ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

CONSOLIDATED WATER TREATMENT FACILITY

HEALTH AND SAFETY PLAN

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Prepared for

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Resource Conservation and Recovery Act (RCRA) Part A

RCRA Part B Permit Application (DOE 1986b, DOE 1986c)

Draft Interagency Agreement (IAG 1990)

Final Phase III RFI/RI Work Plan, Rocky Flats Plant, 881 Hillside Area Operable Unit No 1

Phase II RFI/RI Work Plans for Alluvial and Bedrock, 903 Pad, Mound, and East Trenches Areas

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Final Phase I RFI/RI Work Plan for OU11 (West Spray Field), Rocky Flats Plant

Standard Test Methods for Chemical Permeability (ASTM F-739)

NIOSH Pocket Guide to Chemical Hazards (June 1994)

ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1994-1995)

1 0 INTRODUCTION AND PURPOSE

1 1 PURPOSE

The purpose of this plan is to protect plant personnel, the general public, equipment, and the environment. This plan establishes requirements and provides guidelines for worker safety and hazard identification during subcontractor operation of the Consolidated Water Treatment Facility (CWTF) The CWTF is located in Building 891 and associated areas at the Rocky Flats Environmental Technology Site (RFETS) in Golden, Colorado

1 2 SCOPE

This plan applies to RFETS contractors, subcontractors and visitors involved in operation, management, or administration at the CWTF in or near Building 891 and associated areas It addresses comprehensive health and safety concerns involved in routine activities but should not be considered to cover all conceivable situations Non-routine tasks will be reviewed and approved by sub-contractor Health and Safety, contractor Industrial Health and Safety, and Radiological Engineering (if applicable) This plan should not be construed to override or eliminate any other requirement that applies to work at the CWTF

2 0 SITE HISTORY AND NATURE OF CONTAMINATION

2 1 ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

2 1 1 Physical Setting

RFETS is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver The cities of Boulder, Broomfield, Westminster, and Arvada are located less than 10 miles to the north, northeast, east, and southeast, respectively RFETS consists of approximately 6,550 acres of federal land and occupies Sections 1 through 4 and 9 through 15 of Township 2 South, Range 70 West, 6th Principal Meridian. Major plant buildings are located within an RFETS security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres. RFETS is generally bounded on the north by State Highway 128 To the east is Jefferson County Highway 17, also known as Indiana Street, to the south are agricultural and industrial properties, and State Highway 72, and to the west is State Highway 93

2 1.2 Site Background

RFETS is a government-owned and contractor-operated facility that is part of the nationwide nuclear weapons production complex. It was operated for the U S Atomic Energy Commission (AEC) from RFETS's inception in 1951 until the AEC was dissolved in January 1975 Then, responsibility for RFETS was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by the Department of Energy (DOE) in 1977 Dow Chemical USA, an operating unit of the Dow Chemical Company, was the managing and operating contractor of the facility from 1951 until June 30, 1975 Rockwell International succeeded Dow Chemical USA from July 1, 1975 to January 1, 1990 EG&G Rocky Flats, Inc. succeeded Rockwell International and operated the plant from January 1, 1990 to July 1, 1995

2 1.3 Rocky Flats Plant Operations

Until 1992, Rocky Flats' primary mission was to produce metal components for nuclear weapons. These components were fabricated from plutonium, uranium, and nonradioactive metals, principally beryllium and stainless steel Parts made at the plant were shipped elsewhere for final assembly When a nuclear weapon is determined to be obsolete, components of these weapons that had been fabricated at RFETS are returned for

special processing to recover plutonium Other activities at RFETS include research and development in metallurgy machining nondestructive testing coatings remote engineering, chemistry and physics

2 1 4 Previous Investigations

Various studies have been conducted at RFETS to characterize environmental media and to assess the extent of radiological and chemical contaminant releases to the environment. These have included geological studies, surface water and groundwater studies, and geophysical and radiometric surveys Several environmental, ecological and public health studies culminated in the Final Sitewide Environmental Impact Statement (DOE 1980)

In 1986 two major environmental investigations were completed at RFETS The first was the Comprehensive Environmental Assessment and Response Program (CEARP) Installation Assessment (DOE 1986a), which included analyses and identification of current operational activities, active and inactive waste sites, current and past waste management practices and potential environmental pathways through which contaminants could be transported. Several sites that could potentially have adverse impacts on the environment were identified These sites were divided into three categories

- Hazardous waste management units that will continue to operate and need a Resource Conservation and Recovery Act (RCRA) Part A operating permit

- Hazardous waste management units that will be closed under RCRA interim status

- Inactive waste management units that will be investigated and cleaned up under Section 3004 (u) of RCRA or under CERCLA

The second major environmental investigation completed at RFETS in 1986 involved a hydrogeologic and hydrochemical characterization of the entire RFETS site Results of these investigations were reported by Rockwell International in 1986 Investigation results indicated four areas to be significant contributors to environmental contamination with each area containing several sites Those areas are commonly referred to as the 881 Hillside Area the 903 Pad Area the Mound Area and the East Trenches Area

2.2 CREATION OF THE OPERABLE UNITS AND INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS'S)

The Draft Installation Assessment under the Comprehensive Environmental Restoration Program (CERP), formerly the Comprehensive Environmental Assessment and Response Program (CEARP) (DOE 1986a), appears to have been the first document to compile a list of potential hazardous waste sites at RFETS. The Assessment also attempted to prioritize the sites on the basis of the EPA's Hazard Ranking System (HRS) and DOE's Modified HRS scoring. High priority sites, such as the 881 Hillside, were recommended for further investigation and remedial investigations commenced at the high priority sites. The RCRA Part B Permit Application (DOE 1986b, DOE 1986c) for the RFETS was completed in November 1986 for RFETS hazardous waste management units that would continue to operate Appendix 1 of the permit application (DOE 1987), RCRA 3004 (u) Waste Management Units, defined the inactive waste sites as solid waste management units (SWMUs) A plan for investigating the remaining sites, referred to as the low priority sites, was prepared in 1988 This plan identified 103 low priority SWMUs and recommended appropriate additional investigations. The plan also presented groups of SWMUs based on their geographical locations, similar contaminants, and applicable pathways. The SWMUs were combined into ten Operable Units (OU's) in the Draft Interagency Agreement (IAG 1990)

Additional SWMUs were added to the IAG based on the Part B RCRA application and independent reviews of aerial photographs and facility submittals. A total of 178 SWMUs were identified. The ten OU's were reprioritized and divided into sixteen OU's (Operable Units 1 through 16) in the final IAG (1991) The SWMU's were also renamed Individual Hazardous Substances Sites (IHSS's) in the final IAG The term IHSS is used in the remainder of this Section

2.2 1 Operable Unit 1 - 881 Hillside

Information on the nature and extent of contamination is taken from the Final Phase III RFI/RI Work Plan, Rocky Flats Plant, 881 Hillside Area Operable Unit No 1 (DOE 1990) Section 2 3 1 of that Work Plan describes how background levels of chemical constituents were calculated Section 2 3 and the Appendixes of that Work Plan present available analytical data

Phase I and Phase II soils investigations indicated tetrachloroethane, trichloroethane, and 1,1,1-trichloroethane contamination in some samples at the 881 Hillside. Plutonium and americium were detected above background

in soil samples that include the ground surface however windblown dust from the 903 Pad (OU2) is the suspected source of these radionuclides Tetrachloroethane and trichloroethane are the principal volatile organic compounds which have been detected in surface water samples in the area Numerous metals and other inorganic compounds have occasionally been above background Gross alpha gross beta, uranium and plutonium levels exceed background in many of the surface water samples

Groundwater is contaminated in both the eastern and western portion of the 881 Hillside The most pronounced organic contamination is in the eastern portion of the Hillside area with tetrachloroethane, trichloroethane, 1 1 dichloroethene 1,1-dichloroethane 1 1 1-trichloroethane, 1,1 2-trichloroethane, and carbon tetrachloride reaching several thousand micrograms per liter in many samples Organic contamination in the western portion of the 881 Hillside area occurs at much lower concentrations Concentrations of metals and inorganic constituents in the eastern portion of the study area include numerous occurrences of nickel, strontium, selenium, zinc, copper, and uranium above background

2 2.2 Operable Unit 2 - 903 Pad, Mound, and East Trenches

Information on the nature and extent of contamination is taken from the Phase II RFI/RI Work Plans for Alluvial and Bedrock, 903 Pad Mound and East Trenches Areas (Operable Unit 2) (DOE 1991a, DOE 1991b) Section 2 3 of the Work Plan describes how background levels of chemical constituents were calculated Section 2 3 and the Appendixes of the Work Plan present available analytical data

Plutonium uranium and americium occur above background in surface soils Other radionuclides and trace metals occur at low concentrations and are infrequently above background but may also be soil contaminants Data suggest plutonium uranium, and americium were released to soils in the area via wind dissemination during clean up efforts at the 903 Drum Storage Site

Based on existing results carbon tetrachloride tetrachloroethane, and trichloroethane are the primary volatile organic contaminants found in the upper hydrostratigraphic unit groundwater flow system Trace elements commonly occurring above background in groundwater include strontium, barium, copper, and nickel and to a lesser extent, chromium manganese, selenium, lead zinc, and molybdenum Also, major cations and anions and total dissolved solids are somewhat elevated above background throughout and downgradient of the OU Uranium

238 is the predominant radionuclide occurring above background in the upper groundwater, but a few samples indicate plutonium and americium downgradient of the 903 Pad and possibly north of the Mound.

There is considerable interaction between surface water and groundwater As a result, organic contamination is observed in seeps downgradient of the 903 Pad and in the upper reaches of South Walnut Creek at the Mound Area Also, somewhat elevated concentrations of total dissolved solids, major ions, strontium, zinc, and uranium are present at many of the surface water stations. Plutonium and americium are also observed in two seeps downgradient of the 903 Pad and in the upper reaches of South Walnut Creek. This may be attributed to the water from the seeps coming in contact with surface soils exhibiting elevated concentrations of these radionuclides.

2.2.3 Operable Unit 3 - Off Site Releases

Information on the nature and extent of contamination is taken from Final RFI/RI Work Plan for Operable Unit 3, Rocky Flats Plant (DOE 1991c)

IHSS 199, Contamination of the Land's Surface, is comprised of 350 acres of land with concentrations of plutonium greater than 0 9 picocuries per gram Hot spots may occur outside the designated acreage, however, it is reasonable to assume that areas outside the designated acreage contain lower concentrations of plutonium than the designated areas Remediation has been implemented on 120 of the 250 acres of contaminated land owned by Jefferson County Tilling of the 120 acres resulted in soil concentrations below the mandated cleanup level Revegetation of this land is in progress Very few data exist for contaminants other than plutonium.

Sampling at Great Western Reservoir (IHSS 200) indicates that layers of sediment containing plutonium above background levels are present in the bottom of the reservoir Plutonium exists in discrete sediment horizons (at depths of 17 inches and 7 5 inches) corresponding to historical releases from RFETS The highest concentrations are found in the deepest areas of the reservoir There is no evidence of plutonium migration through the sediment column Concentrations of plutonium and other radionuclides in water at the reservoir are below background levels and/or EPA drinking water standards.

Radioactive materials released from RFETS may have been transported to Standley Lake (IHSS 201) through surface water and/or airborne particulates. Plutonium has been measured in sediment in the lake. The concentrations in the sediment layers exceeded baseline levels beginning in the 1966 layer, peaked in 1969, and

declined after 1969 The time period correlates with the known period of windblown plutonium release from the 903 Pad at RFETS Studies of the sediments concluded that plutonium rapidly and almost irreversibly attaches itself to clay sediments In 1974 Battelle conducted an investigation of radionuclide concentrations in reservoirs and streams near RFETS Concentrations of plutonium-239 plutonium-240 and americium-241 in the water at the lake were above the expected atmospheric fallout background, which was not specifically quantified in the study but were more than four orders of magnitude below EPA National Primary Drinking Water Regulation of 15 pCi/L for total long-lived alpha activity

Only very limited data have been collected to characterize Mower Reservoir (IHSS 202) RFETS derived contaminants in the reservoir are believed to have been transported primarily as airborne particulates, and, to a lesser degree, by surface water through the Woman Creek drainage It can be inferred that contaminant concentrations resulting from releases into Woman Creek would be similar for Mower Reservoir and Standley Lake, while concentrations resulting from airborne releases and from erosion and transport of contaminated soils by surface runoff would be similar for Mower Reservoir and Great Western Reservoir It is expected that Mower Reservoir received similar amounts of plutonium through airborne transport as the nearby land surface

2 2 4 Operable Unit 4 - Solar Evaporation Ponds

Information on the nature and extent of contamination is taken from the Draft Final Phase I RFI/RI Work Plan (DOE 1991d) and Environmental Assessment, Dewatering and RCRA Partial Closure Action on Solar Evaporation Ponds Rocky Flats Plant (DOE 1991f) Section 2 5 of the Work Plan describes the calculation of background concentration and summarizes the chemical data for OU4

Liquids and sludges in the Solar Evaporation Ponds contain detectable levels of the radionuclides plutonium, americium tritium and uranium Metals of concern in the liquids and sludges include beryllium, cadmium, chromium and nickel Nitrates are also a major constituent of the liquids and sludges Soil samples in the vicinity of the solar ponds contain concentrations of chromium nickel nitrate, potassium, sodium, calcium, magnesium, and radionuclides that are likely attributable to the Solar Ponds Low levels of nitrates and radionuclides have been detected in both alluvial and bedrock groundwater Surface water in the form of seeps near the solar ponds contains nitrate metal and radionuclides

2.2.5 Operable Unit 5 - Woman Creek Priority Drainage

Information on the nature and extent of contamination is taken from Section 2 0 of the Final Phase I RFI/RI Work Plan, Woman Creek Priority Drainage (Operable Unit No 5) (DOE 1991g)

The Original Landfill (IHSS 115) received numerous materials during its operation. Chemicals that may have been placed in the Original Landfill include commonly used solvents, such as trichloroethylene, carbon tetrachloride, tetrachloroethylene, petroleum distillates, 1,1,1-trichloroethane, dichloromethane, benzene, paint and paint thinners. Metals such as beryllium uranium, lead, and chromium may also be present. Radiological surveys of the area have indicated the presence of radionuclides, and some soil containing uranium was previously removed from the Original Landfill Metals and radionuclides have been detected in groundwater near the Original Landfill

The nature and extent of contamination at the Ash Pits, Incinerator and Concrete Wash Pad (IHSS's 133 1 through 133 6) are not well known General combustible wastes from RFETS were burned in the incinerator along with as estimated 100 grams of depleted uranium Metals were detected in Ash Pit 3 Metals and radionuclides have been detected in groundwater wells near the Ash Pits.

Detention ponds C-1 and C-2 have been regularly sampled in recent years. Water in the ponds is known to contain detectable concentrations of metals and radionuclides, but background levels have not been determined for the Woman Creek area Sediment samples also contain measurable metals and radionuclides.

2.2 6 Operable Unit 6 - Walnut Creek Priority Drainage

Information on the nature and extent of contamination is taken from Section 2.0 of the Final Phase I RFI/RI Work Plan, Walnut Creek Priority Drainage (Operable Unit No 6) (DOE 1991h)

Ponds A-1 and A-2 contain radionuclides including plutonium and uranium in both the water and the sediments Pond A-3 is reported to contain elevated uranium-233/234 and uranium-238 concentrations like Pond A-2 Water quality in Pond A-4 is similar to background levels. Pond B-1 has moderately elevated uranium-233/234 and uranium-238 concentrations, and plutonium is reported in both the water and the sediments. Pond B-2 water contains background levels for the various radionuclides except plutonium Pond B-3 has detectable plutonium as well as zinc and nitrates Ponds B-4 and B-5 have detectable levels of uranium-233/234 and 238 Ground

water in the vicinity of the A- and B-series ponds contains several metals and radionuclides above detection limits but these concentrations could represent background levels

No previous studies have been conducted at the four spray fields However analytical results from water samples collected from the East and West Landfill Ponds provide significant data regarding the North, South and Pond Area Spray Fields (IHSS s 167 1-3) Strontium and tritium were detected in the Landfill Ponds water In addition, minor organics and several metals and radionuclides have been reported in surface water and groundwater samples collected near the spray fields Analytical data from Pond B-3 water provides data regarding the East Area Spray Field (IHSS 216 1) Radionuclides and metals have been detected in the water from Pond B-3

Only one previous soils investigation has reportedly been conducted at Trench A Uranium-233/234 and 238, and several volatile organics were detected in the soils Metals radionuclides and one volatile organic compound have been detected in groundwater in the vicinity of the trenches No previous studies have been conducted at the Sludge Dispersal Area (IHSS 141) A potential for contamination within the drying beds by a variety of chemicals in the sludge particularly plutonium is possible Volatile organics, metals and radionuclides have been detected in groundwater and surface water samples downgradient of the IHSS

At the Triangle Area (IHSS 165) previous radiometric soil surveys have indicated the presence of radionuclides The contaminated soils were removed on several occasions following the soil surveys Metals, radionuclides and organic compounds have been detected in groundwater near the area

Previous soils investigations at the Old Outfall (IHSS 143) reported elevated levels of plutonium and organics Contaminated soils were removed from the site in 1971 Metals and radionuclides have been detected in surface water samples taken downgradient of the IHSS

No previous investigations have been completed at the Soil Dump Area The soils may contain plutonium

2 2 7 Operable Unit 7 - Landfill and Inactive Hazardous Waste Storage Area

Since little direct characterization of the types of contaminants in the landfill or inactive storage area has been conducted to date most of what is known is based on waste stream identification studies and groundwater and surface water quality monitoring (DOE 1991i) Previous evaluations of groundwater quality from wells at the

periphery of the landfill indicate the landfill contributes calcium, bicarbonate, and, to a lesser extent, sulfate, iron, manganese, zinc and strontium to the groundwater Volatile contamination, primarily trichloroethylene and 1,1,1-trichloroethane has been found sporadically and at low concentrations in groundwater in some areas at the landfill periphery Elevated uranium and tritium levels also exist in some areas. Soil contamination has not been characterized, but it may be reasonable to assume that the nature of contamination is similar to the groundwater contamination

The primary mechanism for release of contaminants from the Present Landfill into the affected media appears to be by percolation of groundwater (leachate) through the wastes and then out of the landfill Groundwater flow is currently intercepted and treated by the Passive Seep Collection and Treatment Systems operated by the CWTF staff These systems consist respectively of a french drain designed to capture landfill seepage and a combined filtration and Granular Activated Carbon adsorption system

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2.2 8 Operable Unit 8 - 700 Area

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and on previous site uses (Rockwell International 1988, DOE 1987, DOE 1992a, DOE 1992c)

Materials stored in the tanks involved in the Multiple Solvent Spills (IHSS's 118 1 and 188.2) included carbon tetrachloride, petroleum distillates, paint thinners, 1,1,1-trichloroethane and methyl ethyl ketone Process wastes, typically containing uranium, solvents, oils, beryllium, nitric acid, hydrochloric acid, and fluoride, were released from Valve Vault 7 (IHSS 123 1) Cooling Tower Blowdown from IHSS's 135, 137, and 138 typically contained algicides and chromates The 1976 spill from IHSS 138 also contained some radioactivity The 1990 spill from IHSS 138 contained phosphates. Materials stored in the tanks involved in the Caustic/Acid Spills (IHSS's 139 1 and 139 2) included hydrochloric, hydrofluoric, nitric and sulfuric acids, and sodium hydroxide and potassium hydroxide Spills of #2 fuel oil were the cause of IHSS 151, Fuel Oil Leak. A spill of a mixture of nitric and hydrochloric acid was the cause of the Acid Leak (IHSS 188)

The Sewer Line Break (IHSS 144) involved the release of radioactive laundry wastewater The radioactive Liquid Leaks (IHSS 150 1-8) were primarily releases of liquid process wastes containing radioactive compounds and solutions containing caustics and acids

The Radioactive Sites - 700 Area (IHSS 163 1 and 163 2) and Radioactive Sites - 900 Area (IHSS 173) may have been contaminated with radioactive compounds including americium No radioactivity above background levels has been detected by radiometric surveys of the IHSS 163 locations Radioactivity has been measured at IHSS 173 Radiometric surveys have not detected radioactivity above background levels at the Building 991 Steam Cleaning Area (IHSS 184) The Central Avenue Waste spill (IHSS 172) consisted of less than 100 gallons of plutonium contaminated oils and oils with lathe coolant (hydraulic oil and carbon tetrachloride)

2 2 9 Operable Unit 9 - Original Process Waste Lines

Information on the nature and extent of contamination is taken from Draft Final Phase I RFI/RI Work Plan, Original Process Waste Lines (OPWL) Operable Unit No 9 (DOE 1991j)

Low-level radioactive aqueous wastes with high nitrate concentrations were a primary OPWL waste stream Volatile and semivolatile organics were transferred through the OPWL in small quantities Numerous acids were discharged to the OPWL as well as bases, metals, and small quantities of other liquids, including pickling liquor from foundry operations, medical decontamination fluids, miscellaneous laboratory wastes, and laundry effluent Releases from the OPWL and associated IHSS's may have occurred as a result of leakage, deterioration of pipes, breakage and overflows The lateral and vertical extent of releases are not precisely known but are expected to be largely confined to the pipeline trench backfill materials and adjacent soils

2 2 10 Operable Unit 10 - Other Outside Closures

Information on the nature and extent of contamination is taken from Draft Final Phase I RFI/RI Work Plan, Rocky Flats Plant Other Outside Closures (Operable Unit No 10) (DOE 1991k)

Analytical results for soil samples taken in the vicinity of the Oil Leak (IHSS 129) indicate the presence of organics including 1 1 1-trichloroethane, methylene chloride, benzene, toluene, ethylbenzene, 2-butanone and total xylenes, and metals including mercury, cadmium, copper, and lead Radionuclides were not tested Groundwater data are not available for this site

No previous investigations have been performed at the P U &D Storage Yard (IHSS 170) so the nature and extent of contamination is unknown Soil sampling has been conducted at the Waste Spills (IHSS 174) Soils contain

concentrations of volatile organics, metals, nitrates, and radionuclides above background levels. Acetone methylene chloride and nitrate/nitrite were detected in a groundwater sample from a well northeast of IHSS's 170 and 174

Soil samples were collected in the S&W Building 980 Container Storage Facility (IHSS 175) area in 1988 Volatile organics, metals, nitrate, and radionuclides were detected above background levels in the samples. No groundwater data are available

Analysis of soil samples taken from borings in the S&W Contractor Storage Yard (IHSS 176) indicate levels of volatile organics, metals, nitrate, and radionuclides above background concentrations. Groundwater data from an upgradient well indicate the presence of metals, other inorganics, and radionuclides above background levels.

Potential contaminants at IHSS 207, Former Building 444 Acid Dumpsters, are cadmium, chromium, lead, silver, and radionuclides No previous soil or water sampling investigations have been performed at the IHSS

No previous investigations have been conducted at the Inactive 444/447 Waste Storage Area (IHSS 208) or Unit 16, Building 980 Cargo Container (IHSS 210) Therefore, no information is available concerning the nature and extent of contamination.

Analysis of soil samples taken in the area of the Unit 15, 904 Pad Pondcrete Storage Area (IHSS 213) indicated levels above background for gross alpha, gross beta, total plutonium, total uranium, uranium-234, uranium-238, americium-241, and plutonium-239 In addition, analysis of surface water samples taken in the area of IHSS 213 indicates levels above background for nitrate, cyanide, and cadmium Further data are needed to assess groundwater contamination.

Soil samples taken from the Unit 25, 750 Pad Pondcrete and Saltcrete Storage Area (IHSS 214) indicate levels above background for gross alpha and gross beta Surface water samples have levels above background for nitrate, cyanide, and cadmium Further data are needed to assess groundwater contamination.

2 2 11 Operable Unit 11 - West Spray Field

Information on the nature and extent of contamination is taken from Final Phase I RFI/RI Work Plan for OU11 (West Spray Field) Rocky Flats Plant (DOE 1991l)

The West Spray Field was contaminated by liquids from the Solar Evaporation Ponds that were sprayed on the field The liquids are known to contain major ions radionuclides, metals, and some organics Previous sampling has been done at the West Spray Field and the results have been compared to background levels in the area

Soil samples from the spray field show slightly elevated levels of arsenic, lead, manganese, mercury, zinc and several volatile organic compounds Gross alpha, plutonium, uranium-233, -234, and -238 are also above background levels in soils Groundwater monitoring wells have been installed in the West Spray Field Alluvial groundwater quality is effected sporadically by several metals radionuclides, nitrate and tetrachloroethylene Two of the three bedrock wells have occasionally exhibited above-background concentrations of magnesium, strontium, and manganese The radionuclides and volatile organic compounds were not elevated Surface water sampling has not been done at the West Spray Field

2 2 12 Operable Unit 12 - 400/800 Area

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (Rockwell International 1988 DOE 1992a)

Releases of radionuclides from buildings adjacent to the Multiple Solvent Sites (IHSS s 116 1 and 116 2) may have resulted in soil contamination at these sites Since the actual contents of the drums stored on the loading docks are unknown it is assumed that volatile organic compounds may have been stored and may have leaked in the dock areas

At the Building 664 Fiberglassing Areas (IHSS s 120 1 and 120 2), the chemicals of interest are believed to be polyester resins (styrene monomer) and cleaning solvents Also, an area of significantly high radiation was measured directly west and overlapping the site

The potential contaminant at the Cooling Tower Ponds (IHSS's 136 1 and 136 2) is chromium. Blowdown discharged to the ponds contained chromium and algicides Uranium may also be buried at the pond sites

The Process Waste Leaks (IHSS 147 2) area may have been contaminated by infiltration of water that contacted equipment stored at the site The Radioactive Site South Area (IHSS 157 2) may be contaminated by uranium, beryllium and solvents Plutonium may also be present. Contamination is not expected at the Acid Leak sites (IHSS 187) or the Multiple Acid Spills (IHSS 189) since the acid was likely neutralized in the soil

2.2 13 Operable Unit 13 - 100 Area

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (Rockwell International 1988, DOE 1992a)

The Chemical Storage Sites (IHSS 117 1-3) were used for storage of acids, organic solvents, soaps, and oils. These materials are presumed to be the potential contaminants at these IHSS's.

The Oil Burn Pit No 1 Waste Leak (IHSS 128) is a pit area that contains approximately 70 cubic feet of depleted uranium. The Lithium Metal Destruction Site (IHSS 134) may contain residues of lithium and small amounts of sodium, calcium, and magnesium The lithium has possibly reacted with the soil to form lithium carbonate Radionuclides may have been spilled at the Waste Spill (IHSS 148) site, although radioactive surveys of the area have found radioactivity levels consistent with background levels.

Fuel oil is the potential contaminant at the Fuel Oil Tank Spill (IHSS 152) The Radioactive Site South Area (IHSS 157 1) may be contaminated by uranium, beryllium and solvents. Plutonium may also be present. The Radioactive Site - Building 551 (IHSS 158) is suspected of being contaminated with uranium. The Waste Drum Peroxide Burial (IHSS 169) may still contain peroxide which can be an explosion hazard. The site is not considered to be a chemical hazard. Residues of the burning of waste solvents are the concern at the Solvent Burning Ground (IHSS 171)

Radioactive process waste may have contaminated the Valve Vault 12 (IHSS 186) area. Sodium hydroxide is the potential contaminant at IHSS 190 However, it is likely that any sodium hydroxide remaining in the environment

would have been neutralized by the buffering action of the soil The soil also would have buffered any remaining hydrogen peroxide from the Hydrogen Peroxide Spill (IHSS 191)

2 2 14 Operable Unit 14 - Radioactive Sites

Since previous investigations have not been conducted at these units the nature and extent of contamination is based on materials stored at the sites and previous site uses (Rockwell International 1988 DOE 1992a)

Radioactive Site #1 - 700 Area (IHSS 131) and Radioactive Burial Site - Building 334 Parking Lot (IHSS 156 1) may have been contaminated by plutonium Small amounts of plutonium and uranium may have remained at the Building 444 Parking Lot (IHSS 160) and Building 664 (IHSS 161), however, no radioactivity above background levels was detected during the radiometric survey of the area The radioactive hot spots in the pavement on 8th Street may still exist as Radioactive Site #2 - 700 Area (IHSS 162) Radioactivity may also exist at the Radioactive Sites in the 800 Area (IHSS 164 1-3)

2 2 15 Operable Unit 15 - Inside Building Closures

Since previous investigations have not been conducted at these units, the nature and extent of contamination is based on materials stored at the sites and previous site uses (DOE 1988, DOE 1987, DOE 1992a)

Hazardous wastes such as volatile organic compounds and low-level radioactive waste oil have been stored in the Building 881 Drum Storage Area (IHSS 178) Waste oils contaminated with beryllium and chlorinated solvents have been stored in the Building 865 Drum Storage Area (IHSS 179) Waste oils contaminated with volatile organic compounds beryllium and radioactivity have been stored at the Building 883 Drum Storage Area (IHSS 180)

Uranium chips, coated with freon TF and 1 1 1 trichloroethane were handled in the Original Chip Roaster (IHSS 204) The freon and 1,1 1-trichloroethane burned away during the roasting process

Low-level radioactive mixed wastes including low-level combustibles, low-level metal and glass low level combustible hazardous waste and low-level glass and metal hazardous waste, were stored at Unit 26 Building 881 Drum Storage (IHSS 211) Transuranic wastes and solvents such as carbon tetrachloride 1 1 1-trichloroethane

and toluene are stored in Unit 63, Building 371 Drum Storage (IHSS 212) Up to 4 liters of cyanide contaminated laboratory wastes were stored in Unit 32, Building 881 Cyanide Bench Scale Treatment (IHSS 217)

An site map showing IHSS locations in the south east area of the RFETS is included as Figure 2 1

2.3 SCOPE OF WORK

Work at the Consolidated Water Treatment Facility (CWTF) primarily consists of the operation and maintenance of the treatment processes that make up the CWTF Support activities such as water sampling, data management, training, and project management are also included in the scope of work. The following is a general breakdown of the major activities involved

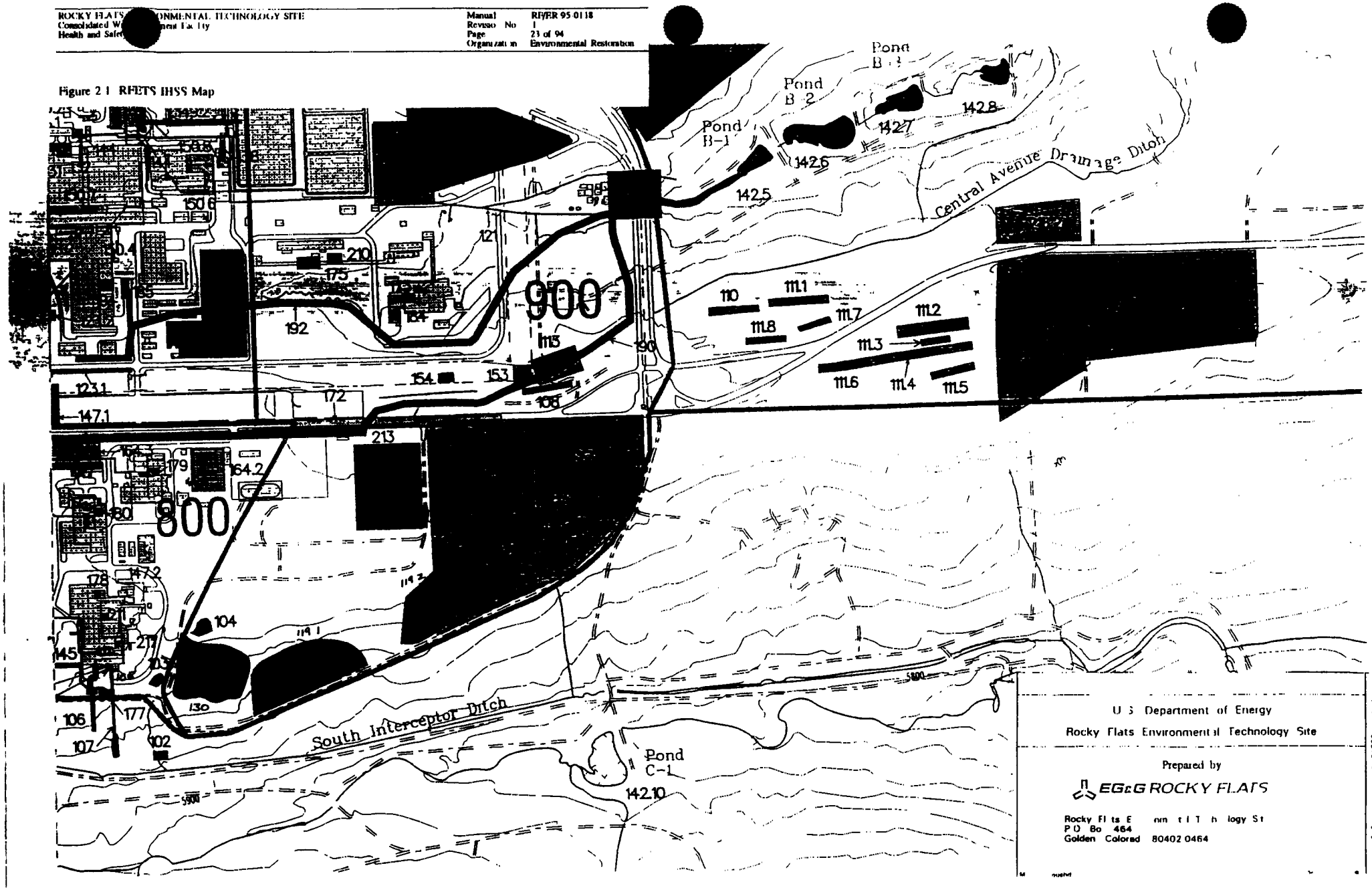
- *Water Treatment Systems Operation* - Operation in accordance with approved procedures to remove a wide variety of contaminants from wastewaters Water volume and sources may vary due to natural precipitation and changes in operations elsewhere on the RFETS

- *Water Treatment Systems Maintenance* - Perform preventive and corrective maintenance on treatment and collection systems as required to maximize overall systems performance. Records of maintenance activities are kept and periodically reviewed and evaluated for effectiveness.

- *Water Sampling and Analysis* - Influent waters are sampled to determine whether contaminants and concentrations are within pretreatment parameters prior to water treatment. Operational samples are taken to evaluate systems performance Effluent samples are drawn and analyzed prior to discharge to ensure compliance with the CWTF treatment requirements.

- *Waste Handling and Management* - Waste generated by the treatment process will be handled safely and in accordance with applicable plant procedures These wastes include but are not limited to filtered sludge from the precipitation/filtration process, spent granular activated carbon, exhausted ion exchange resin, neutralized resin regenerant, and disposable personal protective equipment.

Figure 2 1 RFETS IHSS Map



- *Plant Records and Reporting / Data Management* - Records of surveillances and routine observations will be retained for supervisory review and trend analysis. Data concerning chemical and radiological contaminant levels will be handled to confirm accuracy and conform with plantwide standards.

- *Training and Qualification* - Operations and management personnel shall maintain an appropriate level of qualification and take specific training as recommended by project management.

The treatment plant is typically operated 40 hours per week but may be operated significantly longer, depending upon the amount of water requiring treatment. A subcontractor is responsible for operation and maintenance of the CWTF Section 3 0 provides a more detailed description of the treatment system.

3 0 SYSTEM DESCRIPTIONS

The CWTF is illustrated in Figure 3 1 and consists of six treatment systems and five collection systems These treatment systems are in turn made up of several subsystems The following is a breakdown of this arrangement

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Water Collection Systems

- 881 hillside groundwater collection and equalization
- 881 hillside collection well pumping station & tank trailer
- SW 59 surface water collection and equalization
- Building 891 truck dock to accept water from other sources
- OU-7 Seep Passive Collection System

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Treatment Systems

- Ultraviolet (UV)/Hydrogen Peroxide (H_2O_2) Oxidation
- Precipitation and Microfiltration System
  - Chemical treatment and precipitation
  - Solids concentration and microfiltration
  - Neutralization
  - Solids dewatering
- Ion Exchange
  - Ion Exchange Regeneration
  - Regenerant Neutralization
- Granular Activated Carbon (GAC) adsorption
- Pretreatment filtration
- OU-7 Seep Passive Treatment System

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Figure 3 1 is an overhead drawing showing the general layout of the CWTF and location of those subsystems located within the facility Figure 3 2 is a process flow diagram illustrating the flowpaths and interconnections of CWTF process subsystems Figure 3 3 is an overhead drawing of the OU-7 Seep Passive Collection and Treatment Systems Each of these systems is discussed in detail in sections 3 1 and 3 2

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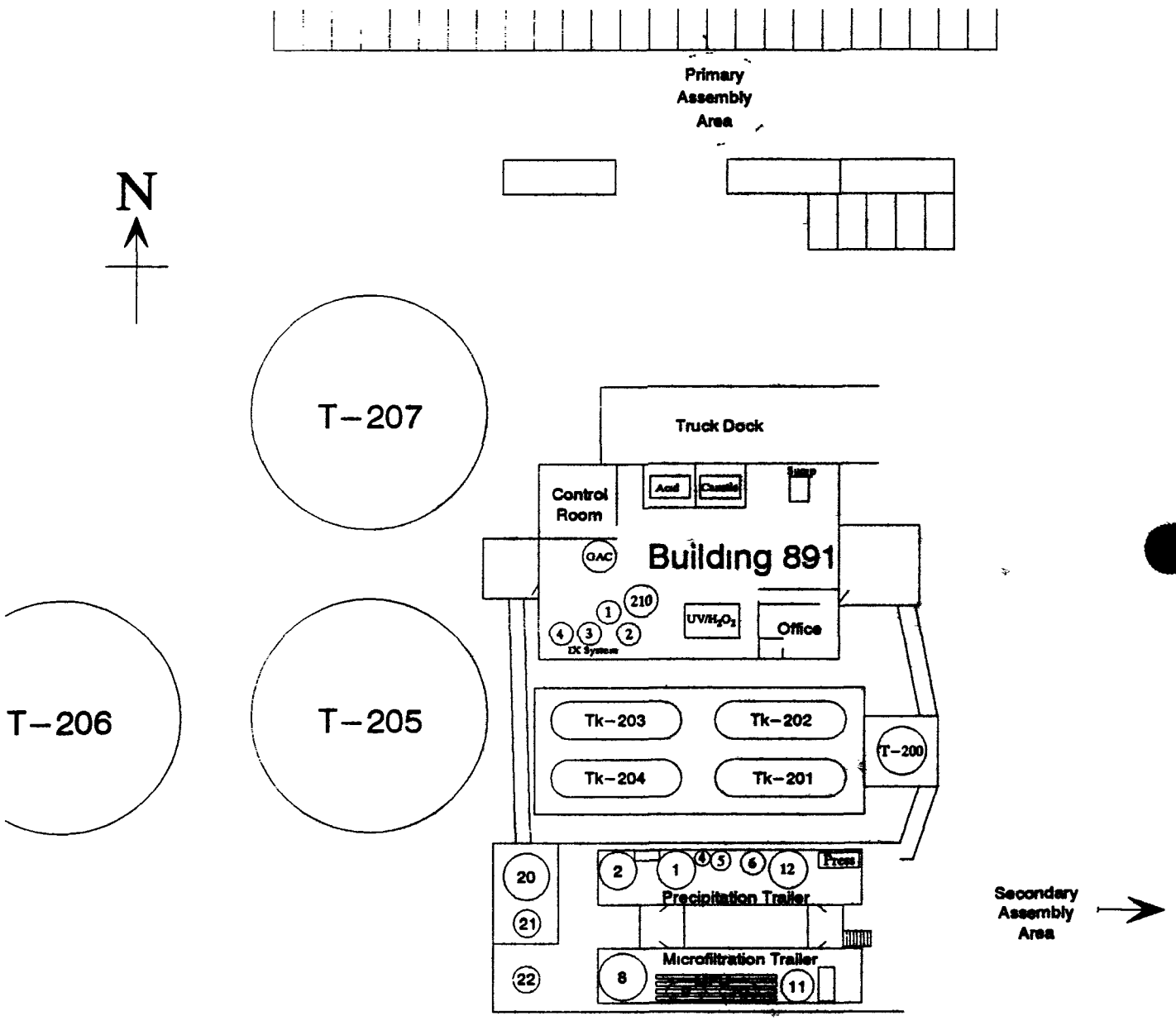
Figure 3 1 Consolidated Water Treatment Facility Overhead Drawing



* Drawing is not to scale

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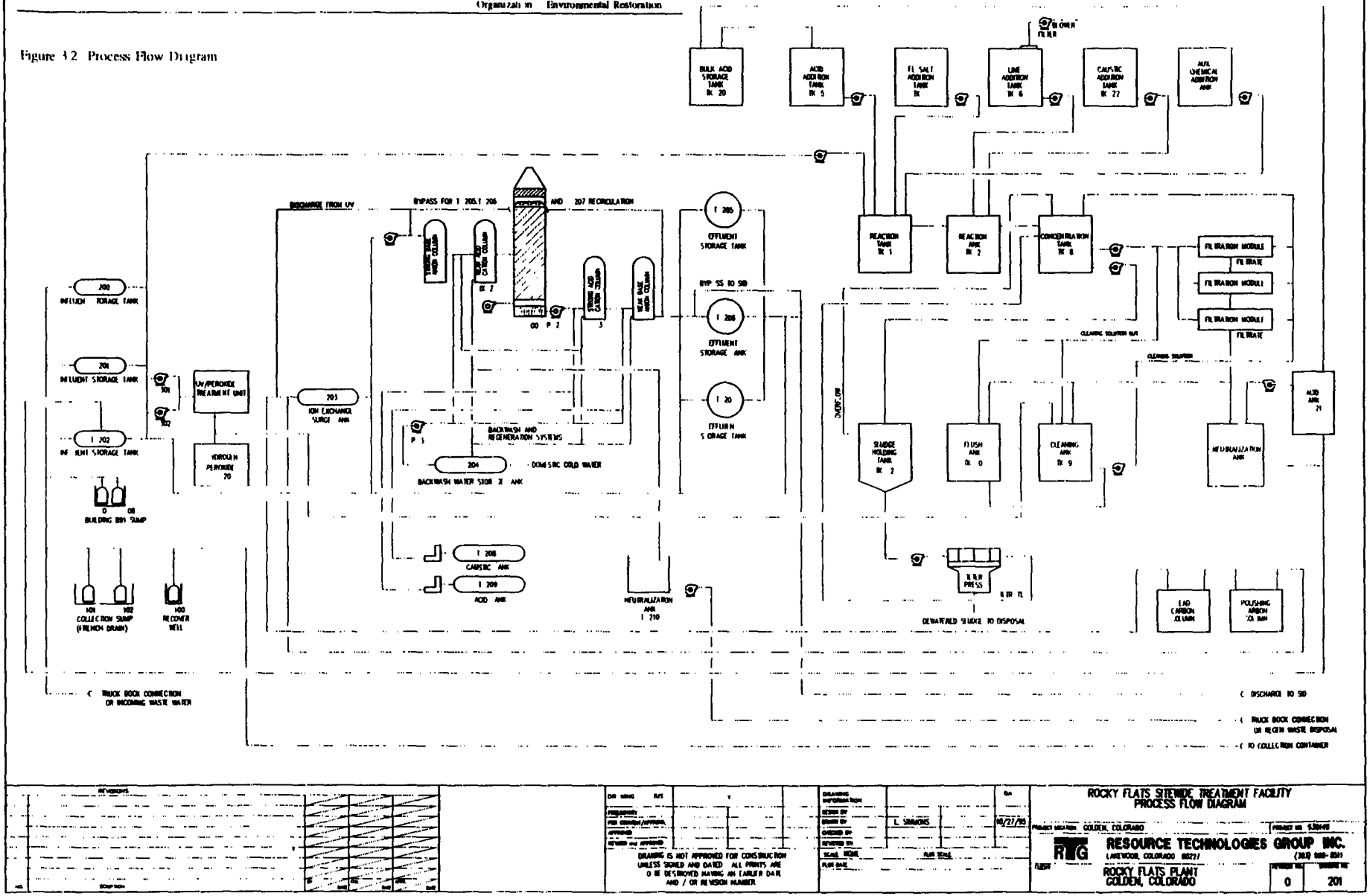
Figure 3.2 Process Flow Diagram



REVISIONS

DRAWING IS NOT APPROVED FOR CONSTRUCTION UNLESS SIGNED AND DATED ALL PRINTS ARE TO BE DESTROYED HAVING AN EARLIER DATE AND / OR REVISION NUMBER

L. SIMMONS

ROCKY FLATS SITEWIDE TREATMENT FACILITY
PROCESS FLOW DIAGRAM

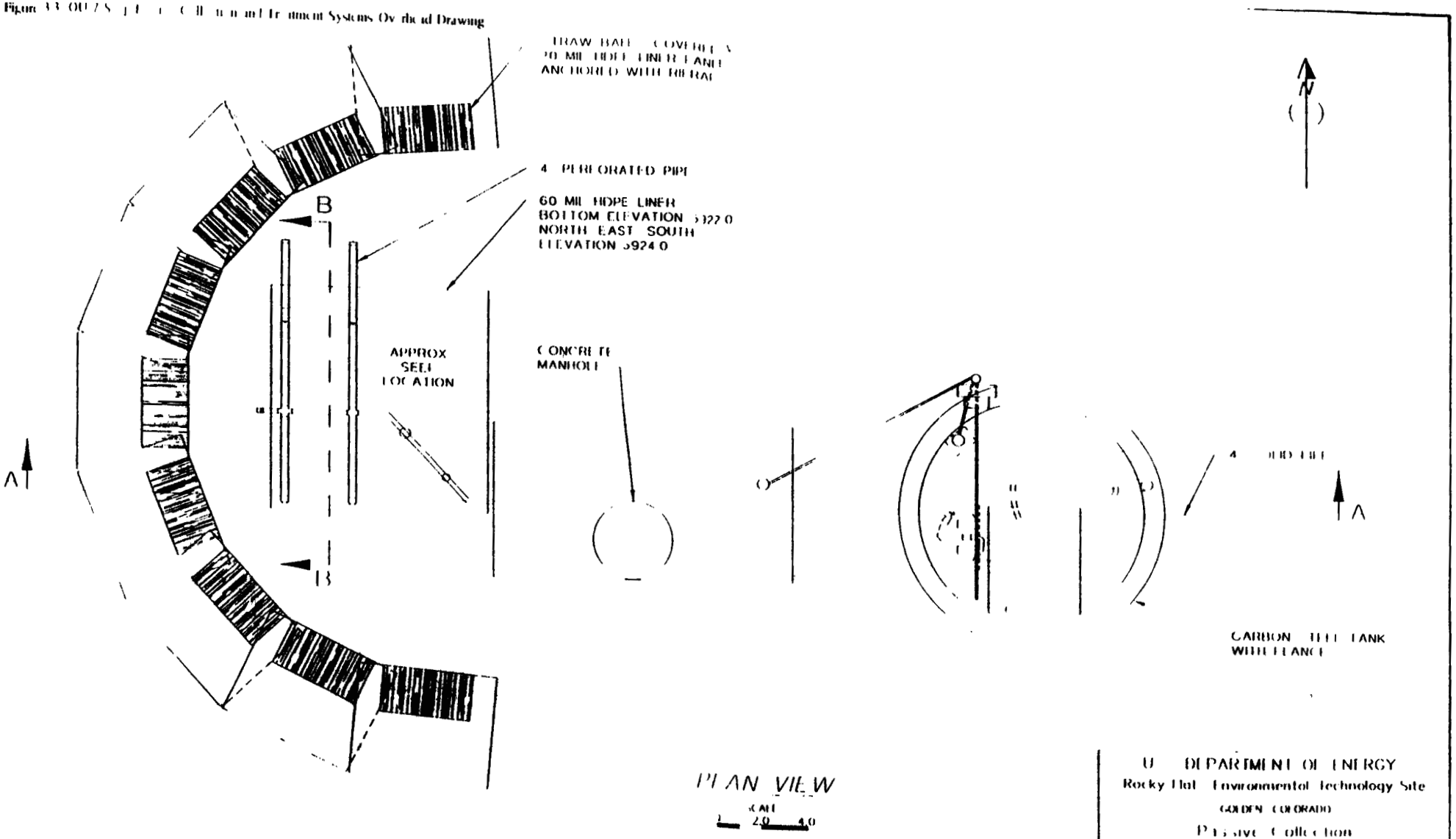
GOLDEN, COLORADO

RESOURCE TECHNOLOGIES GROUP INC.
LAKEWOOD, COLORADO 80227

ROCKY FLATS PLANT
GOLDEN, COLORADO

0 | 201

Figure 3-3. OU 2 Surface Collection and Treatment Systems Overhead Drawing



U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

Passive Collection
and Treatment System
Plan View

Proposed Action Memorandum Operable Unit No. 7
DRAFT 1999

3 1 COLLECTION SYSTEMS

3 1 1 881 Hillside Groundwater System

The groundwater collection system serves to divert and transfer collected water from recovery well pumps P 101 and P-102 to groundwater equalization/storage tanks T-201 and T-202 located on the south side of Building 891 The raw water is pumped from the collection points to the equalization tanks through double-contained piping buried to prevent freezing The influent piping is equipped with leak detection equipment to monitor for leaks Tank levels are continuously monitored and displayed in Bldg 891

3 1 2 Collection Well Pumping Station

Groundwater is continuously collected in the 881 hillside collection well Periodically the CWTF operators pump the collected water from the collection well into a mobile tank trailer for transport. The tank trailer is then pumped into the CWTF influent tank system via the truck dock

3 1 3 SW-59 Surface Water System

The OU-2 surface water collection system serves to divert and transfer collected water from SW-59 The collection system includes a precast reinforced concrete catch basin with a stainless steel submersible pump located inside the catch basin Pump operation is controlled by an automatic level switch The raw water is pumped from the catch basin to a collection tank through double wall polyethylene piping The piping is wrapped with heat tape and insulation to protect against freezing during the winter months This system is located in OU-2 and is drained using a mobile tank trailer

3 1 4 Building 891 Truck Dock

The truck dock at Building 891 is used to receive water from remote collection locations and other facilities Water from non-routine sources is sampled before they are accepted for treatment. Contaminants and their concentrations are analyzed to ensure compatibility with CWTF treatment systems

3 1 5 OU-7 Passive Collection System

The Passive Collection System consists primarily of a semicircular french drain connected to a collection vault. The system contains no moving parts and is almost entirely located underground. French drain effluent is collected on a liner and then drained into the collection vault via a slotted pipe collection system. A high level sensor activates a solar and battery powered visual alarm when vault level reaches 59 inches below the measuring vent. Collection system maintenance or access is not anticipated. Figure 3 3 provides an overhead view of the Passive Collection System

3 2 TREATMENT SYSTEMS

3 2 1 Ultraviolet / Hydrogen Peroxide Organic Destruction System

The ultraviolet / hydrogen peroxide (UV/H_2O_2) oxidation process is used to remove volatile organic compounds (VOC) contamination The process oxidizes volatile organic constituents using 50 percent H_2O_2 - a strong oxidizer - and UV light The UV light serves to catalyze the oxidation reaction by converting the peroxide to a hydroxyl radical thus making it a more effective oxidant The UV/H_2O_2 unit consists of two stainless steel reactor vessels each containing high intensity (high pressure) UV lamps The lamps are installed inside quartz tubes to prevent direct contact of the water and the lamp The reactors and control panel are mounted on a common skid

3 2 2 Precipitation and Microfiltration System

Chemical treatment and precipitation subsystem

The chemical treatment system in the precipitation trailer consists of two reaction tanks (1200 gallons each) one ferric sulfate addition tank (50 gallons), one lime addition tank (250 gallons), one auxiliary chemical addition tank (250 gallons) currently used for sulfuric acid and one caustic soda tank (Tank 22) All the tanks are equipped with mixers and level control instrumentation The first step of chemical treatment is to lower influent pH in Reaction Tank No 1 with sulfuric acid to approximately 4 5 to break the carbonate complexation of uranium and to neutralize total alkalinity Ferric sulfate is then added as a coagulant and co-precipitating agent Caustic soda is added in Reaction Tank No 2 to raise the pH to 10 5 which causes the precipitation of iron and dissolved heavy metals as metal hydroxides Slurried lime is also added at this point to provide solids for microfiltration membrane scouring to maintain high flowrates through the filter membranes Radionuclides and metals adsorb to particulates and are entrained in the floc Auxiliary chemicals such as biological inhibitors and coagulant aids may be added to enhance the total effectiveness of the process

The ferric sulfate and any auxiliary chemical solutions are prepared in feed tanks by mixing powdered or liquid reagent with water and are fed to Reaction Tank No 1 by metering pumps The pH in Reaction Tank No 1 is maintained within the optimal range by acid addition, which is controlled by on-line pH instrumentation From Reaction Tank No 1 water overflows to Reaction Tank No 2 where caustic soda, lime slurry and any required auxiliary chemicals are added The caustic soda is fed to Tank No 1 from Tank 22 by a metering pump The supply of caustic soda to Reaction Tank No 2 is controlled by an automated pH monitoring and control system

The lime slurry is prepared in the lime addition tank which is provided with a filter, dust control hood, and a slurry recirculation pump

Solids concentration and microfiltration subsystem

The concentration and microfiltration subsystem in the microfiltration trailer physically separates the floc formed in Reaction Tank No 2 Water from Reaction Tank No 2 gravity flows to the concentration tank (TK-8 / 3,000 gallons), which is constructed of fiberglass reinforced plastic and equipped with baffles, level controls and a recirculation pump The process stream is pumped from the concentration tank to a microfiltration system. The membrane filter is a shell and tube configuration with the membrane on the inside of the tubes. The permeate passes through the tubes perpendicular to the main flow at a relatively low pressure Manifolds are provided to collect the filtrate and direct it by gravity to the neutralization tank.

Filtered solids are returned to the concentration tank. Solids in the concentration tank are periodically pumped to the solids holding tank (TK-12) located in the precipitation trailer Overflow from the solids holding tank is recycled to the concentration tank. The solids removal rate from the concentration tank is adjusted manually to maintain the desired solids concentration in the filtration modules. A clean-in-place system, comprised of a flush tank and a chemical holding tank, is included in the design of the microfiltration unit. Both tanks have a 400-gallon capacity

Neutralization subsystem

A neutralization subsystem is provided to adjust the filtrate to a pH range of 6 0 - 9 0 by addition of sulfuric acid. The pH adjustment prepares the filtrate for further treatment and discharge or recycle The equipment and components of the neutralization system are as follows.

- 1,500 gallon, heavy-duty fiberglass tank (TK-11)
- Heavy-duty rim mounted mixer
- 200 gallon acid tank (TK-21) with metering pump and mixer
- Control panel containing
  - pH monitor/controller/alarm
  - pH recorder

Solids dewatering subsystem

The solids dewatering subsystem is used to process the solids in the solids holding tank This system includes an air operated slurry pump to transfer concentrated solids from the solids holding tank to the filter press The filter press removes water from the solids and creates a filter cake that is 35 to 50 percent solids by weight The filtrate produced by the filter press is recycled to the concentration tank The filter cake is transferred into drums placed beneath the elevated filter press

3 2 3 Ion Exchange System

From the surge tank (T-203) water is pumped to two ion exchange columns (IX-1 and IX-2) in series The first, IX-1 contains a strong base anion resin in the chloride form for the removal of uranium The second column, IX-2 contains a weak acid cation resin for the removal of alkalinity and heavy metals The contaminated water is pumped from IX-2 to a degasifier where the liberated carbon dioxide escapes to the atmosphere From the degasifier the water is pumped to the final two ion exchange columns (IX-3 and IX-4) in series for removing total dissolved solids (TDS) IX-3 contains a strong acid cation resin that removes remaining positively charged cations including excess hardness and metals IX-4, with weak base anion resin, is the last unit and removes excess negatively charged ions contributing to TDS The treated water then exits the building and flows to one of three 150 000 gallon final effluent storage tanks (T-205 T-206 and T-207) where it is held until analytical results indicate that it is acceptable for release to the south interceptor ditch

Ion exchange regeneration and regenerate neutralization

The ion exchange backwash and regeneration subsystems provide a means for maintaining the ion exchange resins while minimizing the volume of waste produced by the system The caustic tank (T-208) contains 35% sodium hydroxide and is used for regenerating IX-4 IX-1 is not regenerated but is monitored for removal efficiency of uranium oxides The acid tank (T-209) contains 35% hydrochloric acid and is used to regenerate IX-3, after which it is used to regenerate IX-2 Spent regenerant chemicals from both processes are neutralized in the regenerant neutralization tank (T-210) prior to removal by tank truck for final treatment. In addition to regeneration the water backflush tank (T-204) is used for storage of water for use in backflushing the ion exchange beds

3.2 4 Granular Activated Carbon Adsorption

The processed water may be pumped through one GAC column located in Building 891 Additional GAC adsorption units are maintained in a standby mode Each carbon column contains 3000 pounds of granular activated carbon The GAC units are skid-mounted, poly lined, and are connected to the process piping via stainless steel, quick connect couplings

3.2.5 CWTF Pretreatment Filtration

An oil absorbent media drum unit has been built and staged in the Building 891 truck dock to remove oil and greases from influent waters The system is skid mounted and may be moved by forklift. It contains 5 5 cubic feet of Clarion PM-100 Absorbent and operates at a maximum flowrate of 12 gallons per minute. Operation of this system is not significantly different from other equipment incorporated in the CWTF

3.2 6 OU-7 Seep Passive Treatment System

The OU-7 Seep Passive Treatment System consists of two parallel 25 micron sock filters followed by one to three 55 gallon Granular Activated Carbon (GAC) drums placed in series. These components are contained in a below grade carbon steel tank. Other components include a combination totalizer and flowrate meter, a hydrogen peroxide (H_2O_2) addition system, and a sump high level visual alarm for leak detection. The system receives water from the Passive Collection System by gravity drain and gravity provides the motive force for system operation Entry into the system vault requires a confined space permit.

4 0 PROJECT TEAM ORGANIZATION AND RESPONSIBILITIES

The Rocky Flats oversight contractor has overall responsibility for the Health and Safety Program at the Rocky Flats Plant The subcontractor is specifically responsible for the Health and Safety Plan for the operation and maintenance of the Consolidated Water Treatment Facility The project Health and Safety Organization is shown in Figure 4 1 Major responsibilities for key personnel are summarized in Table 4 2

Figure 4 1 Project Organization

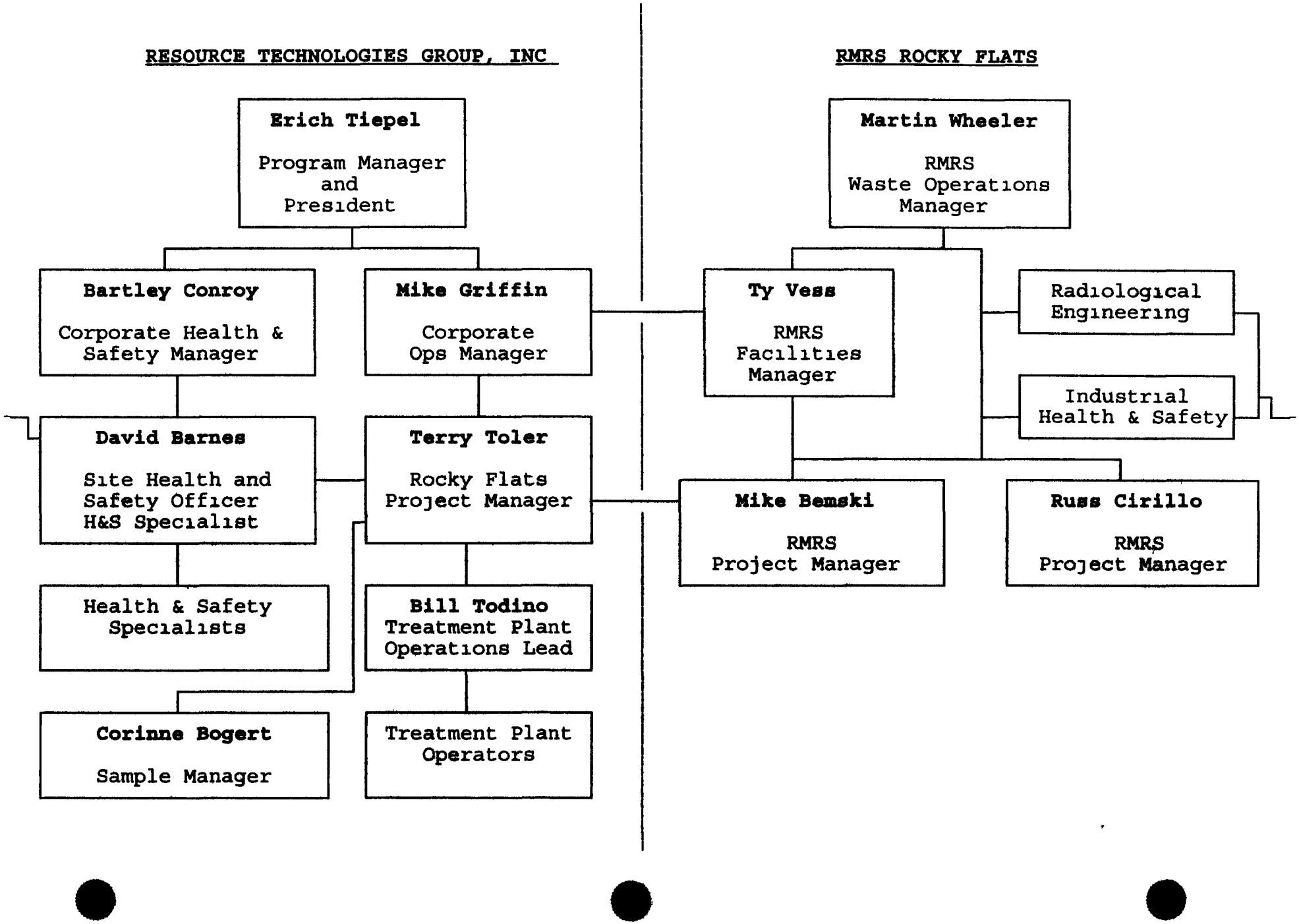


Table 4 2 Project Personnel

COMPANY	NAME AND FUNCTION	EXTENSION	PAGER (966-4000)
RMRS	**Ty Vess** Contractor's Technical Representative	966-6540	4012
RMRS	**Tonya Sangaline** ER Health and Safety	966-5392	3052
RMRS	**Randal Tyson** ER Radiological Engineer	966-8172	7982
RMRS	**Annette Schmiechen** Project Manager	966-3191	4484
RMRS	**Russ Cirillo** Project Manager	966-5876	4011
RTG	**Erich Tiepel** Program Manager	969-8511	
RTG	**Bartley Conroy** Corporate Health and Safety Officer	969-8511	
RTG	**Terry Toler** Project Manager	966-6377	1361
RTG	**David Barnes** Site Safety Officer	966-5352	3542

Table 4.3 Subcontractor Personnel Responsibilities

Title	General Description	Responsibilities
Project Manager	Has authority to direct response operations Assumes total control over site activities. Stop work authority	• Prepares and organizes the background review of the situation, Work Plan, the Project Health and Safety Plan, and the field team. • Ensures that the Work Plan is completed and on schedule • Oversees the Project Health and Safety Officer to ensure that safety and health requirements are met. • Prepares the final report and support files on the project activities.
Project Site Safety Officer	Advises the Project Manager on all aspects of health and safety on site Stops work if any operation threatens worker or public health or safety	• Periodically inspects PPE and equipment. • Ensures that protective clothing and equipment are properly stored and maintained. • Implements the health and safety plan • Conducts periodic inspections to determine if the Project Health and Safety Plan is being followed. • Knows emergency procedures, evacuation routes, and the telephone numbers for emergency response

Table 4 3 (Continued)
Subcontractor Personnel Responsibilities

Title	General Description	Responsibilities
Project Site Safety Officer (continued)		• Sets up decontamination lines and the decontamination solutions appropriate for the type of chemical contamination on site • Controls the decontamination of all equipment, personnel, and samples from the contaminated areas • Assures proper disposal of contaminated clothing and materials • Ensures that all required equipment is available • Notifies RMRS personnel by telephone or radio in the event of a emergency
Subcontractor Health and Safety Manager		• Develops Health and Safety Guidelines • Reviews Project Health & Safety Plans • Develops site-specific Health & Safety procedures with Project Site Safety Officer • Conducts inspections, reviews compliance and reviews health & safety records

Table 4.3 (Continued)
Subcontractor Personnel Responsibilities

Title	General Description	Responsibilities
Health and Safety Specialist	Provides support of operations involving monitoring processes and radiological contaminants	• Performs routine monitoring of lab and PPE waste materials in accordance with applicable RFETS procedures to ensure control of radiological contaminants. • Performs routine monitoring of sample shipment containers in accordance with RMRS procedures to ensure control of radiological contaminants • Performs special monitoring for radiological contaminants as required in accordance with RMRS procedures. • Conducts air monitoring, as required.
Plant Operator	Provides daily operations and maintenance of the facility Stop work authority	• Follows standard operating procedures. Verifies that the plant is operating in a safe manner and complies with RFETS procedures and management specified regulations. • Maintains daily records of all activities. • Advises Project Health and Safety Officer of any unusual events.

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5 0 HEALTH AND SAFETY RISK ANALYSIS

The hazards associated with the operation of the Consolidated Water Treatment Facility include hazardous substances (chemical and radiological), physical hazards thermal hazards, and possible construction hazards

5 1 HAZARDOUS SUBSTANCES

Potentially contaminated wastewater collected on the RFETS site are expected to contain numerous hazardous substances This Section identifies and addresses potential chemical hazards

5 1 1 Chemical Contaminant Hazards

It would be impossible to list all potential hazardous contaminants to be found in RFETS wastewaters Chemical hazards posed by site contaminants in routine CWTF waste water sources are listed in Table 5 1 Non-routine waste water sources will be analyzed on a case by case basis and any new routine sources will be added to this document and Table 5 1

Table 5.1 Contaminant Chemical Hazards

Chemical Hazards Posed by Site Contaminants and Route of Exposure

Contaminant (Synonyms) (Abbreviations)	Action Level (½ PEL)	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/ Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	IP eV
Acetone	375 ppm	750 ppm	2500 ppm	Colorless liquid with a fragrant mint-like odor Fl. pt. 0°F LEL. 2.5% UEL. 12.8% VP 180 mm Hg (@ 68°F)	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention, Irrigate and wash area affected immediately	Eye, nose and throat irritation, headache dizziness; dermatitis	9 69
Benzene	0.5 ppm	PEL = 1 ppm TLV = 10 ppm REL = 0 1 ppm	Carcinogen (500 ppm)	Colorless to light yellow liquid with an aromatic odor Fl. pt. 12°F LEL. 1 2% UEL. 7 8% VP 75 mm Hg (@ 68°F)	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention, Irrigate and wash area affected immediately	Severe eye, nose, and throat irritation, headache giddiness; staggered gait.	9.24
Carbon Disulfide (Carbon Bisulfide)	2 ppm	PEL = 4 ppm TLV = 10ppm REL = 1 ppm	500 ppm	Colorless to faint yellow liquid, UEL. 50% LEL 1 3%	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Dizziness headache fatigue, poor sleep, nervousness, psychosis coronary heart disease; gastritis; eye, skin burns	10 08
1 1 Dichloro-ethylene (Vinylidene chloride) (1 1-Dichlor oethene) (1 1 DCE)	0 5 ppm	PEL = 1 ppm TLV = 5 ppm	Carcinogen	Colorless Liquid mild sweet odor LEL. 6.5% UEL. 15.5%	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Liver and kidney changes.	10 00
Methylene Chloride (Dichloro-methane. Methylene Dichloride)	25 ppm	PEL = 500 ppm TLV = 50 ppm	Carcinogen (2300 ppm)	Colorless liquid with chloroform like odor BP 104°F UEL. 22% LEL 14%	Inhalation Ingestion Contact Absorption	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Fatigue; weakness sleepiness lightheaded-ness; numb-ness and tinging in limbs nausea eye and skin irritation	11 32

Table 5 1 (Continued)

Chemical Hazards Posed by Site Contaminants and Route of Exposure

Contaminant (Synonyms) (Abbreviations)	Action Level (½ PEL)	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/ Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	IP eV
1 1 Dichloro-ethane	50 ppm	100 ppm	3 000 ppm	Colorless, oily liquid Chloroform like odor	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	CNS depression liver and kidney damage, skin irritation.	11 06
1,2 Dichloro-ethene (1 2 Dichloro ethylene)	100 ppm	200 ppm	1 000 ppm	Colorless liquid with slightly acrid, chloroform like odor UEL 12 8% LEL 5 6%	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Eye irritation, CNS depression Respiratory system	9 65
Naphthalene	5 ppm	10 ppm	250 ppm	Colorless to brown solid with an odor of mothballs. Flammable solid UEL 5 9% LEL 0 9%	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Eye and skin irritation, excitement headache vomiting profuse sweating jaundice.	8 88
1 1 1 Trichloro ethane (Methyl Chloroform) (1 1 1 TCA)	175 ppm	350 ppm	700 ppm	Colorless liquid, mild sweet odor LEL 7 5% UEL 12 5%	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Eye and skin irritation, dermatitis headache drowsiness	11 00
Carbon Tetrachloride (Tetrachloro-methane)	1 ppm	2 ppm	Carcinogen (300 ppm)	Colorless liquid, sweet odor not combustible VP 91 mm Hg	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	CNS depression nausea and vomiting liver and kidney damage, skin irritation.	11 47
Trichloro-ethylene (Ethylene Trichloride) (TCE) (Trichloro-ethene)	25 ppm	50 ppm	Carcinogen (1 000 ppm)	Colorless liquid, sweet odor LEL 8% UEL 10 5%	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Headache vertigo visual disturbance vomiting nausea, eye and skin irritation	9 45

Table 5 1 (Continued)

Chemical Hazards Posed by Site Contaminants and Route of Exposure

Contaminant (Synonyms) (Abbreviations)	Action Level (½ PEL)	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/ Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms	IP eV
1 1,2 Tri chloroethane	5 ppm	10 ppm	Carcinogen (100 ppm)	Chloroform like odor Non-combustible	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Carcinogen Irritate eyes, nose, throat; cramps; vomiting; diarrhea, affects sleep and appetite	11 00
Tetrachloro ethylene (Perchloro ethylene) (Tetrachloro-ethene) (Perchlor)	12 ppm	25 ppm	Carcinogen (150 ppm)	Colorless liquid with sweet odor Not combustible. VP 14 mm Hg	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Eye, Nose, throat irritation, nausea, flush face vertigo, headache liver kidney CNS	9 32
Toluene (Methyl Benzene) (Methyl Benzol)	50 ppm	100 ppm	500 ppm	Colorless liquid with a sweet, pungent odor UEL. 7 1% LEL. 1 1%	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention, Irrigate and wash affected area immediately	Fatigue, weakness confusion dizziness, headache dilated pupils nervousness, insomnia	8 82
Vinyl Acetate	2 ppm	REL = 4 ppm (Ceiling)	NA	Flamable, colorless liquid with a pleasant, fruty odor UEL. 13 4% LEL. 2.6% Fl. Pt. 18 F	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention Irrigate and wash affected area immediately	Eye, Nose, throat irritation; cough, loss of smell skin blisters.	9 19
Vinyl Chloride	0 5 ppm	1 ppm	Carcinogen	Flamable colorless gas or liquid with a pleasant odor at high concentrations. UEL. 33 3% LEL. 3 6% BPt. 7 F	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention treat exposed eyes and skin for frostbite.	Weakness abdominal pain, pallor frostbite if exposed to liquid.	9 99
Aluminum	2.5 mg/m³ (Resp)	15 mg/m³ (Total) 5 mg/m³ (Resp.)	NA	Silvery ductile metal	Inhalation Contact	NA	Pulmonary fibrosis, possibly Alzheimer	N/A
Antimony	0 25 mg/m	0 5 mg/m³	50 mg/m³	Silvery white metal	Inhalation Contact Ingestion	Artificial respiration; Seek medical attention Irrigate and wash affected area,	Irritates eyes, nose, throat, cramps; vomiting, diarrhea, affects sleep and appetite	N/A

Table 5 1 (Continued)

Chemical Hazards Posed by Site Contaminants and Route of Exposure

Contaminant (Synonyms) (Abbreviations)	Action Level (½ PEL)	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/ Chemical Character istics	Routes of Exposure	First Aid	Exposure Symptoms	IP eV
Arsenic	0 005 mg/m³	0 010 mg/m³	Carcinogen (5 mg/m³)	Silver gray or tin white brittle solid	Inhalation Absorption Contact Ingestion	Irrigate and wash affected area immediate medical attention	Nasal ulceration, GI disturbances, respiratory irritation.	N/A
Barium	0 25 mg/m³	0 5 mg/m³	50 mg/m³	Silver white, slightly lustrous	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Irritates eyes, nose, throat upper respiratory GI, muscle spasm slow pulse skin burns	N/A
Beryllium	0 5 µg/m³ IAW HSP 13 04 section 5 1 1	0 002 mg/m³	Carcinogen (4 mg/m³)	A brittle, grey white solid noncombustible slight explosion hazard in dust or powder form	Inhalation Contact	For eye exposure, irrigate eyes immediately	Respiratory symptoms fatigue, weakness weight loss.	N/A
Cadmium	0 0025 mg/m³	0 005 mg/m³	Carcinogen (9 mg/m³)	Silver white blue tinged solid	Inhalation Ingestion	Artificial respiration, Seek medical attention	Pulmonary edema cough tight chest chills, muscle aches, nausea, vomiting diarrhea.	N/A
Cesium	NA	NA	No Evidence	Silver white, ductile metal or silvery liquid	Inhalation Ingestion	Artificial respiration, Seek medical attention	Hyperirritability spasms	N/A
Chromium	0 25 mg/m³	0 5 mg/m³	No Evidence	Blue-white to steel gray lustrous solid	Inhalation Ingestion	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Corrosive to skin and mucous membranes, carcinogen of the lungs, nasal cavity stomach, larynx	N/A
Copper	0 5 mg/m³	1 mg/m³	100 mg/m³	Reddish, lustrous malleable solid	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Irritation of eyes and mucous membranes, pharynx, poison by ingestion, metal taste, damage of nervous system kidneys, and liver	N/A
Iron	5 mg/m³	10 mg/m³	2500 mg/m³	Reddish brown solid	Inhalation Ingestion	Artificial respiration, Seek medical attention	Poison by intraperi toneal route, tissue and lung irritant and carcinogen	N/A

Table 5 1 (Continued)

Chemical Hazards Posed by Site Contaminants and Route of Exposure

Contaminant (Synonyms) (Abbreviations)	Action Level (½ PEL)	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/ Chemical Character-istics	Routes of Exposure	First Aid	Exposure Symptoms	IP eV
Lead	0 025 mg/m³	0 050 mg/m³	100 mg/m³	Bluish-gray soft metal	Inhalation Ingestion Contact	Artificial respiration Seek medical attention, Irrigate and wash area affected immediately	Carcinogen of lungs and kidneys; affects CNS. GI tract, blood	N/A
Lithium	NA	NA	NA	Silver-colored light metal	Inhalation Ingestion	Artificial respiration Seek medical attention; Irrigate and wash area affected immediately	Reacts with body moisture to cause burns; toxic to CNS	N/A
Manganese	2.5 mg/m³	5 mg/m³	500 mg/m³	Silvery or reddish gray solid, brittle combustible	Inhalation Ingestion	Artificial respiration seek medical attention.	Parkinson's, CNS and lung damage; sleepiness; vomit, weakness, tremors	N/A
Mercury	0 005 mg/m³	0 01 mg/m³	10 mg/m³	Silvery mobile, odorless liquid	Inhalation Ingestion Contact Absorption	Artificial respiration Seek medical attention, Irrigate and wash area affected immediately.	Eye and skin irritant poison by inhalation, cough, tremor; headache; irritability· GI and CNS affected	N/A
Molybdenum	7 5 mg/m³ (Metal) 2.5 mg/m³ (Soluble)	15 mg/m³ (Insoluble) 5 mg/m³ (Soluble)	5000 mg/m³ (Insoluble) 1000 mg/m³ (Soluble)	Dark gray or black powder with a metallic luster	Inhalation Ingestion Contact	Artificial respiration; Seek medical attention immediately	Irritates eyes, nose and throat, diahrea,list-lessness, liver, kidney damage.	N/A
Nickel	0 0075 mg/m³	0 015 mg/m³	10 mg/m³ Carcinogen	Silvery white, hard, malleable, and ductile metal	Inhalation Ingestion Contact	Artificial respiration Seek medical attention, Irrigate and wash area affected immediately	Nasal, lung and skin irritant, carcinogenic	N/A

Table 5 1 (Continued)

Chemical Hazards Posed by Site Contaminants and Route of Exposure

Contaminant (Synonyms) (Abbreviations)	Action Level (½ PEL)	PEL (OSHA) or TLV (ACGIH) or REL	IDLH	Physical/ Chemical Character- istics	Routes of Exposure	First Aid	Exposure Symptoms	IP eV
Potassium cyanide	2 5 mg/m³	5 mg/m³	25 mg/m³	White granular or crystalline solid with a faint, almond like odor Contact with acids releases highly flammable hydrogen cyanide.	Inhalation Absorption Ingestion Contact	Irrigate and wash area affected immediately Artificial respiration, Seek medical attention	Irritated eyes. nose, throat, and skin. Headache, vomiting, changes in respiration.	N/A
Selenium	0 1 mg/m³	0 2 mg/m³	1 mg/m³	Steel gray nonmetallic element combustible	Inhalation Absorption Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Irritated eyes. nose, throat, GI distress, chills headache	N/A
Silver	0 005 mg/m³	0 01 mg/m³	10 mg/m³	White, lustrous solid metal	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention immediately Flush affected area with water	Blue-gray eyes, nasal septum, throat and skin, skin irritation, ulceration GI distress.	N/A
Sodium cyanide	2 5 mg/m³	5 mg/m³	25 mg/m³	White granular or crystalline solid with a faint, almond like odor Contact with acids releases highly flammable hydrogen cyanide.	Inhalation Absorption Ingestion Contact	Irrigate and wash area affected immediately Artificial respiration, Seek medical attention	Irritated eyes. nose, throat, and skin. Headache, vomiting, changes in respiration.	N/A
Strontium	NA	NA	NA	Silvery white metal	Ingestion Inhalation	NA	Moderately toxic by ingestion, inhalation	N/A
Thallium	0 05 mg/m³	0 1 mg/m³ Soluble (Skin)	15 mg/m³	Depends upon specific compound	Inhalation Ingestion Absorption Contact	Artificial respiration, Seek medical attention immediately Flush affected area with water	Nausea, diahrrea, abdominal pain, vomiting, ptosis, strabismus, tremor chest pain pulmonary edema liver,kidney damage.	N/A
Vanadium	0 025 mg/m³	0 05 mg/m³	35 mg/m³	Yellow-orange powder or dark gray odorless flakes dispersed in air	Inhalation Ingestion Absorption Contact	Flush affected area with water Seek medical attention	Eye, skin and throat irritation, green tongue, metallic taste.	N/A
Zinc	7 5 mg/m³ (Total) 2 5 mg/m³ (Resp)	15 mg/m³ (Total) 5 mg/m³ (Resp)	None Detected	White, odorless solid.	Inhalation Contact	NA	Lung and skin irritant, relatively non-toxic to humans by inhalation	N/A

Table 5 1 (Continued)

Chemical Hazards Posed by Site Contaminants and Route of Exposure

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
mg/m^3	milligrams per cubic meter
N/A	Not applicable
NA	Not available
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit-Concentration is a time weighted average that must not be exceeded during any 8-hour workshift of a 40-hour workweek.
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
$\mu g/m^3$	micrograms per cubic meter
VP	Vapor Pressure at 68 F in millimeters (mm) mercury (Hg) unless otherwise noted

References

Air Contaminants- Permissible Exposure Limits (29 CFR 1910 1000).

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1994 to 1995

National Institute of Occupational Safety and Health, Pocket Guide to Chemical Hazards, June 1994

Sax, N Irving Dangerous Properties of Industrial Materials. Van Nostrand Reinhold Company New York, 1979

5 1 2 Process Chemical Hazards

In addition to the hazards posed by contaminants contained in the influent waste stream, chemicals used in the treatment process pose a hazard to personnel Table 5 2 presents a summary of the chemical hazards routes of exposure and first aid for each process chemical used in the water treatment Material Safety Data sheets are contained in the facility MSDS binder, which will be maintained in conjunction with this document

Table 5 2 Process Chemical Hazards

Chemical Hazards Posed by Process Chemicals and Routes of Exposure

Chemical (Synonyms)	Concentration	TLV/PEL	IDLH	Physical/ Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Hydrochloric Acid	7 38% (Reagent Grade)	5 ppm (7 mg/m^3)	50 ppm	Green or yellow liquid	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Nose and throat irritation, burns throat and eyes cough choking
Sodium Hydroxide (Caustic Soda) (Lye)	50% Solution 25% Solution	2 mg/m^3	10 mg/m^3	White, odorless solid before mixing disagreeable, sweet odor in solution	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Severe skin irritation, nose irritation, temporary loss of hair
Liquid Nitrogen	100 %	None	None	BP 320 4 F	Inhalation Contact	Artificial respiration, Wash skin off with tepid water	Asphyxiant at high concentrations Freezes tissue narcotic at high concentrations and pressure
Hydrogen Peroxide	50% UV System 35% In drums 2% 3% Tk 9	1 ppm	75 ppm	Colorless liquid with a slightly sharp odor	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash area affected immediately	Eye, nose and throat irritation, corneal ulcer

Table 5.2 (Continued)

Chemical Hazards Posed by Process Chemicals and Routes of Exposure

Chemical (Synonyms)	Concentration	TLV/PEL	IDLH	Physical/ Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Ferric Sulfate (Ferri Floc)	89% (Dry Chemical)	1 mg/m³ (as Fe)	NA	Soluble Iron-Acid Dust	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Abdominal pain; diarrhea, pallor lassitude, drowsiness
Sulfuric Acid	93% (in drum) 20% (TK 5) 10% (TK-9) 3% (Feed to TK 11)	1 mg/m³ STEL=3 mg/m³	15 mg/m³	Colorless to dark brown, oily odorless liquid non-combustible	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately.	Eye, nose and throat irritation, pulmonary edema, bronchitis emphysema
Calcium Hydroxide (Hydrated Lime)	10% Solution	5 mg/m³	Unknown	White, odorless solid before mixing disagreeable, sweet odor in solution	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately	Severe skin irritation, nose irritation, eye irritation.
Sodium Hypochlorite (Bleach)	12% 30%	1.5 mg/m³	Unknown	Light yellow to green clear liquid chlorine odor	Inhalation Ingestion Contact	Artificial respiration, Seek medical attention Irrigate and wash affected area immediately.	Cough skin irritation, GI distress; eye, nose, and throat irritation
Granular Activated Carbon (GAC)	100%	0 7 mg/m³ (Respirable) 2.1 mg/m³ (Total)	NA	Black granular solid	Inhalation Ingestion Contact	Remove to fresh air; drink liquids irrigate and wash affected area immediately	Cough, skin irritation, GI distress, eye irritation

5 2 RADIOLOGICAL HAZARDS

The radiological hazards associated with operation of the Consolidated Water Treatment Facility arise from alpha, beta, and gamma radiations which are emitted from the attendant radionuclides during decay Alpha beta and gamma radiations are all forms of ionizing radiation The chronic health hazards associated with exposure to ionizing radiation may include an increased risk of cancer and genetic effects Various acute health effects are associated with high radiation exposures An acute health effect is defined as an observable physiological change appearing within days to several weeks after exposure Actual radiation levels and radionuclide concentrations experienced in operating the facility are well below those necessary to produce measurable acute health effects The primary radiological concern at the CWTF is the possibility of becoming internally contaminated with radioactive material

CWTF operators could be exposed to low levels of alpha, beta, and gamma radiation through external beta/gamma radiation, radioactive air particulates and radioactive contamination The greatest potential for health effects is from radioactive materials at processes or material locations in which the contaminants contained in the waste stream are concentrated (e g filter press, ion exchange column #1) Monitoring methods, worker exposure limits, and administrative action levels for these radiation exposure aspects are separately addressed in this plan

5 2 1 External Radiation Exposure

Both beta and gamma radiations are emitted by the radionuclides which may be present in the Consolidated Water Treatment Facility waste stream External beta radiation cannot penetrate beyond the shallow layers of the skin or the lens of the eye, and so associated hazards are confined to these areas Eye exposure to external beta radiation is greatly reduced or eliminated through the use of eye protection

External gamma radiation, unlike beta radiation, readily penetrates deep into the body and is therefore hazardous to internal organs Clothing and eye protection are not effective at reducing external gamma radiation exposure Three accepted methods to minimize gamma exposures are

- the use of shielding between personnel and the radiation source,
- minimizing time in the radiation area and
- maximizing distance from the radiation source

Due to low levels of gamma radiation, external shielding designed to reduce gamma radiation exposure should not be necessary for workers at the CWTF Should external radiation be of concern, the most effective methods of reducing worker exposure to external gamma radiation will be by posting areas where elevated gamma exposure rates exist and limiting the amount of time workers spend in these areas. Systems and work assignments may be reevaluated to ensure that operators are maintaining a maximum possible distance from radiation sources.

5.2.2 Internal Radiation Exposure

Alpha radiation is the primary radiation hazard which may be present in the CWTF waste stream. Personnel involved in normal operations at the CWTF should not encounter quantities of radioactive material above ROI 3 01, Appendix #1 free release limits in normal influent waters. Alpha radiation, due to it's relatively large mass and charge, does not pose an external hazard and will not penetrate the outer layer of dead skin cells However, alpha radiation is a significant internal hazard due to the large amount of energy deposited in small, localized areas of internal organs. Alpha radiation is principally admitted to the body by inhalation of airborne contamination but ingestion, injection, and absorption of surface contamination through the skin are also possible Radioactive contamination existing in the form of loose material is capable of migrating or being transported by a variety of mechanisms such as movement of personnel, vehicles, equipment, and wind

Air particulates that are suspended or have settled out on horizontal surfaces (equipment) and have been resuspended pose an inhalation hazard. Drinking contaminated water, eating contaminated food, and/or transferring contamination to the mouth pose an ingestion hazard. Abrasions, lacerations, or punctures of the skin resulting from contact with contaminated surfaces pose an injection hazard. Absorption hazards exist when radioactive isotopes are chemically incorporated in a substance that is able to permeate the skin.

Exposure to radioactive contamination and the potential for internal contamination can be controlled by the proper use and removal of PPE, administrative controls in controlled areas including prohibitions against smoking, eating, drinking and chewing, and proper use of respirators when airborne contamination above prescribed limits is possible or suspected.

5 3 OPERATIONAL SAFETY HAZARDS

The primary operational safety hazards and associated with this work and the control measures which will be implemented include the following

- Injuries from moving and/or energized or pressurized parts and machinery, engineering controls include the installation of guards to prevent contact with moving machinery, administrative controls include the use of lock out/tag out procedures to prevent injury from energized and/or pressurized systems

- Injuries from defective tools or mishandling of tools, materials, or equipment, controls will include inspection of all tools prior to use for defects or damage and thorough training of operational personnel in the proper handling and use of the materials and equipment in use at the treatment facility, proper equipment use will be controlled through the use of approved Standard Operating Procedures

- Injuries from falls during work performed at above ground locations or from being struck by falling objects controls will include training and use of the proper fall protection equipment and use of hard hats where construction hazards are present.

- Injuries from slips, trips, and falls from working on wet surfaces or in inadequately illuminated work areas controls will include proper housekeeping and control of liquid and snow and ice on walking surfaces and the use of slip resistant surfaces adequate lighting will be provided and maintained in all work areas requiring access

- Injury during work in confined spaces, All entries into designated confined spaces will be performed in accordance with the Health & Safety Practices manual, section 1-E36-HSP-6 04 (Confined Space Entry Program)

- Injuries from failure to wear proper personal protective equipment, Section 8 0 of this Health and Safety Plan contains requirements for selection and use of personal protective equipment during all tasks associated with operation and maintenance of the treatment facility Operational personnel receive training in the use of personal protective equipment and are required to read and acknowledge understanding of the contents of this plan Additionally, Daily Safety Briefings

are conducted at the beginning of each shift to discuss planned activities and control measures required, including the proper personal protective clothing In addition, safety concerns for non-routine activities will be addressed in the requisite pre-evolution briefing

5 4 ENVIRONMENTAL AND BIOLOGICAL HAZARDS

In addition to the hazards described above, during the operation and maintenance of the treatment facility, there is the potential for worker exposure to high winds, serious temperature extremes, biological hazards, UV light and noise High winds pose a hazard to workers in areas outside the CWTF buildings Outside work will be curtailed due to sustained winds following RFETS Plant announcements. Potentially serious temperature extremes could produce heat related illnesses such as heat stroke, heat exhaustion, and heat cramps for workers outside the buildings. During extreme cold weather, the primary hazards of concern for workers outside will be hypothermia and frostbite

The main biological hazards of concern, again primarily outside the buildings, will be insect and snake bites Hantavirus from mouse droppings may also be a concern in areas that mice inhabit Contact Health and Safety personnel if there is any question of a biological hazard.

Additionally, equipment and machinery may generate levels of noise that could contribute to chronic hearing loss UV light from the UV/H_2O_2 system could cause UV radiation damage to the eyes and skin if the shields are removed from the viewing ports while the equipment is in operation

6 0 GENERAL SITE REQUIREMENTS

Given the diverse nature and potential effects of the expected contaminants at the Consolidated Water Treatment Facility safety precautions are necessary to ensure maximum protection of human health and the environment This section presents general requirements which apply to all activities on the site The purpose of these requirements is to ensure that operators and other subcontractor personnel involved with the operation of the CWTF are properly prepared for the activities they will be performing

6 1 EMPLOYEE TRAINING

All operators and associated personnel working on this project shall be trained in accordance with the requirements of 29 CFR 1910 120(e) A training file for each subcontractor site employee will be maintained on site This training file will include certificates and training records required by the subcontractor as well as site specific forms generated by the main contractor A training file containing the subcontractor records will also be maintained at the contractor's project management office

6 1 1 40-Hour Hazardous Waste Training

This training shall be a 40-hour hazardous waste course comparable to RFETS HAZWOPER training and shall fulfill the requirements of 29 CFR 1910 120(e)

6 1 2 24-Hour On-The-Job Training

In addition to 40-hour Hazardous Waste Site Training a site specific OSHA 24-hour on-the-job training shall be given to all workers and properly documented This shall consist of a review of site contaminants and hazards the contents of this plan and the actions to be taken in the event of emergencies Employees shall also be trained on the use of MSDS sheets which will be available to all personnel for chemicals used at the treatment facility

6 1 3 Respiratory Protection Training

The subcontractor Respiratory Protection Program (RSP) has been approved by the main contractor Industrial Safety and Health Respiratory protection training is integral to the RSP Field personnel will complete the level of respiratory protection training that is appropriate to their job description (in accordance with 29 CFR 1910 134 and HSP 7 03) during initial 40 hour OSHA training and annually

thereafter Topics that will be covered for the subcontractor operations personnel at the CWTF will include the following

- Overview of respiratory protection,
- Physiology of the respiratory system,
- Classification of respiratory hazards,
- Air-purifying respirators,
- Respirator selection, use and limitations,
- Fit testing, maintenance and cleaning,
- Examination

6 1 4 Supplemental Training

Supplemental training shall include the following

- 8-hour OSHA supervisor training (managers, supervisors, shift foremen, site Health and Safety Officer),
- Current 8 hour OSHA refresher training (all employees), in accordance with 29 CFR 1910 120,
- Respiratory protection training (all employees),
- First aid and CPR training (at least one employee per shift and the HSO),
- Confined Space Entry Training (shift foremen and HSO),
- Pressure Safety Awareness and Intermediate Pressure Safety (shift foremen, operators, and HSO)

The Project Manager shall be responsible for verifying the current status of training for all employees assigned to the project. Any deficiencies shall be cleared prior to the employee beginning work on the field portion of the project.

Finally, all employees must read and acknowledge in writing that they have read this site specific Health and Safety Plan A sample acknowledgement form is shown on Figure 6 1 Blank forms must be kept in the site office and will be accessible to the on duty operator at all times. Original signed forms for project personnel will be kept in the project files All personnel working under the project Health and Safety Plan will also read and understand the subcontractor Health and Safety Program Manual The preceding requirements are those that must be satisfied for any subcontractor field work

RESOURCE TECHNOLOGIES GROUP INC

HEALTH AND SAFETY PROGRAM
HEALTH AND SAFETY PLAN
ACKNOWLEDGEMENT

Project Number _____

Project Name _____

Project Location _____

I hereby acknowledge that I have been given a safety briefing on the work I am to do on the above-referenced site I understand that the site may contain materials classified by EPA or others as potentially hazardous I have read and understand the safety plans for this project and will adhere to the procedures contained therein I have been instructed in and understand the use of the safety equipment for this project

Employee

Date _____

Print Name _____

Signature _____

Project Manager or Representative

Date _____

Print Name _____

Signature _____

regardless of the site There are also many site-specific training requirements and qualifications for particular job descriptions or tasks. These requirements shall be addressed on an individual basis as needed All operations personnel will receive site specific training pertaining to chemicals and materials used in the operation of the CWTF regarding the routes of exposure and adverse health effects.

6.2 MEDICAL MONITORING

All employees assigned to a field project at a hazardous waste site shall be part of a Medical Monitoring Program and shall comply with the requirements of 29 CFR 1910 120(f) The subcontractor Project Manager shall be responsible for verifying the current medical monitoring status for all employees assigned to the project. An annual physical and medical evaluation is required of all subcontractor personnel to be cleared to work on site Any deficiencies shall be cleared prior to the employee doing any field work on the field project. Written records showing an employee is not restricted from working on a hazardous waste site (and establishing fitness to wear a respirator, if applicable) shall be maintained at the on site project office

6.3 DAILY SAFETY BRIEFINGS

As described in Section 6 1, all workers shall receive a safety briefing on the contents of this plan prior to beginning work. In addition, a health and safety briefing shall be performed at the beginning of each shift. The briefing shall be conducted by the shift Health and Safety Officer, and shall cover the specific tasks to be performed for that shift. Health and safety concerns for planned tasks shall be reviewed, and required procedures discussed. The attendees at the briefing, and the items discussed, shall be documented in the daily Safety Briefing Report shown on Figure 6 2 A supply of blank Safety Briefing Forms will be kept in the operations office

6 4 POSTING AND SITE ACCESS

The Rocky Flats Environmental Technology Site is a controlled access area with the CWTF located inside the Rocky Flats controlled area fencing Access to the working areas of the CWTF shall be limited to subcontractor operations and supervisory personnel in addition to appropriate contractor management and support personnel Personnel entering any area of the facility other than the office shall sign in the Building Access Log located in the office in Bldg 891 First time access for an individual will require a site specific safety briefing given by the facility operator and documented in the Building Access Log Any maintenance or other personnel will be trained in accordance

RESOURCE TECHNOLOGIES GROUP, INC

HEALTH AND SAFETY PROGRAM
SAFETY BRIEFING REPORT

Project Number _____ Name _____

Project Location _____

Project Manager _____

Site Health and Safety Officer _____

Date _____ Weather _____

Task Specific Safety Requirements

Task _____

_____

Personnel

Name	Assignment

Safety Requirements _____

_____

_____

_____

_____

Task Specific Safety Requirements

Task _____

_____

Personnel

Name	Assignment

Safety Requirements _____

_____

_____

_____

_____

RESOURCE TECHNOLOGIES GROUP, INC

HEALTH AND SAFETY PROGRAM SAFETY BRIEFING REPORT

Task Specific Safety Requirements

Task _____

_____

Personnel

Name	Assignment

Safety Requirements _____

_____

_____

_____

_____

Task Specific Safety Requirements

Task _____

_____

Personnel

Name	Assignment

Safety Requirements _____

_____

_____

_____

_____

Briefing Acknowledgement	Printed Name	Signature
Briefing Conducted By		

with the requirements presented in this section and may also be accompanied by an operator, as appropriate Communication between CWTF personnel shall be maintained at all times via voice communication or two way radio communication

No areas of the CWTF are considered to be exclusion zones due to hazardous material, radiological, or physical hazards It is still desirable to minimize and control general access to protect equipment and prevent accidental release of hazardous or radiological materials, therefore access to all enclosed areas of the facility except the office, shall be controlled by CWTF personnel

A map of the CWTF is attached as Figure 3 1

6 5 BUDDY SYSTEM

All work that requires an operator to directly handle sample or transport hazardous materials, hazardous waste or waste containers at Rocky Flats requires the use of the buddy system This includes process chemical preparation drum or chemical transfers and maintenance The buddy system ensures that each worker is observed by another worker who can provide rapid assistance in case of emergency In addition, any work requiring greater than Level D protection requires use of the buddy system Plant personnel may operate the plant without use of the buddy system provided radio contact is maintained. At no time shall any worker engage in any kind of emergency response without the use of the buddy system Workers shall immediately evacuate the danger area upon discovery of a potential emergency situation

7.0 EMERGENCY RESPONSE PLAN

This project involves the operation of an existing CWTF Potential emergency situations during work at the facility include fire, hazardous substance release, employee contamination, accidents and injuries. Safety precautions will be taken to avoid emergency situations. However, if an emergency does arise, the procedures described in this section will be followed Also, preparatory steps necessary for responding to an emergency situation are given below and they should be complied with before beginning any work at the site

The main contractor maintains an emergency response telephone extension of 2911 at Rocky Flats plant. Extension 2911 may be reached from any plant site telephone and will immediately connect the caller with the Fire Department, Plant Security, the Central Alarm Station, the Shift Superintendent and, during first shift, Occupational Health. If evacuation is necessary, exit the building or trailer via the nearest exit and proceed to the primary assembly area located between the two rows of cargo containers directly north of Building 891 If the primary assembly area is downwind from the event that makes evacuation necessary, go to the secondary area The secondary assembly area is located east of the CWTF between trailers T891D and T891P Once there, be certain that your supervisor has accounted for you and follow management directions Emergency escape routes are posted near each exit of the facility and personnel who frequent the CWTF should be familiar with the escape route from any given location at the facility Please note that there is no operation within the CWTF that is vital enough to delay an evacuation for even an instant.

7 1 FIRE

The first responsibility of any employee discovering a fire is to raise the alarm. UNDER NO CIRCUMSTANCES SHOULD ANYONE ATTEMPT TO FIGHT A FIRE ALONE. Those personnel trained as First Responders may then use a fire extinguisher or de-energize small fires in those situations where there is no personal danger in doing so Five fire extinguishers are located in Building 891, one next to each of the five doors. Two fire extinguishers are located in both the precipitation trailer (T900B) and the microfiltration trailer (T900A) also next to each of the four doors. Each company vehicle is equipped with a fire extinguisher for use at the remote collection facilities.

All personnel should move or be moved to a safe distance from any area involved in a fire situation. There is no installed fire alarm system in the CWTF so the emergency extension at 2911 shall be called immediately The Subcontractor Shift Foreman shall immediately notify subcontractor and contractor personnel

7 2 HAZARDOUS SUBSTANCE RELEASE

7 2 1 Definitions

EMERGENCY RESPONSE action is a response effort to an occurrence which results, or is likely to result in an uncontrolled release of hazardous materials or substances This does not include response to incidental releases of hazardous materials or substances An **EMERGENCY RESPONSE** involves support efforts by employees from outside the immediate release area or by designated responders (e g , HAZMAT Team or Radiological Assistance Team)

INCIDENTAL RELEASE includes spills leaks or other releases where the substance can be safely absorbed neutralized or otherwise controlled by employees or maintenance personnel in the immediate release area at the time of the release It also includes releases of hazardous substances for which there is no potential safety or health hazard (i e , fire, explosion or chemical exposure) above the normal operating conditions in the work area Use of additional personal protective equipment (e g , chemical cartridge respirators) not used during normal work activities is not allowed

RELEASE means any spilling, leaking pumping, pouring emitting, emptying, discharging, or dumping of a hazardous material or hazardous waste in any building/containment or to the environment.

REPORTABLE RELEASE any unplanned solid or liquid releases of a hazardous material or a hazardous substance that occur inside or outside of any building or containment

7.2.2 CWTF Release Hazard Analysis

Table 7 1 contains a hazard analysis of all materials at the Consolidated Water Treatment Facility that have the potential to be released and the appropriate level of personal protective equipment required for spill response This listing of appropriate PPE should not to be construed as permission for operators or other personnel lacking the proper training to respond to a spill

Table 7 1 Spill Response Hazard Analysis

MATERIAL SPILLED	SPILL PROCEDURES	PERSONAL PROTECTIVE EQUIPMENT REQUIRED
Hydrochloric Acid	Flush with water neutralize with soda ash or lime only with adequate ventilation as carbon dioxide is generated eliminate sources of ignition as hydrogen gas may be generated, place in appropriate container for disposal.	Level D- Work clothes with plastic coated Tyvek, safety shoes with neoprene boot covers, safety glasses with full face shield elbow length neoprene or butyl gloves. Level B. No entry without SCBA[b] in event of a spill of concentrated hydrochloric acid
Sodium Hydroxide	Flush with water neutralize with dilute acid, pick-up spill with vacuum or pumping equipment; place in appropriate container for disposal	Level D Work clothes with plastic coated Tyvek or apron, elbow length neoprene gloves and overboots, safety glasses will full face shield.
Hydrogen Peroxide	Flush area with water place in appropriate container for disposal	Level D Work clothes with plastic-coated Tyvek, safety shoes with neoprene boot covers, safety glasses with full face mask; neoprene or butyl gloves. SA[a] or SCBA[b] required if monitoring indicates levels above TWA of 1 ppm.
Liquid Nitrogen	Shut off leak if it can be done without risk of skin contact and if ventilation is adequate Evacuate area until ventilation can restore a safe oxygen level, Allow spilled liquid to evacuate.	Level D- Work clothes with insulated gloves; safety goggles. If spill is significant amount in a small area, oxygen deficiency is a hazard and use of SCBA[b] may be required.
Ion Exchange Resin	Sweep up. Ion exchange resin on smooth surfaces may be slippery place in appropriate container for storage or disposal.	Level D- Work clothes; safety glasses with side shields, safety shoes.
Sodium Hypochlorite	Evacuate and ventilate area. Contact RFETS HAZMAT (ext. 2911) Neutralize with 5% Sodium Bisulfite solution	Level D Work clothes with plastic coated Tyvek or apron, elbow length neoprene gloves and overboots; safety glasses will full face shield.
Ferric Sulfate	Flush with water pick up spill with vacuum or pumping equipment, place in appropriate container for disposal	Level D- Work clothes with plastic coated Tyvek or chemical apron with neoprene boot covers; safety glasses with full face shield elbow length neoprene or butyl gloves.

Notes
[a] Supplied Air
[b] Self Contained Breathing Apparatus
Air Purifying Respirator

Table 7 1 (Cont)

Spill Response Hazard Analysis

MATERIAL SPILLED	SPILL PROCEDURES	PERSONAL PROTECTIVE EQUIPMENT REQUIRED
Calcium Hydroxide (Lime)	Dry Sweep up and containerize for reuse or disposal control dust generation during cleanup Liquid solution Absorb with universal absorbents or clean up with wet vacuum.	Level D Work clothes (Tyvek optional) safety shoes safety glasses or goggles and full face shield leather work gloves Air purifying respirator with HEPA cartridges for dry cleanup if dust cannot be controlled
Sulfuric Acid	Cover with sand neutralize with soda ash, lime, or neutralizer only with adequate ventilation as carbon dioxide is generated place in appropriate container for disposal	Level D Work clothes with plastic coated Tyvek safety shoes with neoprene boot covers safety glasses with full face shield elbow length neoprene or butyl gloves No entry without SA or SCBA[b] if monitoring indicates levels above TLV of 1 mg/m^3
Hydrogen Peroxide	Flush area with water place in appropriate container for disposal	Level D Work clothes with plastic-coated Tyvek safety shoes with neoprene boot covers safety glasses with full face mask, neoprene or butyl gloves. SA or SCBA[b] required if monitoring indicates levels above TWA of 1 ppm.
Powdered or Granular Activated Carbon	Sweep up and place in appropriate container for storage or disposal If large spill in small space, ensure oxygen levels are above 19 5%	Level D Work clothes safety glasses with side shields safety shoes
Spent Granular Activated Carbon	Contain spill place material in appropriate container for disposal	Level B Total body Saranex suit safety shoes with neoprene boot covers inner and outer chemical resistant gloves Air monitoring for compounds in Section 8 2
Liquid Wastewater and Slurry	Contain spill absorb with universal absorbents or recover with wet vacuum or pump place in appropriate container for disposal	Level B Total body Saranex suit safety shoes with neoprene boot covers inner and outer chemical resistant gloves Air monitoring for compounds in Section 8 2
Sludge	Place sludge material in appropriate container for disposal perform decontamination of area with soap and water	Level D Tyvek coverall safety shoes safety glasses with full face shield neoprene or butyl gloves APR or SCBA[b] required if monitoring indicates levels above those noted in Section 8 2

Notes

Supplied Air

[b] Self Contained Breathing Apparatus

Air Purifying Respirator

7.2 3 Initial Response Requirements

If an employee properly trained in accordance with the requirement in Section 6 0 discovers an incidental release in his/her work area and is knowledgeable of the associated hazards, the employee may take immediate action to contain or control the release (e g , shut a valve to stop the flow) The shift foreman shall be immediately informed of any such action and (in accordance with Section 6 5) be present for any further actions taken An incidental release may be cleaned up as part of the first response actions.

Note Actions should only be taken if employees can perform them in a safe manner, without endangering themselves or others

If the spill or release is life threatening or involves a fire, the Shift Foreman shall immediately call the Plant Emergency Number (extension 2911) All other spills and releases shall be immediately reported to RMRS and the subcontractor supervision, who will assess the event or condition to determine if an emergency response is required. Supervision may request assistance, as required, of support groups (e g , Industrial Hygiene, Radiological Engineering, etc) to make this determination.

If the event or condition requires an emergency response, supervision shall immediately call the Plant Emergency Number (extension 2911 for life threatening emergencies) or the Shift Superintendent (extension 2914 for non-life threatening emergencies) for assistance Containment measures shall only be performed by personnel with First Responder Operations Level training

7.3 EMPLOYEE CONTAMINATION

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her coworker(s) will immediately leave the work area for which the PPE was required Re-entry to the area will not be permitted until the equipment has been repaired or replaced. If any incidents occur that involve the contamination or exposure of an employee to hazardous or toxic substances, the RFETS emergency extension at 2911 shall be notified immediately to dispatch the appropriate emergency personnel

First aid or other decontamination procedures should be administered if they can be without endangering other operations personnel Contaminated personnel should proceed to the nearest decontamination safety shower and thoroughly irrigate the contaminated area(s) No contamination situation at the CWTF will be made worse by the use of large amounts of water A first aid kit is located in the office area of the

CWTF The Shift Foreman or operator shall notify project management and the subcontractor supervision immediately Consult the chemical specific MSDS for direction concerning the chemical(s) involved

7 4 ACCIDENT / INJURY

In the event of an accident or other event that causes injury to operations or any other personnel present at the CWTF site the RFETS emergency extension at **2911** shall be notified immediately The site Fire Department EMTs and Security will be dispatched immediately Details of the emergency and the exact location must be given over the phone Basic first aid may be administered by the subcontractor personnel until emergency medical assistance is available Each shift will have a minimum of one subcontractor staff member trained in American Red Cross First Aid and CPR Any non-emergency medical situation such as minor cuts or sprains should be attended to at RFETS Medical - Building 122

The subcontractor Shift Foreman or operator shall immediately notify project management and the subcontractor supervision of any accident or injury

7 5 COMMUNICATIONS

The Consolidated Water Treatment Facility consists of the treatment plants inside Buildings 891, associated trailers and tankage outside the building in close proximity The small work area and requirement of the buddy system during work activities allows face to face communication among workers A phone is located in the office area of the treatment facility for communication in emergencies Any work required at other areas of the RFETS plant site require the availability of two way radios for emergency use The on-site emergency phone number is **2911** which is the Rocky Flats emergency extension

7 6 INCIDENT REPORTING

The following list of supervisory personnel and their telephone numbers will be posted by the telephone(s) closest to ongoing field activities One main contractor and one subcontractor staff member will be notified using the call in order listed of any spill release, personnel contamination, accident or injury, major equipment failure or out of specification discharge Complete the reporting process in accordance with procedure 1-66100-HSP-3 03 Reporting Occupational Injury or Illness and Vehicle or Property Damage

Table 7.2 Emergency Telephone Numbers

RFETS Emergency Contacts	Telephone Number
Contact Russ Cirillo	RFETS Phone 966-5876 Pager # 4011 Home Phone 431-6389
Contact Mike Bemski	RFETS Phone 966-4090 Pager # 7466 Home Phone 278-2697
Contact Ty Vess	RFETS Phone 966-6540 Pager # 4012 Home Phone 456-2725

If none of the project management personnel listed above are available, contact the RFETS Shift Superintendent at 966-2914

RFETS Emergency Response Extension: 2911

RTG Emergency Contacts

RTG Project Manager Contact Terry Toler	RTG Phone 966-6377 Home Phone 425-3660
RTG Site Health and Safety Officer Contact David Barnes	RTG Phone 966-5352 Home Phone 989-6003
RTG Health and Safety Officer Contact. Bart Conroy	RTG Phone 969-8511 Home Phone 989-1347
RTG Operations Manager Contact Mike Griffin	RTG Phone 969-8511 Home Phone 838-9590
RTG Program Manager Contact Erich Tiepel	RTG Phone 969-8511 Home Phone 795-1381

8 0 PERSONAL PROTECTIVE REQUIREMENTS

The purpose of personal protective equipment (PPE) including clothing, is to shield or isolate individuals from the chemical physical and biological hazards that they may encounter at sites containing hazardous or toxic materials The careful selection and use of PPE will protect the respiratory system, skin eyes, face hands feet head body and hearing

No single combination of protective equipment and clothing is capable of protecting against all hazards, and PPE must be used in conjunction with other protective methods The use of PPE can in itself create significant worker hazards such as heat stress physical and psychological stress, impaired vision, mobility, and communication

Specific protective garments are selected on the basis of a variety of criteria In general, the greater the level of PPE the greater the associated risks For any given situation, equipment and clothing must be selected to provide an adequate level of protection Over protection as well as under-protection can be hazardous and should be avoided

Table 8-1 summarizes PPE requirements for specific tasks associated with operation of the CWTF Non-routine tasks which are not addressed in Table 8 1 will be addressed on a case-by-case basis by the subcontractor Health and Safety Officer and the appropriate level of PPE determined will be approved by Project Management The following sections detail the criteria for selecting specific PPE which will apply to this project Any changes to this plan including additional tasks, PPE, etc , must be approved by appropriate company and main contractor personnel

Table 8.1 Personal Protective Equipment Summary

Task	Level	Body	Foot	Head[1]	Eye	Hand	Respirator [2,3]
Routine plant operations	D	Work clothes	Safety shoes	None required	Safety glasses	None required	None required
Working on H_2O_2 feed system	D	Work clothes, Chemical apron	Safety shoes	None required	Safety glasses with face shield	Nitrile gloves	None required
Replacing sock filters	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Cleaning basket strainers	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Replacing cartridge filters	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Elevated work (Heights >6 ft)	D	Full body harness	Safety shoes	None required	Safety glasses	None required	None required
Operation of portable pumps to transfer water	D	Work clothes (Apron optional)	Safety shoes	None required	Safety glasses (Face shield optional)	Nitrile or butyl gloves	None required
Removal and replacement of filter bags	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Cleaning UV lamps and changing bulbs	D	Work clothes	Safety shoes	None required	Safety glasses	Elbow length neoprene or butyl gloves	None required
Loading or offloading mobile water dumpsters	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Miscellaneous maintenance work	D	Work clothes	Safety shoes	None required	Safety glasses	Leather work gloves or none required	None required
Collecting water or process samples (unpressurized)	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Collecting water or process samples (pressurized)	D	Work clothes	Safety shoes	None required	Safety glasses with face shield	Nitrile gloves	None required

1 The Subcontractor Health and Safety Officer and RMRS shall specify hardhat areas.
2 Respiratory protection requirements based upon continuing monitoring for airborne contaminations as discussed in Section 8.2
3 Respirators will be required if contaminants are >½PEL or >10%DAC measured or expected.

Table 8 1 (Continued)

Personal Protective Equipment Summary

Task	Level	Body	Foot	Head[1]	Eye	Hand	Respirator [2,3]
Pumping or Mixing Hydrated Lime	D	Work Clothes (Tyvek optional)	Safety shoes	None Required	Safety glasses with face shield	Leather work gloves	None required with blower and filter operational
Pumping or Mixing Ferric Sulfate	D	Work Clothes (Tyvek optional)	Safety shoes	None Required	Safety glasses with face shield	Leather work gloves	None required
Handling or Mixing Hydrogen Peroxide	D	Acid Apron or Poly coated Tyvek suit	Safety shoes with neoprene boot covers	None Required	Safety glasses with face shield	Neoprene or butyl gloves	None required
Handling or Mixing Sulfuric Acid or Hydrochloric Acid	D	Acid apron or Poly Coated Tyvek	Safety shoes with neoprene boot covers	None Required	Safety glasses with face shield	Elbow length neoprene or butyl gloves	As determined by Health and Safety personnel
Working with Sodium Hydroxide (Caustic Soda)	D	Acid apron or Poly Coated Tyvek	Safety shoes with neoprene boot covers	None Required	Safety glasses with face shield	Nitrile, neoprene or butyl gloves	None required
Handling or Mixing Sodium Hypochlorite	D	Acid apron or Poly Coated Tyvek	Safety shoes with neoprene boot covers	None Required	Safety glasses with face shield	Nitrile, neoprene or butyl gloves	None required
Handling virgin G A C	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	None required
Handling spent G A C	D	Work clothes	Safety shoes	None required	Safety glasses	Nitrile gloves	Air monitoring
Packaging sludge with filter press	D	Saranex or Poly-coated Tyvek suit External dosimeter	Safety shoes with neoprene boot covers	None Required	Safety glasses	Nitrile, neoprene or butyl gloves	None required
Cleanup of small spills	See Table 7 1						
Cleaning filter press	D	Poly-coated Tyvek suit External dosimeter	Safety shoes with neoprere boot covers	None Required	Safety glasses with full face splash shield	Nitrile, neoprene or butyl gloves	None required

[1] The Subcontractor Health and Safety Officer and RMRS shall specify hardhat areas
[2] Respiratory protection requirements based upon continuing monitoring for airborne contaminations as discussed in Section 8 2
[3] Respirators will be required if contaminants are >½PEL or >10%DAC measured or expected

8 1 CLOTHING

The use of Level D protective equipment is defined by the following criteria

- No contaminants are present, or contaminants are present below the action levels established in the HASP for respirator use, **and**
- Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals

Experience with previous treatment operations indicates that the chance of encountering contamination in the work area is minimal given the low concentration of contaminants Therefore, Level D protection will be adequate during most normal work activities. This is a field work uniform affording minimal protection, consisting of the following PPE

- Safety boots, leather or chemical resistant, with steel toe and shank.
- Safety glasses (ANSI Z87 1-1989 compliant) with side shields or goggles.

The following additional PPE may be required as part of Level D protection depending on the specific tasks being performed

- Coveralls,
- Work gloves,
- Face shield
- Hard hat

In addition, proper chemical resistant gloves shall be worn when handling process treatment chemicals Face shields and aprons shall also be worn during operations with the potential for splashing A poly-coated Tyvek suit may also be worn if the splashing potential is judged to be high. Tank top shirts, shorts, and tennis shoes are not permissible PPE shall meet the requirements applicable to ANSI and OSHA standards. Where appropriate and more stringent, the subcontractor will comply with Rocky Flats Plant PPE requirements Modifications or substitutions of the PPE specified herein shall require the concurrence of the Site Safety Officer and be subject to written approval by RMRS project management.

If air monitoring as described in Section 9 0 indicates the presence of organic vapors in excess of action levels Level C PPE may be required The subcontractor Respiratory Protection Program is not approved for airborne radioactive contamination and subcontractor operations personnel should not enter an Airborne Radioactivity Area (ARA) under any circumstances Health and Safety Specialists who may be required to enter such areas will be qualified under RFETS Respiratory Protection Program The PPE for Level C shall include the following

- Full-face air purifying respirator with appropriate cartridges or canisters
- Chemical resistant clothing consisting of
  coveralls
  - hooded one- or two-piece chemical splash suit, or
  chemical-resistant hood and apron, or
  disposable chemical-resistant coveralls
  inner and outer chemical resistant gloves and
  chemical-resistant safety boots with steel toes

- Optional
  - hard hat
  - outer disposable chemical-resistant boot covers,
  - face shield
  2-way intrinsically safe radios,
  long cotton underwear

The criteria to evaluate when considering whether Level C PPE is required include the following

- Oxygen concentrations are greater than 19 5 percent and less than 23 5 percent by volume,

- Measured air concentrations of identified substances will be reduced by the respirator below the PEL TLV or REL and the concentration is within the service limit of the cartridge

- Atmospheric contaminant concentrations do not exceed IDLH levels

- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect anyone left unprotected by chemical-resistant clothing,

- Job functions do not require self-contained breathing apparatus, and

- Continuous direct readings on monitoring instruments, such as FIDs or PIDs, are within the action levels prescribed in the HASP for air-purifying respirator use

The main selection criterion for Level C, as opposed to the more restrictive Level B, is that conditions permit wearing air-purifying respirators. Cartridges must be able to remove the substances encountered.

A full-face, air-purifying respirator can be used only if

- Oxygen concentrations are greater than 19 5 percent and less than 23 5 percent by volume,
- The substance in question has adequate warning properties,
- The individual using the mask has passed at least a qualitative fit-test,
- The individual has medical clearance for the use of respirators, and
- The appropriate cartridge is used and its service limit concentration is not exceeded.

The chemical and radiological hazards expected to be encountered at the CWTF were discussed previously in Section 5 0 and presented on Table 5 1 and Table 5 2 It is apparent from reviewing this information that a full-face respirator with a combination organic vapor - acid gas - HEPA cartridge should be adequate in situations that require respiratory protection and will be maintained at the site in the event that they are required If experience and data indicate that the contaminants are significantly different than those discussed in Section 5 0, then the respiratory protection requirements must be reevaluated.

An air surveillance program is part of all hazardous material/waste site operations when atmospheric contamination is known or suspected. It is mandatory that the ambient air be thoroughly and continuously monitored when personnel are wearing air-purifying respirators. Surveillance using a photoionization detector (PID), colorimetric tubes or other air sampling equipment, in accordance with the HASP, is required during all Level C and B operations to detect changes in air quality necessitating a higher level of respiratory protection Level C protection with an air purifying respirator will be worn routinely in an atmosphere only

after the type of air contaminant is identified, concentrations measured, and the criteria for wearing air purifying respirators are met

8 2 RESPIRATORY PROTECTION

The requirements for respiratory protection have been discussed briefly in Section 8 1 and will be presented in greater detail in this section Respiratory protection requirements shall be based on air monitoring data Air quality shall be monitored with a photoionization detector (PID) equipped with an 11 7 eV lamp colorimetric tubes or personal air samplers Action levels for respiratory protection are listed in Tables 5 1 and 5 2 and shall generally be one half the applicable OSHA PEL as listed in the Table 5 1

Exposure to the VOCs listed is possible when breaking the integrity of the collection systems or process systems upstream of the treatment designed to eliminate VOC's, sampling influent waters, or transferring influent water into a water dumpster which is vented directly to atmosphere When necessary to perform maintenance on the influent system or perform system sampling recent influent water samples shall be reviewed for actual contaminants and concentrations present Air monitoring of void spaces following draining will be accomplished with a PID Exposure to the listed VOC's could also theoretically occur during handling of spent Granular Activated Carbon (GAC) Air sampling will be performed during handling of spent GAC to monitor for these compounds

Weekly air sampling of all work areas combined with periodic spot checking of sampling and water transfer operations will be performed to monitor contaminant levels Should the PID indicate levels above 50% of the most limiting PEL (1 ppm for Vinyl Chloride) monitoring with colorimetric tubes or personal air samplers may also be determined to be necessary to supplement data concerning specific compounds Any analysis of cartridges from personal air samplers will be performed for the compounds of interest by an independent industrial laboratory approved by the main contractor The subcontractor Health and Safety Officer Project Manager and the Site Health and Safety Officer will review the results of this evaluation to determine whether engineering controls can be installed to minimize the concentration of VOC's If engineering controls can be utilized they will be recommended and installed upon approval

If engineering controls are not practical work may continue only after air monitoring results are completed and with the concurrence of the subcontractor Health and Safety Officer and RMRS project management

8.3 GENERAL REQUIREMENTS FOR CHEMICAL HANDLING

Hydrogen peroxide is routinely used during waste treatment in the UV/H_2O_2 system and in cleaning the microfiltration system Sodium hypochlorite is also used as a cleaning agent in the microfiltration system Hydrochloric acid and sodium hydroxide are used in bulk quantities during regeneration of the ion exchange resins Sulfuric acid, sodium hydroxide, ferric sulfate, and calcium hydroxide are all used in conjunction with metering pumps and/or automatic feed controllers in the chemical precipitation system. Direct contact with all chemicals shall be prevented with the use of chemical-resistant personal protective equipment as described in Table 8 1 and Section 8 1 Two emergency eyewash/shower stations are located inside the operations area of Building 891 and a station is centrally located in both the precipitation and microfiltration trailers. The subcontractor operations personnel shall ensure that the emergency showers and eyewash stations are in operable condition prior to handling process chemical materials Emergency eyewash and shower facilities shall be inspected in accordance with Rocky Flat Plant ODM-PO-2 and the condition documented at least once per week Contact lenses may be worn when using respiratory protection or when handling or transferring chemicals provided that the appropriate supervisors are notified and special precautions are taken to keep contaminnants out of the eyes. Transfer of chemicals shall be performed only within approved secondary containment areas of the groundwater treatment facility Chemicals should never be mixed outside the parameters given in the Standard Operating Procedures (SOP's) for the CWTF

8 4 GENERAL REQUIREMENTS FOR CHEMICAL STORAGE

Chemicals shall be stored in the approved chemical storage containers to prevent inadvertent mixing of incompatible materials Container labeling shall be maintained in accordance with RFETS requirements and the NFPA hazard warning system.

8.5 CONFINED SPACE ENTRY

Posting of and entry into Confined Spaces will be performed according to the Health & Safety Practices manual (section 1-E36-HSP-6 04) by personnel who have received Confined Space Entry training Hazard evaluation by subcontractor Health and Safety, with Industrial Health and Safety approval, will be performed prior to any confined space entry

8 6 COMPRESSED GAS HANDLING AND STORAGE

The treatment facility environment is monitored with a variety of instruments that require compressed gas calibration Cylinders will be stored handled transported and used in accordance with the requirements contained in 29 CFR 1910 101 Compressed Gases and HSP 11 01 Compressed Gas Cylinders

9 0 AREA MONITORING

Monitoring of the environmental conditions in and around Consolidated Water Treatment Facility (CWTF) must occur because of the potential for contaminants to be present in environmental media, the water being treated filters ion exchange resins, waste sludge, and activated carbon. The following sections describe the monitoring program to be implemented and appropriate exposure limits and actions levels. Where feasible, personnel exposures to hazardous materials (other than radioactive substances) shall be maintained within the TLVs adopted by the ACGIH or the PELs adopted by OSHA, whichever is more stringent. Exposure to radioactive material will be maintained below the RFETS administrative limits. Table 9 1 presents a summary of the monitoring program.

9 1 CHEMICAL MONITORING

Air monitoring shall be conducted in and around the CWTF using a PID device with at least an 11 5 eV lamp during treatment operations and during the following tasks when sampling uncharacterized water; when changing filters when transferring GAC, and when changing or hand cleaning UV bulb sleeves. These devices are used to monitor for the presence of volatile organic compounds. PID devices are used as a screening instrument to detect the presence of organic compounds but cannot quantify or identify specific organic substances The PID will be calibrated with a 100 ppm standard of isobutylene prior to use If any reading above 50% of the most limiting PEL is found personnel will leave the affected area and Health and Safety Personnel will investigate to determine the source and make the necessary changes to reduce the concentration below 50% Use of Level B PPE and monitoring with colorimetric tubes and/or personal air samplers to determine the compound(s) present may be necessary Monitoring will be performed should the subcontractor find it necessary to break the integrity of the influent system as discussed in Section 8.2

Work can be resumed provided that the monitoring results can be reduced to less than 50% of the PEL. If readings are more than 50% of the PEL, it will be necessary to investigate to determine the compound(s) present, the source of the compound, and whether the use of engineering controls can reduce concentrations to less than 50% of the PEL

Table 9 1 Monitoring Program Summary

RADIATION			
Hazard/Sample Type	**Action Level**	**Precaution if Action Level**	**Monitoring Frequency**
Equipment and material contamination	Alpha contamination >20 dpm/100cm^2 removable >100 dpm/100cm^2 total Beta/gamma contamination >1000 dpm/100cm^2 removable >5000 dpm/100cm^2 total	Equipment and material decontamination.	Prior to removal from radiological control area
Personnel contamination.	>Background	Personnel decontamination.	Prior to exiting access control.
Long lived radioactive airborne particulates	10% of the DAC (if respirators not worn)	Full face-piece air purifying respirators (APRs) with HEPA cartridges.	As determined by Site Safety Officer and RMRS Rad. Eng
External shallow beta/gamma radiation exposure rate	>5 mrem per hour	Remove personnel from elevated beta/gamma exposure rate area and investigate source	As specified in Section 9 2 3

CHEMICAL			
Hazard/Sample Type	**Action Level**	**Precaution if Action Level**	**Monitoring Frequency**
Air monitoring for volatile organic compounds	50% of the most limiting PEL for compounds present	Full face air purifying respirators with organic vapor acid fumes cartridges	As specified in Section 9 1

DAC Derived Air Concentration

[b] Monitoring will be performed when work area temperature exceeds 85 F and coveralls or protective clothing is being worn

Table 9 1 (Cont.)

Monitoring Program Summary

MISCELLANEOUS MONITORING

NOISE			
Hazard/Sample Type	**Action Level**	**Precaution if Action Level**	**Monitoring Frequency**
Area.	85 decibels in accordance with 1 I87 HSP 7 06	Suitable hearing protection	At discretion of the subcontractor Site Safety Officer and RMRS I H&S

HEAT STRESS			
Hazard/Sample Type	**Action Level**	**Precaution if Action Level**	**Monitoring Frequency**
Oral and heart rate monitoring [b]	Oral temperature 38°C (99 6 F) heart rate 110 dpm.	Use of ice vests, reduce work cycle duration, or other RMRS approved measures.	Monitoring frequency will be dependent on work area temperature and at the discretion of the subcontractor Site Safety Officer and RMRS I H&S
WBGT monitoring	23 C (73 4 F) for heavy labor	Work - Rest regimen as per Health and Safety direction.	Continuously above 23 C (73,4 F)

DAC Derived Air Concentration

[b] Monitoring will be performed when work area temperature exceeds 85 F and coveralls or protective clothing is being worn.

Air monitoring may also be done utilizing colorimetric tubes for any of the VOCs present Any indication of concentrations exceeding 50% of the PEL for a specific compound will require work to stop

Compliance with limits on airborne metal or carbon contaminants can be reasonably assured if dust concentrations in the worker breathing zone are kept under control

Confined space entries will require real time air monitoring for oxygen concentration, carbon monoxide concentration and explosivity Additional monitoring may be required depending on the specific confined space to be entered Requirements of the RFETS Confined Space Entry Program will be met

9 2 RADIOLOGICAL MONITORING

The radiation exposure of an occupational worker will be maintained as far below the U S Department of Energy (DOE) limits as is reasonably achievable A local annual administrative dose equivalent level of 750 mrem committed effective dose equivalent is in effect If any worker exceeds 20% of the administrative dose equivalent level a comprehensive evaluation will be performed and if necessary, the employee will be reassigned to a job where his or her radiation exposure will be minimized for the remainder of the calendar year

9 2 1 Personnel and Equipment Contamination

Personnel and equipment leaving a radiation or contamination area will be monitored for radiological contamination in accordance with the action levels specified in Table 9 1 Decontamination will be in accordance with 1-PO3-HSP-18 12 Release of all equipment and materials from a radiologically controlled area will be in accordance with Rocky Flats Procedures HSP 18 10 and EMRG 3 02 Instrumentation used for personnel and equipment contamination monitoring will be those recommended by RFETS Radiological Engineering Any alternates will be approved by the site HSO and Radiological Engineering

Chemical contamination will be immediately neutralized and/or diluted and the applicable MSDS will be used to determine subsequent decontamination actions for the specific chemical(s) involved

9.2.2 Radioactive Air Particulate Monitoring

The main contractor is responsible for air sampling for radioactive airborne particulates. These samples will be taken in the breathing zone of workers, within the work zone, and outside the work zone

Workers may be required to wear personal air monitoring devices to sample for radioactive particulates in the worker's breathing zone Air sampling in the work areas will be performed at the discretion of the main contractor Area sampling may also be performed in locations within and outside the work zone

9.2.3 External Radiation Monitoring

After successful completion of the medical and training requirements specified in Section 6 0 of this plan, all employees who will work within the controlled area will be issued radiation monitoring badges by RFETS Dosimetry These badges are required only when performing tasks such as IX-1 resin replacement or sludge packaging and are not necessary for access to CWTF buildings.

9.2 4 Internal Radiation Monitoring

The subcontractor employees who are issued radiation monitoring badges are subject to periodic urine and/or fecal samples at the discretion of RFETS dosimetry Additional urine and/or fecal bioassay samples may be required at the discretion of the main contractor if a substantial exposure is suspected. These samples will be analyzed for radionuclides to determine whether the employee has received an internal radiation dose while performing work at the CWTF Sample containers will be provided by the dosimetry department.

9.3 MISCELLANEOUS MONITORING

9.3 1 Noise Monitoring

Sound pressure levels shall be monitored to delineate hearing protection areas. Monitoring frequency will be at the discretion of the subcontractor Health and Safety Officer and Industrial Hygiene Additionally, a personal noise dosimeter may be used in conjunction with a sound level meter in order to assess noise exposures of selected individuals based upon area monitoring Suitable hearing protection with a minimum Noise Reduction Rating (NRR) of 18 dBa shall be worn in areas with an 8-hour TWA noise level greater than 85 decibels Monitoring indicates that areas in the precipitation and microfiltration trailers exceed 85 decibels

during equipment operation and these areas are posted as Hearing Protection Required When Equipment is Operating areas If personnel may be exposed to average noise levels above 85 decibels, personal noise monitoring will be used The subcontractor personnel shall be required to follow the requirements of an effective hearing conservation plan including audiometric testing if working in an area requiring hearing protection

9 3 2 Heat Stress Monitoring

Monitoring will generally consist of periodic measurement of workers body temperature and heart rate during periods when work area temperatures exceed 85°F and protective coveralls are required to be worn Monitoring frequency will be determined by the subcontractor Health and Safety Officer and RFETS Industrial Hygiene and will depend on the work area temperature and the type of work being performed

10 0 SITE CONTROL

Within the controlled access area there are restricted and unrestricted areas. In general, controlled access areas in which radioactive or chemical contamination is present above established guidelines are "restricted areas" Restricted area signs have been posted indicating the nature of contamination present in each of these areas Controlled access areas in which site characterization data have indicated that no significant chemical and radiological hazard is present are "unrestricted areas" Subcontractor personnel shall not be permitted access to restricted areas of the site other than those included in the scope of this project unless specifically authorized access by the main contractor Access to all areas posted as confined spaces shall be in accordance with 1-E36-HSP-6 04, "Confined Space Entry Program"

Access to the Consolidated Water Treatment Facility shall be controlled by the subcontractor operations personnel when present A log-in sheet located in the facility office will be implemented to record the presence of all personnel including visitors The subcontractor operators will be responsible for escorting visitors and providing a short documented briefing concerning hazards associated with visiting the CWTF

11 0 LABORATORY SAFETY

11 1 HISTORY AND GENERAL DESCRIPTION

Water samples will be analyzed during operation of the treatment facility and on an as needed basis for grab samples This will include influent samples from both routine and non-routine sources, process samples from various points in the treatment systems, and effluent samples of water ready to be discharged Lab work associated with this sampling will consist primarily of adding preservatives to sample containers and packaging completed samples for shipping to an analytical laboratory

11 2 HEALTH AND SAFETY RISK ANALYSIS

There are a number of general procedures and safety practices applicable to laboratory work The following section reviews policies and procedures for all personnel involved in laboratory operation

11 2 1 Basic Safe Operating Practices

- Wear proper eye protection at all times in chemical work, handling, and storage areas Contact lenses should normally not be worn Goggles are essential if, for therapeutic reasons, contact lenses must be worn

- Always know the hazards and physiochemical properties of the chemicals used (e g , corrosiveness flammability, reactivity, and toxicity) and follow OSHA Hazard Communication requirements

- Always wear appropriate protective clothing Confine long hair and loose clothing Do not wear high-heeled shoes open-toe shoes, sandals or shoes made of woven material

- Never perform work when alone in the chemical workplace or laboratory

- Do not eat drink smoke or apply cosmetics in these areas

- Do not perform unauthorized work, preparation, or experiments

- Always wash hands with soap and water before leaving the work area This applies even if gloves have been worn

- Never engage in horseplay, pranks, or other acts of mischief in chemical work areas

- Never remove chemicals from the facility without proper authorization.

11 2.2 Precautions for Handling Chemicals

All chemicals are potentially harmful Avoid direct contact with any chemical It is especially important to keep chemicals from hands, face, and clothing, including shoes or other foot coverings. Many substances are readily absorbed into the body through the skin and through inhalation Chemicals can also enter the body through the mouth by contamination of the hands, and chemicals can be transferred to the eyes from the hands Therefore, the following precautions are recommended.

- Do not use or handle any chemical until you read and understand the label and the Material Safety Data Sheet (MSDS) for that chemical. MSDS's applicable to CWTF operations are maintained in an updated binder in the office area nearest the chemical in question.

- Keep your hands and face clean Wash thoroughly with soap and warm water whenever a chemical contacts your skin Always wash your hands before leaving the work area, even if gloves have been worn

- Some solvents, such as dimethyl sulfoxide, serve as vehicles for the rapid transport of dissolved toxic substances through the skin into the body Always wear suitable gloves when handling such materials

- All containers of chemicals must be clearly labeled. Do not use any substance from an unlabeled or doubtfully labeled container

11 2 3 Safe Laboratory Techniques

There are a number of generally accepted laboratory techniques which will make working safer Some of these are delineated below

- When opening bottles hold the bottle with its label toward your palm to protect the label (and also the hand of the next user) in case some reagent drains down the side of the bottle Stoppers which cannot stand upside down on the bench top should be held at the base, and pointing outward, between two fingers of the pouring hand Do not pour toward yourself Use a funnel if the opening being poured into is small If a stopper or lid is stuck use extreme caution in opening the bottle

- Never use mouth suction to fill a pipet Use an aspirator bulb or a loose-fitting hose attached to an aspirator Constantly watch the tip of the pipet and do not allow it to draw air

- When carrying large bottles of corrosive, toxic or flammable liquids, use impact-resistant transport containers

11 2 4 Adequate Ventilation

A large number of common substances present acute respiratory hazards and should not be used in large amounts in a confined area They should be dispensed and handled only where there is adequate ventilation, such as in a fume hood Adequate ventilation is defined as ventilation that is sufficient to keep the concentration of a chemical below half the threshold limit value or permissible exposure limit for those chemicals for which these values have been established

If a chemical can be smelled, it is being inhaled Also remember that the vapors of many chemicals can be at hazardous concentrations without any noticeable odor In many cases, a chemical's odor threshold, or lowest concentration at which a given chemical produces a noticeable odor, is listed on the MSDS and can be a valuable piece of safety information

11.2 5 General Equipment Setup

The following recommendations apply to equipment setup in the laboratory

- Keep work space uncluttered
- Set up clean, dry apparatus
- Use only equipment that is free from flaws such as cracks, chips, and obvious defects Even the smallest chip or crack renders glassware unusable, chipped or cracked glassware should be repaired or discarded
- A properly placed pan under a container will confine spilled liquids in the event of glass breakage
- Fume hoods are recommended for all hazardous operations. The current U S Environmental Protection Agency fume hood standard is 100 linear feet per minute face velocity with fully open sash regardless of the toxicity of the material in use Hoods should be operating properly and obstacles that block proper air movement should not be placed inside the fume hood.
- Whenever hazardous gases or fumes are likely to be evolved, the operation must be confined to a fume hood
- No apparatus, chemical bottles, or equipment should be placed on the floor

11.2 6 Housekeeping

In the laboratory and elsewhere, keeping things clean and neat generally leads to a safer environment. Avoid unnecessary hazards by keeping drawers and cabinets closed while working. Never store materials, especially chemicals, on the floor - even temporarily Work spaces and storage areas should be kept clear of broken glassware, leftover chemicals, and even scraps of paper Keep aisles free of obstructions such as chairs, boxes, and waste receptacles Avoid slipping hazards by keeping the floor clear Use the required procedure for the proper disposal of chemical wastes and solvents

11 2 7 Glassware

Glassware is commonly used in the laboratory for the preparation of standards and samples The following items review general safe handling practices for laboratory glassware

Glass Tubing and Stoppers

When available ground glassware is preferable Glass joints should be clean and dry The use of Teflon stoppers is recommended

Use of Glassware

Borosilicate glassware is recommended for laboratory use Bottles, jars and other containers should be transported in carriers to protect them from breakage as well as to limit spills in case of leaks

Cleaning Glassware

Wear impervious gloves that have been checked to ensure that no holes are present Avoid accumulating too many articles in the cleanup area

Avoid the use of strong chemical cleaning agents such as nitric acid, chromic acid, sulfuric acid, strong oxidizers or any chemical with a per in its name (such as perchloric acid, ammonium persulfate, etc) unless specifically instructed to do so and then only when wearing proper protective equipment. A number of explosions involving strong oxidizing cleaning solutions such as chromic-sulfuric acid mixtures, have been reported The use of flammable solvents should be minimal and appropriate precautions must be observed Consult with Health and Safety personnel to determined approved safety measures for a given substance

Eye Protection

Safety eyewear must be worn for all laboratory work

11 3 LABORATORY SPILLS

The analytical samples associated with the CWTF contain numerous hazardous substances and can result in a potentially significant hazard to personnel The following sections review general spill procedures which shall be followed

Tables 5 1, 5 2 and 7 1 present a summary of the chemical hazards, spill response procedures, routes of exposure, and first aid for chemicals encountered on site

11.3 1 General Procedures for Spills

The following steps are generally applicable to spills

- Immediately alert fellow workers and supervisor in accordance with section 7 0 of this manual All spills must be reported If a spill response is required, consult with Industrial Hygiene to determine PPE requirements

- For all spills, all contaminated clothing must be removed immediately and the skin washed with soap and water Flush skin with water for no less than fifteen minutes. Clothes must be laundered before reuse (do not wash with other clothing)

- If there is no fire hazard and the material is not particularly volatile or toxic, proceed to clean it up as directed in the MSDS, including the use of proper protective clothing To facilitate cleaning up liquids use an absorbent material Various commercial absorbents packaged individually (spill kits) or in bulk are available Vermiculite and clay absorbents such as kitty litter can be more economical substitutes but will not control hazardous vapors. Dry sand is even less effective. A dustpan and brush should be used, and protective gloves should be worn. While wearing gloves, clean the contaminated area with soap and water and mop it dry If the spill is on the floor, some absorbent should be sprinkled on the spot to prevent slipping Dispose of the residue properly CAUTION Vermiculite and some other adsorbents create a slipping hazard when wet.

- If a volatile, flammable, or toxic material is spilled, immediately warn everyone to extinguish flames and turn off spark producing equipment such as brush-type motors. Shut down all equipment and evacuate the area until it is decontaminated Section 7 of this Health and Safety plan contains definitions and required actions depending on the severity of the spill and the chemical involved The supervisor or management will be responsible for designating the extent of evacuation and the proper cleanup procedure

- Avoid skin contact and to prevent inhalation wear appropriate breathing apparatus Clothing contaminated by spills or splashes should be removed immediately to prevent skin penetration

- Many small liquid spills (<100 ml) can be absorbed with paper towels, sand, or an absorbent. However paper towels can increase the surface area and evaporation, increasing the fire hazard Do not leave paper towels or other materials used to clean up a spill in open trash cans in the work area Dispose of them properly

11 3.2 Chemicals on the Skin

For spills covering a small amount of skin, immediately flush with water for no less than fifteen minutes If there is no visible burn wash with warm water and soap, removing any jewelry to facilitate removal of any residual materials Check the MSDS to see if any delayed effects should be expected If a delayed reaction is noted seek medical attention immediately and explain carefully what chemicals were involved

For larger spills quickly remove all contaminated clothing while using the safety shower, and have a co-worker call X2911 to initiate an emergency medical team response Do not attempt to wash chemicals from clothing while wearing it instead, remove the clothing immediately Seconds count, and no time should be wasted because of modesty Be careful not to spread the chemical on the skin, or especially into the eyes Unless the eyes are affected, do not remove safety goggles until all chemicals are washed from the hair and face Use caution when removing pullover shirts or sweaters, to prevent contamination of the eyes It may be better to cut the garments off Immediately flood the affected body area with temperate water for at least 15 minutes and resume flushing the affected areas if pain returns Do not use creams, lotions, or salves, and get medical attention as soon as possible

11 3 3 Chemical in the Eye

For chemical splashes, at least a 15-minute flush is recommended Extension 2911 must be called at once Immediately flush the eye with a copious amount of water under gentle pressure, checking for and removing contact lenses at once However contact lenses may be difficult to remove, and the essential irrigation must not be delayed for contact removal Forcibly hold the eye open to wash thoroughly behind the eyelids Eyeballs should be rotated so that all surfaces are rinsed In the absence of some type of eyewash device,

the injured person should be placed on his or her back and water gently poured into the eye The injured eye must be held open After flushing, the victim must be given prompt medical attention, regardless of the severity (or apparent lack of severity) of the injury Keep the eyes covered with the clean, wet, soft, cold pads while transporting the injured to medical attention

11 4 CHEMICAL STORAGE AND DISPOSAL

Laboratory storage of solvents should be kept to a minimum They should be placed on a low shelf, preferably in a tray adequate to contain spills or leakage Incompatible materials should not be stored together or in close proximity

Careless disposal of chemicals can cause problems The wrong two chemicals spilled together on a bench or put into the same disposal container can catch fire spontaneously or explode Broken glass in a waste paper basket can injure the person who empties that basket.

In addition, strict federal, state and local environmental rules cover most laboratory wastes. These regulations must be strictly followed The Health and Safety Officer or a hazardous waste expert should be consulted for compliance information Waste Operations personnel can provide guidance on managing any waste stream on RFETS

Safety can be promoted by following a few common-sense practices when disposing of chemical wastes.

- To minimize disposal problems, always specify the smallest amount needed when ordering chemicals.
- Obtain directions for disposal from the supervisor Strict Federal and State rules apply to the disposal of hazardous waste
- Dispose of surplus chemicals promptly
- Do not store waste containers open, have the cap and cover in place

- When disposing of chemicals one basic principle applies Keep each different class of waste chemical in a separate disposal container

Put ordinary paper waste in a wastepaper basket separate from chemical wastes If a piece of paper is contaminated such as paper towels used to clean up a spill put the contaminated paper in a special container marked for this use It must be treated as a chemical waste

Broken glass belongs in its own marked waste container for sharps" Place broken plastic apparatus in a marked waste container that is different than the broken glass container

For leftover and unused chemicals put liquid in its own specially marked container Close these containers after each such use Liquid chemicals may be put down the drain only if they are clearly nonhazardous.

11 5 SAFETY EQUIPMENT AND PROTECTIVE CLOTHING

11 5 1 Safety Equipment

There is a certain minimum amount of safety equipment which shall be available for all personnel engaged in laboratory work

Eye Washes/Emergency Showers

Two emergency evewash fountains/emergency showers are located inside the 891 building Each is set to deliver a gentle flow of tempered potable, aerated water and is tested weekly Every operator should know the location of both stations A third station is located in the T891C laboratory where sampling chemicals are stored It must be understood by all that eye protection is more important than eye washes

Fume Hoods

Fume hoods serve to control toxic, offensive, or flammable vapors The effective operation of a hood depends on many factors including face airflow velocity, the general ventilation pattern of the areas, and the methods of working at the hood Before each use be sure that the hood exhaust system is working properly Adequate airflow (100 feet/minute face velocity) and the absence of excessive turbulence is necessary for safe

operation Equipment should be placed as far back in the hood as practical and activities carried out at least 15 cm (6 in) from the front edge of the hood The head should be kept outside of the hood face

Hoods should never be used for storage of chemicals Chemicals should be stored in appropriate locations Remember that in the event of an accident or fire every item in the hood may be involved, including those stored in the hood

11 5.2 Protective Clothing

Level D protective equipment as defined in section 8 of this Health and Safety plan is the standard field work uniform for all personnel directly involved in CWTF operations

Gloves

Gloves can serve as an important part of personal protection when they are used correctly and are required when handling chemicals Do not use gloves with cracks or small holes to protect against chemical exposure Used gloves will be removed before leaving the work area and before handling such things as telephones, doorknobs writing instruments, and laboratory notebooks in order to prevent the unintentional spread of chemicals or other laboratory hazards.

In general Nitrile gloves are required for handling laboratory chemicals. However, a wide variety of gloves are available to protect against chemical exposure Examine the manufacturer's claims and test data carefully before wearing any other type of gloves

Be aware that if a chemical diffuses through a glove, that chemical is held against the worker's hand and the person is then possibly more exposed to the chemical than if he or she were not wearing gloves Be certain the manufacturer s or supplier's information on compatibility with the specific chemicals you are using conforms to the ASTM Standard Test Methods for Chemical Permeability (ASTM F-739) Contact the Health and Safety Manager for guidance on glove selection.