U.S. ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

FOR METAL FINISHING POLLUTION PREVENTION TECHNOLOGIES

GENERIC VERIFICATION PROTOCOL

For

Aqueous Cleaner Recycling Technologies

Revision 0

February 22, 2002

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.

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TITLE: Generic Verification Protocol for Aqueous Cleaner Recycling Technologies

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DOCUMENT CONTROL

This document shall be maintained by Concurrent Technologies Corporation in accordance with the EPA Environmental Technology Verification Program Quality and Management Plan for the Period 1995-2000 (EPA/600/R-98/064). Document control elements include unique issue numbers, document identification, numbered pages, document distribution records, tracking of revisions, a document master filing and retrieval system, and a document archiving system.

ACKNOWLEDGMENT

This is to acknowledge Valerie Whitman for her help in preparing this document.

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Environmental Technology Verification Program for Metal Finishing Pollution Prevention Technologies Generic Verification Protocol for Aqueous Cleaner Recycling Technologies

PREPARED BY:

James Totter
CTC Project Manager

3/28/02
Date

APPROVED BY:

Marion L. Rideout
CTC QA Manager

27 March 2002
Date

Donn W. Brown
CTC ETV-MF Program Manger

3/27/02
Date

George Moore, Ph. D.
EPA ETV Center Manager

March 13, 2002
Date

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ACRONYMS & ABBREVIATIONS

COC	Chain of Custody
CTC	Concurrent Technologies Corporation
DOT	Department of Transportation
DQO	Data Quality Objectives
EHS	Environmental, Health and Safety
EPA	U.S. Environmental Protection Agency
ERP	Emergency Response Plan
ETV-MF	Environmental Technology Verification Program for Metal Finishing Pollution Prevention Technologies
GVP	Generic Verification Protocol
ID	Identification
IDL	Instrument Detection Limit
JTA	Job Training Analysis
LM	Laboratory Manager
MDL	Method Detection Limit
MRL	Method Reporting Limit
MSDS	Material Safety Data Sheet
NRMRL	National Risk Management Research Laboratory
OSHA	Occupational Safety and Health Administration
P	Percent Recovery
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity
PPE	Personal Protective Equipment
PQL	Practical Quantification Limit
QA	Quality Assurance
QC	Quality Control
QMP	Quality Management Plan
Ref.	Reference
RPD	Relative Percent Difference
SR	Sample Result
SSR	Spiked Sample Result
U.S.	United States

1.0 INTRODUCTION

The purpose of this generic verification protocol (GVP) is to document the objectives, procedures, and other aspects of testing that shall be utilized during verification testing of aqueous cleaner recycling technologies. This GVP 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 ETV-MF Center prepares a test plan for testing individual technologies at a metal finishing site where the technology is installed. The results of verification tests are documented in verification reports that provide objective performance data to metal finishers, environmental permitting agencies, and industry consultants. Verification statements, which are executive summaries of verification reports, are prepared and signed by the EPA National Risk Management Research Laboratory (NRMRL) Director and the *CTC* ETV-MF Program Manager. After one or more technologies of a class have been tested, a GVP is prepared to guide the development of future test plans. Verification of two aqueous cleaner recycling technologies (microfiltration and microbiological digestion) has been performed and forms the basis for this GVP.

Under the ETV Program, verification testing is conducted only on commercial-ready technologies. As defined by EPA, commercial-ready technologies are either in use or ready for full-scale production. This does not include technologies at the bench or pilot scale, or those in the research and development stage.

Aqueous cleaners are widely used in the metal finishing industry to prepare parts for subsequent processing. The cleaners used vary widely in composition, and choosing a cleaner for a particular application is complex. Some of the factors considered are the materials of the part, the types and amounts of the soils to be removed, the degree of cleanliness required, the amount of time available for cleaning, and the available methods for disposal of the used cleaner. A cleaner that is successful in one application may be unsuited for other applications.

As a cleaner bath is used, soils are removed from parts and are retained by the cleaning bath. The accumulation of soils limits the useful life of the cleaning bath, since there is a limit to the amount of soil the bath can retain prior to soils being redeposited on the parts. However, the constituents of the bath that perform the cleaning operation are still present. Therefore, when used cleaner baths are discarded, useful chemicals are discarded along with the soils. These discarded chemicals add to the treatment burden of the metal finishing operation.

If the soils can be removed from the cleaning bath, the useful life of the bath can be greatly extended, reducing the amount of waste requiring treatment and disposal. The methods for removing soil while preserving the beneficial components of a cleaning bath will vary with the soil and the cleaner. Microfiltration, biological digestion, precipitation, and other methods have been successfully used.

Verification testing of methods to recycle aqueous cleaners will be different for different recycling technologies. However, in broad terms, the goal of verification testing of aqueous cleaner recycling technologies will be to measure the efficiency of soil removal from the cleaning bath and to verify the extent to which the recycling technology removes beneficial cleaning components.

This generic verification protocol has been structured based on a format developed for ETV-MF projects. This document describes the intended approach and explains plans for testing with respect to areas such as test methodology, procedures, parameters, and instrumentation. Also included are quality assurance/quality control (QA/QC) requirements for testing that will ensure the accuracy of data, the use of proper data interpretation procedures, and an emphasis on worker health and safety considerations. The following sections (sections 2 through 10) are required to be included in all verification test plans specific to technologies for recycling aqueous cleaners.

2.0 TECHNOLOGY DESCRIPTION

2.1 Theory of Operation

The theory of operation of the technology shall be described. In general, aqueous cleaner recycling technologies operate by removing contaminants from the working bath in order to extend bath life. This has been accomplished by many commercially available separation technologies. The basic requirement for aqueous cleaner recycling is that the separation method removes the contaminants of interest with little or no effect on the constituents of the cleaner. Additionally, the materials of construction of the recycling technology must be compatible with the chemistry of the cleaner and the working environment.

2.2 Technology Decription

A detailed description of the recycling technology, as installed at the test site, shall be provided. Pictures or flow diagrams are helpful in describing the metal finishing process as well as how the technology interfaces with the process.

2.3 Test Site Description

A description of the test site shall be provided. Information on expected pollutants and concentrations, flow rates, number of process lines, square feet processed per day, and hours of operation are helpful.

2.4 Previous Testing

Summarize any previous testing done with the technology, including the type of application and results. A review of existing manufacturer or third party performance test results will assist in planning the verification testing. Cite any literature searches that have been conducted and include the scope and quality of available data. Existing reports

will provide a starting point for setting test conditions. The information should include the following:

?? Test conditions
?? Description of the aqueous cleaner solution
?? Key operating parameters
?? Operating range
?? Performance results
?? QA/QC procedures/techniques
?? Technology/application sensitivities
?? Interferences

Summarize the available information rather than providing an extensive set of data or other details. If applicable or vital to the results reported for the verification, portions of this information can be placed into the appendix of the test plan. However, if the information can be found in a publicly available document (e.g., QA standard, methods, guidance documents, government report or trade journal), it is only necessary to summarize it and include a reference to sources of such information.

3.0 TEST DESIGN

In general, there are four objectives in evaluating aqueous cleaner recycling technologies:

1) Determine the efficiency of bath contaminant removal.
2) Determine the amount of bath constituents removed by the technology.
3) Determine the cost of using the technology.
4) Determine the reduction of waste caused by the technology.

3.1 Data Quality Objectives (DQO)

The systematic planning elements of the data quality objectives process identified in "Guidance for the Data Quality Objectives Process" (EPA QA/G-4, August 2000) shall be utilized during preparation of verification test plans. The verification project team, composed of representatives from the verification organization, technology vendor, test site, analytical laboratory, and EPA, jointly develops the test objectives; critical and non-critical measurements; test matrix; sample quantity, type and frequency; analytical methods; and QA objectives to arrive at an optimized test designed to verify the performance of the technology.

3.2 Critical and Non-Critical Measurements

Measurements that will be taken during testing are classified as either critical or non-critical. Critical measurements are those that are necessary to achieve the primary project.

3.3 Test Matrix

The test matrix is dependent upon the technology undergoing verification. In general, technologies operate as either flow-through technologies (for example, filtration) or *in situ* technologies (for example, biological digestion). The design of the matrix is either event driven, condition driven, or time driven. In the case of flow-through technologies, samples shall be taken from the influent, product, and waste streams. Sampling for *in situ* technologies shall be of the working bath, possibly at various points of the system. When verifying an *in situ* technology, it is also necessary to take samples to determine the rate of contaminant introduction to the bath. In order to assess variability of the system, a minimum of four sampling events (days, runs, etc.) should be scheduled.

3.4 Sample Collection and Handling

Prior to the start of testing, the variability of the streams to be sampled should be evaluated, either by a review of records or a preliminary sampling episode. Streams with a high degree of variability will require composite sampling, while steady state streams can use grab sampling.

At the time of sampling, each sample container shall be labeled with the date, time, and sample identification (ID) number. Samples to be analyzed at an off-site laboratory shall be accompanied by a chain of custody (COC) the verification Project Manager will generate. The COC form will provide the following information:

?? project name
?? project address
?? sampler's name
?? sample numbers
?? date/time samples were collected
?? sample matrix
?? required analyses
?? appropriate COC signatures

All samples shall be transported in appropriate sample transport containers (e.g., coolers with packing and blue ice). The transport containers shall be secured with tape to ensure sample integrity during the delivery process to the analytical laboratory. The verification Project Manager or designee will perform sampling and labeling, and ensure that samples are properly secured and shipped to the laboratory for analysis per regulations required by the Department of Transportation (DOT) and the Occupational Safety and Health Administration (OSHA) to the laboratory for analysis.

3.4.1 Process Measurements and Information Collection

Process measurements and information collection shall be conducted to provide the data required in supporting the test objectives. Additionally, process data are collected to indicate proper operation of the technology. Typically, samples of

the cleaner are taken and analyzed for contaminants and cleaner constituents. Additional measurements may include process conditions such as temperature, flow rate, amount of work processed, etc. Calibration information for any equipment used to collect data should be included in the individual test plan.

3.5 Analytical Procedures

Chemical analyses of the samples shall be conducted to evaluate the effectiveness of the technology in removing contaminants from the cleaner and preserving cleaner constituents. Particular methods will depend on the cleaner being used and the soils being cleaned. Whenever possible, standard EPA analysis methods shall be used. Analytical laboratories used must be accredited by the National Environmental Laboratory Accreditation Program. The test plan should include sample amount, preservation, container required, and hold time for each method used.

3.6 Cost Evaluation

In order to evaluate the costs associated with a technology, various areas will require evaluation. They may incluede the following: consumable costs (chemicals, filters, etc.), energy costs (heating, pumps, etc.), labor costs, and possibly others. These costs can be obtained from the test site records and the technology vendor. When possible, these costs should be compared to the process used prior to installation of the technology.

3.7 Waste Reduction

The amount of waste generated by the technology should be evaluated. This is generally calculated from the amount of rinsewater required and the bath dump and remake frequency, but different technologies may reduce waste in other ways. When possible, this should be compared to the process used prior to the installation of the technology.

4.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

QA/QC activities shall be performed according to the applicable section of the Environmental Technology Verification Program Metal Finishing Technologies Quality Management Plan (ETV-MF QMP) [Ref. 1].

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. Data quality objectives for precision, accuracy, and completeness for each analysis method must be determined prior to testing.

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 sampling, standards, and reference QC analyses. Data may be collected both manually and electronically. At a minimum, the date, time, sample ID, raw signal or processed signal, and/or qualitative observations shall be recorded. Comments to document unusual or non-standard observations shall be included in the data package submitted by the laboratory to the verifying organization.

Raw data are typically processed manually by the analyst, automatically by an electronic program, or electronically after being entered into a computer. The analyst shall be responsible for scrutinizing the data according to laboratory precision, accuracy, and completeness policies. Raw data bench sheets and calculation or data summary sheets shall 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.

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 shall be prepared, initialed, and dated. The entire package and final report shall be submitted to the Laboratory Manager (LM) for review.

The LM shall be ultimately responsible for all final data released from the laboratory. The LM or designee will review the final results for conformance to task QA objectives. If the LM 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 and the analysis procedures shall be reviewed. If suspicion about data validity still exists after internal review of laboratory records, the LM shall 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 LM shall flag the data as suspect. The LM signs and dates the final data package.

Data Reporting. The final report shall contain the laboratory sample identification, date reported, date analyzed, the analyst, the standard operating procedure 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).

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 influent, effluent, and waste streams are different matrices. Therefore, a field duplicate, matrix spike and matrix spike duplicate from all three streams shall be analyzed for every ten samples collected from these streams.

The following sections identify the formulae used to calculate the PARCCS parameters.

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:

$$RPD = \{(|X_1 - X_2|)/(X_1 + X_2)/2\} \times 100\% = \left[\frac{|X_1 - X_2|}{\frac{X_1 + X_2}{2}}\right] \times 100\ \%$$

where:

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

Multiple determinations shall be performed for each test on the same test specimen.

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:

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

where:

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

Analyses shall be performed with periodic calibration checks with traceable standards to verify instrumental accuracy. These checks shall be performed according to established procedures in the contracted laboratory(s) that have been acquired for this verification test. Analysis with spiked samples shall be performed to determine percent recoveries as a means of checking method accuracy.

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:

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

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.

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.

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 shall 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 definitions of detection shall 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) shall be laboratory qualified as "estimated.")

MDL is defined as follows for all measurements:

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

where:

MDL	=	method detection limit
$t_{(n-1,1-? = 0.99)}$	=	students t-value for a one-sided 99 percent 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.)

4.3 Quality Audits

Technical System Audits. The verification organization may perform a technical systems audit during the verification test. The EPA QA 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 shall be conducted to ensure compliance with written procedures and standard protocols.

Corrective Action. Corrective action for any deviations to established QA and QC procedures during verification testing shall be performed according to section 2.10, Quality Improvement, of the ETV-MF QMP [Ref. 1].

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 shall be documented on a standard laboratory form and provided along with the results to the verification organization. Corrective action shall 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 LM detects these types of non-conformances. In all cases of non-conformance, the LM shall 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 LM shall contact the Verification Project Manager to discuss generating new samples. In all cases, a non-conformance shall be rectified before sample processing and analysis continues.

5.0 PROJECT MANAGEMENT

5.1 Organization/Personnel Responsibilities

The Verification Project Team that will conduct the evaluation of the system shall be identified by the *CTC* ETV-MF Program Manager. The verification organization will have ultimate responsibility for all aspects of the technology evaluation. The Verification Project Manager shall be assigned by the verification organization. The Verification Project Manager and/or his staff designee shall be on-site throughout the test period and will conduct or oversee all sampling and related measurements. The *CTC* ETV-MF QA Manager shall approve the test plan and determine the requirement for a technical system audit. Additional members of the project team include representatives from the technology vendor, the test site, and the analytical service laboratory.

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 shall be documented using a Test Plan Modification Request (**Appendix A**), which is submitted to the verification organization for approval. Upon approval, the modification request shall be assigned a number, logged, and transmitted to the requestor for implementation.

6.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan provides guidelines for recognizing, evaluating, and controlling health and physical hazards during the verification test. More specifically, the Plan specifies the training, materials, and equipment necessary for assigned personnel to protect themselves from hazards created by chemicals and any waste generated by the process. Test site plans can be used if available. If a test site plan is not available, one must be developed.

6.1 Hazard Communication

All personnel assigned to the project shall 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. All appropriate Material Data Safety Sheet (MSDS) forms shall be available for chemical solutions used during testing.

6.2 Emergency Response Plan

An Emergency Response Plan (ERP) protects employees, assigned project personnel, and visitors in the event of an emergency at the facility. All assigned personnel shall be provided with information about the plan during the initial training, and the plan shall be accessible to them for the duration of the project.

6.3 Hazard Controls Including Personal Protective Equipment

All assigned project personnel shall be provided with appropriate personal protective equipment (PPE) and any training needed for its proper use, considering their assigned tasks. The use of PPE shall be covered during training as indicated in section 8.0.

6.4 Lockout/Tagout Program

The Lockout/Tagout Program safety requirements shall be reviewed prior to testing, and relevant lockout/tagout provisions implemented as required. Lockout/tagout safety must be practiced if electrical, pressure, or other sources of energy must be installed or disconnected during verification testing.

6.5 Material Storage

Any materials used during the project shall be kept in proper containers and labeled according to Federal, state, and local laws. Proper storage of the materials shall be maintained based on associated hazards. Spill trays or similar devices shall be used as needed to prevent material loss to the surrounding area. The test site Hazard Communication Program is a source of information on these requirements.

6.6 Safe Handling Procedures

All chemicals and wastes or samples shall be transported on-site in non-breakable containers used to prevent spills. Spill kits shall 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 shall be performed according to the host facility ERP.

7.0 WASTE MANAGEMENT

If waste is generated in the course of verification testing, waste handling, storage, and disposal should be covered by the host facility's waste permit. If not, special accommodations must be made, including contacting the local regulatory authority.

8.0 TRAINING

Environmental, health, and safety (EHS) training shall be coordinated with the test site. All verification program personnel shall undergo EHS training prior to initiating the verification test.

Also, the ETV-MF Job Training Analysis (JTA) Plan [Ref. 2] shall 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, 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 verification program. The JTA Plan describes the method for studying verification project activity and identifying training needs. The ETV-MF Operation Planning Checklist (**Appendix B**) shall be used as a guideline for identifying potential hazards, and the Job Training Analysis Form (**Appendix C**) shall be used to identify training requirements. After completion of the form, applicable training shall be performed. Training shall be documented on the ETV-MF Project Training Attendance Form (**Appendix D**).

9.0 REFERENCES

1) Concurrent Technologies Corporation. "Environmental Technology Verification Program Metal Finishing Technologies (ETV-MF) Quality Management Plan, Rev. 1." March 26, 2001.

2) Concurrent Technologies Corporation. "Environmental Technology Verification Program Metal Finishing Technologies (ETV-MF) Pollution Prevention Technologies Pilot Job Training Analysis Plan." May 10, 1999.
3) 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.

10.0 DISTRIBUTION

Distribution of the verification test plan to all participants (the verification organization, technology vendor, test site, analytical laboratory, and EPA) is required. Distribution of the test plan will occur after the test plan has been signed by the verification organization, the *CTC* Project Manager, the *CTC* ETV-MF Program Manager, the U.S. EPA ETV Center Manager, the test site, and the technology vendor.

APPENDIX A

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* ETV-MF Program Manager, who will either approve the modification or request clarification. Upon approval, the modification request shall 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 B

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 shall be developed, and applicable personnel will receive required training. As each concern is addressed, the ETV-MF Project Manager will initial and date the "Initials & Date Completed" column above.

ETV-MF Project Manager: _____ _____ _____
(Name) (Signature) (Date)

APPENDIX C

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 D

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