U.S. ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

FOR METAL FINISHING POLLUTION PREVENTION TECHNOLOGIES

VERIFICATION TEST PLAN

For the

Evaluation of Davis Technologies International Corp. Industrial Wastewater Treatment Plant for the Metal Finishing Industry

Revision 0

March 1, 2001

Concurrent Technologies Corporation is the Verification Partner for the EPA ETV Metal Finishing Pollution Prevention Technologies Center under EPA Cooperative Agreement No. CR826492-01-0.

U.S. Environmental Protection Agency
Environmental Technology Verification Program
For Metal Finishing Pollution Prevention Technologies
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Environmental Technology Verification Program for Metal Finishing Pollution Prevention Technologies Verification Test Plan for the Evaluation of Davis Technologies International Corp. Industrial Wastewater Treatment Plant for the Metal Finishing Industry

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ACRONYMS & ABBREVIATIONS

ASTM	American Society for Testing and Materials
avg.	Average
Ba	Barium
BPT	Best Practical Treatment
C	Centigrade
CAS#	Chemical Abstract Number
Cd	Cadmium
CFR	Code of Federal Regulations
Cr	Chromium
CTC	Concurrent Technologies Corporation
Cu	Copper
DAF	Dissolved Air Flotation
DOT	Department of Transportation
DTIC	Davis Technologies International Corp.
EPA	US Environmental Protection Agency
ETV-MF	Environmental Technology Verification for Metal Finishing
FPS	Final Polishing System
ft^2	Square feet
ft^3	Cubic feet
g/L	Gram(s) per liter
gpd	Gallon(s) per day
gph	Gallon(s) per hour
gpm	Gallon(s) per minute
h	Height
HCL	Hydrochloric acid
HDPE	High Density Polyethylene
HEM	n-Hexane Extractable Materials
Hz	Hertz
ICP - AES	Inductively Coupled Plasma - Atomic Emission Spectroscopy
ID	Identification
IDL	Instrument Detection Limit
IWTP-MF	Industrial Wastewater Treatment Plant for Metal Finishing
JTA	Job Training Analysis
kWh	Kilowatt hour
lb.	Pound
L	Liter
L/day	Liter(s) per day
Lpm	Liter(s) per minutes
Max.	Maximum
MDL	Method Detection Limit
mg/L	Milligram(s) per liter
mg/kg	Milligram(s) per kilogram
ml	Milliliter
mm	Millimeter

ACRONYMS & ABBREVIATIONS (continued)

MP&M	Metal Products and Machinery
MRL	Method Reporting Limit
MS	Matrix spike
MSD	Matrix spike duplicate
MSDS	Material Safety Data Sheet
ND	No data
Ni	Nickel
NR	Not regulated
O&G	Oil and Grease
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PARCCS	Precision, accuracy, representativeness, comparability, completeness, and sensitivity
Pb	Lead
pH	Value used to express acidity or alkalinity
POTW	Publicly Owned Treatment Works
PPE	Personal Protective Equipment
ppm	Parts per million
PQL	Practical quantification limit
PSES	Pretreatment Standards for Existing Sources
psi	Pounds per square inch
PVC	Polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
QMP	Quality Management Plan
R	Radius
Ref.	Reference
RPD	Relative Percent Difference
rpm	Revolutions per minute
S	Sulfur
SOP	Standard Operating Procedures
T	Total
TCLP	Toxicity Characteristic Leachate Procedure
TDS	Total dissolved solids
TOC	Total organic carbon/compound
TOP	Total organic parameter
TPH	Total petroleum hydrocarbons
TS	Total solids
TSS	Total suspended solids
U.S.	United States
VAC	Voltage alternating current
µ	Micron

1.0 INTRODUCTION

The purpose of this test plan is to document the objectives, procedures, equipment, and other aspects of testing that will be utilized during verification testing of the Davis Technologies International Corp. (DTIC) Industrial Wastewater Treatment Plant for the Metal Finishing Industry (IWTP-MF). This test plan has been prepared in conjunction with the U.S. Environmental Protection Agency's (EPA's) Environmental Technology Verification Program for Metal Finishing Pollution Prevention Technologies (ETV-MF). The objective of this program is to identify promising and innovative pollution prevention technologies through EPA-supported performance verifications. The results of the verification test will be documented in a verification report that will provide objective performance data to metal finishers, environmental permitting agencies, and industry consultants. A verification statement, which is an executive summary of the verification report, will be prepared and signed by the EPA National Risk Management Research Laboratory Director.

The IWTP-MF system is designed to process wastewaters containing oils and/or dissolved metals. The focus of testing will be to determine the quality of the effluent produced by the IWTP-MF system at a pre-set flow rate, the quantity and characteristics of wastewater sludge produced during treatment, the characteristics of recovered oil, and the approximate cost of operation. In terms of effluent water quality, of particular interest is the ability of the IWTP-MF to meet existing effluent standards for the Metal Finishing category [Ref. 1] and proposed more stringent effluent standards for the Metal Products and Machinery (MP&M) industrial point source category [Ref. 2]. The Metal Finishing regulations were promulgated in July 1983 and have served as the wastewater discharge limits for most companies engaged in metal finishing operations since 1984. The proposed MP&M limitations were published on January 3, 2001, and will be promulgated in final form in December 2002. The MP&M limitations will replace the Metal Finishing limitations for most metal finishing companies. Although the proposed MP&M limitations are subject to change, the final limitations are expected to be similar.

Testing of the IWTP-MF system will be conducted at Federal-Mogul Corporation's facility in Blacksburg, VA. Federal-Mogul is a major global manufacturer of original and aftermarket automobile parts (www.federal-mogul.com); engine bearings are manufactured at the Blacksburg facility. The industrial operations that generate wastewater at this location include machining, metal forming, cutting, cleaning, electroplating, and conversion coating.

Testing will consist of three test runs, with a different raw wastestream processed during each test run. The three wastestreams represent wastewaters from three common metal finishing and/or MP&M manufacturing configurations:

1) Oily wastewater from metal machining/forming/cleaning.
2) Metal bearing wastewater from metal finishing.
3) A 10%/90% mixture of (1) and (2).

This test plan has been structured based on a format developed for ETV-MF projects. This document describes the intended approach and explains testing plans with respect to areas such as test methodology, procedures, parameters, and instrumentation. Also included are quality assurance/quality control requirements of this task that will ensure the accuracy of data, the use of proper data interpretation procedures, and an emphasis on worker health and safety considerations.

2.0 TECHNOLOGY DESCRIPTION

2.1 Theory of Operation

The IWTP-MF system combines well known physical-chemical treatment processes (pH adjustment, flocculation, and dissolved air flotation) that the manufacturer indicates have been enhanced through design and engineering of the processing hardware and control software and through use of a proprietary polymer that works over a wide range of conditions. The treatment system is constructed of standard off-the-shelf components (PVC Schedule 80 piping, pumps, sensors, etc.) and custom stainless steel dissolved air flotation (DAF) tanks. It is also equipped with remote monitoring capability.

Effluent from the IWTP-MF system is reported to be very low in organics (i.e., oil), and metals, and users may be able to directly reuse the treated effluent or recycle it after further polishing (e.g., ion exchange or membrane technology).

According to the manufacturer, the IWTP-MF system is particularly applicable to wastestreams containing both oils and dissolved metals, a situation common to metal finishing and MP&M facilities. The IWTP-MF system can reportedly process wastewaters containing oil in free, dissolved, dispersed, and emulsified forms. Most wastewater treatment systems employed by metal finishing facilities are not specifically designed to process wastewaters containing significant concentrations of oil, although oil is usually present in these wastewaters as a result of metal cleaning operations, where cutting oils and coolants are removed from the parts prior to metal finishing. Also, ancillary activities, such as machining, are often present at these facilities and may contribute oily wastes. Significant concentrations of oil can prevent complete and cost-effective treatment of the heavy metal wastewater and can reduce the ultimate reusability of the wastewater.

2.2 Description of IWTP-MF System

The IWTP-MF system that will be tested is a mobile unit with a flow capacity of 75 to 115 liters/min (approximately 20 to 30 gallons per minute (gpm)). Photographs of the exterior and interior of the mobile system are shown in **Figures 1** and **2**. A diagram showing the layout of tanks is presented in **Figure 3**.

The IWTP-MF system consists of two separate processes, oil recovery and metals precipitation, and each process consists of three stages. In the first stage of oil recovery, the hydrocarbon (oil) is cracked via a pH adjustment with hydrochloric acid (HCL). The second stage is flocculation, where a proprietary polymer is added that captures the hydrocarbons in a floc (small mass). In the third stage, dissolved air is injected into the wastewater, forcing the flocculated material to the surface, where it is skimmed off and pumped to a collection tank.

The metals treatment process is also conducted in three stages. In the first stage, the pH of the wastewater is adjusted using sodium hydroxide. This causes metals to precipitate in a hydroxide form. In the second stage, ferric chloride, acting as a coagulant and a proprietary polymer are added, which causes precipitated metals to agglomerate in a dense floc. In the third stage, dissolved air is injected into the wastewater, forcing the flocculated material to the surface, where it is skimmed off and pumped to a collection tank.

Figure 1. Exterior of Mobile DTIC IWTP-MF System

Figure 2. Interior of DTIC IWTP-MF System

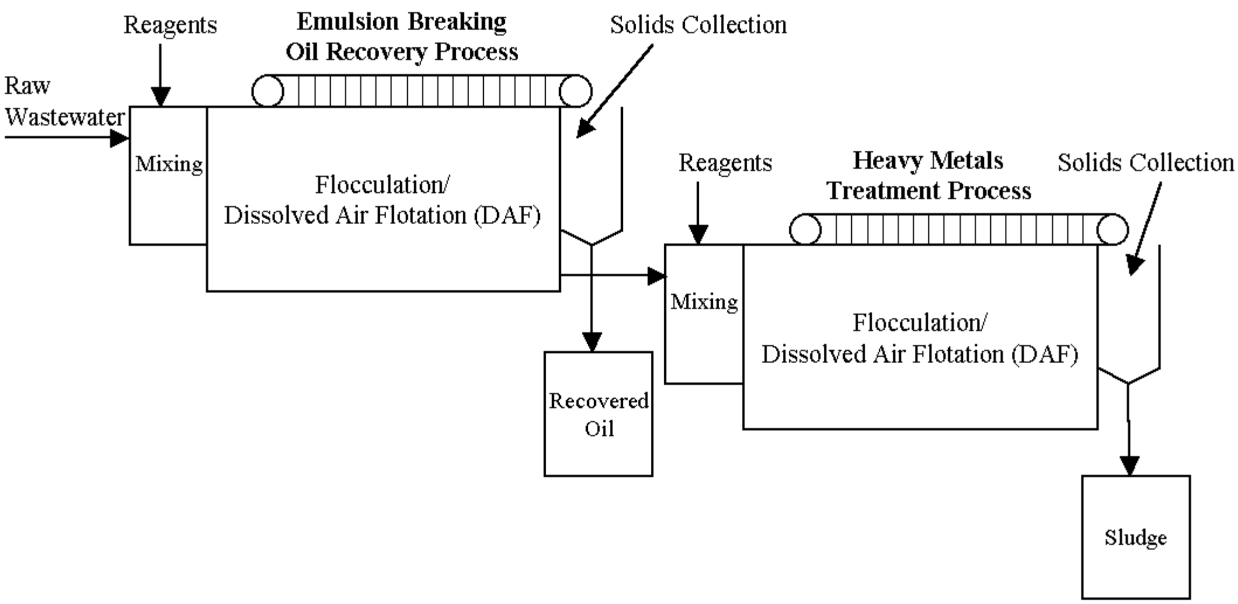

Figure 3. Diagram of DTIC IWTP-MF System

2.3 Commercial Status

The DTIC IWTP-MF is a commercial product. A DTIC mobile unit can be leased and used on a temporary basis, or a permanent system can be purchased and installed. The mobile system has been used to treat wastewaters generated from metalworking, metal finishing, machinery repair/cleaning, and textile processes. **Figure 4** shows the IWTP-MF system operating at an industrial site.

Figure 4. DTIC IWTP-MF in Use at an Industrial Site

2.4 Environmental Significance

Wastewaters containing oil are often inadequately treated by conventional hydroxide precipitation systems because oil can cause precipitated particles to remain suspended or float in clarifiers, resulting in carryover of solids to the discharge. As a result, both the oil and grease (O&G) and metals concentrations of the effluent may exceed effluent limitations.

The DTIC IWTP-MF system is designed to process oily wastewater, metal-bearing wastewater, or a combination of these two common Metal Finishing or MP&M industrial point source category wastestreams. In each case, the effluent often is reported to be below 10 mg/L O&G and near detection limits for regulated metals. When processing oily wastewater, the oil is recovered prior to metals treatment and can be used as a source of energy. In addition to recovering a valuable resource, oil recovery improves subsequent treatment operations (e.g., filtration) and reduces the quantity of sludge generated by the metals precipitation process. Also, by producing an effluent that is very low in O&G content, the effluent is more amenable to recycling. This is due to the fact that oil can blind technologies such as ion exchange resins and membranes that are used for final polishing prior to water reuse.

2.5 Local Installation

The DTIC IWTP-MF system will be installed at Federal-Mogul in Blacksburg, VA. This facility manufactures engine bearings used in automobiles. The Federal-Mogul facility has been in production since 1971. The present facility consists of 208,000 ft^2 of manufacturing and office space.

At Federal-Mogul, process wastewater is generated from various manufacturing operations. These operations can be divided into two main types: (1) metal forming/machining/cleaning and (2) metal finishing. Wastewaters from metal forming/machining/cleaning average approximately 38,000 l/day (10,000 gpd), and they contain oil (free and emulsified), which is a concern during treatment. The quantity of metal finishing wastewater averages approximately 680,000 l/day (180,000 gpd). It contains certain regulated metals (chromium, copper, lead, and zinc) and a low concentration of oil.

The wastewater treatment system in use at Federal-Mogul was installed in 1982, and some changes and additions have been made since then. The present system consists of pretreatment (destruction of cyanide, chromium reduction, ultrafiltration for oil removal), hydroxide precipitation of metals, clarification, and sand filtration. Wastewaters containing high concentrations of lead are segregated from other streams and are separately processed using an evaporator system. However, lead also is present in the wastestreams processed though the wastewater treatment system. Sludge generated by the main treatment system is dewatered on a filter press. Treated effluent is discharged to the city sewer system.

The current discharge limits for Federal-Mogul and recent analyses of discharges are shown in **Table 1**. Also shown in **Table 1** are the proposed pretreatment limits for existing sources for the MP&M General Metals subcategory.

The proposed MP&M limitations for the General Metals subcategory are based on:

- In-process flow control and pollution prevention
- Segregation of wastewater streams
- Preliminary treatment steps as necessary (including oils removal using oil-water separation by chemical emulsion breaking)
- Chemical precipitation using lime or sodium hydroxide
- Sedimentation using a clarifier

The pretreatment standards for existing sources for the MP&M Oily Waste subcategory are presented in **Table 2**. The proposed MP&M limitations for the Oily Waste subcategory are based on:

- In-process flow control
- Pollution prevention
- Oil-water separation by ultrafiltration

The proposed MP&M General Metals subcategory (40 CFR 438.15) limitations are significantly lower than the existing limitations. These new standards will be published in final form in December 2002, and companies will need to comply with the limitations starting in December 2005. It is apparent that the existing Federal-Mogul wastewater treatment system is consistently meeting current limitations, but not meeting all of the proposed MP&M limitations. With respect to the proposed MP&M limits, the parameters of greatest concern are chromium, copper, lead, and zinc. Recent analyses of Federal-Mogul raw wastewater (i.e., before treatment) for these four parameters are summarized in **Table 3**.

Table 1. Summary of Current Limitations and Proposed Regulations Applicable to Federal-Mogul and Recent Discharge Data

Parameter	Current Federal-Mogul Limitations IWTP Permit		Federal-Mogul Historical Effluent Data		Proposed MP&M Pretreatment Standards for Existing Sources (PSES) General Metals Subcategory	
	Daily Max., mg/L	Monthly Avg., mg/L	Daily Max., mg/L	Monthly Avg., mg/L	Daily Max., mg/L	Monthly Avg., mg/L
Cyanide T	0.5	NR	0.018	0.01	0.21	0.13
Cyanide A	NR	NR	ND	ND	0.14	0.07
Cadmium	0.02	NR	0.004	<0.004	0.14	0.09
Chromium T	1.0	NR	NR	NR	NR	NR
Copper	1.0	NR	0.699	0.643	0.55	0.28
Lead	0.5	NR	0.466	0.169	0.04	0.03
Mercury	0.005	NR	0.0002	<0.0002	NR	NR
Manganese	NR	NR	ND	ND	0.13	0.09
Molybdenum	NR	NR	ND	ND	0.79	0.49
Nickel	1.0	NR	0.07	0.02	0.50	0.31
Silver	NR	NR	0	0	0.22	0.09
Tin	NR	NR	ND	ND	1.4	0.67
Zinc	2.61	1.48	1.05	0.584	0.38	0.22
Selenium	0.02	NR	0	0	NR	NR
Total Residual Cl	0	NR	0	0	NR	NR
O&G (local limit)	100	NR	57	82.14	NR	NR
O&G (as HEM)	NR	NR	ND	ND	15	12
TSS	NR	NR	18.5	13.9	NR	NR
TOC	NR	NR	ND	ND	87	50
TOP	NR	NR	ND	ND	9.0	4.3
Sulfide (as S)	NR	NR	ND	ND	31	13

Notes:
NR = not regulated.
ND = no data.
Federal-Mogul discharge data are from seven recent months.
Current Federal-Mogul limitations are based on a combination of local standards and Federal standards (40 CFR 433). The values shown are the most stringent limitations.
O&G (as hexane extractable material (HEM)) is not regulated under pretreatment standards for the General Metals subcategory. However, it is regulated under the Best Practical Treatment (BPT) limitations for direct dischargers in the General Metals subcategory (40 CFR 438.12). The values shown are the BPT proposed limitations.

Table 2. Pretreatment Standards for Existing Sources for the MP&M Oily Wastes Subcategory (40 CFR 438.65)

Parameter	Maximum Daily, mg/L	Maximum Monthly mg/L
TOC (as indicator)	633	378
TOP	9.0	4.3
Sulfide (as S)	31	13
O&G (as HEM)	27	20

Notes:
Upon agreement with the permitting authority, facilities must choose to monitor for total organic parameters (TOP) or total organic carbon (TOC), or implement a management plan for organic chemicals as specified in 40 CFR 438.4(a).
O&G (as HEM) is not regulated under pretreatment standards for the Oily Wastes subcategory. However, it is regulated under the best practical treatment (BPT) limitations for direct dischargers in the Oily Wastes subcategory (40 CFR 438.62). The values shown are the BPT proposed limitations.

Table 3. Raw Wastewater Influent Data from Federal-Mogul

Parameter	Average Concentration, mg/L	Maximum Concentration, mg/L
Chromium	0.5	13.8
Copper	23.3	60.2
Lead	7.3	36.6
Zinc	5.2	6.5

Notes:
Based on analyses of 90 samples collected between 5/24/00 and 11/16/00.

3.0 EXPERIMENTAL DESIGN

3.1 Test Goals and Objectives

The overall goals of this ETV-MF project are to (1) evaluate the ability of the DTIC IWTP-MF system to remove pollutants from metal finishing and MP&M point source category wastewaters, with the metal finishing and proposed MP&M effluent guidelines used as target effluent concentrations, and (2) to evaluate the operating characteristics of the system with respect to approximate operating costs, effluent characteristics, oil recovery, and sludge characteristics.

The following is a summary of primary project objectives. For the installation at Federal-Mogul:

- Conduct verification testing in order to:

1) Determine the ability of the IWTP-MF system to remove specific pollutants from wastestreams and meet the applicable metal finishing and proposed MP&M daily maximum limitations.
2) Determine the ability of the IWTP-MF system to recover oil from wastewater.
3) Determine the quantity and chemical characteristics of the sludge generated by the treatment process.

- Determine the cost of operating the IWTP-MF system for the specific conditions encountered during testing.

1) Identify operating and maintenance (O&M) tasks.[1]
2) Determine the quantity and cost of chemical reagents used.
3) Determine the quantity and cost of energy consumed by operating the system.
4) Determine the cost of sludge disposal.
5) Determine the cost savings associated with the recovered oil.

- Quantify the environmental benefit by determining the reduction in metals discharged to the Blacksburg Publicly Owned Treatment Works (POTW) and the percentage of oil recovered.

3.2 Critical and Non-Critical Measurements

Measurements that will be taken during testing are classified below as either critical or non-critical. Critical measurements are those that are necessary to achieve the primary project objectives. Non-critical measurements are those related to process control or general background readings.

<u>Critical Measurements:</u>

- source and input volumes of raw wastewater (liters/test run)
- input quantity of chemical treatment reagents (kg/test run) and other materials used in treatment and costs ($/test run)
- output volume of recovered oil (liters/test run)
- output volume of sludge (liters/test run)
- chemical characteristics of raw wastewater [mg/L of TSS, O&G, O&G (as HEM)[2], TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, sulfide (as S), zinc, and TDS]*
- chemical characteristics of treated effluent [mg/L of TSS, O&G, O&G (as HEM), TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, sulfide (as S), zinc, and TDS]*
- chemical characteristics of recovered oil (% water)
- chemical characteristics of sludge (% solids, mg/L of cadmium, chromium, copper, lead,

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[1] O&M tasks will be observed and documented; however, the associated costs will not be verified during this project since operation of the mobile IWTP-MF system by DTIC staff will not be representative of a permanently installed system operated by plant personnel.
[2] O&G refers to oil and grease as measured by EPA Method 413.1 (freon extraction). O&G (as HEM) refers to oil and grease as measured by EPA Method 1664 (hexane extraction).

manganese, molybdenum, nickel, tin, and zinc)
- O&M labor tasks
- energy use for IWTP-MF (e.g., pumps) (kWh/test run) and costs ($/test run)

*Parameters vary by test run as described in section 3.4.3.

Non-Critical Measurements:

- pH
- instantaneous flow rate of input wastewater

3.3 Test Matrix

The verification test will be performed in three distinct test periods or "runs." The raw wastestream will be varied for each test run. Test run 1 will have a duration of one day, and test runs 2 and 3 will each have a duration of 4 days. During each 24-hour period, a separate set of influent and effluent samples will be collected and analyzed. Therefore, one paired set of influent and effluent data points will be generated during run 1 and four sets of paired data points will be generated each for test runs 2 and 3. Sampling of the oil and sludge will be limited to once per test run. The varied operating conditions for the three test runs are shown in **Table 4**.

Table 4. Test Matrix

Test Run	Duration	Conditions
Test Run 1	One -24 hr Test	-75 liters/min (20 gpm) flow -100% oily wastewater
Test Run 2	Four -24 hr Tests	-75 liters/min (20 gpm) flow -100% metal-bearing wastewater
Test Run 3	Four -24 hr Tests	-75 liters/min (20 gpm) flow -10% oily/90% metal-bearing wastewater

Raw wastewater (prior to treatment by ultrafiltration) generated by the Federal-Mogul metal forming/machining/cleaning operations will be used as the source of oily wastewater. Wastewater from metal finishing operations will be the source of metal-bearing wastewater. This wastewater will be pretreated for cyanide destruction and chromium reduction, prior to treatment in the IWTP-MF system.[3]

Test objectives and measurements are summarized in **Table 5**.

The analytical test parameters selected for this verification test are the parameters found in the metal finishing and proposed MP&M regulations for the applicable subcategories.

[3] The system that will be tested at Federal-Mogul is not designed for cyanide oxidation or chromium reduction. Therefore, the metal-bearing wastewater will be processed through these two pretreatment steps using the existing Federal-Mogul system. The pretreated metal-bearing wastewater will then serve as the influent for the IWTP-MF system.

3.4 Testing and Operating Procedures

3.4.1 Set-Up and System Initialization Procedures

DTIC will be responsible for transporting the IWTP-MF to the test site, connecting the system to the Federal-Mogul wastewater sumps, initializing the system, and operating the system during testing. They will also be responsible for reporting to the ETV-MF Project Manager all operational and maintenance activities performed during the verification test. The system will be set up and operated for a time period of at least 24 hours prior to start of the first test run. The first test run will begin once DTIC indicates that the system is operational and stable. Following each test run and prior to the start of subsequent test runs, the wastewater feed will be changed according to the test matrix described in section 3.3, and the system will be run for a minimum time period of 4 hours before initiating the next test run. This time period will allow the system to stabilize under the new feed characteristics.

A photograph of the area where the IWTP-MF system will be located during testing is shown in **Figure 5**. The DTIC trailer will be parked in a fenced area, between the cooling tower shown on the right and the building shown on the left (see **Figure 5**). This building houses the existing Federal-Mogul treatment system. The existing raw and treated wastewater sumps (in ground) are located directly next to the building. This location will provide easy access to the source of raw wastewater and the receiving tank for the treated effluent.

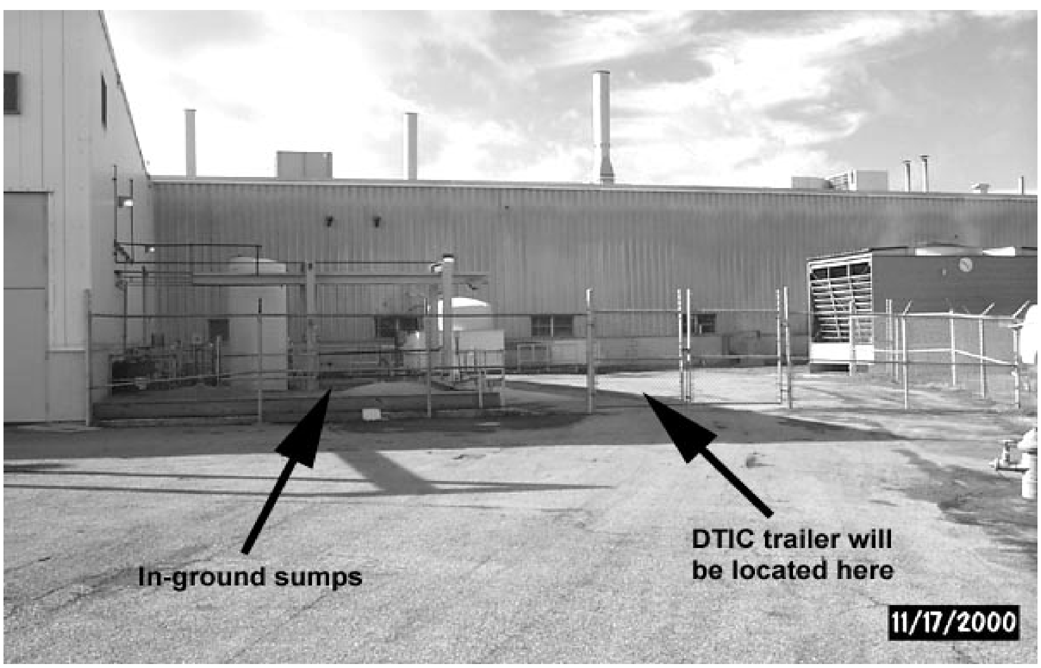

Figure 5. Planned Location for IWTP-MF During Verification

Table 5. Test Objectives and Related Test Measurements for Evaluation of the IWTP-MF System

Test	Test Objective	Test Measurement
Runs 1, 2 and 3	Determine the ability of the IWTP-MF system to remove specific pollutants from wastestreams and meet the applicable metal finishing and proposed MP&M limitations.	-Source and input volumes of raw wastewater. -Chemical characteristics of the influent and effluent.
Runs 1, 2 and 3	Determine the ability of the IWTP-MF system to recover oil from wastewater.	-Source and input volumes of raw wastewater. -O&G content of the influent and effluent. -Quantity of recovered oil. -Chemical characteristics of recovered oil.
Runs 1, 2 and 3	Determine the quantity and chemical characteristics of the sludge generated by the treatment process.	-Source and input volumes of raw wastewater. -Quantity and chemical characteristics of the sludge.
Runs 1, 2 and 3	Determine the cost of operating the IWTP-MF system for the specific conditions encountered during testing.	-Source and input volumes of raw wastewater. -O&M labor tasks performed. -Energy use for IWTP-MF. -Input quantity and costs of chemical treatment reagents (pounds/test run) and other materials used in treatment. -Cost of sludge disposal. -Cost savings associated with the recovered oil.
Run 3	Quantify the environmental benefit by determining the reduction in metals discharged to the Blacksburg POTW.	-Source and input volumes of raw wastewater. -Chemical characteristics of the effluent. -Historical effluent data.

3.4.2 System Operation

DTIC will be responsible for operating the IWTP-MF system according to the procedures found in **Appendix A**. As discussed in section 3.4.1, the first test run will begin once DTIC indicates that the system is operational and stable. Following each test run, and prior to the start of subsequent test runs, the wastewater feed will be changed according to the test matrix described in section 3.3, and the system will be run for a minimum time period of 4 hours before initiating the next test run. This time period will allow the system to stabilize under the new feed characteristics. The unit will be operated for one day during test run 1 and four days each during each test runs 2 and 3.

The source of raw wastewater is an equalization sump that is part of the Federal-Mogul wastewater treatment system. Federal-Mogul will be responsible for diverting the correct wastestream (i.e., untreated oily, metal-bearing, or mixture) to the equalization sump. The effluent from the IWTP-MF system will be pumped to Federal-Mogul's mixing tank located at the head of their treatment system. Oil recovered by the IWTP-MF system and sludge generated by the system will be collected in separate drums that will be located next to the DTIC trailer. These products will be disposed through means used by the Federal-Mogul operation.

3.4.3 Sample Collection and Handling

Automatic composite samplers (ISCO 6700 Series or equivalent) will be used to collect the influent and effluent samples. These samples will be collected in glass containers. The composite samples will be collected on a time-proportioned basis. The automatic samplers will be set to collect 80 ml ± 10 ml every 15 minutes. Grab samples of the influent and effluent will be collected for O&G, O&G (as HEM), pH, and sulfide (as S) analyses. These grab samples will be collected 4 ± 2 hours after the start of the sampling and 4 ± 2 hours before the end of the 24-hour test period. The automatic sampler will be used to accomplish the collection of grab samples. It will be used between sampling events to avoid interfering with the collection of the composite samples. The composite sample collection container will be set aside. The automatic sampler will be set on "manual pump" and the grab sample bottles will be filled. When grab sampling is completed, the composite sample collection container will be placed back into the automatic sampler and composite sampling resumed. Because there is the potential for oil to adhere to the inside of the sampler tubing and sample collection container, the sampler tubing and collection container will be observed for adherence of oil and documented in the field notebook. An abbreviated sampling run using the automated sampler and fresh water will be performed to ensure the sampler is programmed to collect the correct amount of sample prior to the first test run. An equipment blank sample will be collected prior to the each test run. Deionized water will be pumped through the automated sampler and tubing to clean the tubing and pump. After the pump and tubing has been cleaned deionized water will be pumped through the sampler and the deionized water will be analyzed for O&G, O&G (as HEM), TOC, metals, and sulfide (as S).

Grab samples of the recovered oil will be collected using a clean ladle, after first completely mixing the material. Grab samples of the sludge will be collected using a clean spatula, after first completely mixing the material. Oil and sludge samples will be placed into 1-liter, wide mouth glass jars. Samples will be collected according to the schedule presented in **Table 6**. The analytical parameters for each sample are also presented in **Table 6**. Sampling events will be recorded on the form shown in **Appendix B**.

At the time of sampling, each sample container will be labeled with the date, time, and sample ID number. Samples to be analyzed at an off-site laboratory will be accompanied by a chain of custody form; the ETV-MF Project Manager will generate the chain of custody form. The chain of custody form will provide the following information: project name, project address, sampler's name, sample numbers, date/time samples were collected, matrix, required analyses, and appropriate chain of custody signatures. All samples will be transported in appropriate sample transport containers (e.g., coolers with packing and blue ice) directly to the lab or by common carrier using two-day express service. The transport containers will be secured with tape to ensure sample integrity during the delivery process to the analytical laboratory. The ETV-MF Project Manager or designee will perform sampling, and

Table 6. Sampling Locations, Frequency and Parameters

Test Run	Sample	Sample Location	Frequency/Type	Parameters
Run 1	Raw wastewater	Automatic composite sampler will draw sample from the Federal-Mogul equalization sump.	Daily 24-hour composite samples collected during each test run.	TSS, TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, zinc, TDS
Run 1	Raw wastewater	Sample from the Federal-Mogul equalization sump.	2 per 24 hours. Grab samples.	O&G, O&G (as HEM), sulfide (as S), pH
Run 1	Treated effluent	Automatic composite sampler will draw sample from treated effluent return line.	Daily 24-hour composite samples collected during each test run.	TSS, TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, zinc, TDS
Run 1	Treated effluent	Sample from treated effluent return line.	2 per 24 hours. Grab samples.	O&G, O&G (as HEM), sulfide (as S), pH
Run 1	Recovered oil	Recovered oil drum	1/test run. Representative grab sample collected after completion of test run.	% water
Run 1	Sludge	Sludge drum	1/test run. Representative grab sample collected after completion of test run.	% solids, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, zinc
Runs 2 and 3	Raw wastewater	Automatic composite sampler will draw sample from the Federal-Mogul equalization sump.	Daily 24-hour composite samples collected during each test run.	TSS, TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, zinc, TDS
Runs 2 and 3	Raw wastewater	Sample from the Federal-Mogul equalization sump.	2 per 24 hours. Grab samples.	O&G, O&G (as HEM), sulfide (as S), pH
Runs 2 and 3	Treated effluent	Automatic composite sampler will draw sample from treated effluent return line.	Daily 24-hour composite samples collected during each test run.	TSS, TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, zinc, TDS
Runs 2 and 3	Treated effluent	Sample from treated effluent return line.	2 per 24 hours. Grab samples.	O&G, O&G (as HEM), sulfide (as S), pH
Runs 2 and 3	Recovered oil	Recovered oil drum	1/test run. Representative grab sample collected after completion of test run.	% water
Runs 2 and 3	Sludge	Sludge drum	1/test run. Representative grab sample collected after completion of test run.	% solids, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, zinc

labeling, and ensure that samples are properly secured and shipped per regulations under Department of Transportation (DOT) and OSHA to the laboratory for analysis.

The sample quantities required for analysis of samples, field duplicates, matrix spike and matrix spike duplicates are identified in **Table 7**. Sample container volumes are identified in **Table 8**.

Table 7. Sample Quantities from Each Wastestream by Parameter

Sample Location	Parameter	Equipment Blank	Run 1 Day 1	Run 2 Day 1	Run 2 Day 2	Run 2 Day 3	Run 2 Day 4	Run 3 Day 1	Run 3 Day 2	Run 3 Day 3	Run 3 Day 4
Influent	TOC		4	4	4	4	4	4	8	4	4
	TSS/TDS		1	1	1	1	1	1	2	1	1
	Metals		1	1	1	1	1	1	2	1	1
	O&G		4	4	4	4	4	4	7	4	2
	O&G (as HEM)		4	4	4	4	4	4	7	4	2
	Sulfide		2	2	2	2	2	2	5	2	1
Effluent	TOC	3	8	4	8	4	4	4	8	4	4
	TSS/TDS		2	1	2	1	1	1	2	1	1
	Metals	3	2	1	2	1	1	1	2	1	1
	O&G	3	7	4	7	4	4	4	7	4	4
	O&G (as HEM)	3	7	4	7	4	4	4	7	4	4
	Sulfide	3	5	2	5	2	2	2	5	2	2
Recovered oil			2				3				2
Sludge			1				2				1

3.4.4 Process Measurements and Information Collection

Process measurements and information collection will be conducted to provide the following data: flow, reagent usage, recovered oil quantity, sludge quantity, electricity use, operation and maintenance activities, and historical discharge data. The methods that will be used for process measurements and information collection are discussed in this section.

3.4.4.1 Wastewater Flow Rate and Volume Processed

The volume of wastewater processed during each test run will be measured using a GFI 5500 series flow meter/totalizer. This instrument is presently installed in the IWTP-MF system. The flow meter will be calibrated prior to testing using a "stopwatch and bucket" method. The flow totalizer will be read at the start and end of each test run and three times per day during each test run. The instantaneous flow rate will be read three times per day during each test run. The flow meter readings and the times those readings are taken will be recorded on the data collection form in **Appendix B**.

3.4.4.2 Chemical Reagent Usage Data

The quantities of treatment reagents (hydrochloric acid, ferric chloride, polymer and sodium hydroxide) used will be measured and recorded on a daily basis. This will be accomplished by filling the feed tanks at the beginning of each day to a preset point, and measuring the volume needed to refill the feed tanks at the end of each 24-hour period. The volume of reagent used will be entered on the form in **Appendix B**.

3.4.4.3 Quantities of Recovered Oil and Sludge

Empty drums will be used at the start of each test run for collection of recovered oil and sludge. The quantities of recovered oil and sludge generated will be measured at the end of each 24-hour sampling period in terms of both volume and weight. This will be accomplished by measuring the volume in the drums at the end of the 24-hour period. The two volume/weight measurements will be recorded on the form in **Appendix B**. The volume of the contents of the drums will be calculated by subtracting the initial volume from the final volume. Volume will be determined by measuring the depth of the material in the drum and the diameter of the drum and using the standard formula for calculating the volume of a cylinder (3.141 x r^2h). These measurements will be made using a meter stick with increments of 0.001 m. The weight of the recovered oil and sludge will be determine by weighing a container and than weighing it with a liter of contents. The weight of the recovered oil and sludge is weight (final weight minus the weight of the container) of one liter volume time the number of liters. A scale (0 to 100 kg) will be used for weighing the container. The scale will be calibrated with mass weights prior to the verification test; the calibration will be recorded in the field notebook.

3.4.4.4 Electricity Use Data

Electricity use will be calculated by determining the power requirements and cycle times of pumps and other powered devices associated with the IWTP-MF.

3.4.4.5 System Operation and Maintenance Labor Tasks

The ETV-MF Project Manager will observe operation of the IWTP-MF system during the verification test. DTIC operating personnel will report any IWTP-MF system changes or maintenance activities to the ETV-MF Project Manager. This includes changes to the flow rate or chemical feed rate, filter replacement, and similar activities. The ETV-MF Project Manager will record notes pertaining to these activities on the form in **Appendix B**.

3.4.4.6 Historical Discharge Data

Historical discharge data covering the previous 12 months will be provided by Federal-Mogul. These data will be used to establish the performance of the existing treatment system. This performance will be used in the analysis of environmental benefits.

3.4.4.7 Cost Data

DTIC will provide unit cost data for the chemical reagents. Federal-Mogul will provide the cost data for electricity, labor, sludge disposal, and the value of recovered oil.

3.5 Analytical Procedures

Chemical analyses of the samples will be conducted to evaluate the effectiveness of the DTIC IWTP-MF and the characteristics of residuals. The selected analytical parameters are primarily chemical parameters that are regulated under 40 CFR 433 or proposed under 40 CFR 438. All analytical procedures that will be used during this verification test are EPA methods. A summary of analytical tests is presented in **Table 8,** and the discussion of these parameters follows.

3.5.1 Oil and Grease (O&G)

Oil is contributed to the cleaner bath when parts are processed. The oil is a combination of machining and cutting oils and coolants that are used in metalworking. Oil loading and the efficiency of oil separation will be measured by performing oil measurements on both the influent and effluent streams of the DTIC IWTP-MF.

Two analytical methods for measuring oil and grease will be used, EPA Method 413.1 and EPA Method 1664. It is necessary to use both methods in order to determine if the DTIC IWTP-MF can meet applicable regulations and to compare with historical records. The selected samples will be acidified with hydrochloric acid to lower the pH to less than 2. Method 413.1 uses Fluorocarbon 113 as the extraction solvent, and Method 1664 uses n-hexane as the extraction solvent. The EPA Method 1664 is a liquid/liquid extraction, gravimetric procedure for the determination of the extractable materials. EPA Method 413.1 is liquid/liquid extraction gravimetric procedure for the determination of oil and grease.

3.5.2 Solids

Solid material is present in the wastewater in both dissolved and suspended forms. Removal of solids is often an objective of treatment even though solids themselves are not always regulated. This is due to the fact that the solids present in wastewater are often composed of regulated material such as metals. A high suspended solids concentration in a treated effluent is often a sign of a poorly operated treatment system. High dissolved solids may limit the reusability of the water for rinsing or other purposes.

To determine the effectiveness of the DTIC IWTP-MF unit with regard to removal of particulates, tests for non-filterable residue (EPA Method 160.2) will be performed. The referenced method produces values commonly referred to as total suspended solids (TSS). The EPA Method 160.1, filterable residue, will be used to determine total dissolved solids (TDS).

160.1 = Filterable Residue (TDS)
160.2 = Non-filterable Residue (TSS)

Table 8. Summary of Analytical Tests and Requirements

Parameter	Test Method	Sample Bottle	Sample Container	Preservation/ Handling 4°C	Hold Time
O&G	EPA Method 413.1	Glass jar	1000 ml	4°C Acidify to pH <2 w/HCL	28 days
O&G	EPA Method 1664	Glass jar	1000 ml	4°C Acidify to pH <2 w/HCL	28 days
TSS	EPA Method 160.2	Polyethylene	500 ml	4°C	7 days
TOC	EPA Method 415.1	Glass	40 ml vials x 4	4°C Acidify to pH <2 w/H_2SO4	28 days
TDS	EPA Method 160.1	Polyethylene	250 ml	4°C	7 days
pH	Digital meter	Polyethylene	100 ml	N/A	Analyze immediately
Metals Wastewater	SW-846 3005A/6010B	Polyethylene	500 ml	4°C Acidify to pH <2 w/HNO3	6 months
Metals Sludge	SW-846 3050B/6010B	Polyethylene	500 g	4°C	6 months
Sulfide (as S) Wastewater	EPA Method 376.1	Polyethylene	1000 ml	4°C Zinc Acetate + NaOH to pH > 12	7 days
% water	Karl-Fisher	Glass	250 ml	4°C	28 days

Note: A separate portion of the sludge sample will be dried at 100°C to constant weight to determine percent moisture. The moisture results will be used to correct sample concentrations to a dry weight basis.

3.5.3 Total Organic Carbon (TOC)

Total organic carbon is a direct measure of the organic content of water. It can be used to monitor processes for the treatment or removal of organic contaminants without undue dependence on the oxidation states, and can do so at low concentrations. Organic brighteners, cleaning compounds, oil and similar materials contribute to the organic content of metal finishing wastewaters. To determine the effectiveness of the DTIC IWTP-MF unit with regard to removal of organics, a TOC test (EPA 415.1) will be performed. The selected samples will be preserved with sulfuric acid to lower the pH to less than 2. The samples should be collected so they contain as little air as possible (zero headspace). The analysis method is a combustion-infrared method.

3.5.4 Metals

Various metals are regulated under 40 CFR 433 and 40 CFR 438. The regulated metal parameters include cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, and zinc. These metals are contributed to MP&M wastewaters from electroplating and similar processes. To determine the effectiveness of the DTIC IWTP-MF system with regard to removal of metals from the wastewater, the selected test will determine the concentration of cadmium, chromium, copper, lead, manganese, molybdenum, nickel, tin, and zinc. The selected aqueous samples will be acidified with nitric acid to lower the pH to less than 2. For the aqueous influent and effluent samples, the sample is digested using SW-846 Method 3005A and analyzed using SW-846 Method 6010B. This method is Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES). For the analysis of the solid waste samples, the solid waste will be digested using SW-846 Method 3050B and will be analyzed using SW-846 Method 6010B.

3.5.5 Sulfide (as S)

Through development of the MP&M regulations, EPA has determined that sulfide is present in MP&M facility wastewaters. Very little data exist for this parameter for MP&M wastewaters and related treatment systems. To determine the effectiveness of the DTIC IWTP-MF unit with regard to removal of sulfide, tests for sulfide (as S) (EPA Method 376.1) will be performed on wastewater. The sample will be preserved with zinc acetate and pH adjustment using sodium hydroxide to a pH greater than 12.

3.5.6 pH

The pH provides a general indication of the acidity or alkalinity of a wastewater. It is also a regulated parameter for most dischargers. The pH of the influent and effluent samples will be determined by using a digital meter (electrometric). The digital meter will be calibrated using pH 7 and 10 buffers. The ETV-MF Program Manager will record the manufacturer, lot number and the expiration date of the buffer in the field notebook.

3.5.7 Percent Water in Oil

Percent water provides an indication concentration of the oil collected and the analytical procedures determine the concentration is a Karl-Fisher method.

3.5.8 Percent Solids in Sludge

Percent moisture in the sludge will be determined for part of the sludge sample. It will be dried to constant weight at 100°C. The weight lost is the amount of moisture that it contained. By subtracting the amount of moisture from the total weight, the percent solids can be obtained.

4.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

Quality Assurance/Quality Control activities will be performed according to the applicable section of the Environmental Technology Verification Program Metal Finishing Technologies Quality Management Plan (ETV-MF QMP) [Ref. 3].

4.1 Quality Assurance Objectives

The first QA objective is to ensure that the process operating conditions and test methods are maintained and documented throughout each test and laboratory analysis of samples. The second QA objective is to use standard test methods (where possible) for laboratory analyses. The test methods to be used are listed in **Table 8**.

4.2 Data Reduction, Validation, and Reporting

4.2.1 Internal Quality Control Checks

Raw Data Handling. Raw data are generated and collected by laboratory analysts at the sampling site. These include original observations, printouts, and readouts from equipment for sample, standard, and reference QC analyses. Data are collected both manually and electronically. At a minimum, the date, time, sample ID, raw signal or processed signal, and/or qualitative observations will be recorded. Comments to document unusual or non-standard observations also will be included in the data package submitted by the laboratory to *CTC*.

Raw data will be processed manually by the analyst, automatically by an electronic program, or electronically after being entered into a computer. The analyst will be responsible for scrutinizing the data according to laboratory precision, accuracy, and completeness policies. Raw data bench sheets and calculation or data summary sheets will be kept together for each sample batch. From the standard operating procedure and the raw data bench files, the steps leading to a final result may be traced. The ETV-MF Program Manager will maintain process-operating data for use in verification report preparation.

Data Package Validation. The generating analyst will assemble a preliminary data package, which shall be initialed and dated. This package shall contain all QC and raw data results, calculations, electronic printouts, conclusions, and laboratory sample tracking information. A second analyst will review the entire package and check sample and storage logs, standard logs, calibration logs, and other files, as necessary, to ensure that all tracking, sample treatments, and calculations are correct. After the package is reviewed in this manner, a preliminary data report will be prepared, initialed, and dated. The entire package and final report will be submitted to the Laboratory Manager.

The Laboratory Manager shall be ultimately responsible for all final data released from the laboratory. The Laboratory Manager or designee will review the final results for adequacy to task QA objectives. If the manager or designee suspects an anomaly or non-concurrence with expected or historical performance values, or with task objectives for test specimen performance, the raw data will be reviewed, and the generating and reviewing analysts queried. If suspicion about data validity still exists after internal review of laboratory records, the manager will authorize a re-test. If sufficient sample is not available for re-testing, a re-sampling shall occur. If the sampling window has passed, or re-sampling is not possible, the manager will flag the data as suspect. The Laboratory Manager signs and dates the final data package.

Data Reporting. A report signed and dated by the STL Project Manager will be submitted to the ETV-MF Project Manager. The ETV-MF Project Manager will decide the appropriateness of the data for the particular application. The final report contains the laboratory sample ID, date reported, date analyzed, the analyst, the SOP used for each parameter, the process or sampling point identification, the final result, and the results of all QA/QC analyses (field duplicates, matrix spike, and matrix spike duplicates). The ETV-MF Program Manager shall retain the data packages as required by the ETV-MF QMP [Ref. 3].

4.2.2 Calculation of Data Quality Indicators

Analytical performance requirements are expressed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). Summarized below are definitions and QA objectives for each PARCCS parameter.

The oily wastewater, metal-bearing wastewater and oily/metal-bearing wastewater mixture are different matrices. Therefore, a field duplicate, matrix spike and matrix spike duplicate from the effluent of all three waste streams will be analyzed. A field duplicate, matrix spike, and matrix spike duplicate from the influent of the oily/metal-bearing wastewater mixture will also be analyzed. In addition, a field duplicate on a sludge sample and on a recovered oil sample will be analyzed.

4.2.2.1 Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision is estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the relative percent difference (RPD), and calculated as:

$$RPD = \{(|X_1 - X_2|)/(X_1 + X_2)/2\} \text{ x } 100\% = \left\{ \frac{|X_1 - X_2|}{\frac{(X_1 + X_2)}{2}} \right\} \text{x } 100\,\%$$

where; X_1 = larger of the two observed values
X_2 = smaller of the two observed values

Multiple determinations will be performed for each test on the same test specimen. The replicate analyses must be equal to or less the relative percent deviation limits provided in **Table 9.**

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4.2.2.2 Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. It is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix is the preferred technique because it provides a measure of the matrix effects on analytical accuracy. Accuracy, defined as percent recovery (P), is calculated as:

$$P = \frac{SSR - SR}{SA} \text{ x } 100\%$$

where: SSR = spiked sample result
SR = sample result (native)
SA = the concentration added to the spiked sample

Analyses will be performed with periodic calibration checks with traceable standards to verify instrumental accuracy. These checks will be performed according to established procedures in the contracted laboratory(s) that have been acquired for this verification test. Analysis with spiked samples will be performed to determine percent recoveries as a means of checking method accuracy. QA objectives will be satisfied if the *average* recovery is within the goals described in **Table 9**.

4.2.2.3 Completeness

Completeness is defined as the percentage of measurements judged to be valid compared to the total number of measurements made for a specific sample matrix and analysis. Completeness is calculated using the following formula:

$$\text{Completeness} = \frac{\text{Valid Measurements}}{\text{Total Measurements}} \times 100\%$$

Experience on similar projects has shown that laboratories typically achieve about 90 percent completeness. QA objectives will be satisfied if the percent completeness is 90 percent or greater as specified in **Table 9**.

4.2.2.4 Comparability

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. Sample collection and handling techniques, sample matrix type, and analytical method all affect comparability. Comparability is limited by the other PARCCS parameters because data sets can be compared with confidence only when precision and accuracy are known. Comparability will be achieved in this technology verification by the use of consistent methods during sampling and analysis and by traceability of standards to a reliable source.

Table 9. QA Objectives

Critical Measurements	Matrix	Method	Reporting Units	Method of Determination	MRL mg/L or mg/kg	Precision (RPD)	Accuracy (% Recovery)	Completeness
O&G	Water	EPA 413.1	mg/L	gravimetric	1.0	<14	77 – 129	90
O&G (HEM)	Water	EPA 1664	mg/L	gravimetric	2.85	<30	70 – 130	90
TSS	Water	EPA 160.2	mg/L	gravimetric	4.0	<15	N/A	90
TDS	Water	EPA 160.1	mg/L	gravimetric	10	<10	N/A	90
TOC	Water	EPA 415.1	mg/L	combustion or oxidation	1.0	<10	85 – 111	90
Metal	Water	SW-846 3005A 6010B	mg/L	ICP-AES	.003 – 0.1*	<10 – 12*	85 – 111	90
	Solid	SW-846 3050B 6010B	mg/kg	ICP-AES	0.25 – 5.0*	<10 – 36*	85 – 111	90
Sulfide (as S)	Water	EPA 376.1	mg/L	titration	1.0	<10	90 –110	90
pH	Water	Digital Meter	pH units	electrometric	.1 pH unit	<.2 pH unit	N/A	90
% Water	Recovered oil	Karl-Fisher	%	titration	N/A	N/A	N/A	90
Flow rates:								
Wastewater Feed (Influent)	Water	Flow Totalizer	Liters/min	Stop watch & bucket	10 %	<10	N/A	90
Wastewater Product (Effluent)	Water	Flow Totalizer	Liters/min	Stop watch & bucket	10 %	<10	N/A	90

EPA: EPA Methods and Guidance for Analysis of Water
SW-846: EPA Test Methods for Evaluating Solid Waste
* Depending on analyte

4.2.2.5 Representativeness

Representativeness refers to the degree to which the sample represents the properties of the particular wastestream being sampled. For the purposes of this demonstration, representativeness will be determined by submitting identical samples (field duplicates) to the laboratory for analysis. The samples will be representative if the relative percent difference between the sample and the field duplicate is similar to or less than the precision (laboratory duplicates) calculation of the sample.

4.2.2.6 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method is commonly referred to as the detection limit. Although there is no single definition of this term, the following terms and definition of detection will be used for this program.

Instrument Detection Limit (IDL) is the minimum concentration that can be measured from instrument background noise.

Method Detection Limit (MDL) is a statistically determined concentration. It is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined in the same or a similar matrix. (Because of the lack of information on analytical precision at this level, sample results greater than the MDL but less than the practical quantification limit (PQL) will be laboratory qualified as "estimated.")

MDL is defined as follows for all measurements:

$$MDL = t_{(n-1,1-\alpha = 0.99)} \times s$$

where:
- MDL = method detection limit
- $t_{(n-1,1-\alpha = 0.99)}$ = students t-value for a one-sided 99% confidence level and a standard deviation estimate with n-1 degrees of freedom
- s = standard deviation of the replicate analyses

Method Reporting Limit (MRL) is the concentration of the target analyte that the laboratory has demonstrated the ability to measure within specified limits of precision and accuracy during routine laboratory operating conditions. (This value is variable and highly matrix-dependent. It is the minimum concentration that will be reported without qualifications by the laboratory.)

4.2.3 Other Calculations

4.2.3.1 Ability to Meet Metal Finishing and Proposed MP&M Limitations

The results from each daily set of analytical data will be compared to the applicable Metal Finishing (**Table 10**) and Proposed MP&M limitations (**Table 11**). To meet a Metal Finishing or MP&M daily maximum limit, the analytical result must be equal to or below the corresponding daily maximum limit.[4] The comparison will be made on a parameter-by-parameter basis for each daily analysis of the effluent. The applicable limitations for test run 1 are the proposed pretreatment standards for existing sources for the MP&M Oily Wastes subcategory (40 CFR 438.65). The applicable limitations for test runs 2 and 3 are the pretreatment standards for existing sources for the Metal Finishing category (40 CFR 433.15) and proposed pretreatment standards for existing sources for the MP&M General Metals subcategory (40 CFR 438.15).

Table 10. Applicable Pretreatment Standards for Existing Sources for the Metal Finishing Subcategory (40 CFR 433.15)

Parameter	Metal Finishing Category (40 CFR 433.15)	
	Daily Max., mg/L	Monthly Avg., mg/L
Cadmium	0.69	0.26
Chromium	2.77	1.71
Copper	3.38	2.07
Lead	0.69	0.43
Nickel	3.98	2.36
Zinc	2.61	1.48

[4] It is anticipated that for certain parameters the influent concentration will be below the discharge limit. These instances will be identified during data reduction and reported as such in the verification report.

Table 11. Applicable Proposed Pretreatment Standards for Existing Sources for the MP&M Oily Wastes Subcategory (40 CFR 438.65) and General Metals Subcategory (40 CFR 438.15)

Parameter	MP&M Oily Wastes Subcategory (40 CFR 438.65)		MP&M General Metals Subcategory (40 CFR 438.65)	
	Daily Max., mg/L	Monthly Avg., mg/L	Daily Max., mg/L	Monthly Avg., mg/L
Cadmium	NR	NR	0.14	0.09
Chromium	NR	NR	0.25	0.14
Copper	NR	NR	0.55	0.28
Lead	NR	NR	0.04	0.03
Manganese	NR	NR	0.13	0.09
Molybdenum	NR	NR	0.79	0.49
Nickel	NR	NR	0.50	0.31
Tin	NR	NR	1.4	0.67
Zinc	NR	NR	0.38	0.22
O&G (as HEM)	27	20	15	12
TOC	633	378	87	50
TOP	9.0	4.3	9.0	4.3
Sulfide (as S)	31	13	31	13

Notes:
NR = not regulated.
O&G (as HEM) is not regulated under pretreatment standards for the Oily Wastes or General Metals subcategory. However, it is regulated under the BPT limitations for direct dischargers in the Oily Wastes subcategory (40 CFR 438.62) and General Metals subcategory (40 CFR 438.12). The values shown are the BPT proposed limitations.

4.2.3.2 Mass Balance

Mass balance calculations are performed for the metals parameters for test runs 2 and 3. These results will be used as an indicator of the accuracy of the verification test. The mass balance criterion will be satisfied when the mass balance is within the range of 75% to 125%. The equation for the zinc mass balance is shown below. Other mass balance equations will be similar.

$$\text{Mass Balance (\%)} = [((Z_E \times V_E) + (Z_S \times V_S))/(Z_I \times V_I)] \times 100\%$$

where:
- Z_E = avg. effluent zinc concentration for test run (mg/L)
- V_E = effluent volume processed during the test run (liters)
- Z_S = sludge zinc concentration (mg/kg)
- V_S = sludge quantity processed during the test run (kg)
- Z_I = avg. influent zinc concentration for test run (mg/L)
- V_I = influent volume processed during the test run (liters)

4.2.3.3 Oil Recovery Efficiency

The oil recovery efficiency is determined by comparing the quantity of oil recovered to the quantity of oil in the influent. These calculations are performed for each daily set of analytical results. The equation for oil recovery calculation is shown below.

$$O_{eff}\ (\%) = [(O_{OR} \times V_{OR})/(O_I \times V_I)] \times 100\%$$

where:
- O_{eff} = oil recovery efficiency
- O_{OR} = concentration of oil in the oil recovery tank (mg/L)
- V_{OR} = volume collected in the oil recovery tank during the test run (liters)
- O_I = avg. concentration of oil in the influent for test run (mg/L)
- V_I = influent volume processed during the test run (liters)

4.2.3.4 Pollutant Removal Efficiency

The pollutant removal efficiency is calculated based on a comparison of influent and effluent concentrations for each pollutant parameter.[5] These calculations are performed for each daily set of analytical results. The equation for zinc removal is shown below. The removal efficiency rate for each pollutant parameter will be separately calculated. These include: O&G, O&G (as HEM), TOC, cadmium, chromium, copper, lead, manganese, molybdenum, nickel, sulfide (as S), tin, and zinc.

[5] Pollutant removal efficiency will only be calculated for parameters that are found at concentrations above detection limits in the influent.

$$Z_{remove}\,(\%) = [((Z_I \times V_I) - (Z_E \times V_E))/(Z_I \times V_I)] \times 100\%$$

where:
Z_{remove} = zinc removal efficiency
Z_I = influent zinc concentration (mg/L)
V_I = influent volume processed during the test period (liters)
Z_E = effluent zinc concentration (mg/L)
V_E = effluent volume processed during the test period (liters)

4.2.3.5 Energy Use

Energy requirements for the IWTP-MF system will be calculated by summing the total quantity of horsepower hours and dividing by 1.341 HP-hr/kWh to arrive at electricity needs.

4.2.3.6 Cost Analysis

This analysis will determine the operating cost of the IWTP-MF system considering the following cost parameters: chemical reagents, other materials (e.g., filters), electricity, sludge management, and oil recovery. Costs will be calculated separately for each cost parameter for each test run and expressed in dollars per thousand liters processed ($/1000 l) by dividing the cost by the total volume of wastewater processed for a given test run. Total costs for each test run will be calculated by summing the individual cost elements. The calculation of treatment cost for test run 1 is shown below. Cost equations for other test runs will be similar.

$$C_{treat\ cost\ 1} = (R_1 + M_1 + E_1 + S_1 + O_1)$$

where:
$C_{treat\ cost\ 1}$ = total cost of treatment for test run 1 ($/1000 l)
R_1 = cost of chemical reagents for test run 1 ($/1000 l)
M_1 = cost of materials for test run 1 ($/1000 l)
E_1 = cost of electricity for test run 1 ($/1000 l)
S_1 = cost of sludge management for test run 1 ($/1000 l)
O_1 = cost (or savings) of oil recovery for test run 1 ($/1000 l)

4.2.3.7 Sludge Generation Analysis

The quantities of recovered oil and sludge and will be measured each day. This will be accomplished by measuring the volume and weight of the collection drums prior to the start of a 24-hour sampling period and at the end of the collection period. The volume/weight of the contents of the drums will be calculated by subtracting the initial volume/weight from the final volume/weight.

4.2.3.8 Environmental Benefit

This analysis will quantify the environmental benefit of the technology for test run 3.[6] Using historical data provided by Federal-Mogul, the concentration of pollutants in the effluent from the existing Federal-Mogul treatment system will be calculated (average of 12 months of data). These values will be converted to grams per year discharged for each pollutant parameter using historical flow rate data. These values will be compared to the projected performance of the IWTP-MF system by using the analytical results of verification testing[7] and the same historical flow rate data.

$$P_B = P_H - P_V$$

where:
- P_B = projected reduction of pollutant mass discharged during 12 month historical period
- P_H = sum of actual pollutant mass discharged during 12 month historical period
- P_V = calculated sum of pollutant mass discharged during 12 month historical period using verification test results

Another aspect of the environmental benefit determination will be the percentage of oil recovered during test run 3. The calculation presented in 4.2.3.3 will be used for this purpose.

4.3 Quality Audits

Technical System Audits. CTC will not perform a technical systems audit on this verification test. The EPA Quality Assurance Manager may conduct an audit to assess the quality of the verification test.

Internal Audits. In addition to the internal laboratory quality control checks, internal quality audits will be conducted to ensure compliance with written procedures and standard protocols.

[6] The influent wastewater during test run 3 closely resembles the actual treatment system influent at Federal-Mogul. Test runs 1 and 2 are not representative of the influent at Federal-Mogul and therefore will not be evaluated under this particular analysis.

[7] Historical effluent data are only available for certain parameters. Therefore, this environmental benefit analysis will be limited to a comparison of those parameters only.

Corrective Action. Corrective action for any deviations to established quality assurance and quality control procedures during verification testing will be performed according to section 2.10, Quality Improvement, of the ETV-MF QMP [Ref. 3].

Laboratory Corrective Action. Examples of non-conformances include invalid calibration data, inadvertent failure to perform method specific QA, process control data outside specified control limits, failed precision and/or accuracy indicators, etc. Such non-conformances will be documented on a standard laboratory form and provided along with the results to the *CTC* ETV-MF Program Manager. Corrective action will involve taking all necessary steps to restore a measuring system to proper working order and summarizing the corrective action and results of subsequent system verifications on a standard laboratory form. Some non-conformances are detected while analysis or sample processing is in progress and can be rectified in real time at the bench level. Others may be detected only after a processing trial and/or sample analyses are completed. Typically, the Laboratory Manager detects these types of non-conformances. In all cases of non-conformance, the Laboratory Manager will consider sample re-analysis or instrument calibration verification as sources of corrective action. If insufficient sample is available or the holding time has been exceeded, the Laboratory Manager will contact the *CTC* ETV-MF Program Manager to discuss generating new samples, if possible, if a determination is made that the non-conformance jeopardizes the integrity of the conclusions to be drawn from the data. In all cases, a non-conformance will be rectified before sample processing and analysis continues.

5.0 PROJECT MANAGEMENT

5.1 Organization/Personnel Responsibilities

The ETV-MF Project Team that is headed by *CTC* will conduct the evaluation of the DTIC IWTP-MF system. The ETV-MF Program Manager, Donn Brown, will have ultimate responsibility for all aspects of the technology evaluation. The ETV-MF Project Manager assigned to this evaluation is George Cushnie. Mr. Cushnie and/or his staff member will be on-site throughout the test period and will conduct or oversee all sampling and related measurements.[8]

James Davis will head the DTIC staff. DTIC will be responsible for transportation, set-up, shutdown, and operation of the IWTP-MF system. They will be on-site or on-call throughout the entire test period.

Federal-Mogul personnel will assist as needed by providing historical data and identifying wastestreams. Federal-Mogul will be responsible for the disposal of all residuals generated during the verification test.

The ETV-MF Project Manager or staff member will collect samples and record data from process measurements.

[8] The *CTC* ETV-MF Program Manager, Donn Brown, will make a determination as to the qualifications of any staff member assigned to the project. This will occur prior to testing.

Severn Trent Laboratories of Tampa, FL, is responsible for analyzing verification test samples. The Project Manager, Michele Lersch, will be the point of contact (813-621-0784). Severn Trent Laboratories is approved by the State of Florida for the analyses identified in this test plan.

The ETV-MF Project Manager and Federal-Mogul (host facility) have the authority to stop work when unsafe or unacceptable quality conditions arise. The *CTC* ETV-MF Program Manager will provide periodic assessments of verification testing to the EPA ETV Center Manager.

5.2 Test Plan Modification

In the course of verification testing, it may become necessary to modify the test plan due to unforeseen events. These modifications will be documented using a Test Plan Modification Request (**Appendix C**), which is submitted to the *CTC* ETV-MF Program Manager for approval. Upon approval, the modification request will be assigned a number, logged, and transmitted to the requestor for implementation.

6.0 EQUIPMENT AND UTILITY REQUIREMENTS

The DTIC IWTP-MF system is a self-contained mobile system that is owned by DTIC. Pumps and hosing that will be used to transfer the wastewater are also owned by DTIC. Influent wastewater will be pumped from a storage tank, processed by the IWTP-MF system and returned to a different storage tank. The storage tanks are part of the existing Federal-Mogul wastewater treatment system. The only utility requirement for operating the IWTP-MF system is electricity, and the requirement is 480 VAC/60Hz/three-phase/100 amperes. The IWTP-MF system has a quick-connect for electricity. An appropriate electrical supply will be provided by Federal-Mogul. The electrical supply connection will be performed by Federal-Mogul.

7.0 HEALTH AND SAFETY PLAN

This Health and Safety Plan provides guidelines for recognizing, evaluating, and controlling health and physical hazards throughout the workplace. More specifically, the Plan specifies the training, materials, and equipment necessary for assigned personnel to protect themselves from hazards created by acids and any waste generated by the process.

7.1 Hazard Communication

All personnel assigned to the project will be provided with the potential hazards, signs and symptoms of exposure, methods or materials to prevent exposures, and procedures to follow if there is contact with a hazardous substance. The Federal-Mogul (host facility) Hazard Communication Program will be reviewed during training prior to the start of any work and will be reinforced throughout the test period. All appropriate Material Data Safety Sheet (MSDS) forms will be available for chemical solutions used during testing.

7.2 Emergency Response Plan

Federal-Mogul (host facility) has a contingency plan (Consolidated Emergency Response Plan) to protect employees, assigned project personnel, and visitors in the event of an emergency at the facility. This plan will be used throughout the project. All assigned personnel will be provided with information about the plan during the initial training, and the plan will be accessible to them for the duration of the project

7.3 Hazard Controls Including Personal Protective Equipment

All assigned project personnel will be provided with appropriate personal protective equipment (PPE) and any training needed for its proper use, considering their assigned tasks. The use of PPE will be covered during training as indicated in section 9.0.

The following PPE will be required and must be worn at all times while in the Federal-Mogul (host facility) manufacturing facility: approved safety glasses with side splashguards, ear plugs, and safety shoes.

The IWTP-MF system is essentially a closed process and fully contained within the trailer. The system will be located in a secure area during verification testing (see **Figure 5**). There are no apparent hazards to the surrounding community due to operation or testing of the system.

7.4 Lockout/Tagout Program

The Federal-Mogul (host facility) Lockout/Tagout Program will be reviewed prior to testing, and relevant lockout/tagout provisions of the program will be implemented.

7.5 Material Storage

In accordance with the Federal-Mogul Hazard Communication Program, any materials used during the project will be kept in proper containers and labeled according to local, state, and Federal laws. Proper storage of the materials will be maintained based on associated hazards. Spill trays or similar devices will be used as needed to prevent material loss to the surrounding area.

7.6 Safe Handling Procedures

All chemicals and wastes or samples will be transported on-site in non-breakable containers used to prevent spills. Spill kits will be strategically located in the project area. These kits contain various sizes and types of sorbents for emergency spill clean-up. Emergency spill clean-up will be performed according to the Federal-Mogul Consolidated Emergency Response Plan.

8.0 WASTE MANAGEMENT

The IWTP-MF system will process wastewater generated by manufacturing operations at Federal-Mogul. After processing, the effluent from the IWTP-MF system will be transferred to the existing Federal-Mogul treatment system and processed through the existing system before being discharged to the Blacksburg POTW. Any residuals generated by the IWTP-MF system will be managed by Federal-Mogul in accordance with local, state, and Federal laws.

Prior to testing, local and state authorities will be notified of the verification test by Federal-Mogul .

9.0 TRAINING

Environmental, health and safety training will be coordinated with Federal-Mogul staff. All ETV-MF personnel will undergo environmental, health and safety training provided by Federal-Mogul prior to initiating the verification test.

Also, the ETV-MF Job Training Analysis (JTA) Plan [Ref. 5] will be utilized to identify additional training requirements relating to quality control, worker safety and health, and environmental issues. The purpose of this JTA Plan is to outline the overall procedures for identifying the hazards and quality issues and training needs. This JTA Plan establishes guidelines for creating a work atmosphere that meets the quality, environmental, and safety objectives of the ETV-MF Pilot. The JTA Plan describes the method for studying ETV-MF project activity and identifying training needs. The ETV-MF Operation Planning Checklist (**Appendix D**) will be used as a guideline for identifying potential hazards, and the Job Training Analysis Form (**Appendix E**) will be used to identify training requirements. After completion of the form, applicable training will be performed. Training will be documented on the ETV-MF Project Training Attendance Form (**Appendix F**).

10.0 REFERENCES

1) EPA. Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards for the Metal Finishing Point Source Category.
2) EPA. Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards for the Metal Products and Machinery Point Source Category; Proposed Rule.
3) Concurrent Technologies Corporation. “Environmental Technology Verification Program Metal Finishing Technologies (ETV-MF) Quality Management Plan.” December 9, 1998.
4) EPA Office of Research and Development. “Preparation Aids for the Development of Category IV Quality Assurance Project Plans.” EPA/600/8-91/006, February 1991.

5) Concurrent Technologies Corporation. "Environmental Technology Verification Program Metal Finishing Technologies (ETV-MF) Pollution Prevention Technologies Pilot Job Training Analysis Plan." May 10, 1999.

11.0 DISTRIBUTION

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James and Geri Davis, DTIC
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George Cushnie, CAI Resources, Inc.
Donn Brown, *CTC* (3)
Clinton Twilley*, CTC*
Michele Lersch, Severn Trent Laboratories

APPENDIX A

DTIC IWTP-MF Operating Procedures

DTIC IWTP-MF Operating Procedures

The IWTP-MF operates in a semiautomatic process. The following provides an overview of the daily startup and shutdown procedure. The plant is self-regulating during normal operating conditions. However, there are four (4) steps where the operator is required to be involved.

Step #1

Prior to daily starting of the plant, the operator is required to perform an inspection of the plant's physical condition to ensure all equipment appears to be normal and ready for operation. This will be done in accordance with a checklist provided in the Operator's Guide.

Step #2

Daily initialization is a two-step process, checking certain items in accordance with the Operator's Guide in preparation to power up the system.

<u>First Part: Power Circuit</u>

Initialize the master power circuit, 480 VAC

1. Power up the 120 VAC power circuit
    1. Power on the interior lights
    2. Power on the 120 VAC pump circuit
    3. Power on the sensor control circuit and check the following:
        (1) water level controls
        (2) pH monitoring circuit
        (3) flow meter
        (4) interior lighting

2. Power up the 480 VAC motor control circuit

    1. Check all variable speed motor controller displays
    2. Power on the skimmer and inspect for proper operation
    3. Momentarily start sludge discharge pumps

<u>Second Part: Chemical Circuit</u>

Check each chemical pump for proper operation

3. Manually start each pump and check for proper operation
4. Check and fill, as necessary, all chemical feed tanks
5. Observe the pH control circuit is operating properly for the adjustment of the acid and alkaline levels

Step #3

Start the system in accordance with the Operator's Guide. Observe that all mixer motors and pumps are operating properly. Observe that the dissolved air flotation (DAF) pumps have come up to proper operating levels of dissolved air in the treatment water. This indicates that the treatment process is ready to go online. Then start the feed and discharge pumps and open the discharge and feed valves. The system is now online and operating under internal control. The operator should continue to observe the operation of the plant for the next 30 minutes to ensure proper and stable operation.

Step #4

Shut down

The following two-step procedure must be followed in order to shut down the plant.

First part

1. Close the feed pump value and the discharge valve
2. Shut off power to the feed pump and mixer motors in accordance with the Operator's Guide and checklist for overnight or weekend shutdown; follow the Operator's Guide for extended or transport shutdown procedures.

Second part

3. Follow the Operator's Guide and secure the DAF pumps
4. Secure the secondary 480 VAC power
5. Secure the 120 VAC sensor power circuit
6. Inspect the system for any leaks and abnormal conditions
7. Secure the lighting power circuit
8. Secure the secondary 120 VAC circuit
9. Secure the main 480 VAC power circuit

APPENDIX B

Data Collection Form for DTIC IWTP-MF System

Data Collection Form for DTIC IWTP-MF System

Test Run/Day: ______________________

ETV-MF Project Manager: ______________________

DTIC Operator: ______________________

Parameter/Date/Time	Reading/Sample #	Observations/Comments
Flow Totalizer		
Start (l):		
Reading (l):		
Reading (l):		
Reading (l):		
Stop (l):		
Flow Instantaneous		
Start (l/min):		
Reading (l/min):		
Reading (l/min):		
Reading (l/min):		
Stop (l/min):		
Wt. of Sludge		
Start (kg):		
Stop (kg):		
Depth of Sludge Drum Contents		
Start (m):		
Stop (m):		
Wt. of Oil		
Start (kg):		
Stop (kg):		
Depth of Oil Drum Contents		
Start (m):		
Stop (m):		
Reagent Usage		
Acid (l):		
Caustic (l):		
Polymer (l):		
Ferric chloride (1)		
Samples Collected		
Influent:		
Effluent:		
Sludge drum:		
Oil drum:		

Additional Notes:

____

____

____

____

APPENDIX C

Test Plan Modification

Test Plan Modification

In the course of verification testing, it may become necessary to modify the test plan due to unforeseen events. The purpose of this procedure is to provide a vehicle whereby the necessary modifications are documented and approved.

The Test Plan Modification Request form is the document to be used for recording these changes. The following paragraphs provide guidance for filling out the form to ensure a complete record of the changes made to the original test plan. The form appears on the next page.

The person requesting the change should record the date and project name in the form's heading. Program management will provide the request number.

Under Original Test Plan Requirement, reference the appropriate sections of the original test plan, and insert the proposed modifications in the section titled Proposed Modification. In the Reason section, document why the modification is necessary; this is where the change is justified. Under Impact, give the impact of not making the change, as well as the consequences of making the proposed modification. Among other things, the impact should address any changes to cost estimates and project schedules.

The requestor should then sign the form and obtain the signature of the project manager. The form should then be transmitted to the *CTC* program manager, who will either approve the modification or request clarification. Upon approval, the modification request will be assigned a number, logged, and transmitted to the requestor for implementation.

TEST PLAN MODIFICATION REQUEST

Date:__________ **Number:**__________ **Project:**________________________

Original Test Plan Requirement:____
____
____
____
____

Proposed Modification:____
____
____
____
____

Reason: ____
____
____
____
____

Impact:____
____
____
____
____

Approvals:

Requestor:___________________________

Project Manager:______________________

Program Manager:_____________________

APPENDIX D

ETV-MF Operation Planning Checklist

ETV-MF Operation Planning Checklist

The ETV-MF Project Manager prior to initiation of verification testing must complete this form. If a "yes" is checked for any items below, an action must be specified to resolve the concern on the Job Training Analysis Form.

Project Name: ______________________________ Expected Start Date:

ETV-MF Project Manager: ______________________________ ______________

Will the operation or activity involve the following:	Yes	No	Initials & Date Completed
Equipment requiring specific, multiple steps for controlled shutdown? (E.g., in case of emergency, does equipment require more than simply pressing a "Stop" button to shut off power?) *Special Procedures for emergency shutdown must be documented in Test Plan.*			
Equipment requiring special fire prevention precautions (e.g., Class D fire extinguishers)?			
Modifications to or impairment of building fire alarms, smoke detectors, sprinklers or other fire protection or suppression systems?			
Equipment lockout/tagout or potential for dangerous energy release? *Lockout/tagout requirements must be documented in Test Plan.*			
Working in or near confined spaces (e.g., tanks, floor pits) or in cramped quarters?			
Personal protection from heat, cold, chemical splashes, abrasions, etc.? *Use Personal Protective Equipment Program specified in Test Plan.*			
Airborne dusts, mists, vapors and/or fumes? *Air monitoring, respiratory protection, and/or medical surveillance may be needed.*			
Noise levels greater than 80 decibels? *Noise surveys are required. Hearing protection and associated medical surveillance may be necessary.*			
X-rays or radiation sources? *Notification to the state and exposure monitoring may be necessary.*			
Welding, arc/torch cutting or other operations that generate flames and/or sparks outside of designated weld areas? *Follow Hot Work Permit Procedures identified in Test Plan.*			
The use of hazardous chemicals? *Follow Hazard Communication Program, MSDS Review for Products Containing Hazardous Chemicals. Special training on handling hazardous chemicals and spill clean-up may be needed. Spill containment or local ventilation may be necessary.*			
Working at a height of six feet or greater?			

ETV-MF OPERATION PLANNING CHECKLIST

The ETV-MF Project Manager prior to initiation of verification testing must complete this form. If a "yes" is checked for any items below, an action must be specified to resolve the concern on the Job Training Analysis Form.

Project Name: ______________________________

ETV-MF Project Manager: ______________________________

Will the operation or activity involve the following:	**Yes**	**No**	**Initials & Date Completed**
Processing or recycling of hazardous wastes? *Special permitting may be required.*			
Generation or handling of waste?			
Work to be conducted before 7:00 a.m., after 6:00 p.m. and/or on weekends? *Two people must always be in the work area together.*			
Contractors working in *CTC* facilities? *Follow Hazard Communication Program.*			
Potential discharge of wastewater pollutants?			
EHS aspects/impacts and legal and other requirements identified?			
Contaminants exhausted either to the environment or into buildings? *Special permitting or air pollution control devices may be necessary.*			
Any other hazards not identified above (e.g., lasers, robots, syringes)? *Please indicate with an attached list.*			

The undersigned responsible party certifies that all applicable concerns have been indicated in the "yes" column, necessary procedures will be developed, and applicable personnel will receive required training. As each concern is addressed, the ETV-MF Project Manager will initial and date the "Iinitials & Date Completed" column above.

ETV-MF Project Manager: ____________________ ____________________ ____________

(Name) (Signature) (Date)

APPENDIX E

Job Training Analysis Form

Job Training Analysis Form

ETV-MF Project Name: ____

Basic Job Step	Potential EHS Issues	Potential Quality Issues	Training

ETV-MF Project Manager:____

Name **Signature**

____

Date

APPENDIX F

ETV-MF Project Training Attendance Form

ETV-MF Project Training Attendance Form

ETV-MF Project:____________________________________

Date Training Completed	**Employee Name** **Last** **First**	**Training Topic**	**Test Score (If applic.)**

ETV-MF Project Manager: ____

Name Signature

____

Date