous decomposition products. It reacts with CO_2 in the air to form sodium carbonate. It reacts violently with acids accompanied by heat generation and with many organic chemicals, especially nitrocarbons and halocarbons. It can react with trichloroethylene to form spontaneously flammable dichloroacetylene.
Avoid contact with leather and wool. Contact with aluminum, tin, magnesium, zinc, and alloys that contain these metals causes the formation of hydrogen gas (MSDS #65) (flammable).

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SECTION 6. HEALTH HAZARD INFORMATION

TLV Ceiling Unit: 2 mg/m^3

Sodium Hydroxide is a strong alkali and is dangerous when improperly handled. It is destructive to all human tissue it contacts, producing severe burns. Eye contact causes severe, permanent injury. Skin contact causes irritation and, if not removed immediately, severe burns with scarring. The effects of inhalation of the mist varies from mild irritation to destructive burns. Pneumonitis may occur. Ingestion causes severe burns of the mouth, throat and stomach and may be fatal.

FIRST AID: Wash eyes immediately with plenty of running water for at least 15 minutes, including under eyelids and all surfaces. Speed in rinsing eyes with water is important if permanent injury is to be avoided. Get medical help immediately. SKIN CONTACT: Flush exposed area promptly with large quantities of water. Remove contaminated clothes while washing. Prolong washing in serious cases until medical help arrives. Get medical attention for serious exposure. INGESTION: Immediately give person large quantities of water or milk to drink. (Never give anything by mouth to an unconscious person). Do not induce vomiting. Obtain medical assistance immediately. INHALATION: Remove from exposure to mist and get prompt medical help. (Paramedic, Inplant, community).

SECTION 7. SPILL, LEAK AND DISPOSAL PROCEDURES

Planning ahead is essential for handling spills. Clean-up personnel should wear protective equipment to prevent skin and eye contact. Pick-up spill with vacuum equipment (alkali resistant) for disposal or flush to holding area with water. Neutralize residue with dilute acid and rinse with water.

DISPOSAL: Waste caustic must never be discharged directly to sewers, drains or surface waters. Dilute well with water and carefully neutralize with acid. Follow all applicable federal, state and local regulations.

EPA HAZARDOUS WASTE NUMBER: D002, corrosive (soln c̄ pH $\geq$12.5)-40CFR 261.22

REPORTABLE SPILL QUANTITY: 1000 lbs (40CFR117)

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide adequate general ventilation and exhaust ventilation to meet TLV requirement, especially where the possibility of mist formation exists. Use a NIOSH-approved respirator with full face covering for mist, where needed. Use chemical safety goggles. A plastic faceshield, in addition to safety goggles, should be worn if splashing is probable. Use rubber gloves, apron or protective clothing and rubber boots where needed to prevent contact with sodium hydroxide solution.

Eyewash stations and safety showers must be immediately available.

THIS MATERIAL POSES A SPECIAL HAZARD TO CONTACT LENSES WEARERS; the slippery nature of this solution would make it extremely difficult to remove the contact lenses. Critical rinsing of the contaminated eye would be delayed.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store in well-sealed containers. Protect containers from physical damage. Avoid handling conditions which can lead to spills or mist formation. Have abundant water (preferably running water) available where material is stored, unloaded, and handled for emergency use. Drains servicing areas where this material is stored or used should have retention basins for pH adjustment and dilution of spills and flushings before discharge. Workers handling this material should be trained in proper handling precautions and emergency procedures, with proper protective equipment nearby.

DOT HAZARD CLASSIFICATION: Corrosive Material

DOT LABEL: Corrosive

DOT ID NUMBER: UN1824

DATA SOURCE(S) CODE (See Glossary) 2, 4, 9, 11, 12, 27, 55, 58.V.

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APPROVALS. JO Accrocco, 11/85

INDUST. HYGIENE/SAFETY 11/85

MEDICAL REVIEW: Nov 85

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perox-gard.
Hydrogen Peroxide

Material Safety Data Sheet

Section I	Name		
Product	Hydrogen Peroxide 50%		
Chemical/ Synonyms	H_2O_2/Peroxide		
Chemical Family	Inorganic Peroxide		
C.A.S. Number	7722-84-1	UN Number	2014

Emergency Assistance

Chemtrec - 1-800-424-9300
P.S.I. - (602)-327-0277

Hazard Rating

Least 0 | Slight 1 | Moderate 2 | High 3 | Extreme 4

Health	2
Fire	0
Reactivity	2

Section II — Ingredients

Composition	%	Toxicity Data
Hydrogen Peroxide	50	90% H_2O_2
Water	50	Oral LD_{50}: 2gm/kg (mouse)
Stabilizers	Trace	

Section III — Physical Data

Boiling Point (°F)	237 @ 760 MM Hg.	Melting Point (°F)	-61	Vapor Pressure (mmHg)	18 @ 86°F
Specific Gravity (H_2O = 1)	1.195 @ 68°F	% Volatile By Volume	100	Vapor Density (Air = 1)	NA
Solubility In Water	Complete	Evaporation Rate (Butyl Acetate = 1)	Less than 1		

Appearance And Odor: Clear, colorless liquid. Concentrations over 35% may have sharp odor.

Section IV — Reactivity

Stability: ☐ Unstable ☒ Stable

Hazardous Polymerization: ☐ May Occur ☒ Will Not Occur

Conditions And Materials To Avoid

Contamination by many substances including heavy metals and their salts, reducing agents, strong oxidizers, alkalies and particulate solids will cause decomposition. The rate of decomposition increases with increasing temperature and may be very vigorous with rapid generation of large volumes of oxygen and steam. Consult Peroxidation Systems, Inc. on handling and materials of construction.

Hazardous Decomposition Products

Oxygen, steam, peroxide vapor and heat.

4.0 **SAFETY DATA SHEET(S)**

MSDS #: 88227(1) (Hydrogen Peroxide)

Section V	Fire And Explosion Hazards		
Flash Point And Method Used NA	Flammable Limits (% Volume In Air) non-flammable	Lower	Upper

Extinguishing Media

Water

Special Fire Fighting Procedures And Precautions

Wear protective clothing and self-contained breathing apparatus.

Unusual Fire And Explosion Hazards

Strong oxidizer: Hydrogen peroxide is not flammable but can initiate spontaneous combustion of paper, wood, cloth, and other organic materials. Ignition may be rapid, but can be delayed for several hours. Rapid oxygen evolution from decomposing hydrogen peroxide may increase the intensity of a fire.

Oxygen enrichment of poorly ventilated organic atmospheres increases the potential of vapor phase explosions.

Section VI — **Emergency And First Aid Procedures**

Skin/eyes: Flush with large amounts of water for at least 15 minutes. Quickly remove contaminated clothing and shoes. Flush clothing with large amounts of water. Contact a physician in case of eye contact with peroxide.

Ingestion: Drink large amounts of water to dilute. Sit upright. Contact physician.

Note to Physician

It may be advisable to insert a gastric tube to relieve or prevent increased pressure that may result from the rapid evolution of oxygen upon decomposition.

Inhalation: Remove victim to fresh air. Contact a physician.

Section VII — Employee Protection

Respiratory Protection

Self-contained breathing apparatus should be available.

Protective Clothing

Adequate eye protection, rubber gloves and boots, PVC slicker suit.

Additional Protective Measures

Water source and safety shower/eye wash should be located close to where hydrogen peroxide is handled.

Section VIII — Health Information

Exposure to skin or eyes may cause chemical burns. Inhalation of vapor or mist may cause irritation or chemical burns to mucous membranes and respiratory system.

Ingestion may cause chemical burns as well as injury by distention of the esophagus or stomach due to the sudden evolution of gasses.

Section IX — Occupational Exposure Limits

ACGIH - TLV - TWA - 1 ppm
OSHA - 8 hour time weight average (TWA) = 1 ppm

Section X — Environmental Protection

Spill Or Leak Procedures

Flush spill area with large amounts of water. Do not return spilled material to original container. Comply with Federal, State and local regulations on reporting spills.

Waste Disposal

Dilute with large amounts of water then flush to sewer. Comply with Federal, State and local regulations.

Environmental Hazards

None

perox-gard

Hydrogen Peroxide

Material Safety Data Sheet

Section XI — Special Precautions

1) Avoid heating hydrogen peroxide and store away from combustibles.

2) Do not contaminate hydrogen peroxide.

3) Storage containers/vessels for hydrogen peroxide must be vented and made of compatible plastics, 304 or 316 stainless steel, or high purity aluminum. Contact Peroxidation Systems, Inc. for additional information regarding other compatible materials.

Section XII — Transportation Requirements

Department Of Transporation Classification

☐ Flammable Liquid	☐ Combustible Liquid	☒ Oxidizing Material	☐ Non-Flammable Gas
☐ Flammable Solid	☐ Poison, Class A	☐ Corrosive Material	☐ Not Hazardous By D.O.T. Regulations
☐ Flammable Gas	☐ Poison, Class B	☐ Irritating Material	☐ Other - Specify Below

D.O.T. Proper Shipping Name

Hydrogen peroxide solution, 50% peroxide.

Other Regulations

Hydrogen peroxide in concentrations below 52% is not regulated as a hazardous material when shipped in tank trucks or tank cars.

Section XIII — Other Regulatory Controls

Contains stabilizers and promoters compatible for use with the perox-pure™ UV/Hydrogen Peroxide chemical oxidation process and perox-gard™ sulfide control services.

FDA - Food grade hydrogen peroxide must meet Food Chemical Code specifications.

Peroxidation Systems, Inc.
4400 E. Broadway, Suite 602
Tucson, Arizona 85711

Phone: 1-(602) 327-0277

To the best of our knowledge the information contained in this Material Safety Data Sheet is accurate. However, Peroxidation Systems makes no warranty, expressed or implied, or accepts any liability in connection with this information or its use.

Date Prepared

MAY 1989

5.0 HYDROGEN PEROXIDE FEED MODULE OPERATING INSTRUCTIONS

General

The H_2O_2 feed module provided by PSI for storing and feeding 50% H_2O_2 consists of a polyethylene tank and two or more metering pumps (one pump is an installed spare). The tank and pumps are mounted on a steel channel skid. The metering pumps are connected to the tank outlet by 1/4 inch diameter stainless steel tubing. The pump discharges are manifolded for connecting to the single H_2O_2 injection point at the **perox-pure™** Module via 1/4 inch diameter tubing. Shutoff valves are provided in the metering pump suction and discharge manifolds so that each pump can be isolated to facilitate repairs.

A pressure regulating valve is provided at the pump discharge manifold to prevent excessive pressure in the discharge line. An injection valve is provided at the point of connection to the **perox-pure™** System piping to prevent process water from entering the H_2O_2 feed line. See Arrangement Drawings (Appendix 3.0) for details of this piping.

A safety shower and eyewash are attached to the feed skid for the safety of operating personnel. This must be provided with adequate water supply.

The H_2O_2 pump discharge manifold is provided with a low flow sensor wired to the H_2O_2 module control panel. When wired to the **perox-pure™** Module control panel, this switch will shut the entire system down upon low H_2O_2 flow. This avoids discharging contaminated water.

Receiving and Installation

Upon equipment arrival, inspect immediately for missing parts and shipping damage and note discrepencies on shipping papers before return to driver. PSI must be notified of any shipping problems within ten days of equipment delivery.

Unit may be lifted by use of rectangular fork lift slots in base channels. Carefully set on concrete pad, shim to level and bolt in place. It is recommended that base be shimmed approximately 1" above the concrete to keep steel out of incidental moisture. Grout under base flange at corners and at center of each side. Entire channel base flange may be grouted but leave at least 1 foot gap on down slope side of concrete to act as scupper for drainage. Route 1/4" tubing from pump discharge manifold to injection point of process piping. Tubing should be 316 stainless steel for permanent installations. It may be polyethylene tubing for temporary installations. These components are shop assembled and shipped separately in a parts box.

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 30A

HYDROCHLORIC ACID
(Revision B)
Issued: October 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION 27

Material Name: HYDROCHLORIC ACID

Description (Origin/Uses): Used in the production of chlorides; in refining ore in the production of tin and tantalum; for the neutralization of bases; for pickling and cleaning metal products; for oil- and gas-well treatments; and in removing scale from boilers and heat-exchange equipment.

Other Designations: Aqueous Hydrogen Chloride; Muriatic Acid; HCl/H_2O; CAS No. 7647-01-0

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

NFPA: 0 / 3 / 0 / -

HMIS			
H	3	R	1
F	0	I	4
R	0	S	4
PPG*		K	0

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Hydrogen Chloride, CAS No. 7647-01-0	38 or Less	**OSHA PEL** Ceiling: 5 ppm, 7 mg/m³
Water	Balance*	**ACGIH TLV, 1988-89** TLV-Ceiling: 5 ppm, 7 mg/m³
*Impurities such as iron, chlorine, and traces of organic matter may be present in small amounts, depending on the grade of acid. **See NIOSH, *RTECS* (MW4025000), for additional data with references to reproductive and mutagenic effects. Continue to monitor NIOSH, *RTECS* (MW40300000), for toxicity data on hydrochloric acid itself.		**Toxicity Data**** Human, Inhalation, LC_{Lo}: 1300 ppm (30 Mins) Rat, Inhalation, LC_{50}: 3124 ppm (1 Hr) Rabbit, Oral, LD_{50}: 900 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 227°F (109°C) (20.22%)
Melting Point: -85°F (-65°C) (20.69%)
Vapor Density (Air = 1): 1.268
pH: Strong Mineral Acid
Molecular Weight: Not Applicable
Solubility in Water (%): Complete
Specific Gravity (H_2O = 1): >1
% Volatile by Volume: Ca 100

Appearance and Odor: A clear, colorless-to-lightly yellowed, fuming liquid; sharp, pungent, characteristic, irritating odor of hydrogen chloride gas. This odor is detectable at 1 to 5 ppm and becomes unpleasant and irritating at 5 to 10 ppm; however, the odor serves as a good warning property.

Comments: The specific physical properties of aqueous hydrochloric acid solutions vary with the amount of dissolved hydrogen chloride gas. Hydrochloric acid forms a constant boiling azeotrope (a mixture of hydrochloric acid and water that behaves like a single substance in that its vapor has the same composition as the mixture itself) with water (at 227°F or 109°C) that contains 20.22% hydrogen chloride and has a density of 1.096. Boiling weaker or stronger aqueous solutions results in the loss of either component until the constant boiling acid is produced.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	LEL	UEL
*	*	*	*

Extinguishing Media: *Hydrochloric acid solutions do not burn. Use extinguishing agents that will put out the surrounding fire. **Unusual Fire or Explosion Hazards:** Use a water spray to cool fire-exposed containers of hydrochloric acid to prevent ruptures. Explosive hydrogen gas can be produced by the reaction of hydrochloric acid with metals such as iron. Neutralize spilled hydrochloric acid with limestone, slaked lime, or soda ash to minimize the possible generation of hydrogen gas. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Special neutralization procedures, if applicable, include the application of chemically basic substances such as soda ash or slaked lime.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Hydrochloric acid is stable in closed containers during routine operations at room temperature. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Hydrochloric acid reacts dangerously with acetic anhydride, 2-aminoethanol, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, ethylene diamine, ethylenimine, oleum, perchloric acid, ß-propiolactone, propylene oxide, silver perchlorate and carbon tetrachloride, sodium hydroxide, sulfuric acid, uranium phosphide, vinyl acetate, sodium, and many carbide compounds (Genium ref. 84). This material is a strong mineral acid that is very reactive with bases. **Conditions to Avoid:** Avoid exposure to incompatible chemicals and to any other material whose compatibility with hydrochloric acid or its vapor has not yet been established. The corrosive action of hydrochloric acid on most metals can liberate extremely flammable/explosive hydrogen gas (H_2); piping systems and containment systems must be chosen carefully. **Hazardous Products of Decomposition:** During fires hydrochloric acid may decompose by reacting with certain metals to produce very flammable and explosive hydrogen gas (H_2). Significant amounts of hydrogen chloride gas (HCl) are given off at room temperature; the rate of this generation increases as the temperature and the strength (1%) by weight of HCl in H_2O increase. **Comments:** Reactions between hydrochloric acid and cyanides, sulfides, and formaldehyde, will produce extremely toxic hydrogen cyanide (HCN), hydrogen sulfide (H_2S), sulfur dioxide (SO_2), and *bis*chloromethylether, respectively.

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SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Hydrochloric acid is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: See Genium Industrial MSDS 30 for details of the health effects of hydrogen chloride gas. Hydrochloric acid solutions will generate hydrogen chloride gas with all its health effects. These are irritating to the skin, eyes, and mucous membranes of the upper respiratory tract (URT). The severity of eye injury from splashes depends upon quantity, concentration/strength, and duration of the contact. Permanent visual damage has been reported. Ingestion of hydrochloric acid causes corrosion of the mucous membranes, esophagus, and stomach, as well as nausea, vomiting, intense thirst, and diarrhea. Erosion of exposed teeth may occur. Circulatory collapse and death are possible. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, URT. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Corrosive skin and eye burns, tissue damage, and severe irritation of the URT. **Chronic Effects:** None reported. **FIRST AID: Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Rinse the affected area with flooding amounts of water and then wash it with soap and water. Remove contaminated clothing under a safety shower. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion.** Not likely. Should this type of exposure occur, and the exposed person is responsive, give him or her 2 to 3 glasses of water, then milk of magnesia or limewater to drink. Do not induce vomiting. Spontaneous laryngeal spasms can occur. Never give anything by mouth to someone who is unconscious or convulsing. **Get medical help (in plant, paramedic, community) for all exposures.** Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to physician:** Treatment for respiratory effects following inhalation of hydrogen chloride gas includes using a 5% sodium bicarbonate solution as an aerosol; maintaining a proper fluid balance (diuretics may be useful); and decreasing the inflammatory response of the lungs by administering steroids on a short-term basis (2 to 4 days). Severe inhalation exposure requires hospitalization and observation (72-hour minimum) for the delayed onset of pulmonary edema. Serial chest X rays and respiratory support, including intubation, may be required as an early intervention.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately (hydrogen gas may be generated), and provide adequate ventilation. Cleanup personnel need a full set of protective clothing, including a self-contained breathing apparatus (SCBA). Small spills and residue can be covered with an excess of a mixture of soda ash and slaked lime. After neutralization, do not flush waste directly to a sewer or into lakes, ponds, or streams. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. The allowable concentration of neutral salt in the effluent discharge is apt to be regulated; study and follow Federal, state, and local regulations. Consider saving the waste hydrochloric acid for use as a neutralizing agent during cleanup operations of basic materials.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).
EPA Designations (40 CFR 302.4)
CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg), per the Clean Water Act (CWA), §311 (b) (4)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. All respirators must be acid resistant. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any contact with this material. All clothing must be acid resistant. **Ventilation:** Install and operate general and local maximum-explosion-proof ventilation systems powerful enough to maintain airborne levels of hydrogen chloride below the OSHA PEL cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Make ventilation system ductwork and exposed fan components acid resistant. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. **Other:** Design all engineering systems to be acid resistant and explosion proof (hydrogen gas may be accidentally generated). **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale hydrochloric acid vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store hydrochloric acid in closed containers in a cool, dry, well-ventilated area away from sources of ignition, strong oxidizers, strong bases, out of direct sunlight, and away from incompatible chemicals (see sect. 5). Protect containers from physical damage. **Special Handling/Storage:** Storage areas should have acid-resistant floors and approved drainage facilities. Use nonsparking tools in areas around tanks and pipes where hydrogen gas may be generated. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum-explosion-proof design. Ground and bond all containers and pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations to prevent static sparks. Hydrogen gas may become concentrated inside metal equipment; perform operations to search out possible hidden areas of hydrogen gas carefully. **Other Precautions:** Carefully follow your supplier's recommendations concerning the proper handling and storage procedures for hydrochloric acid. Provide emergency neutralization materials (soda ash, limestone, or slaked lime) and equipment near storage and use areas.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Hydrochloric Acid
DOT Hazard Class: Corrosive Material
ID No. UN1789
DOT Label: Corrosive
DOT Packaging Requirements, DOT Packaging Exceptions: 49 CFR 173.263

IMO Shipping Name: Hydrochloric Acid, Solution
IMO Hazard Class: 8
IMO Label: Corrosive
IMDG Packaging Group: II

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

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Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: W Silverman, MD

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Attachment 4
Safety Procedures for Perox-Pure System

Attachment 4
Safety Procedures for the Perox-Pure System

To prevent injury, operating and maintenance personnel must be properly trained, alert, and must exercise caution when working with the perox-pure™ System. The following specific safety requirements are to be followed. Refer to the operations and maintenance manual.

1. **H_2O_2 is a strong oxidizer.** Always wear protective clothing, gloves of vinyl or other H_2O_2-resistant material, and Class III eye protection and full face shield according to EG&G HSP 7.01 when filling the H_2O_2 feed tank or when working with the H_2O_2 feed system.

   Refer to the Hydrogen Peroxide Safety Data Sheet provided in Attachment 3.

2. **The perox-pure™ Process operates at up to 3,000 volts.** The main disconnect must be in the off position before opening the lamp drive or lamp end enclosure doors for maintenance.

3. **Exposure to ultraviolet light will cause damage to eyes and burns to unprotected skin.** All UV emitting parts are shielded for safety. Nevertheless, always wear plastic, UV-filtering safety glasses when operating the unit. The lamp end enclosure doors at each end of the oxidation chamber must be closed whenever the perox-pure™ Process is operating.

   Intrusion (limit) switches are provided to prevent operation when lamp end enclosure doors are open. Do not interfere with operating of these switches.

4. **The perox-pure™ System is designed to oxidize dissolved organics contained in the untreated water.** These organics may include carcinogens and toxics. Therefore, maintenance personnel should wear suitable protective clothing, eye protection, and breathing apparatus (as specified in Section 2.7) whenever any portion of the process piping or pump must be disassembled for repair, or when the oxidation chamber access panels are opened.

5. **Sight ports are provided for viewing of each lamp and quartz tube.** The sight port glass consists of two parts, a quartz window covered by a blue plastic shield. The plastic shield filters out UV light to allow visual inspection without injury.

   Do **not** remove blue plastic shield from sight port. Eye damage may result. Use UV-filtering safety glasses when operating unit.

6. **Never attempt to insert or remove quartz tubes with bare hands since the tubes may be broken and may cause severe injury.**

7. **The air release valve outlet must be open to the atmosphere at all times to insure against air binding the oxidation chamber.** Do not allow the opening to become plugged or restricted.

8. **Do not allow H_2O_2 to become trapped between closed valves.** Oxygen evolved from decomposition of hydrogen peroxide must be vented properly to prevent injury or equipment damage resulting from excessive pressure within the injection or process systems.

9. **Spillage of H_2O_2 must be washed down immediately with large quantities of water.** Care must be taken to avoid contact with skin, eye, or clothing.

Refer to Hydrogen Peroxide Material Safety Data Sheet provided in Attachment 3.

Appendix B

Respiratory Protection Plan

ROCKY FLATS PLANT WORK PLAN FOR THE STARTUP AND O&M OF THE IM/IRA FOR THE 881 HILLSIDE OU 1	Manual No.: Procedure No.: Effective Date: Organization:	21100-WP OU 01.5 Appendix B 3/3/92 Environmental Management

Appendix B - Respiratory Protection Plan

Approved by:

M C Burmeister

Project Manager

3/4/92

Date

"REVIEWED FOR CLASSIFICATION

By [illegible] (U)

Date [illegible]"

RESPIRATORY PROTECTION PROGRAM

Title: RESPIRATORY PROTECTION

Doc. No.: SOP: HS-08

Rev. No.: 0

Date: 11/01/89

Approved by: David Zuniga Date: 11/27/89
Director, Health and Safety

RESPIRATORY PROTECTION

1.0 PURPOSE AND APPLICABILITY

This standard of practice (SOP) establishes respiratory protection procedures for CH2M HILL employees. The respiratory protection program is based on federal standard 29 CFR 1910.134 (Ref. 1) and the American National Standards Institute (ANSI) standard Z88.2 (Ref. 2). While a variety of respiratory protection equipment is allowable under these standards, the equipment discussed below, which provides a high degree of protection, shall be used for field activities posing health and safety hazards.

2.0 DEFINITIONS

Air Purifying Respirator (APR)	A respiratory protective device that reduces or removes contaminants from ambient air. The devices are not approved for oxygen deficient atmospheres.
Atmosphere Supplying Respirator (ASR)	A respirator that provides air from a source other than the surrounding atmosphere.

3.0 PROCEDURE

Employees working in hazardous or potentially hazardous atmospheres wear respiratory protection under the following conditions:

- Feasible engineering controls cannot provide sufficient oxygen or sufficiently improve atmospheric quality to the point where airborne chemical concentrations are reduced to acceptable limits.
- Protective measures are required for an interim period until feasible engineering controls can be installed.
- The evaluation of hazards is difficult or unreliable, and appropriate feasible engineering controls cannot readily be defined (for any number of reasons, one being chemical variability of site atmospheres).

- Routine or emergency operations (e.g., chemical leak and spill mitigation) could create a hazardous atmosphere that cannot be controlled through engineering means.

- Emergency response might not afford sufficient time to implement effective engineering controls.

The protection program consists of the following elements:

- Procedures for selecting respirators for use at specific work sites

- Medical evaluations of employees who wear respirators

- Procedures for the use of respirators

- Fit testing of negative-pressure APRs

- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, or otherwise maintaining respirators

- Procedures for providing proper quality air for ASRs

- Training of employees in the proper use and maintenance of respirators

- Procedures for periodically evaluating the effectiveness of the program

3.1 MEDICAL SURVEILLANCE

Respirator users shall be certified by a licensed physician. The certification shall be obtained prior to initial use, and annually thereafter. (See SOP HS-01, MEDICAL SURVEILLANCE.)

3.2 EMPLOYEE TRAINING

On an annual basis, each respirator user shall be trained or retrained regarding respiratory protection. Respirator training is an integral part of the initial 40-hour health and safety training and annual 8-hour refresher training conducted in accordance with SOP HS-02 (HEALTH AND SAFETY

TRAINING); such training complies with 29 CFR 1910.120 (Ref. 3).

3.3 RESPIRATOR SELECTION AND USE

Selection of appropriate respiratory protection for field activities is by necessity a dynamic process reflecting the way conditions can change in the course of a site investigation or remedial action. Therefore, selection cannot be based on static decision logic, no matter how well defined. Instead, selection shall be based on flexible policy as well as on the professional judgment of the health and safety officer (HSO) and the site safety coordinator (SSC). This selection process is based on the following:

- Basic restrictions and policies underlying respirator selection and use
- Site-specific factors

Four types of respirators make up the basic inventory of respiratory equipment for field activities:

- Full-facepiece air purifying respirators
- Full-facepiece powered air purifying respirators
- Dual purpose, pressure-demand self-contained breathing apparatus (SCBA)/air line respirators
- Emergency escape respirators (5- to 15-minute capacity)

Only respiratory equipment approved by the National Institute of Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA) shall be used by CH2M HILL employees.

A site safety plan (SSP) is required anytime site conditions dictate use of respiratory protection, whether worn or carried. The SSP preparer is responsible for selecting the appropriate level of respiratory protection.

The HSO is responsible for approving the respirator selection. The respiratory protection specified in an SSP shall include all types of respirators required for the ba

level of protection and for any upgrades that may reasonably be required.

Site decisions about the appropriate level of protection shall be made by the SSC on the basis of the criteria established in the SSP. Unanticipated conditions for which the level of protection allowed by the SSP is not sufficient require an amendment to the SSP specifying appropriate respiratory protection in accordance with SOP HS-19 (SITE SAFETY PLANS).

Selection of respirators depends primarily on the assessment of site- and project-specific factors, and on established policies. These policies, listed in Attachment 1, have been derived from regulatory requirements and established industrial hygiene practice. Restrictions and conditions defined in the NIOSH Guide to Industrial Respiratory Protection (DHHS Publication 87-116) (Ref. 4) should also be recognized in the selection process.

Site-specific factors are the primary factors in respirator selection. Most of these factors and the decisions typically associated with them are listed in Attachment 2. However, no single set of criteria or decision logic applies to all sites.

3.4 FIT TESTING

APR wearers shall be fit tested to establish that the selected respirator affords a proper fit for that wearer. Qualitative fit testing shall be performed in accordance with NIOSH Publication 87-116, Appendix B.2, Paragraph I--Isoamyl Acetate Protocol, or in accordance with 29 CFR 1926.1025. These tests are performed initially during 40-hour health and safety training and at least annually thereafter, usually during 8-hour refresher training. Fit testing may also be conducted any time the wearer, the SSC, or the HSO indicates that such testing is needed. Quantitative fit testing with a challenge aerosol may be substituted for qualitative protocols. Quantitative fit testing is accomplished in accordance with NIOSH Publication 87-116, Appendix B.3. Challenge aerosols of dioctyl sebacate or ambient aerosol (TSI, portacount) are acceptable. A record of the initial and annual respirator fit test shall be completed for each respirator wearer (see Attachment 3),

with copies retained by the HSO and the medical and training administrator.

APR wearers shall conduct negative-positive pressure checks each time they don an APR. These checks are conducted in accordance with NIOSH Publication 87-116, Appendix B.1.

3.5 INSPECTION, CLEANING, STORAGE, AND MAINTENANCE

3.5.1. Inspection and Checkout

A regular inspection program for air purifying respirators and air supplied respirators (self-contained breathing apparatuses and air line respirators) is critical.

The regional equipment coordinator (REC) maintains and inspects respirators. Appropriate procedures and the means of documentation are specified in the CH2M HILL Equipment Procedures Manual (Ref. 5).

During site activities, the SSC shall inspect respirators prior to issuance and reinspect, at least weekly, each respirator that is used. Notation of the inspections, any problems identified, and corrective actions shall be recorded in the SSC's logbook.

The inspection procedures for air purifying, powered air purifying, SCBAs/air line, and emergency escape respirators are set forth in Attachments 4, 5, 6, and 7.

The respirator user is in the best position to ascertain that the respirator on which he or she depends is in working condition. Each respirator user shall inspect the respirator prior to each use and perform positive pressure and negative pressure fit tests prior to each entry into potentially contaminated atmospheres. Any malfunction detected during the inspection or positive/negative pressure fit test shall be immediately reported to the SSC. The respirator is either repaired to the user's and SSC's satisfaction, or is taken out of service.

3.5.2 Cleaning and Disinfection

Each respirator user shall clean his/her respirator at the end of each day's use. If a facepiece is to be transferred

from one user to another, the user shall sanitize the respirator prior to transfer. Respirators in regular use shall be disassembled, cleaned, and sanitized at least once weekly by the user. The procedures for daily cleaning are presented in Attachment 8. The procedures for weekly cleaning and sanitizing are presented in Attachment 9.

3.5.3 Storage

Facepieces

After the respirators have been inspected, cleaned, and repaired, place the facepieces into clean plastic bags and store them to protect against dust, excessive moisture, damaging chemicals, extreme temperatures, and direct sunlight. The straps on the facepieces should be completely loosened and laid straight.

Do not store respirators in clothes lockers, bench drawers, tool boxes, or car trunks where they may be distorted or broken. Store them in the original carton or carrying case if possible.

Self-Contained Breathing Apparatuses

- Refill the cylinder if necessary.
- Make sure the cylinder valve is closed.
- Check that the high pressure hose connector is connected tightly to the cylinder.
- Make sure that pressure has been bled from the high pressure hose and regulator.
- Check to see that the bypass valve is closed.
- Check to see that the mainline valve is closed.

Powered Air Purifying Respirators

- Recharge the battery, following the manufacturer's instructions, for a minimum of 16 hours but no more than 24 hours.
- Do not store the battery module in "charge" mode.

- Store the battery module at temperatures of 65° to 80°F to maximize the battery's usefulness. Higher temperature will shorten the battery module's life. Lower temperatures will decrease the battery's available capacity and thus, the respirator's running time.

- Components of powered air purifying respirators other than the battery module can be stored at temperatures of 0° to 120°F.

3.5.4 Maintenance and Repairs

Maintenance and repair of respirators beyond regular cleaning and other routine maintenance tasks, such as replacement of worn straps and lens covers, shall be performed by an individual certified by the manufacturer to perform this maintenance. The REC arranges such maintenance. Repair of SCBA regulators or air line respirators shall be carried out by the manufacturer or by CH2M HILL'S equipment service specialist at the firm's instrument repair facility. Defects or malfunctions in any respirator shall be noted by the SSC in his/her field log; written notice of these defects shall accompany each respirator to the equipment service center.

Respirators shall be serviced by the equipment service center at least annually, in accordance with the Equipment Management Plan. The RECs have responsibility for identifying and scheduling each respirator for its annual inspection and maintenance check at the equipment service center.

3.6 SAFE HANDLING AND STORAGE OF COMPRESSED AIR

Compressed air is dangerous and shall be handled properly. CH2M HILL uses compressed air in several forms: 45-cubic-foot tanks pressurized at 2,216 psig or 4,500 psig are used with SCBAs; 350-cubic-foot tanks pressurized at 2,216 psig are used with air line respirators or to recharge SCBA tanks. Compressed air used as breathing air for SCBAs and air line respirators shall meet or exceed Grade D requirements as specified in the Compressed Gas Association Commodity Specification for Air (G-7.1) Ref. 6). The SSC is responsible for verifying the quality of compressed (breathing) air delivered to a site if the air has been purchased

by CH2M HILL or purchased by a client and designated for the use of CH2M HILL employees or subcontractors under the firm's SSP. Quality can be verified by reviewing the shipping receipts, invoices, and any other accompanying paperwork such as affidavits. If quality cannot be confirmed through document review, the SSC shall obtain verbal verification from the supplier and note such verification in the field log. Each "quality lot" of compressed (breathing) air shall be certified as meeting "Grade D" or better. The SSC should reject any compressed air if its quality cannot be determined or completely verified.

Note: The use of pure oxygen for breathing air is prohibited.

3.6.1 General Handling and Storage Rules

- An empty cylinder is never completely out of gas. Therefore, the same handling rules shall apply to an empty cylinder as to a full cylinder of the same gas. An empty cylinder should be marked "Empty" with chalk, crayon, magic marker, or tag.

- Using a chain, fasten gas cylinders in an upright position to a wall, cylinder truck, or cylinder rack or post, or lay the cylinders down and block them to prevent movement. This rule is especially important when the gas is in use because the regulator is on the cylinder valve and the cap is not in place.

- Cylinders shall never lie prone in a pickup truck because they may roll when the truck is in motion. They should be transported upright in a cylinder truck and fastened so they will not fall.

- Always replace the cylinder cap when the cylinder is not in use and when it is being moved.

- Never lift a cylinder by its valve or its cap, or with chains, slings, or magnets. If a crane is needed to move a number of cylinders, the cylinders should be secured on a platform or cradle. A cylinder should never be dragged. Instead, tilt the cylinder and roll it along its bottom edge.

- Never place a cylinder in a work area where it could be hit by moving vehicles or struck by falling objects. This rule applies to cylinders in use and to cylinders in storage.

- Do not use a cylinder as a table leg or to hold up other objects.

- Never hammer, pry, or wedge a cylinder valve to loosen it, and never use a wrench. If a valve cannot be opened by hand, call the gas distributor.

- Do not drop a cylinder.

- Never use a cylinder unless the gas it contains is clearly stenciled on it or marked with a decal. Altering or defacing the name, numbers, or other markings on a gas cylinder is illegal and hazardous.

- Do not rely on the color of a cylinder to identify the gas inside. Suppliers use different color codes. Return all unidentifiable cylinders to the supplier.

- Keep cylinders away from electrical circuits and excessive heat. Cylinders are made of steel and will conduct electricity and heat.

- Never ground a cylinder or place it near an electrical conductor, including piping, plumbing, or anything that might carry stray electric current.

- Never strike an arc or tap a welding electrode on a cylinder.

- Using or storing a cylinder in an area where it may get hotter than 130°F violates Department of Transportation regulations. Keep cylinders out of direct sunlight and avoid storing them in vehicles if the temperature will get too high.

- If a cylinder that has been stored outside is frozen fast to the ground, use warm water to free it. If the valve is frozen, use warm water to thaw it, or bring the cylinder inside and let it thaw at room temperature.

3.6.2 Valves and Regulators

- Always use the proper regulator for the gas in the cylinder. Gas regulators are designed for use with specific gases, within prescribed pressure ranges.

- Always check the regulator before attaching it to a cylinder. If the connections do not fit together readily, you are using the wrong regulator. Damaged threads on the connecting nut or valve outlet can also make a regulator difficult to attach and likely to leak.

- Always "crack" the breathing air cylinder valve (open it slightly and close it immediately) before attaching a regulator. "Cracking" removes any dirt that may be lodged in the valve outlet, and prevents dirt from entering the regulator. Do not stand in front of the valve outlet while cracking it, and do not point the outlet at anyone.

- Wipe the outlet with a clean, dry, lint-free cloth after the cylinder valve has been cracked. The threads and mating surfaces of the regulator and hose connections should also be cleaned before the regulator is attached.

- Always use a cylinder wrench or other tightly fitting wrench to tighten the regulator nut and hose connections. If you use an oversized wrench, pliers, or pipe wrench, you could damage the fittings and make it impossible to tighten them properly. Dirty or damaged threads will cause leaks when the cylinder is used.

- Attach the regulator securely before opening the valve wide.

- Stand to the side of the regulator when opening the cylinder valve.

- If a cylinder is leaking, mark it and put it outdoors, away from sources of ignition. Attach warning signs to it and keep it away from other cylinders. Call the cylinder supplier or gas distributor.

- Never hang tools, gloves, clothes, or other items on top of the cylinder. They may interfere with operation of the valve and prevent the gas from being shut off quickly in an emergency.

When removing a regulator from a cylinder:

- Close the cylinder valve first.
- Bleed off the gas remaining in the regulator.
- Unscrew the regulator.
- Replace the cap on the cylinder.

3.7 RECORDKEEPING

3.7.1 Medical Records

The annual medical certification of employees for respirator use is maintained by the medical and training administrator (MTA) according to SOP HS-15 (RECORDKEEPING).

3.7.2 Training Records

Records of training and respirator fit testing are maintained by the MTA according to SOP HS-15 (RECORDKEEPING).

3.7.3 Respirator Maintenance Records

The REC is responsible for keeping maintenance records for respirators.

Each employee assigned a respirator for his or her individual use is responsible for maintaining the respirator and reporting defects to the REC (if discovered during monthly maintenance in the office) or to the SSC (if discovered during field activities). In the latter case, defects are recorded in the SSC's logbook. The SSC's logbook entry includes identification of failed and replaced parts, including identification by manufacturer and part number. When the respirator is surrendered to the REC, a tag with information about the defects (it may be copied from the logbook entry) shall be attached to the respirator.

3.8 PROGRAM QUALITY ASSURANCE

The HSOs and SSCs shall monitor performance of, and compliance with, the respiratory protection program. The SSCs shall identify and explain program noncompliance and corrective action(s) in the SSC's log. If noncompliance continues, the SSC shall notify both the project manager and the HSO for that region for further action.

4.0 RESPONSIBILITIES

The project manager is responsible for providing the resources and project-specific information necessary for the SSC to implement this SOP.

The SSC is responsible for implementing the procedures specified in this SOP, which include:

- Ordering and maintaining adequate supplies of respirators onsite
- Monitoring the use of respirators to determine compliance with the provisions of this SOP
- Monitoring respirator cleaning, inspection, storage, and maintenance procedures performed by respirator wearers to determine compliance with this SOP
- Conducting respirator inspections and performing respirator fit tests as specified in this SOP, and in the SSP as modified by site-specific considerations
- Taking respirators out of service when defects are reported by wearers
- Keeping the onsite respirator inspection and maintenance records
- Returning respirators to the REC

The SSP writer is responsible for defining the appropriate type of respiratory protection according to the criteria specified in this SOP. The HSO is responsible for approving that selection.

The REC is responsible for shipping properly working, sanitized, and inspected respirators to the site, inspecting and repairing respirators upon their return, and maintaining respirator repair records.

Respirator wearers are responsible for performing negative/positive respirator fit tests before each use, reporting any respirator defects to the REC or to the SSC, and inspecting, cleaning, storing, and maintaining the issued respirator in accordance with the procedures specified in this SOP.

HSOs are responsible for conducting quality assurance procedures as defined in this SOP.

5.0 REFERENCES

1. OSHA. 29 CFR 1910.134 Respiratory Protection Standard. October 1987.

2. ANSI. Z88.2 Practice For Respiratory Protection. 1980.

3. OSHA. "Hazardous Waste Operations and Emergency Response." 29 CFR 1910.120. March 6, 1989.

4. NIOSH. Guide to Industrial Respiratory Protection. Publications 87-116. 1987.

5. CH2M HILL. Equipment Procedures Manual. 1984.

6. CGA. G-7.1 Safe Handling of Compressed Gases. 1979.

6.0 ATTACHMENTS

Attachment 1: General Restrictions and Considerations for the Selection of Respiratory Protection

Attachment 2: Factors for Consideration in Respirator Selection

Attachment 3: Record of Respirator Fit Test

Attachment 4: CH2M HILL Respirator Inspection Record

Attachment 5: Checklist for Inspection of Powered Air Purifying Respirators

Attachment 6: Checklist for Inspection of Pressure Demand Self-Contained Breathing Apparatus and Air Line Respirators

Attachment 7: Checklist for Inspection of ISI Emergency Life Support Apparatus

Attachment 8: Daily Respirator Cleaning Procedures

Attachment 9: Weekly Cleaning and Sanitizing of Respirator Facepiece

WDCR454/021.50

GENERAL RESTRICTIONS AND CONSIDERATIONS FOR THE SELECTION OF RESPIRATORY PROTECTION

1. Quarter-face, half-mask, and mouthpiece respirators shall not be used.

2. Blowers and air compressors shall not be used to supply breathing air to respirators (see 29 CFR 1910.134(d)).

3. Breathing air shall meet or exceed the requirements of Grade D breathing air as specified in the Compressed Gas Association Commodity Specification for Air, G-7.1.

4. Respirators and respirator components must be NIOSH/MSHA approved.

5. Respirators from each individual manufacturer shall be repaired or used daily with proper replacement parts from the same manufacturer (e.g., MSA canisters with MSA air purifying respirators, MSA air lines with MSA-supplied air respirators). Mixing manufacturers invalidates the NIOSH/MSHA approval.

6. Air lines shall not exceed 300 feet in length.

7. Air purifying respirators shall never be worn in conditions that are or may become immediately dangerous to life and health (IDLH) or oxygen-deficient (less than 19.5 percent oxygen).

8. Combination SCBA/supplied air respirator must not be worn without the compressed air tank attached. The NIOSH/MSHA approval will otherwise be invalidated.

FACTORS FOR CONSIDERATION IN RESPIRATOR SELECTION

FACTOR	ACTION	DISCUSSION
1. Extent of information available about the identify, quantity, location of hazardous materials, and release potential	Choose higher level of protection until more information is available.	
2. Target organ toxicity of the hazardous material(s)	Determine additive toxicity for desired protection factor.	
3. Is hazardous material a carcinogen, mutagen, or teratogen?	Choose higher level of protection (typically, air-supplied respirator).	
4. Permissible exposure limits (PELs) or threshold limit values (TLVs) of materials present	Choose respirator with appropriate protection factor.	
5. Available monitoring equipment's ability to detect materials at or below PEL and TLV	Consider higher level of protection until additional information is available.	If release of hazardous material seems likely, yet real-time monitoring is not available/feasible, assumption of exposure must err on side of safety.
6. Warning properties	Air-purifying respirators may not be used if warning properties are poor.	NIOSH/MSHA approvals for air-purifying respirators prohibit use against organic vapors with poor warning properties. 30 CFR 11) Adequate warning properties can be assumed when the substance's odor, taste, or irritation effects are detectable and persistent at concentrations below the PEL or TLV. The properties provide some indication to the wearer of poor facepiece fit or other respirator malfunction.

FACTORS FOR CONSIDERATION IN RESPIRATOR SELECTION (Continued)

FACTOR	ACTION	DISCUSSION
7. Eye irritation	Only full facepiece respirators are permitted.	
8. Capacity of cartridge or cannister sorbent is low for compounds present.	Air-purifying respirator must not be used unless appropriate sorbent is available and breakthrough time is acceptable.	
9. Cartridge or cannister sorbent has or may have a high heat of reaction with substance(s) present (e.g., strong oxidizers).	Air purifying respirator must not be used unless appropriate sorbent is available.	
10. Substance is or may be shock sensitive when sorbed on a cartridge.	Air purifying respirators must not be used.	
11. High humidity	Air purifying respirators may not be feasible or appropriate.	Water vapor may clog sorbent, reducing breakthrough time and making breathing difficult.
12. Atmosphere could become IDLH.	SCBA or dual purpose air line/SCBA combination must be used. Engineering controls (ventilation) should be used to reduce chemical concentration.	Supplied-air respirators are not recommended for use in IDLH atmospheres without an escape SCBA (30 CFR 11).
13. Difficulties caused by limitations of SCBA.	Consider trade-offs between SCBA and air line respirators.	Bulk and weight of SCBA may interfere with task performance or cause unnecessary stress. Duration of air line air supply must be sufficient for tasks to be performed.

FACTORS FOR CONSIDERATION IN RESPIRATOR SELECTION (Continued)

FACTOR	ACTION	DISCUSSION
14. Worksite is far from the location of air tanks for air line respirator.	Consider trade-off between SCBA and air line respirators.	Air lines must not be threatened by damage or obstruction (e.g., heavy equipment, falling drums, etc.) or by permeation/degradation by chemicals (e.g., pools of chemicals). Air line limited to 300 ft. length.
15. High ambient temperatures	Exposure factors being equal, consider relative comfort associated with APRs, SCBAs, ASRs, PAPRs.	
16. Freezing ambient temperatures		Exhalation valves/regulators can freeze up, making respirator inoperable. Facepiece fit may also be impaired. Facepiece fogging must be prevented.

RECORD OF RESPIRATOR FIT TEST

NAME: _____ EMPLOYEE NO.: _____

PLACE/PROJECT NO. AND NAME (If onsite): _____

_____

==========

Respirator: MSA Ultratwin, Size _____

Challenge:

QUALITATIVE

Amyl Acetate		Irritant Smoke	
Pass _____	Fail _____	Pass _____	Fail _____

QUANTITATIVE

(Attach Computer Printout of Test Results)

_____
Signature of Test
Operator/Date

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CH2M HILL RESPIRATOR INSPECTION RECORD

1. TYPE _____ 2. NO. _____

3. DEFECTS FOUND:

A. Facepiece and Lens _____
B. Inhalation Valve _____
C. Exhalation Valve Assembly _____
D. Headbands _____
E. Cartridge Holder _____
F. Cartridge/Cannister _____
G. Filter _____
H. Harness Assembly _____
I. Hose Assembly _____
J. Speaking Diaphragm _____
K. Gaskets _____
L. Connections _____
M. Other Defects

_____
_____
_____
_____

CHECKLIST FOR INSPECTION OF POWERED AIR PURIFYING RESPIRATORS

A. Facepiece

1. Visually inspect the head harness for cracked or damaged serrations and deteriorated rubber. Visually inspect the rubber facepiece for signs of deterioration or distortion.

2. Visually inspect the lens for proper seal in the rubber facepiece, proper placement of retaining clamp, and cracks or large scratches.

3. Remove the exhalation valve covers. Carefully inspect the valve for visible deterioration or foreign material build-up. Make sure that the valves have not adhered at edges.

4. Check connections for pressure and proper condition of gaskets and "O" rings and for proper tightness.

5. Stretch the breathing tube and visually inspect it for deterioration and holes.

6. Visually inspect the breathing tube connector to evaluate the condition of its threads.

B. Battery Check

1. Connect the PAPR battery to the charger to check that the battery is fully charged. Green light indicates that the unit has been charged.

2. If the green light does not come on, recharge the battery in a nonexplosive atmosphere for a minimum of 16 hours but no more than 24 hours (damage to battery may occur).

C. Flow Check

1. With a cartridge installed in the filter assembly, turn the respirator on and check for operation.

2. Fit the respirator on your nose bridge, making sure that you are able to breath through your nose, then swing the facepiece into contact with your chin. A steady flow of air should fill the facepiece, creating a slight positive pressure.

CHECKLIST FOR INSPECTION OF PRESSURE DEMAND SELF-CONTAINED BREATHING APPARATUS AND AIR LINE RESPIRATORS

Items marked "M" should be done monthly by the regional equipment coordinator. Prior to beginning inspection, the user shall:

1. Check to determine that the high pressure hose connector is tightly secured on the cylinder fitting.

2. Make sure the valve cover is in place.

3. Check to ensure that the mainline valve closes properly.

4. Make sure the regulator outlet is not covered or obstructed.

5. Verify that the hydrostatic test date is current.

6. Verify that the cylinder is charged to at least 1,800 psi.

I. Back Pack and Harness Assembly

A. Straps

1. Visually inspect for complete set.
2. Visually inspect for frayed or damaged straps that may break during use. Be sure that the screws holding straps together are present.

B. Buckles

1. Visually inspect mating ends.
2. Check locking function.

C. Backplate and Cylinder Lock (SCBAs only)

1. Visually inspect backplate for cracks and for missing rivets or screws.

2. Visually inspect cylinder hold-down strap and physically check cylinder strap tightener. Full engage the lock.

II. Cylinder and Cylinder Valve Assembly (SCBAs only)

A. Cylinder

1. Physically check to see that the cylinder is tightly fastened to the backplate.
2. Check hydrostatic test date to establish that it is current. (M)
3. Visually inspect the cylinder for large dents or gouges in metal (M).

B. Head and Valve Assembly

1. Visually determine that the cylinder valve lock present.
2. Visually inspect the cylinder gauge for conditio of its face, needle, and lens (M).
3. Open the cylinder valve and listen or feel for leakage around the packing. (If leakage is note do not use the respirator until it is repaired.) Note check for proper functioning of valve lock.

III. Regulator and High Pressure Hose

A. High Pressure Hose and Connector

1. Listen or feel for leakage in the hose (air line or at hose-to-cylinder connector. (A bubble in the outer hose covering may be caused by seepage of air through the hose when stored under pressure. This does not necessarily mean a faul hose.)

B. Regulator and Low Pressure Alarm

1. Cover the outlet of the regulator with the pal your hand. Open the mainline valve and read t

regulator gauge; it must read at least 1,800 psi but not more than the rated cylinder pressure.

2. Close the cylinder valve and slowly move your hand from the regulator outlet to allow a slow flow of air. The gauge should begin to show immediate loss of pressure as the air flows. A low pressure alarm should sound when pressure falls to between 650 and 550 psi in a cylinder rated at 2,216 psi. Remove your hand completely from the outlet and close the mainline valve.
3. Place your mouth on or over regulator outlet and blow lightly. A positive pressure should be created and maintained for 5 to 10 seconds without any loss of air. Next suck the regulator to create a slightly negative pressure and hold it for 5 to 10 seconds. Vacuum should remain constant. This tests integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak that must be reported to the SSC.
4. Open the cylinder valve.
5. Place your hand over the regulator outlet and open the mainline valve. Remove your hand from the outlet and rapidly replace it again. Repeat this twice. Air should escape when your hand is removed each time, indicating a positive pressure in the chamber. Close the mainline valve and remove your hand from the outlet.
6. Ascertain that no obstruction is in or over the regulator outlet. Open and close the bypass valve momentarily to assure that there is a flow of air through the bypass system.

IV. Facepiece and Corrugated Breathing Tube.

A. Facepiece

1. Visually inspect the head harness for damaged serrations and deteriorated rubber. Visually inspect the rubber body of the facepiece for signs of deterioration or extreme distortion.
2. While retaining the clamp properly in place,

visually inspect the lens for proper seal in th rubber facepiece; check for cracks or large scratches.

3. Visually inspect the exhalation valve for visib deterioration or foreign materials build-up.

B. Breathing Tube and Connector

1. Stretch the breathing tube and visually inspect for deterioration and holes.
2. Visually inspect the connector to determine the condition of its threads and for presence and proper condition of the "O" ring or rubber gask

NOTE: The final test of the facepiece should include a negative pressure test for overall seal, and a check the exhalation valve. If monthly inspection is bein performed, the mask may now be placed against your f and the following tests performed. If you are preparing for use, first don the backpack, then don facepiece and use the following procedure.

C. Negative Pressure Test on Facepiece

1. With the facepiece held tightly on your face an the facepiece properly donned, stretch the breathing tube to open for corrugations and pla your thumb or hand over the end of the connecto Inhale. Negative pressure should be created inside the mask, causing it to pull tightly to your face. This negative pressure should remai for 5-10 seconds. If the negative pressure fad the facepiece assembly is not adequate and shou not be worn.

NOTE: Any discrepancy found shall be cause to set the unit aside for repair by an individual certified by the respirator manufacturer to make such repairs.

CHECKLIST FOR INSPECTION OF ISI EMERGENCY LIFE SUPPORT APPARATUS

1. Remove the apparatus from its carrying bag. Do not disconnect the supply hose from the reducing valve.

2. Examine the hood and supply hose for signs of damage.

3. Check to see that the cylinder is fully charged (the gauge should read "full") and that the hydrostatic test date is current.

4. If the cylinder is not full, connect the compressor hose to the charging connector located on the cylinder valve. Charge the cylinder to 2,216 psig (the gauge on the valve should read "full"). The cylinder should be charged at a rate of 1 to 2 cubic feet per minute. At this rate, it should take about 3 to 5 minutes. Charging at a faster rate may damage the charging valve.

5. Check to see that the air hood is securely attached to the supply hose.

6. Check to see that the supply hose is securely attached to the cylinder.

7. Place the cylinder and valve assembly in the carrying bag. Fold the hood and place in the top portion of the carrying bag. Fold the flap of the bag over the hood and fasten it with the fastening strips.

DAILY RESPIRATOR CLEANING PROCEDURES

1. Remove cartridges and filters from APRs or PAPRs.

2. Using a sponge or soft bristle brush, clean facepiece and straps with a mild detergent mixed with warm water (128-140°F). Breathing tubes (SCBA or air line respirators) may be completely immersed. Remove any soil or other visible evidence of contamination.

3. Wipe down facepiece and straps twice with clean, warm water.

4. Air dry in a designated clean area.

WDCR454/125.50

APPENDIX C. SAMPLING AND ANALYSIS PLAN

C.1 INTRODUCTION

The primary objective for this Sampling and Analysis Plan (SAP) is to describe the sampling and analysis activities to determine and monitor the performance of the Interim Measure/Interim Remedial Action (IM/IRA) treatment system for the 881 Hillside Operable Unit 1 (OU 1). More detailed information on the IM/IRA at OU 1 is presented in Section 2.0 of the Work Plan.

This SAP addresses two distinct phases of the IM/IRA:

- SO testing
- Systems operation

The objectives for sampling during SO testing include optimizing the following operating parameters:

- The ultraviolet/hydrogen peroxide (UV/H_2O_2) oxidation process to assess effectiveness for removing organic contaminants.

- The ion exchange (IX) process to assess effectiveness for removing inorganic contaminants (radionuclides, heavy metals, total dissolved solids)

The objective for sampling during system operation includes determining the treatment system's ability to meet treatment goals.

Section C.2 of the SAP describes the specific data quality objectives (DQOs) for the IM/IRA for an assessment of the performance and continued operation of the treatment system. Testing data

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collected during the SO tests and IM/IRA systems operation will help to determine what modifications may be needed to provide successful system operation over a longer time frame. Only those parameters that are difficult to remove, are indicators of other parameters, or have a potential to exceed the treatment goals, as identified during the SO test, will be sampled and analyzed for during systems operation.

Sections C.3 and C.4 describes appropriate sampling and analysis protocols and procedures for the before and after-treatment concentrations of the contaminants of concern. Standard operating procedures (SOPs) are referenced, where available and applicable, for bias-free collection of data.

Section C.5 references the appropriate SOPs for personal protection, sampling equipment decontamination, proper containers and preservatives, sample identification, sample custody, and sample shipping.

C.2 DATA QUALITY OBJECTIVES AND SAMPLING STRATEGY

The primary objective of the 881 Hillside IM/IRA SO testing and systems operation is to evaluate the effectiveness of the proposed technologies in removing organics, heavy metals, radionuclides, including uranium, and total dissolved solids from contaminated water from 881 Hillside alluvium. Secondary objectives are to obtain essential information for optimization of the technologies to meet treatment goals and to formulate a long-term monitoring strategy.

Data quality objectives (DQOs) express qualitative and quantitative statements describing the quality and quantity of data required for the IM/IRA systems operation and testing. Developing DQOs relies on the following three-stage process:

- **Stage 1**—Identify decision types
- **Stage 2**—Identify data uses/needs
- **Stage 3**—Design a data collection program

Stage 1 has already been completed as part of the IM/IRA plan (DOE, January 1990). This SAP addresses Stages 2 and 3 of the DQO process and presents the best approach to fulfill the primary and secondary objectives of the systems testing. The three stages and the sampling strategy are addressed in the following sections.

C.2.1 Stage 1—Identifying Decision Types

The IM/IRA plan identifies the goals and objectives for the IM/IRA and the technical approach. The overall objective of the 881 Hillside IM/IRA program is to cut off groundwater flow and to provide interim treatment of groundwater. The objective of SO testing is to provide information to determine the performance of the two treatment technologies in removing respective contaminants. This information will then be used to optimize the technologies and design a monitoring strategy. The objective of IM/IRA systems operation is to meet the treatment goals.

C.2.2 Stage 2—Identifying Data Uses/Needs

The specific elements addressed in Stage 2 and consistent with the Data Quality Objectives for Remedial Response Activities (EPA, 1987) include the following:

- Data uses
- Data types
- Data quality needs
- Data quantity needs
- Sampling/analysis options
- Precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters

Stage 2 of the DQO process defines data uses and specifies the data types needed to meet the project objectives.

C.2.2.1 Data Uses

As stated previously, the data use objectives for the IM/IRA SO testing include optimizing the following operating parameters:

- The UV/H_2O_2 oxidation process to assess the effectiveness for removing organic contaminants

- The ion exchange process to assess reduction effectiveness for removing inorganic contaminants (radionuclides, heavy metals, and total dissolved solids)

The data use for the IM/IRA systems operation includes determining the treatment system's ability to meet treatment goals.

Tables C-1 and C-2 describe the data needed to fulfill the specific objectives for the 881 Hillside IM/IRA, SO testing and systems operation, the activity used to collect the data, the analytical level, and the intended data use. Table C-1 describes the data needs during SO testing of the IM/IRA system; while Table C-2 describes the data needs during the longer term systems operation.

The SO testing will include a much more comprehensive sampling program than the interim actual systems operation. The SO testing will establish the operating parameters for the system, eliminating the need for most of the sampling done for the SO testing. Therefore, during systems operation, the parameters to be analyzed and the frequency of analysis will be reduced.

TABLE C-1

DATA NEEDS TO FULFILL SPECIFIC OBJECTIVES FOR IM/IRA SO TESTING

Influent

Data Need: Characterize each waste stream (Building 881 drain, french drain, and recovery well).

Activity: Collect representative grab samples of each stream.

EPA Analytical Levels:
Volatile organics, each stream–Level IV.
Metals, each stream–Level IV.
Radionuclides, each stream–Level III.
Anions and TDS, each stream–Level III.
pH, each stream–Level I.

Data Use: Establish contaminant concentrations for each stream.

UV/H_2O_2 Oxidation (Oxidation of Organic Contaminants)

Data Need: Evaluate the effectiveness of oxidation for removing organic contaminants, specifically the volatile organic compounds.

Activity: Operate IM/IRA treatment system semicontinuously for a period of 14 days. Feed the composite alluvial waters to the oxidizer under different conditions of flow rates, and H_2O_2 and UV doses. Collect representative grab samples of the influent and the treated effluent for each set of operating conditions.

EPA Analytical Levels:
Volatile organics, influent and effluent–Level IV.
Metals, influent only–Level IV.
Radionuclides, influent only–Level III.
Anions and TDS, influent only–Level III.
pH, influent and effluent–Level I.

Data Use: Establish influent concentrations for all analytes. Determine effectiveness of the oxidation process in removing organic contaminants. Use this data for potential modifications of the operating parameters to optimize the oxidizer system. Determine if oxidation has an impact on removing/precipitating metals and radionuclides.

Ion Exchange Column No. 1–Strong-Base Anion Exchange (Radionuclide and Uranium Removal)

Data Need: Evaluate effectiveness of the ion-exchange column in removing radionuclides, uranium and other inorganics from the UV/H_2O_2-treated effluent. Determine the concentration of volatile organics in the ion-exchange surge tank off gas.

Activity: Pass the UV/H_2O_2-treated effluent through a strong-base anion-exchange column under different operating conditions. Collect representative grab samples of the influent and the effluent for each test.

EPA Analytical Levels:
Volatile organics, off gas in surge tank–level to be provided by EG&G.
Metals, influent and effluent–Level IV.
Radionuclides and uranium, influent and effluent–Level III.
Anions and TDS, influent and effluent–Level III.
pH, influent and effluent–Level I.

TABLE C-1

DATA NEEDS TO FULFILL SPECIFIC OBJECTIVES FOR IM/IRA SO TESTING (Continued)

Data Use: Assess the effectiveness of the ion-exchange resin in removing the radionuclides, uranium, and any other inorganics. Determine amount of volatilization in the surge tank, if any.

Ion Exchange Column No. 2—Weak-Acid Cation Exchange (Heavy Metal Removal)

Data Need: Evaluate the effectiveness of the ion-exchange resin in removing specific heavy metals and bicarbonate from the ion-exchange column No. 1 effluent.

Activity: Pass the effluent from the ion-exchange column No. 1 under various test conditions. Collect representative grab samples of the effluent from column No. 2 for each test.

EPA Analytical Levels: Metals—effluent only—Level IV.
Radionuclides and uranium, effluent only—Level III.
Anions and TDS, effluent only—Level III.
Volatile organics, effluent only—Level IV.
pH, effluent only—Level I.

Data Use: Assess the effectiveness of the ion-exchange resin in removing selected heavy metals and other inorganics and radionuclides from the column No. 1 effluent. Determine the extent of decarbonation of the bicarbonate sources. Also determine amount of volatiles presents that may be released during degassing.

Degasifier (Degassing of the Ion Exchange Effluent)

Data Need: Determine whether any noxious or hazardous chemicals are released from the degasifier. Carbon dioxide formed as a result of decarbonation of the bicarbonate sources in ion-exchange column No. 2 will necessitate degassing of the effluent before it can be passed through the third ion-exchange column.

Activity: Pass the ion-exchange column No. 2 effluent through the degasifier and remove CO_2 and other gases by purging with air. The degasifier operation will be synchronous with the rest of the treatment train. Collect representative grab samples of the off gas for each test.

EPA Analytical Levels: Volatile organics, off gas—Level III.

Data Use: Use this data to assess whether any hazardous chemicals are released in the degasifier off-gas.

Ion-Exchange Column No. 3—Strong-Acid Cation Exchange (Cation Removal)

Data Need: Evaluate effectiveness of the ion-exchange column in removing the major cations, radionuclides, and other inorganics; thereby reducing the total dissolved solids content of the effluent from the degasifier. Characterize volatiles remaining after degassing.

Activity: Pass the degasifier effluent through the strong-acid cation-exchange column in a semicontinuous mode under various test conditions. Collect representative grab samples of the effluent for each test set.

TABLE C-1

DATA NEEDS TO FULFILL SPECIFIC OBJECTIVES FOR IM/IRA SO TESTING (Continued)

EPA Analytical Levels:	Radionuclides and uranium, effluent only–Level III. Metals, effluent only–Level IV. Anions and TDS, effluent only–Level III. Volatile organics, influent only–Level IV. pH, influent and effluent–Level I.
Data Use:	Assess the effectiveness of the ion-exchange resin in removing major cations and potentially the radionuclides, uranium, and other inorganics. Determine amount of volatile organics that were volatilized in the degasifier, if any.

Ion Exchange Column No. 4–Weak-Base Anion Exchange (Anion Removal)

Data Need:	Evaluate the effectiveness of the ion-exchange resin in removing the anions by exchanging with hydroxyl ions. Also determine effectiveness of entire system.
Activity:	Pass the effluent from the ion-exchange column No. 3 semicontinuously under various test conditions. Collect representative grab samples of the effluent from column No. 4 for each test.
EPA Analytical Levels:	Volatile organics, effluent only–Level IV. Metals, effluent only–Level IV. Radionuclides and uranium, effluent only–Level III. Anions and TDS, effluent only–Level III. pH, effluent only–Level I.
Data Use:	Assess the effectiveness of the ion-exchange resin in removing selected anions from the column No. 3 effluent. Also, determine the overall performance of the IM/IRA treatment system.

Neutralization Tank

Data Need:	Characterize neutralized, spent regenerant before discharge.
Activity:	Regenerate IX columns periodically. Neutralize regenerant solution.
EPA Analytical Levels:	Metals, after neutralization–Level IV. Radionuclides and uranium, after neutralization–Level III. TDS and TSS, after neutralization–Level III. pH, after neutralization–Level I.
Data Use:	Determine contaminant concentrations.

TABLE C-2

DATA NEEDS TO FULFILL SPECIFIC OBJECTIVES FOR IM/IRA SYSTEMS OPERATION

UV/H_2O_2 Oxidation (Oxidation of Organic Contaminants)

Data Need: Monitor the effectiveness of oxidation for removing organic contaminants, specifically the volatile organic compounds to treatment goals.

Activity: Operate IM/IRA treatment system continuously for 10 hours per day. Feed the alluvial waters to the oxidizer under optimized conditions of flow rate and H_2O_2 and UV doses. Collect periodic, representative samples of the influent and the treated effluent.

EPA Analytical Levels: Organics, influent only—Level IV.
Metals, influent only—Level IV.
Radionuclides, influent only—Level III.
Anions and TDS, influent only—Level III.

Data Use: Establish influent concentrations for all analytes. Use this data for a comparison with the IM/IRA effluent to determine performance in meeting treatment goals.

Ion Exchange Column No. 1—Strong-Base Anion Exchange (Radionuclide and Uranium Removal)

Data Need: No data needs during systems operation. The column will not be regenerated; hence, will not produce a regenerant stream nor backwash. The spent column will be replaced once a year.

Ion-Exchange Column No. 2—Weak-Acid Cation-Exchange (Heavy Metal Removal)

Data Need: No performance data needs during the systems operation. The column will be regenerated periodically. The regenerant will be neutralized and then sent to RFP Building 374 for further treatment.

Activity: Regenerate the column with the acid stream produced from regeneration of bed No. 3. Neutralize the column No. 2 regenerant stream with the alkaline regenerant from column No. 4. Periodically, pump the contents of the neutralization tank to Building 374. Collect a representative sample of the neutralized regenerant before transfer to Building 374.

EPA Analytical Levels: Metals, neutralized regenerant only—Level IV.
Radionuclides and uranium, neutralized regenerant only—Level III.
TDS and TSS, neutralized regenerant only—Level III.

Data Use: Building 374 may use this data to properly classify the neutralized regenerant for storage and treatment.

Degasifier (Degassing of the Ion Exchange Effluent)

Data Need: If determined as needed from SO test, determine noxious or hazardous chemicals released from the degasifier.

TABLE C-2

DATA NEEDS TO FULFILL SPECIFIC OBJECTIVES FOR IM/IRA SO OPERATION (Concluded)

Activity: Pass the ion-exchange column No. 2 effluent through the degasifier and remove CO_2 and other gases by purging with air. The degasifier operation will be synchronous with the rest of the treatment train. Collect periodic, representative samples of the off-gas.

EPA Analytical Levels: Volatile organics, off gas—level to be provided by EG&G.

Data Use: Assess whether any hazardous chemicals are released in the degasifier off gas.

Ion Exchange Column No. 3—Strong-Acid Cation Exchange (Cation Removal)

Data Need: No data needs during the systems operation. The column will be periodically regenerated with acid. The spent eluate will be used to regenerant column No. 2.

Ion Exchange Column No. 4—Weak-Base Anion Exchange (Anion Removal)

Data Need: Determine the overall effectiveness of the IM/IRA system in removing the organic, inorganic and radionuclide contaminants, and monitor performance in meeting treatment goals.

Activity: Pass the effluent from the ion-exchange column No. 3 through column No. 4. Pump the effluent to a holding tank. Collect periodic, representative samples of the effluent from column No. 4.

EPA Analytical Levels: Volatile organics, effluent only—Level IV.
Metals, effluent only—Level IV.
Radionuclides and uranium, effluent only—Level III.
Anions and TDS, effluent only—Level III.

Data Use: Compare this data with the influent data to assess performance in meeting treatment goals.

C.2.2.2 Data Types

The IM/IRA system will generate analytical data as well as operating data. The analytical data will include the following:

- Organic parameters in the treatability influent, intermediate treatment streams, and the treatability effluent
- Selected radionuclides and uranium in the treatability influent, intermediate treatment streams, and the treatability effluent
- Metals in the treatability influent, intermediate streams, and the treatability effluent
- Selected anions and total dissolved solids in the treatability influent, intermediate streams, and the treatability effluent
- Volatile organic constituents in the influent tank off gas, ion exchange surge tank off gas, and the degasifier off gas.

The operating data will be used during data evaluation to determine the impact of the operating parameters on performance.

C.2.2.3 Data Quality

The EPA defines five levels of analytical data (EPA, 1987 modified) associated with data quality for treatability studies. These analytical levels are defined as follows:

- **Level I**—Field screening or analysis with portable instruments. This level provides an indication of contamination presence and has few quality assurance/quality control (QA/QC) requirements.

- **Level II**—Field analyses with more sophisticated portable instruments or mobile laboratory. The data quality associated with this level depends on the QA/QC steps used. Data concentrations are usually reported in concentration ranges.

- **Level III**—Organics and inorganics are analyzed in an offsite analytical laboratory that may or may not involve contract laboratory program (CLP) procedures. The detection limits will be similar to those specified by the CLP. Level III uses rigorous QA/QC.

- **Level IV**—Analyses encompass the organic and inorganic parameters by sophisticated laboratory instrumentation such as gas chromatography/mass spectroscopy (GC/MS), atomic absorption (AA), and inductively coupled plasma (ICP). Detection limits reach the low parts-per-billion levels. This analytical level also provides tentative identification of non-HSL parameters. Data require validation to evaluate compliance with rigorous QA/QC requirements. Level IV procedures are appropriate to develop data of known quality.

- **Level V**—Analyses using nonstandard analytical methods. Method development or method modification may be required for specific constituents or detection limits.

Tables C-1 and C-2 specify the appropriate analytical levels for the data needs and data uses described in the tables. Section C.2.4 of this plan describes the quantity needs, the rationale for sampling frequency, and appropriate analytical methods for the IM/IRA systems evaluation and operation.

C.2.2.4 Sampling and Analysis Options

Data collection activities herein are designed to obtain maximum data use. The sampling and analysis approach for the IM/IRA systems operation and evaluation is based on guidelines provided in the IM/IRA decision document (DOE, January 1990). If the systems testing results indicate that

additional analyses or sampling are necessary, the sampling and analysis program will be modified to avoid performing additional, redundant studies. The sampling and analysis options are described in more detail later in this section.

C.2.2.5 PARCC Parameter Information

Precision, accuracy, representativeness, completeness, comparability (PARCC) parameters indicate data quality. Section C.2.4 of this plan describes the analytical requirements for the IM/IRA systems testing and interim operations phases. The analytical program specifies the use of EPA-approved methods, such as the Contract Laboratory Program (CLP) methods where applicable, since these methods and associated QA/QC protocols are generally considered as industry standard for producing accurate and precise data. Additionally, analytical methods referenced in the EG&G Rocky Flats General Radiochemistry and Routine Analytical Services Protocol (GRRASP) (DOE, 1990) are specified for selected analytes. These CLP and GRRASP analytical methods are appropriate for meeting the data quality requirements for levels II through V DQOs. The precision, accuracy, and completeness parameters for analytical levels II through V are discussed below along with the comparability and representativeness for all analytical levels. The DQOs specified for the precision, accuracy, and completeness will be used in evaluating the quality and useability of the laboratory data.

Precision and accuracy objectives for the IM/IRA systems operation and testing data will be evaluated based on the control limits specified in the referenced analytical method and/or in data validation guidelines. For the radionuclide analyses, the accuracy objectives specified in the GRRASP will be followed.

"Representativeness" expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that is most concerned with the proper design of the sampling program. The rationale for the sample program to provide for representative samples is provided in Section C.2.4.

A completeness goal of 90 percent is expected for the IM/IRA; that is, for each sample taken and analysis performed during the IM/IRA systems testing and monitoring, the usable data points will be at least 90 percent of the theoretical amount of data points.

"Comparability" is a qualitative parameter that expresses the confidence with which one data set can be compared with another. To achieve comparability, work performed as part of the SO test and systems operation will follow the approved SAP, use standardized analytical protocols, collect data following Environmental Management Department Operating Procedures (EMD OPS), and report data in consistent units of measurement.

C.2.3 Stage 3—Design Data Collection Program

The Stage 3 DQO process is consistent with Data Quality Objectives for Remedial Response Activities (EPA, 1987) and includes discussions of the following elements:

- Data collection components
- Sampling and analysis plan

To accomplish this, the elements identified in Stages 1 and 2 were assembled in Section C.2.4. A detailed discussion of all samples to be collected, including sample type, frequency of sampling, number of samples, analytical methods, and QA/QC samples, is presented in that section.

C.3 SAMPLING STRATEGY

This section presents information concerning sample locations and frequency, analytical methods, and field quality control procedures for each sample.

C.3.1 Sampling Locations and Frequency

During the SO testing phase, more frequent sampling and analysis will be important. Because the three designated 881 Hillside alluvial locations (see Section C.1 for a discussion of the selected locations) are not planned to be sampled in the field, "field" sampling will not be performed. The samples will be collected from the treatment unit and from the holding tanks associated with the unit. Aqueous and air samples will be collected. During the SO testing phase, the individual contaminant balance around each treatment system component will have to be determined to obtain data on that unit's performance. During the system operation phase, because only the overall performance will be important, the intermediate sampling of each component will be unnecessary, except occasionally to check on system performance.

Sampling points are located either just before or just after a treatment unit. This placement of sampling locations allows each treatment unit to be isolated before other streams are merged with or split from the influent or the effluent. Individual SO tests will require a minimum of 1 hour to achieve steady-state operation. Grab samples will then be collected at sampling locations designated as essential for a particular test. The samples will be properly preserved and stored (as described in Section C.5) for each analysis type until shipment to the analytical laboratory. Table C-3 summarizes the sampling locations (see Figure 2-3), the frequency of sampling, and the analyses to be performed. Not all locations will be sampled for each test nor will every limited analysis be performed. The decision on the sampling locations and the analytical suites will be made by the EG&G RFP IM/IRA O&M Project Manager before initiating the tests.

The samples of neutralized regenerates produced during the testing phase will be collected after every regeneration/neutralization cycle or whenever the contents of the neutralization tank are transferred to Building 374.

During the IM/IRA systems interim operation phase, the primary DQO is to determine the overall system's performance in meeting treatment goals. Therefore, only the influent to the IM/IRA system and the effluent from it will be sampled and analyzed. The sampling location for the influent will be

TABLE C-3

SAMPLING SUMMARY FOR IM/IRA SO TESTING

Sampling Point	Sampling Location	Sampling Frequency	Analytical Suites
1,2,3	Individual influent streams	Three grab samples	VOA, metals, radionuclides;[1] anions,[2] TAs
4	Influent to the UV/H_2O_2 unit	One grab sample per test	VOA, metals, radionuclides,[1] anions,[2] TDS
5	Effluent from the UV/H_2O_2 unit	One grab sample per test	VOA
6	Ion exchange surge tank off gas	To be provided by EG&G	VOA
7	Effluent from the ion exchange surge tank (after the bag filter and before column No. 1)	One grab sample per test	Metals, radionuclides,[1] anions,[2] TDS
8	Effluent from the ion-exchange column No. 1	One grab sample per test	Metals, radionuclides,[1] anions,[2] TDS
9	Effluent from the ion-exchange column No. 2	One grab sample per test	Metals, radionuclides,[1] anions,[2] TDS, VOA, pH
10	Degasifier off gas	To be provided by EG&G	VOA
11	Effluent from the degasifier	One grab sample per test	VOA, pH
12	Effluent from the ion-exchange column No. 3	One grab sample per test	Metals, radionuclides,[1] anions,[2] TDS
13	Effluent from the ion-exchange column No. 4 (before effluent holding tanks)	One grab sample per test	VOA, metals, radionuclides,[1] anions,[2] TDS
14	Neutralized regenerant solution	One grab sample per regeneration/neutralization cycle	Metals, radionuclides,[1] TDS, TSS

Notes: [1] Radionuclides include U 233, 234, 235, and 238, Pu 239 and 240 and Sr 89 and 90 isotopes, tritium, and gross alpha and gross beta activities.

[2] Anions include NO_3/NO_2, SO_4, Cl, and HCO_3.

the same as that during the testing phase; that is, just before entering the UV/H_2O_2 unit. The effluent sampling location will be situated on the transfer line after the effluent holding tanks (see Figure 2-3). The sampling frequency will be one grab sample per day collected during steady-state operating conditions. One daily grab sample of the influent and the effluent. Table C-4 summarizes pertinent sampling and analytical information regarding the systems operation monitoring samples. The neutralized regenerate samples will be collected after every regeneration/neutralization cycle or before the contents of the neutralization tank are transferred to Building 374.

C.3.2 Analytical Methods

Table C-5 summarizes the analytical suites, analytical methods, detection limits and DQO levels for the contaminants of concern for the IM/IRA testing and interim operation. EPA's CLP protocols are considered to be Level IV analytical methods. The CLP methods are based on the EPA SW846 methods for analyzing wastewaters and solid wastes (EPA, 1986). Anions and total dissolved solids (TDS) are also routinely analyzed by the environmental laboratories based on the EPA-developed or EPA-reviewed and approved methods sufficient to meet the Level III DQOs. Radionuclides are not routinely analyzed by most environmental laboratories; however, the analytical methods have been either developed or reviewed and approved by the EPA. Air media is also less commonly analyzed, but EPA-approved methods exist for analyzing the air media samples. These analytical methods for radionuclide and air media satisfy at the least the Level III DQO requirements and occasionally the Level IV requirements.

The methods proposed for the IM/IRA sample analyses are those recommended by the EPA and are deemed to be consistent with the DQOs. In addition, the EG&G Rocky Flats GRRASP analytical and specific QA/QC requirements will be used.

The analytical accuracy and precision goals are presented in the respective methods. These criteria include surrogate recoveries, matrix spike recoveries, matrix spike duplicate or laboratory duplicate precision, calibration linearity, laboratory control sample analyses, etc. Refer to the CLP protocols,

TABLE C-4

SAMPLING SUMMARY FOR IM/IRA SYSTEMS OPERATION

Sampling Point	Sampling Location	Sampling Frequency	Analytical Suites
4	Influent to the UV/H_2O_2 unit	One grab per week	VOA, metals, radionuclides,[1] anions,[2] TDS, pH
10	Degasifier off gas	Optional[3]	VOA
13	Effluent from the effluent holding tanks	One grab per week	VOA, metals, radionuclides,[1] anions,[2] TDS, pH
14	Neutralized regenerate solution	One grab sample per regeneration/neutralization cycle	Metals, radionuclides,[1] TDS, TSS, pH

Notes: [1] Radionuclides include U 233, 234, 235, and 238, Pu 239 and 240 and Sr 89 and 90 isotopes, tritium and gross alpha and gross beta activities.

[2] Anions include NO_3/NO_2, SO_4, Cl, and HCO_3.

[3] If VOAs are found during SO testing, degasifier off gas will be sampled at regular intervals.

TABLE C-5

ANALYTICAL METHODS AND DETECTION LIMITS

Parameter	Method	Detection Limit (µg/l)
Volatile Organics	SW846/8240	5-10
Metals	SW846/6010/7000	0.2-5000
Chloride	SW846/9250	5 mg/L
Nitrate and Nitrite	EPA353.2 or 353.3	1 mg/L
HCO_3	EPA 310.2	10 mg/L
Sulfate	SW846/9035 or EPA 375.4	5 mg/L
Total Dissolved Solids	EPA160.1/160.2	10 mg/L
Gross Alpha	EPA 900	2 pCi/L
Gross Beta	EPA 900	4 pCi/L
Plutonium 239+240	EMSL-LV-0539-17	0.01 pCi/L
Tritium	EPA 906.0	400 pCi/L
Uranium	EPA 908.0	0.6 pCi/L
Sr 89+90	EPA 905.0	

Note: Only the ranges of detection limits are presented for volatile organics and metals. Refer to the analytical methods for detection limits for individual parameters.

the analytical methods, and GRRASP for an exact description of the QA/QC measures and acceptance ranges.

C.3.3 Field Quality Control

Field QC samples will be included in the sampling plan to assure the accuracy and precision of the sampling and decontamination procedures. The QC samples and frequencies outlined below will be used; however, a more accelerated schedule for the type and frequency of field QC samples may be used by the EG&G RFP IM/IRA O&M Project Manager, depending on the testing and operations schedules.

- Field Duplicates—1 per 20 samples
- Field Preservation Blanks (radionuclides and metals only)
  - One per shipping container or 1 per 20 samples, whichever is more frequent
- Trip Blank (Volatile Organics only)—1 per 20 samples
- Equipment Rinseate Blank—not applicable

C.4 SAMPLING PROCEDURES

This section discusses the methods to collect samples during the IM/IRA SO testing and systems operation phases.

The samples will be collected in accordance with Rocky Flats Plant Environmental Management Department Operating Procedures (EG&G, 1991). The RFP EMD procedure (OPS) 5.2000-OPS-SW.07, Collection of Tapwater Samples, will be incorporated with slight modifications to collect the samples during both phases. The amount of sample required for analyses is given in Section C.5

and is based on the minimum quantity of the liquid needed to perform the required analyses. Sampling will be performed by the contractor operations personnel; however, subsequent handling will be performed by the designated RFP personnel inclusive of established chain-of-custody (COC) procedures. The contractor operators will collect the samples from the treatment system and transfer the sample custody of the sample over to the RFP personnel using the COC procedures defined in Section C.5.2.3. RFP personnel will be responsible for properly storing, packaging, and shipping the samples to the analytical laboratory. Radiological screening, if required, will also be the responsibility of the RFP personnel. Sample packaging and shipping must be in accordance with the RFP SOPs and Department of Transportation (DOT) regulations. The RFP personnel will also schedule and coordinate with the analytical laboratory.

C.4.1 Aqueous Samples

Figure 2-3 in the work plan indicated the sampling locations for the influent, intermediate treated streams, and the effluent from the IM/IRA train. The samples will be collected from online locations; that is, from the sampling valves located on the pipelines or the tanks.

Online samples will be collected simply by opening the valve on the sampling port and filling the appropriate sample containers. Initial sample volume, equivalent to approximately five times the volume of the sampling line, will be discarded to flush the sample line of its previous contents. The discarded sample will be stored in 5-gallon containers and recycled to the influent holding tanks via the floor drain sump.

The sampling will be preferentially performed beginning at the front of the treatment system and proceeding toward the end. To correlate the concentrations and flow rates, the samples will be collected from each sampling location within the residence time increments of the particular treatment unit, as possible. Samples will be collected with preservatives already in the sample containers. Samples requiring the same preservatives (such as HNO_3 for metals and radionuclides) can be collected in a larger vessel and then split into appropriate sample containers by the laboratory. Compositing during the continuous operations phase will be performed by the RFP

personnel using the average daily flow rate information. Volatile organics samples will be collected in 40-milliliter (ml) glass vials and filled to the top without any headspace. SOPs for proper containers, preservatives, holding times, and sample volumes are referenced in Section C.4.

No specific sampling equipment for the aqueous sample collection is envisioned. Sampling as described above is to be performed manually.

C.4.2 Air Samples

Procedures and guidelines to be provided by EG&G Rocky Flats. EPA analytical method TO 14 will be followed.

C.4.3 Sample Data Documentation and Procedures

Data Documentation Procedures will be consistent with the Rocky Flats Plant EMD OPS FO.14 entitled, Field Data Management. All measurements and observations will be recorded on the appropriate data form in accordance with the Rocky Flats Plant EMD Procedure 5-21000-OPS-FO.2, Field Document Control (EG&G, 1991). The original data forms will be collected and filed on site by the subcontractor's designated data entry personnel. These forms are to be bound and submitted to EG&G and accompanied by a transmittal letter on a weekly schedule for the entire duration of the task. The following information will be recorded at the time a sample is taken:

- Sampling activity name and number
- Sampling point name and number
- Sample number[1]
- Name(s) of collector(s) and others present[1]
- Date and time of sample collection[1]
- Sample container tag number (if appropriate)[1]

[1]Items to be documented on the COC form.

- Preservative(s) used[1]
- Requested analyses[1]
- Sample matrix[1]
- Filtered/unfiltered[1]
- Collection methods
- Chain of custody (COC) control numbers
- Field observations and measurements during sampling (comment section)
- Signature of responsible observer
- Designation of QC samples (only for matrix spikes [MS] and matrix spike duplicates [MSD])[1]

C.5 DECONTAMINATION AND SAMPLE HANDLING PROCEDURES

C.5.1 Decontamination

Decontamination is required in two aspects of sampling-related activities:

- Personal protective gear worn by the samplers

- Repetitive sampling equipment to minimize contamination carryover during equipment reuse

The HSP (Appendix A) discussed the decontamination procedures for personal protective measures.

Sampling is proposed to be performed directly from the sample lines into the sample containers. For this reason, no decontamination procedures will be necessary. However, if a need for

[1]Items to be documented on the COC form.

equipment decontamination arises, the Rocky Flats Plant EMD procedures 5-21000-OPS-FO.03, General Equipment Decontamination, will be followed.

C.5.2 Sample Handling Procedures

This section presents the procedures for sample designation and references the appropriate RFP SOPs for sample preservatives and containers, holding times, minimum sample volumes, chain-of-custody, and packaging and shipping.

C.5.2.1 Sample Designation

A sample designation system will be used to identify each sample collected during the field sampling effort. The sample designation system will be consistent with the Rocky Flats Plant EMD 5-21000-OPS-FO.14 entitled, Field Data Management (EG&G, 1991).

C.5.2.2 Sample Containers, Volumes, Preservatives, and Holding Times

The RFP personnel will send collected samples to the laboratory for subsequent analysis. Sample containers, volumes, preservatives, and holding times associated with samples collected for analysis will be consistent with the Rocky Flats Plant EMD Procedure 5-21000-OPS-F0.13, entitled, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples.

C.5.2.3 Sample Custody

A required part of this sampling and analytical program is the integrity of the sample from collection to data reporting. This includes the ability to trace the possession and handling of samples from the time of collection, through analysis, to final deposition. The documentation of the samples history is referred to as "chain-of-custody." Sample custody procedures will be consistent with the Rocky Flats Plant EMD OPS FO.13 entitled, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples.

C.5.2.4 Sample Packing and Shipping

Packing and shipping of samples will be consistent with the Rocky Flats Plant EMD Procedure 5-21000-OPS-FO13 entitled, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples (EG&G, 1991).

C.5.2.5 Department/Office Contact List

EG&G Rocky Flats or its designee is responsible for obtaining the appropriate documentation for radiation (RAD) screening, and monitoring of all field samples for shipment off site.

The following departments will need to be contacted before sample shipment.

- **Construction Management Coordinator**—To obtain property passes for shipment of materials off site

- **Radiation Site Survey Office**—For radiation monitoring and clearance of off site shipment of coolers

- **Onsite General Laboratories**—For radiological screening and categorization of field samples

Appendix D

Systems Operation Test Plan

APPENDIX D. SYSTEMS OPERATION TEST PLAN

D.1 EXECUTIVE SUMMARY

Systems operation (SO) testing will be conducted for the Interim Measure/Interim Remedial Action (IM/IRA) for the 881 Hillside OU 1 at the Rocky Flats Plant (RFP). Detailed information on the IM/IRA at OU 1 is presented in Section 2.0 of the Work Plan.

SO testing includes equipment testing to confirm that each unit will function correctly at the design conditions, process testing to verify that each process provides the required treatment, and total system testing to establish that all of the component systems function together as a single treatment system.

The treatment facility installed at Building 891 will treat groundwater collected at the 881 Hillside area. The collection and treatment system consists of the following:

- A recovery well, french drain, and 881 building drain to intercept and pump the groundwater to the treatment facility
- Flow equalization/storage tanks
- An advanced oxidation process consisting of an ultraviolet/hydrogen peroxide (UV/H_2O_2) treatment unit
- An ion exchange (IX) system consisting of four columns containing resins for removal of radionuclides, metals, and total dissolved solids (TDS)

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By
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- Degasifier
- Ion exchange regeneration system
- Treated effluent storage tanks
- Neutralization tank

Figure D-1 presents the treatment facility flow sheet.

Testing will be conducted sequentially according to the status of the treatment units. Both the UV/H_2O_2 and the IX processes will be tested with clean water before groundwater testing of any unit will be started. Clean water testing will be conducted to check out all instrumentation and flow characteristics at selected flow rates. After clean water testing, the IX resins will be regenerated. At that time, SO testing of the groundwater collection/storage system will be started, followed by performance testing of the treatment processes.

The schedule presented in Section D-11 shows that the SO testing will begin March 2, 1992, and end April 3, 1992.

D.2 INTRODUCTION

The purpose of the SO test is to evaluate the capability of equipment and systems installed at Building 891 to transfer and treat the Hillside 881 groundwater. In the SO test, operating conditions will be varied to optimize system performance. The results of the SO test will be used to establish and optimize operating procedures, system flow rates, and other parameters for systems operation.

D.3 ACRONYMS AND ABBREVIATIONS

AOP advanced oxidation process

ARAR	applicable or relevant and appropriate requirements
CO_2	carbon dioxide
DOE	(U.S.) Department of Energy
EMD	Environmental Management Department
ER	Environmental Restoration (Program)
gpm	gallon per minute
HSP	Health and Safety Plan
H_2O_2	hydrogen peroxide
I&C	instrumentation and control
IHSS	Individual Hazardous Substance Sites
IM/IRA	Interim Measure/Interim Remedial Action
IX	ion exchange
l	liter
MCC	motor control center
mg	milligram
ml	milliliter
NaOH	sodium hydroxide
O&M	operation and maintenance
OPS	operating procedures
OU	operable unit
PLC	programmable logic controller
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Recovery and Conservation Act
R&D	research and development
RFP	Rocky Flats Plant
rpm	revolution per minute
SAP	Sampling and Analysis Plan
SO	systems operation
SOP	standard operating procedure

TDS	total dissolved solids
TSD	treatment, storage, and disposal
TSS	total suspended solids
UV	ultraviolet
UV/H_2O_2	ultraviolet/hydrogen peroxide

D.4 PROJECT DESCRIPTION

The SO testing will be conducted to verify the ability of the process units and appurtenances to handle and treat the collected groundwater before beginning systems operation. Because there are three types or classes of groundwater contaminants, each process or part of a process is designed to remove one type of contaminant:

- **UV/H_2O_2**—This is an advanced oxidation process (AOP) that has been found to be effective in removing many organics in groundwater. The major mechanism is oxidation of organic molecules through the use of an oxidant—hydrogen peroxide—in the presence of UV light. If carried to completion, chlorinated organics are oxidized to water, carbon dioxide (CO_2), and hydrochloric acid. Under some conditions, a portion of the organics may escape through vaporization. A closed system will be used to maximize oxidation of the organics and reduce the potential for vaporization.

- **Ion Exchange**—The purpose of the IX process is threefold. The first column contains a strong base resin for removing the radionuclides. The second column in the series contains a weak acid resin designed primarily to remove metals from the groundwater. The two remaining columns contain resins to remove other anions and cations so that the treated water will meet discharge requirements for release to the interceptor ditch.

D.5 TEST OBJECTIVES

In general, the system operation test objectives are to verify that the process equipment and systems function as designed to handle and treat the 881 Hillside groundwater. It is assumed that all system leak and hydrostatic testing will have been completed before the SO tests are started. Objectives for each specific system or process are:

- **Groundwater Collection and Pumping System**—Verify that the pumps at the recovery well, french drain collection sumps, and the Building 891 sump function correctly (turn on and off automatically as the level rises and drops) and that they pump at the required rate. The Building 881 footing drain sump will be gravity fed to the influent storage tanks.

- **Influent Characterization**—Determine the organic and inorganic contaminant concentrations for each influent stream (Building 881 drain, french drain, and recovery well).

- **Influent Transfer Pumps**—Determine actual flow and pressure characteristics for both transfer pumps. Also establish operational flow rates associated with pump speed settings and verify that the pumps can transfer water at 30 gpm or more through the UV/H_2O_2 when the surge tank is full.

- **UV/H_2O_2 Process**—Two major objectives apply to the UV/H_2O_2 process testing. They include establishing process variables that will result in oxidation of the organics to the treatment goals and determining whether pretreatment of the groundwater or other control systems needs to be added.

  Process variables to be evaluated include flow rate/residence time, H_2O_2 dosage, and UV intensity. To adequately oxidize the groundwater organics, they must be in direct contact with the oxidant (H_2O_2) for some minimum period of time while being

exposed to UV light. Preliminary bench-scale tests were previously conducted to determine approximate relationships for the sample of groundwater tested. The SO tests will provide the additional data for setting each of the three variables for the IM/IRA operation.

During the SO tests, particular attention will be given to the potential need for removal of suspended solids or pH adjustment in a pretreatment system to enhance UV light transmission. pH adjustment of the influent may be necessary if iron is present in sufficient quantity to coat the quartz tubes in the UV reactor.

Loss of volatile organics through off gassing or vaporization in or following the UV/H_2O_2 process will be evaluated, and the need for vapor controls at the IX surge tank will be considered. Bench testing revealed that some of the organics may be released through vaporization during the oxidation process and that heating of the water may increase the amount of organics vaporized. The amount of power used in the UV lamps causes significant heating of the water. Therefore, both heating and off-gas generation will be examined in the SO tests.

- **IX Inlet Pump**—The IX inlet pump transfers water to the IX system through two columns and a degasifier from the surge tank. This pump will be tested in the same manner as the influent transfer pumps previously discussed.

- **Intermediate IX Feed Pump**—The intermediate IX feed pump transfers water from the degasifier through the final two IX columns to the effluent holding tanks. This pump must be capable of maintaining a flow rate compatible with the upstream flow rate when discharging into a full effluent tank. Testing will be performed in the same manner as the influent transfer pump.

- **IX System**—The IX system consists of four columns, each containing strong base, weak acid, strong acid, or weak base resin. Removal of radionuclides, metals, and

other pertinent ions will be monitored to determine the required frequency for regeneration and the actual loadings attainable. The effect of operating conditions—notably flow rate/residence time—on treated water quality and resin capacity will be evaluated during the SO test.

- **Degasifier**—The IX degasifier located in the treatment system following the second IX column (weak acid resin) is provided to eliminate gases that may otherwise tend to come out of solution in subsequent columns and cause short circuiting in the resins. The degasifier will be monitored to determine whether degasification is needed and if off-gas treatment will be necessary in a long-term groundwater treatment system.

- **IX Regeneration**—Verify the ability of the regeneration system to operate as designed and confirm the chemical requirements for regeneration of each column. The regeneration success will be evaluated by observing changes in processing efficiencies following successive regenerations.

Additionally, all alarms will be checked to determine if they operate properly.

D.6 TEST PROCEDURES

This section presents the procedures for conducting pretesting instrument calibration and SO tests on the following systems:

- Groundwater Collection and Pumping System
- Influent Transfer System
- UV/H_2O_2
- Ion Exchange System
- Degasifier
- Ion Exchange Regeneration System

D.6.1 Instrument Calibration

Before starting the SO testing, key instruments will be calibrated. Calibrations will be documented in a calibration notebook. Instruments requiring calibration and or setting will include the following:

- Pressure gauges
- Differential pressure gauges (ion exchange unit)
- Flow meters
- Level indicators
- Level switches
- Flow switches
- Electrical ammeters
- Temperature gauges
- pH meters
- Conductivity meters

Each will be calibrated initially and again annually according to the appropriate procedures.

1. **Pressure Gauge**—Before starting any tests, pressure gauges will be removed from the treatment units and calibrated by a commercial gauge shop. They will be reinstalled before starting the tests.

2. **Differential Pressure Gauges**—These gauges measure differential pressure across each ion exchange column. They will be calibrated in accordance with procedures supplied by Bruner in their operations and maintenance (O&M) manual.

3. **Temperature Gauges**—Temperature gauges will be calibrated during the clean water part of the SO tests. This calibration will be conducted by a commercial gauge shop. They will be reinstalled before starting the tests.

4. **Flow Meter**—Both of the treatment processes use paddlewheel type flow meters to indicate and totalize flow. The meters, manufactured by Signet Scientific Company, have a solid state digital readout. Flow rates will be checked and the meters calibrated in accordance with instructions supplied by the manufacturer.

5. **Level Indicators**—During the clean water hydrodynamic SO testing, the treatment system operators will take physical measurements of tanks equipped with level indicators and field calibrate the indicators as directed by manufacturers instructions.

6. **Flow Switches**—Flow switches are used by the process system manufacturers to sense a low-flow situation for alarm or shut down purposes. The switch setting will be verified initially during the SO clean water testing and adjusted as necessary.

7. **Level Switches**—Initially, all sump and tank level switches will be set when there is sufficient water to start the SO tests.

8. **Electrical Ammeters**—The electrical ammeters will be checked for calibration in accordance with manufactures instructions. If calibration is needed, a field calibration procedure (manufacturer supplied) will be followed (if applicable) or the meter will be replaced.

9. **pH Meters**—pH meter calibration will be checked using a standard pH reference solution by the plant operators each time the system is started up. This will typically be on a daily frequency.

10. **Conductivity Meters**—Conductivity meters are installed on the ion exchange system. These will be checked and recalibrated as required in accordance with instructions by the ion exchange system manufacturer.

D.6.2 Groundwater Collection and Pumping System

The system consists of a recovery well pump, french drain sump pumps (2), and Building 891 sump pumps (2). In each installation, the constant speed pumps are controlled by level switches in a well or sump. Testing consists of verifying that the pumps are operable and that they turn on and off at the desired level (level switches are set properly). The following are the testing procedures for each location:

1. Review pump curves to determine operating settings.

2. Verify that the valves are open from the pump(s) to equalization/storage tanks including the motorized inlet valve at the tank to be filled.

3. Confirm that there is water in the sump or well being tested. For the Building 891 sump, add clean water to the sump as necessary.

4. Energize the pump circuit at the control panel so that the pump can be started and stopped locally.

5. Place the local pump switch in the "on" position and verify that the pump operates and pumps the level down.

6. Move the switch to the "auto" position and observe the level when the pump starts and stops.

7. Adjust the level switches as necessary to change the "start" or "stop" level.

8. Repeat steps 2 to 6 for each pump.

D.6.3 Influent Transfer System

Groundwater from the 881 Hillside area is collected and pumped to one of two influent equalization tanks at the treatment facility. Two influent transfer pumps are provided to transfer the water from the equalization tanks to the UV/H_2O_2 process. The influent transfer system will be tested before subsequent systems are tested. The test procedure is as follows:

1. Verify that one of the influent equalization tanks contains a minimum of 2,000 gallons before starting the test.

2. Open the motorized valve at the outlet from the equalization tank containing water for the test. Also, open the valves (inlet and outlet) at the pump being tested and verify that the other treatment system valves are open to allow water to flow through the UV/H_2O_2 unit to the IX surge tank.

3. Verify that the pump disconnect at the motor control center (MCC) is in the "ON" position and that the hand switch at the programmable logic controller (PLC) is in the "OFF" position.

4. If provided, verify that the flowmeter setting at the UV/H_2O_2 control panel is approximately 10 gpm.

5. Start the pump by moving the switch at the PLC to the "AUTO" position.

6. Visually confirm that the pump is running and that the flow rate (flowmeter reading) is 10 gpm.

7. Record the pressure indicator at the pump discharge (open the gauge isolation valve if closed).

8. Verify that there are no leaks in the transfer piping. If leaks are determined, stop the pump, correct the leak(s), and restart the test by repeating the above steps.

9. Increase the pumping rate (pump speed) to 30 gpm and record the pump discharge pressure.

10. Recheck to determine that there are no system leaks.

11. Increase the pumping rate to the maximum setting (if the maximum setting was not already attained) and record the flow rate and pump discharge pressure.

12. Stop the influent transfer pump.

13. Close the pump inlet and outlet valves for the pump previously tested and open the inlet and outlet valves for the other transfer pump.

14. Repeat steps 2 through 12 above for testing the second transfer pump.

15. After the transfer system has been successfully tested, proceed to the testing of the UV/H_2O_2 process.

Although the iron concentration was low in the groundwater samples used for bench-scale testing, some concern remains whether or not the iron concentration is sufficient to precipitate on the UV quartz tube or otherwise reduce the efficiency of the UV/H_2O_2 process. Jar testing may be conducted based on the results from the SO tests to determine how effectively iron can be removed if such removal is required. The mechanism for iron removal in jar testing studies is precipitation as the hydroxide at elevated pH. To accomplish this, sodium hydroxide (caustic) or lime is added to water containing iron to achieve various pH levels. Iron hydroxide is least soluble above pH 8.0, approximately. However, depending on the presence of other inorganics and some organics, a higher pH may be required to remove iron.

The jar tests, if done, will be conducted as follows:

1. Place equal amounts of untreated groundwater in six beakers; suggest 700-milliliter (ml) samples in 1-liter breakers.

2. While rapidly stirring, add caustic (1N sodium hydroxide [NaOH]) dropwise to the first beaker to pH 8.0. The next four beakers should be raised to pH 8.5, 9.0, 9.5, and 10.0. Do not add caustic to the sixth beaker as it will serve as the "control."

   Note: If the target pH is exceeded in any beaker, do not add acid to reduce it. Instead, discard that sample and replace it with a fresh sample.

3. Reduce the speed of the mixer to approximately 15 revolutions per minute (rpm) for 3 minutes.

4. Stop the mixer and allow the sample to settle for 30 minutes. Note and record the pH, comparative floc size, color, settling rate, and supernatant clarity.

5. Retain the supernatant from the best (clearest) beaker and the control beaker for iron analysis.

6. If no (or inadequate) precipitation occurred, repeat the above procedure after adding about 10 milligrams per litter (mg/L) H_2O_2 to the sample.

7. Once the optimum or best pH has been established based on observation, conduct additional jar tests by using polymer to improve the settling of the precipitate.

8. Repeat Step 1 above.

9. While rapidly stirring, add caustic to each beaker to achieve the best pH.

10. While rapidly stirring, add 5 mg/L of polyelectrolyte to each of five beakers by using the following:

    - Strong cationic
    - Weak cationic
    - Nonionic
    - Strong anionic
    - Weak anionic

11. Repeat Steps 3 to 5 above.

D.6.4 UV/H_2O_2 Process

Process testing of the UV/H_2O_2 unit will consist of evaluating the removing organics at various flow rates (reaction time), H_2O_2 concentrations, and UV intensity. The test will also evaluate the potential for fouling of the quartz tubes. Each test will be conducted as follows:

1. Make sure the influent equalization tank has sufficient water to conduct the test. The tank should contain at least 10,000 gallons.

2. Open the valves to allow water to flow from the tank, through the UV/H_2O_2 unit, and to the surge tank.

3. Start the influent transfer pump and establish a flow rate of 30 gpm.

4. Energize the UV lamps in Reactor No. 1.

5. Energize the UV lamps in Reactor No. 2.

6. Start the H_2O_2 feed pump.

7. Check and record the following at 15-minute intervals:

- Flow rate
- Pump discharge pressure
- Reactor outlet temperature
- Reactor UV light intensity

8. After 1 hour of operation, collect samples at the UV/H_2O_2 unit inlet and outlet and at the outlet from the first reactor.

9. Change the H_2O_2 feed setting and repeat steps 7 and 8 above.

10. to
17. Repeat steps 7 and 8 using different flow rates, and H_2O_2 doses.

18. Turn off the UV lamps and H_2O_2 pump.

19. Stop the transfer pump and close the equalization tank outlet valve.

D.6.5 Ion Exchange System

The IX SO tests are established to confirm the system capability to pass the 30-gpm flow, while removing the individual inorganic constituents, metals, and radionuclides to levels below the ARARs.

The IX system consists of the IX surge tank, a feed pump, an intermediate pump, four IX columns, a degasifier, and a regeneration system. For the purpose of this SO test plan, the following functions are assumed to have been previously completed:

- Pump rotation checks

- Calibration of IX system instrumentation

- Clean water hydrodynamic testing of the ion exchange system including the regeneration system and column except that the columns would contain no resin (test completed before charging the resin in the columns).

It is also assumed that a manufacturer's representative will be available to direct the placing of the resin in the columns and to assist with setting the regeneration sequence.

Before starting the IX SO tests, the clean water tank must first be filled. Also, the acid and caustic storage tanks must be filled to start the tests. The test procedures are as follows:

1. Regenerate each column in accordance with instructions contained in the IX system O&M manual provided by the manufacturer.

2. Verify that the surge tank contains at least 10,000 gallons of UV/H_2O_2 treated water for use in the SO test.

3. Set the IX system values to allow water to flow through the columns to one of the effluent tanks.

4. Start an IX feed pump, intermediate pump (both at about 15 gpm), and degasifier blower.

5. Measure and record pressure, temperature, flow rate, pH, and conductivity.

6. After 2 and 4 hours of operating the IX system, collect effluent samples from each column and composite them (two for each column) for analysis in accordance with the SAP (Appendix C).

7. Collect off gas samples from the degasifier for analysis in accordance with the SAP (Appendix C).

8. Repeat steps 5, 6, and 7 above at the design flow rate of 30 gpm.

9. Repeat steps 4 through 8 to evaluate the IX system for water generated by each test of the UV/H_2O_2 process.

D.6.6 Combined System

The SO test for the combined system is conducted to confirm that all processes operate as designed. The procedures described previously for operating the individual processes will be followed.

The best H_2O_2 doseage from the UV/H_2O_2 SO test and the design flow rate will be used during this SO test and will not be varied. One sample will be collected daily from all sampling locations and analyzed for the parameters listed on Table C-3.

D.7 DATA MANAGEMENT

The SO test will generate observational data as well as analytical data for the unit processes. Observations of the tests will be documented in logbooks assigned to the SO test personnel. The influent and the effluent from each unit process will be analyzed as described in Appendix C, Sampling and Analysis Plan.

As described in Section D.6, "SO Test Procedures," the following are the SO tests to be conducted:

- Groundwater collection and pumping system
- Influent transfer system
- UV/H_2O_2

- Ion exchange system
- Degasifier
- Ion exchange regeneration system

At a minimum, the SO test field log books will document the following for each of these tests:

- Test procedures
- Departures from protocols and reasons for departures
- Test observations
- SO test operating parameters
- Instrument calibration, if any
- Sampling methods
- Sample collection and shipment details

Some of the observations are qualitative. Therefore, SO test personnel will need to describe results in qualitative terms to indicate relative differences between different operating conditions. Experimental results that are quantitative (such as pH) will be reported to the accuracy level of the measurement device. In addition to field log books, scientific notebooks will be kept in accordance to Administrative Procedure 3-21000-ADM-05.12.

Comprehensive data packages will be generated by the analytical laboratory for the organics analyses of the unit processes effluent in accordance with the requirements presented in Appendix B. Similar data packages will be generated for radionuclide and water quality parameters, so that the accuracy and the precision of the results can be independently verified. The analytical data packages will be tracked and managed according to the tests performed and laboratory quality control (QC) group numbers assigned by the laboratory. Where applicable, QC data will also be obtained in an electronic format to facilitate data uploading into the project data base.

All SO test analytical data will be input into Lotus or other simple data base for easy data manipulation. The following information will be included with the analytical results:

- Unit process
- SO test number
- Date sample collected
- Date and time test initiated
- Date and time test concluded

Analysis and interpretation of the data are discussed in the following section.

D.8 DATA ANALYSIS AND INTERPRETATION

Upon completion of the SO testing, data will be summarized and evaluated to determine the validity of measurement and performance of the system. Section 3.0 of the RFP Quality Assurance Project Plan (QAPP) described the requirements for data reduction, validation, useability criteria, and reporting of data. Section 6.0, "Quality Assurance Addendum," of the Work Plan addresses the specific QA requirements for performing the SO tests.

D.8.1 Measurements of Performance

Data will be checked to assess data for precision, accuracy, and completeness in accordance with Functional Guidelines for Laboratory Data Validation (EPA, 1988). Where guidelines for data validation are not available, such as for water quality parameters and radionuclides, standard operating procedures will be prepared based on the analytical methods utilized and the QA/QC measures included in the analyses. The Environmental Management Department Operating Procedures (EMD OPS) will allow uniform validation of the water quality parameter and radionuclide data. Qualified personnel not directly associated with the SO testing or laboratory analyses will perform the data validation function at the direction of the SO testing personnel.

D.8.2 Analysis and Interpretation

Once the data have been validated, they will be interpreted to determine if the objectives of the SO test have been met. The primary means for interpreting the data is to calculate percent removals for each contaminant of concern. The SO test logbooks will also be reviewed to determine any operational problems. Data will also be evaluated to determine operating parameters for system operation. All of this information will be used to develop the SO Test Report, described in Section D.10.

D.9 RESIDUAL MANAGEMENT

Residuals expected to be generated during the SO test include the following:

- Excess sample
- Spent regenerant
- In-line bag filters
- Cloth (PPE, chem wipes)
- Sample bottles
- Soil
- Garbage

Excess sample will be generated from the flushing of the sample lines. The discarded sample will be stored in 5-gallon covered containers and dumped into the Building 891 sump for recycling. Not more than 5 gallons per day is estimated to be generated during SO testing. Because the excess sample will be recycled, it will not need to be analyzed. The excess sample should have no impact on the budget or schedule.

Spent regenerant will be a residual generated from the IX columns. The spent regenerant will go to the neutralization tank. The actual volume of spent regenerant that will be generated will be determined after the IX O&M manuals are received. The spent regenerant will be analyzed for metals, radionuclides, TDS, and total suspended solids (TSS) as described in Appendix B. Depending on

the spent regenerant volume, treatment may have to be slowed down. The treatment would need to be slowed down to allow time for analysis before the regenerant is discharged. This could have a significant impact on the schedule and budget.

There are two in-line bag filters: (1) between the IX surge tank and IX column number 1 and (2) in the recycle line to the clean water storage tank. The particulates to be collected by these filters are anticipated to be minimal. These filters will be sampled in accordance with the standard operating procedure (SOP) for OU 2 (South Walnut Creek). The disposition of the filters will be in accordance with EMD procedures 5-21000-OPS-FO.06 and 5-21000-OPS-FO-09. Management of these residuals is not expected to impact the budget or schedule.

The cloth, sample bottles, and soil will be handled in accordance with EMD procedures 5-21000-OPS-FO-06 and 5-21000-OPS-FO-09. Not more that two 55-gallon drums of each type of waste are anticipated to be generated during the SO test. Management of these residuals is not expected to impact the budget or schedule.

Garbage is an anticipated waste from all RFP activities and will be disposed of in the same manner as other RFP garbage.

The laboratory will be responsible for properly disposing of any unused portions of the effluent samples submitted for analyses, and incidental wastes generated during sample preparation and analysis.

D.10 SYSTEMS OPERATION TEST REPORT

The SO test results will be summarized in a System Operation Test Report. The report will be prepared upon completion of SO testing (including analyses) and will summarize the test results and discuss any improvements or additional testing that may need to be conducted. The format of the report is presented in Table D-1.

TABLE D-1

SO TEST REPORT OUTLINE

INTRODUCTION—A brief description that will describe the site location, history, and the remediation activities will be included. The introduction will also include a brief description of the recovery and treatment equipment and technology. More detailed documents on remediation design and implementation will be referenced. A brief description of the purpose and objectives of the SO test will also be included.

SO TEST DESCRIPTION—This section will present a brief description of the SO tests. A more detailed description of test methods will be included in the appendices. This section will also provide information on actual execution of the tests and note any deviations.

RESULTS AND DISCUSSION—This section will present the results. Summary data will be presented in tabular format.

CONCLUSIONS AND RECOMMENDATIONS—This section will discuss whether the test objectives were met. It will also make recommendations on minor improvements and/or modification to the system. If needed, additional testing will be recommended.

REFERENCES—References used during SO testing and data analysis and interpretation will be listed.

APPENDICES—The appendices will include raw data, referenced SO tests, standard operating procedures, and any additional information relevant to the study.

D.11 SYSTEMS OPERATION TEST SCHEDULE

The SO tests will be conducted over a 5-week period beginning March 2, 1992 (see Figure D-2):

- The first and second weeks will include operator familiarization with the treatment facility, equipment and instrumentation checkout and calibration, and hydraulic evaluation. The first and second weeks will also include placing resin in the reactors, clean water operation of the ion exchange system, and initial regeneration of the resin. Weeks 1 and 2 will include pumping of groundwater to the equalization tank, setting of sump level controls and alarms, and initial testing of the UV/H_2O_2 and ion exchange systems. These tests will include the preliminary tests in which two flow rates will be used to evaluate the effect of residence time in the process units. The UV intensity and H_2O_2 dosage will be held constant.

- In the third and fourth weeks, testing of the process units will continue with varying H_2O_2 concentration, UV lamp intensity, and flow rate. Varying combination of these parameters will be evaluated. Bench-scale tests will be conducted to determine treatment requirements for removing TSS and iron.

- The fifth week will be used to make minor corrections in the process units that may have been identified and repeat tests as appropriate to confirm the results of previous tests.

DRAWN BY	Douville	CHECKED BY	Pat L.	2-20-92	DRAWING NUMBER	RF1041
	01/14/92	APPROVED BY	Pat L.	2-20-92		

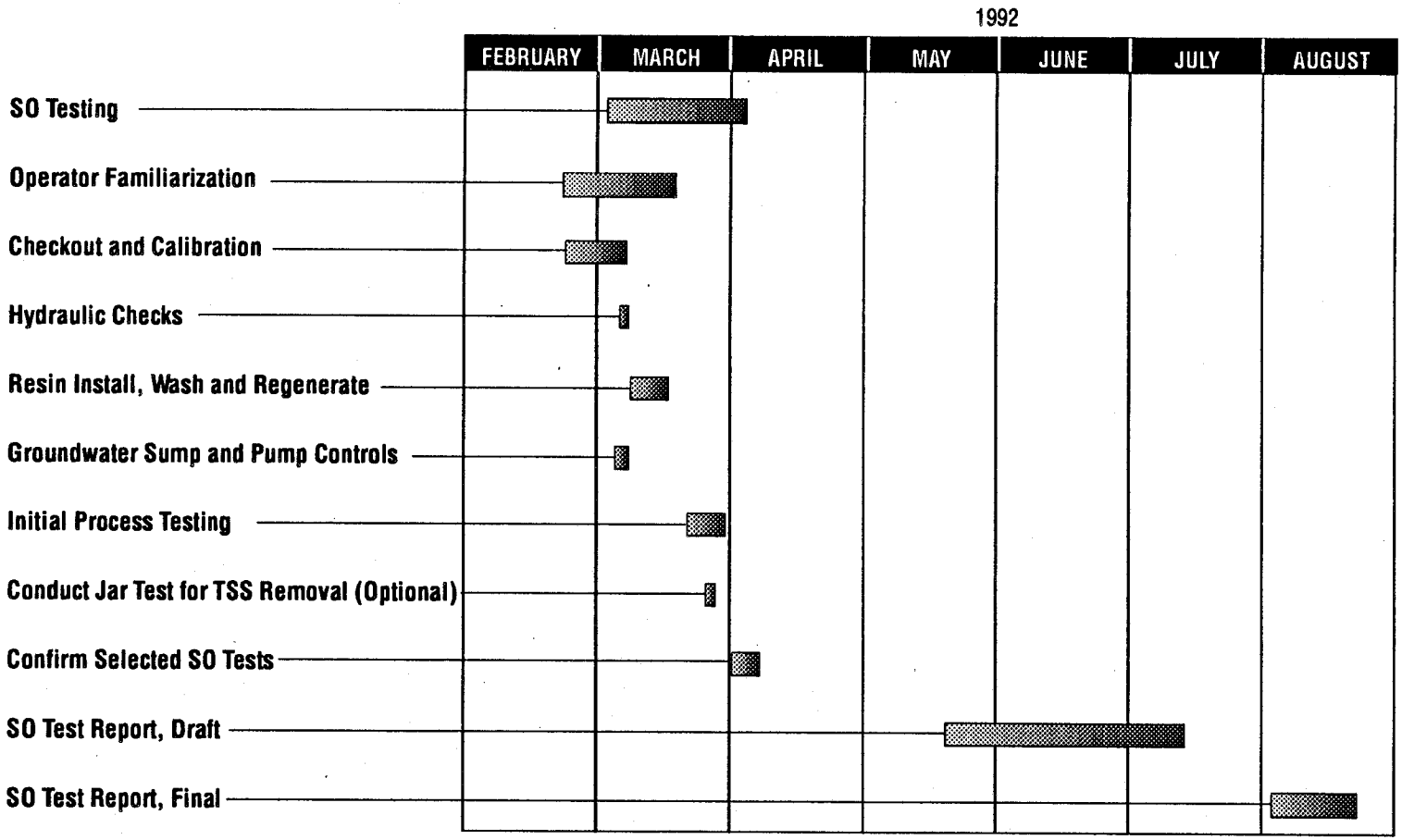

Figure D-2
SYSTEMS OPERATION TEST SCHEDULE

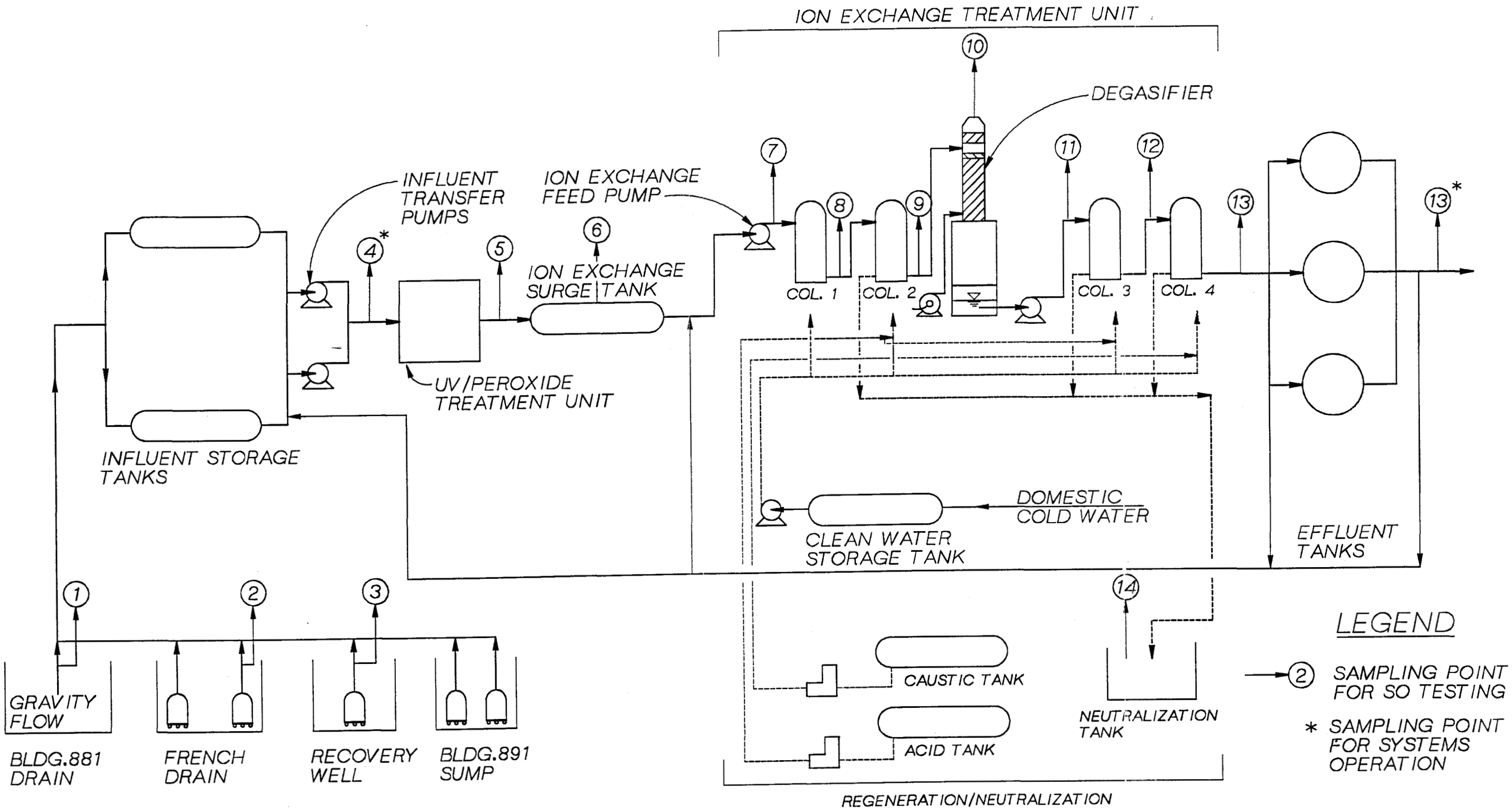

Figure 2-3
IM/IRA TREATMENT SYSTEM

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		APPROVED BY	Pat L.	2-13-92		

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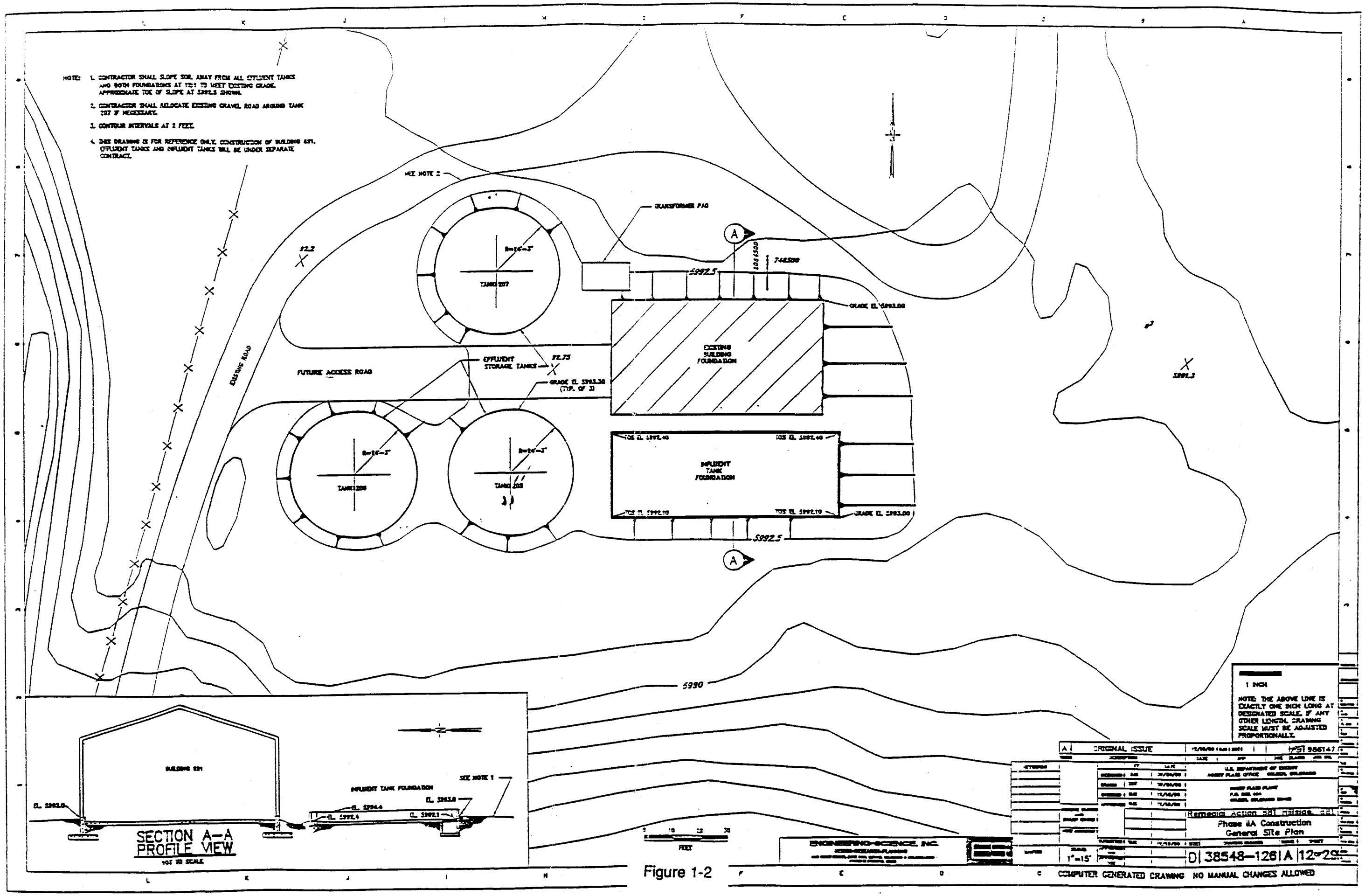
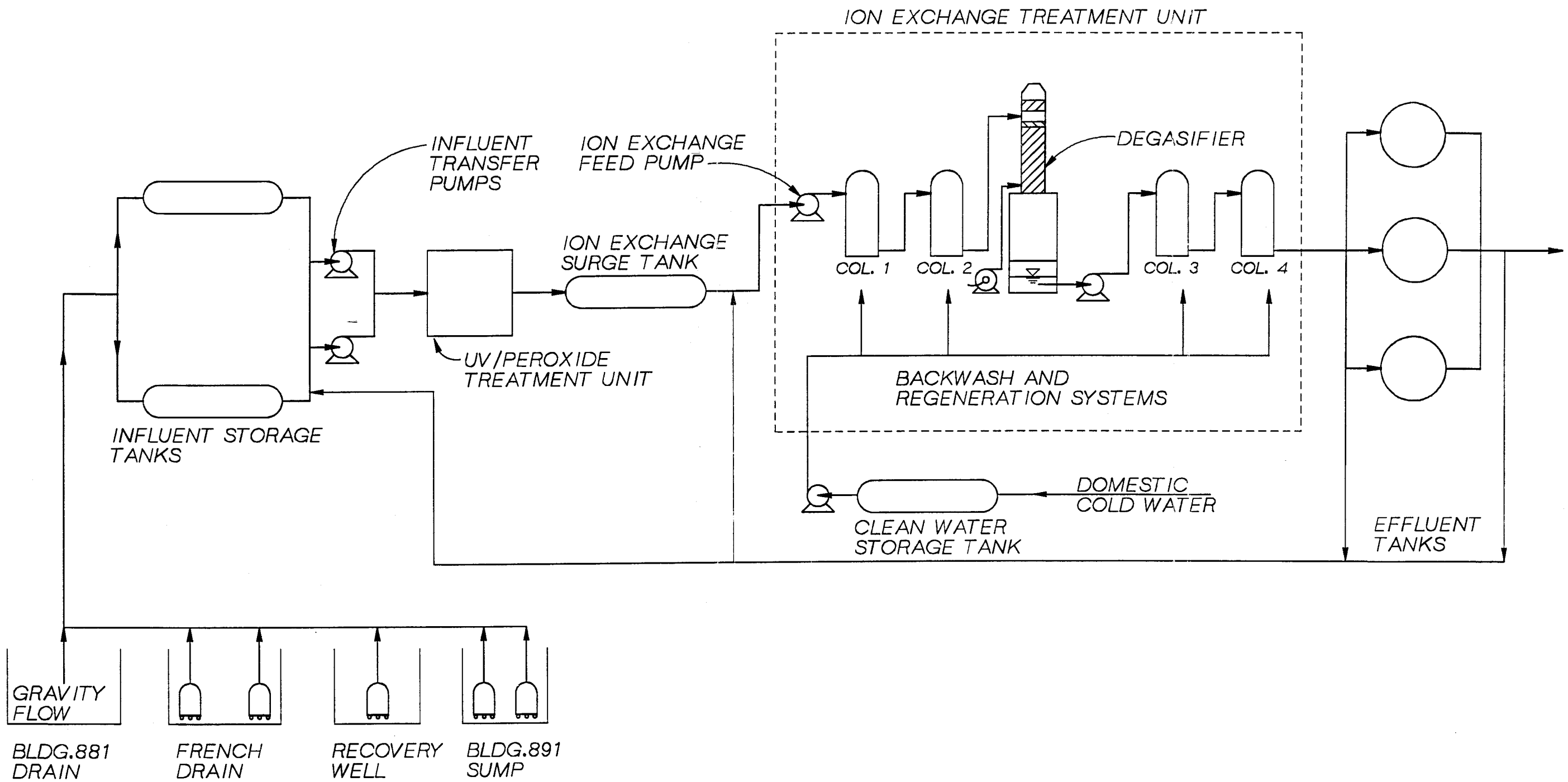

NOTES: 1. CONTRACTOR SHALL SLOPE SOIL AWAY FROM ALL EFFLUENT TANKS AND BOTH FOUNDATIONS AT 12:1 TO MEET EXISTING GRADE. APPROXIMATE TOE OF SLOPE AT 5992.5 SHOWN.
2. CONTRACTOR SHALL RELOCATE EXISTING GRAVEL ROAD AROUND TANK 207 IF NECESSARY.
3. CONTOUR INTERVALS AT 2 FEET.
4. THIS DRAWING IS FOR REFERENCE ONLY. CONSTRUCTION OF BUILDING 521, EFFLUENT TANKS AND INFLUENT TANKS WILL BE UNDER SEPARATE CONTRACT.
SEE NOTE 2
TRANSFORMER PAD
A
2045500
748500
5992.5
GRADE EL. 5993.00
EXISTING BUILDING FOUNDATION
EXISTING ROAD
FUTURE ACCESS ROAD
EFFLUENT STORAGE TANKS
92.73
GRADE EL. 5983.30 (TYP. OF 3)
92.2
5991.3
R=26'-3"
TANK 207
TANK 208
TANK 205
INFLUENT TANK FOUNDATION
TOS EL. 5992.40
TOS EL. 5992.10
5990
BUILDING 521
INFLUENT TANK FOUNDATION
SEE NOTE 1
EL. 5993.0
EL. 5994.4
EL. 5993.0
EL. 5992.1
EL. 5992.4
SECTION A-A
PROFILE VIEW
NOT TO SCALE
0 10 20 30
FEET
1 INCH
NOTE: THE ABOVE LINE IS EXACTLY ONE INCH LONG AT DESIGNATED SCALE. IF ANY OTHER LENGTH, DRAWING SCALE MUST BE ADJUSTED PROPORTIONALLY.
A ORIGINAL ISSUE
ENGINEERING-SCIENCE, INC.
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE
ROCKY FLATS PLANT
Remedial Action 881 Hillside 521
Phase IIA Construction
General Site Plan
1"=15'
D 38548-126 A 12 of 29
COMPUTER GENERATED DRAWING NO MANUAL CHANGES ALLOWED

Figure 1-2



DRAWN BY	Douville 01/14/92	CHECKED BY	Part L. 2-13-92	DRAWING NUMBER	RF1043
		APPROVED BY	Part L. 2-13-92		

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Figure D-1
PROCESS FLOW DIAGRAM