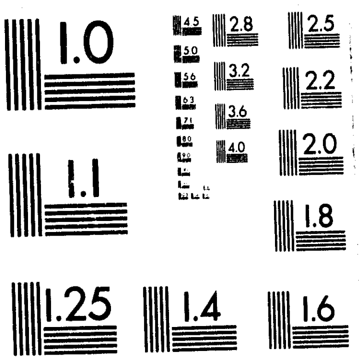
1.0
4.5
2.8
2.5
5.0
3.2
2.2
5.6
6.3
3.6
7.1
2.0
8.0
4.0
9.0
1.1
1.8
1.25
1.4
1.6

# 1 of 1

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# A STRATEGY FOR ANALYSIS OF TRU WASTE CHARACTERIZATION NEEDS[1]

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## ABSTRACT

Regulatory compliance and effective management of the nation's TRU waste requires knowledge about the constituents present in the waste. With limited resources, the DOE needs a cost-effective characterization program. In addition, the DOE needs a method for predicting the present and future analytical requirements for waste characterization. Thus, a strategy for predicting the present and future waste characterization needs that uses current knowledge of the TRU inventory and prioritization of the data needs is presented.

## INTRODUCTION

Transuranic wastes have been generated, packaged, and stored at United States Department of Energy (DOE) facilities nationwide, under a constantly changing climate of rules and regulations, for the past forty years. Always, the rules and regulations in place at the time dictated the extent to which the wastes were scrutinized. Today, the DOE has 300,000m$^3$ of transuranic waste (TRU) stored at eleven facilities across the United States. This translates into over one million drums of TRU. Using today's standards, only a small percentage of the DOE transuranic waste inventory is believed to be adequately characterized.

The Federal Facilities Compliance Act is the most recent in a series of environmental statutes that have brought the need for better characterization of waste inventories to the attention of DOE generator sites. Under the Federal Facilities Compliance Act, DOE facilities must work progressively toward compliance with current environmental regulations including those implementing the Resource Conservation and Recovery Act (RCRA). As a result, all DOE sites have submitted plans to local and federal agencies establishing schedules for their individual commitments to regulatory compliance. In all cases, waste characterization, either through a better understanding of the processes that generate waste or through sampling and analysis programs, is an integral part of the schedule submitted for bringing DOE facilities into regulatory compliance.

Characterization does not mean opening every drum of waste and examining its contents. It is not practical in terms of safety, cost, and schedule to sample every waste package. In particular, the DOE is concerned with sampling and analysis for the TRU waste inventory because of the potential health and safety considerations related to handling and an apparent lack of analytical laboratory capacity for handling samples of TRU waste.

Transuranic waste contains alpha emitting radionuclides that represent a significant health risk when inhaled or ingested by humans. Because of the special handling considerations, commercial laboratories are not generally equipped to handle alpha-contaminated samples. In addition, it is expected that the DOE laboratory capacity for alpha-contaminated samples will be overwhelmed when major characterization programs are begun.

[1] This work was performed at Sandia National Laboratories which is operated for the U.S. Department of Energy under Contract No. DE-AC04-94AL85000 and funded by the Department of Energy's Office of Environmental Restoration and Waste Management.

## OBJECTIVE

The strategy discussed in this paper is part of a larger program called the TRU Waste Inventory Characterization Assessment Program. The immediate goal of the larger program is to provide an estimate of present and future analytical requirements for TRU waste characterization. The more distant goal of the TRU Waste Inventory Characterization Program is to evaluate DOE' s alternatives for meeting the projected laboratory load for alpha-contaminated samples taken from TRU waste. The strategy discussed in this paper is intended to provide a defensible technical basis for predicting the amount of sampling and analysis that will be required for the TRU waste inventory over the next five to fifty years. The strategy is flexible and can account for the planned management scenario for the waste inventory and the current state of knowledge about the waste. In this context, "management" encompasses all of the steps involved from the time a material becomes a waste until it is placed in a permanent disposal site. "Knowledge" encompasses any analytical data pertaining to the waste and any information about the process that produced the waste.

## TECHNICAL APPROACH

Sandia National Laboratories and Consolidated Technical Services, Inc. (CONTECH) of Albuquerque, New Mexico have proposed a strategy for analysis of TRU characterization needs that involves the following steps: 1) the potential waste management scenarios are identified, 2) the maximum amount of sampling and analysis required for a management scenario, given no prior knowledge of the waste, is defined, 3) the quality of the existing knowledge about the waste is determined, 4) the maximum value for sampling and analysis required given no prior knowledge of the waste is reduced to reflect the quality of existing data, 5) the types and quantities of analytical tests required are stored in matrix format for each management scenario, and 6) the process is automated and "what-if" analyses are performed. The following discussion is a simple "walk-through" for each of these steps using a hypothetical sludge waste as an example.

## IDENTIFICATION OF POTENTIAL WASTE MANAGEMENT SCENARIOS

Management of a waste typically includes its designation as either high-level, low-level, or transuranic waste as well as its designation as either hazardous or non-hazardous waste. Management also includes storage, treatment, and transportation of the waste. Depending on the management scenario considered, the knowledge required about the waste will vary. For example, DOE sites that store or produce TRU are currently planning disposal at the Waste Isolation Pilot Plant (WIPP) outside of Carlsbad, New Mexico[1]. As a result, all of the sites that plan to send waste to WIPP must certify that their waste meets the WIPP Waste Acceptance Criteria[2]. One of the waste acceptance criteria sets a limit on the quantity and size of particulates accepted. The sites must provide enough information to certify that their wastes meet the limits set for particulates at WIPP. If, however, disposal at an alternate site was considered, depending on the waste acceptance criteria for the alternate site, information about particulates in the waste might not be required.

In this study, five potential management scenarios for the TRU waste inventory will be considered. The five scenarios are shown in Figure 1. The scenarios considered are derived from current DOE disposal plans [3] and alternate plans [4] that may be considered by the DOE. Each of the five management scenarios begins with characterization of the waste to comply with the Resource Conservation and Recovery Act. Four of the five scenarios involve permanent disposal at the WIPP site. The fifth scenario involves disposal at an alternate site. The scenarios differ in the amount and type of treatment required prior to acceptance at the disposal site.

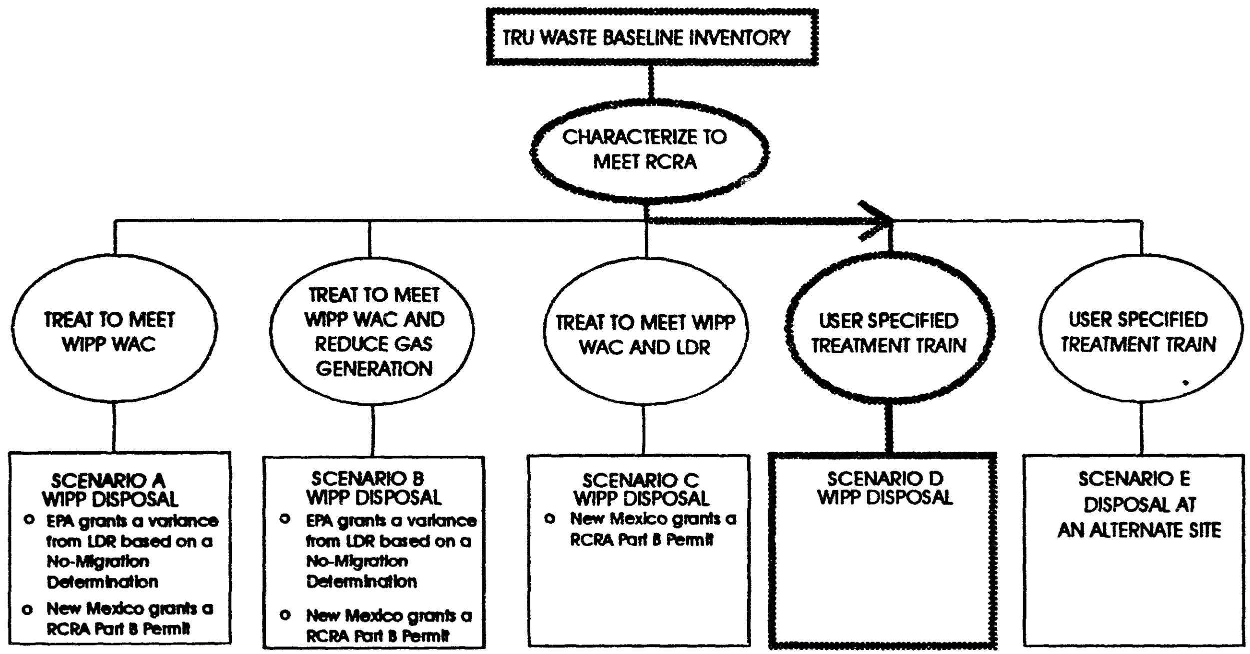

TRU WASTE BASELINE INVENTORY
CHARACTERIZE TO MEET RCRA
TREAT TO MEET WIPP WAC
TREAT TO MEET WIPP WAC AND REDUCE GAS GENERATION
TREAT TO MEET WIPP WAC AND LDR
USER SPECIFIED TREATMENT TRAIN
USER SPECIFIED TREATMENT TRAIN
SCENARIO A WIPP DISPOSAL
o EPA grants a variance from LDR based on a No-Migration Determination
o New Mexico grants a RCRA Part B Permit
SCENARIO B WIPP DISPOSAL
o EPA grants a variance from LDR based on a No-Migration Determination
o New Mexico grants a RCRA Part B Permit
SCENARIO C WIPP DISPOSAL
o New Mexico grants a RCRA Part B Permit
SCENARIO D WIPP DISPOSAL
SCENARIO E DISPOSAL AT AN ALTERNATE SITE

Figure 1. Five Waste Management Scenarios Considered

DOE is currently in the process of applying for a RCRA Part B Permit for WIPP [5] and a variance to the RCRA land disposal restrictions based on a No-Migration Determination from the Environmental Protection Agency (EPA) [6]. The outcome of this process is uncertain. If the EPA grants a variance from the land disposal restrictions based on a No-Migration Determination and the State of New Mexico grants WIPP a RCRA Part B permit, waste will be accepted at WIPP as long as it meets the waste acceptance criteria. Treatment of the waste inventory will be limited to that required to meet the waste acceptance criteria. Another potential scenario involves additional treatment of the waste to reduce gas generation prior to disposal at WIPP.

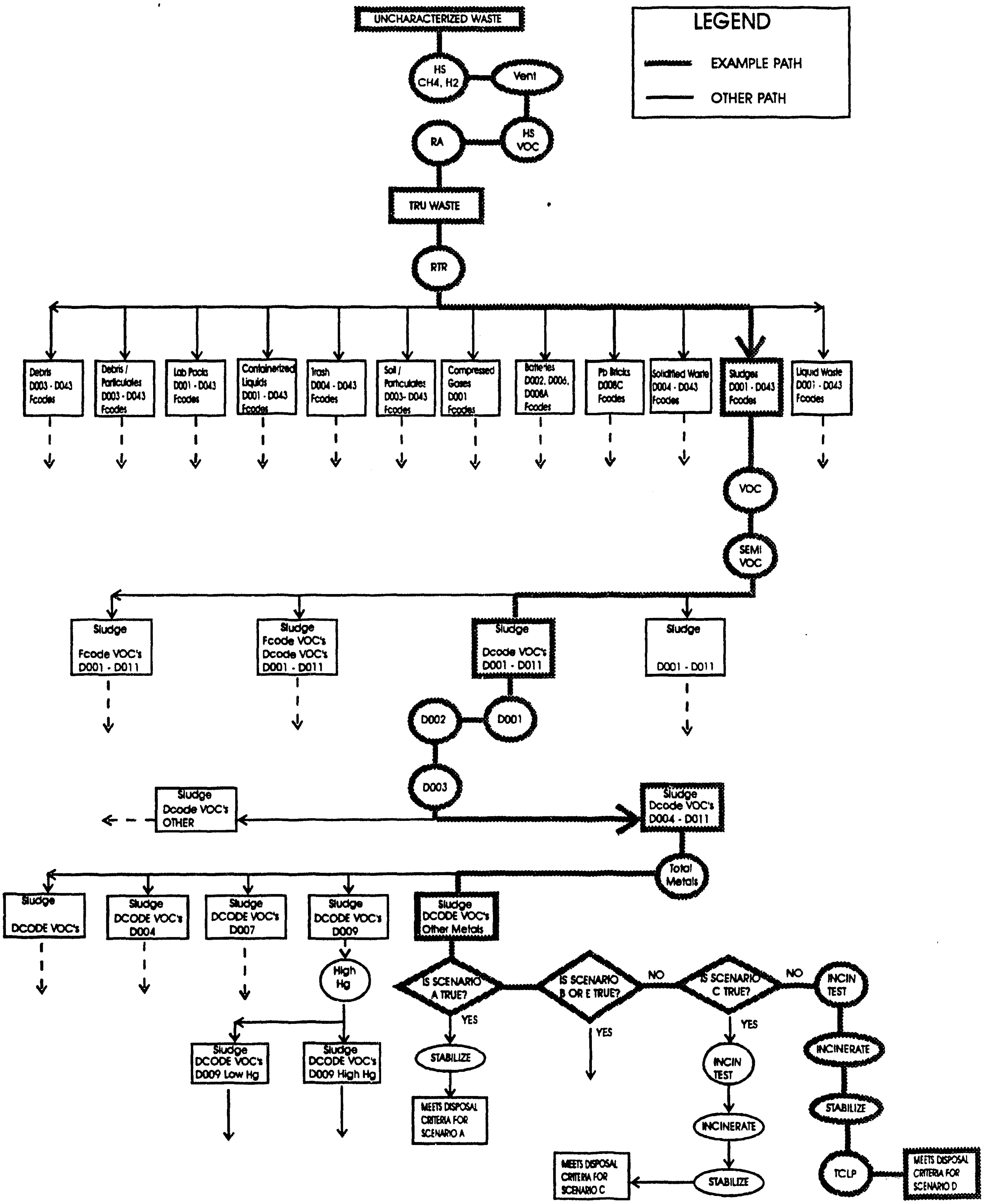
If the EPA denies the variance from the land disposal restrictions, but the State of New Mexico grants WIPP a RCRA Part B Permit, the treatment required for the TRU waste inventory will be much more extensive. DOE TRU will be treated to meet standards set by the EPA before disposal at WIPP. Two further scenarios involve disposal at WIPP without a RCRA Part B Permit and disposal at an alternate site. The treatment train required in these cases is uncertain.

## DEFINING THE THEORETICALMAXIMUM VALUE FOR SAMPLING AND ANALYSIS

The theoretical maximum value for sampling and analysis includes both the number and types of tests that must be performed in order to manage a waste stream assuming no prior knowledge of the waste. The types of tests required can be defined by following a logical procedure for sampling and analysis that would be used in order to characterize the waste. An example of a logical procedure for sampling and analysis is shown in Figure 2.

The logic shown in Figure 2 begins with non-intrusive tests, radioassay, headspace gas analysis, and real time radiography. Radioassay can be used to classify the waste as TRU. The headspace gas analysis is used to determine if methane, hydrogen, and/or volatile organic compounds are present in the headspace gas. Using real time radiography, the contents of the drum are examined and most physical forms (waste types) can be distinguished. The waste type highlighted as an example in Figure 2 is a sludge.

Figure 2. Example Logic Diagram Used to Predict the Number and Type of Analyses Needed



UNCHARACTERIZED WASTE
LEGEND
EXAMPLE PATH
OTHER PATH
HS CH4, H2
Vent
HS VOC
RA
TRU WASTE
RTR
Debris D003 - D043 Fcodes
Debris / Particulates D003 - D043 Fcodes
Lab Packs D001 - D043 Fcodes
Containerized Liquids D001 - D043 Fcodes
Trash D004 - D043 Fcodes
Soil / Particulates D003- D043 Fcodes
Compressed Gases D001 Fcodes
Batteries D002, D006, D008A Fcodes
Pb Bricks D008C Fcodes
Solidified Waste D004 - D043 Fcodes
Sludges D001 - D043 Fcodes
Liquid Waste D001 - D043 Fcodes
VOC
SEMI VOC
Sludge Fcode VOC's D001 - D011
Sludge Fcode VOC's Dcode VOC's D001 - D011
Sludge Dcode VOC's D001 - D011
Sludge D001 - D011
D002
D001
D003
Sludge Dcode VOC's OTHER
Sludge Dcode VOC's D004 - D011
Total Metals
Sludge DCODE VOC's
Sludge DCODE VOC's D004
Sludge DCODE VOC's D007
Sludge DCODE VOC's D009
Sludge DCODE VOC's Other Metals
High Hg
Sludge DCODE VOC's D009 Low Hg
Sludge DCODE VOC's D009 High Hg
IS SCENARIO A TRUE?
YES
STABILIZE
MEETS DISPOSAL CRITERIA FOR SCENARIO A
IS SCENARIO B OR E TRUE?
NO
YES
IS SCENARIO C TRUE?
NO
YES
INCIN TEST
INCINERATE
STABILIZE
MEETS DISPOSAL CRITERIA FOR SCENARIO C
INCIN TEST
INCINERATE
STABILIZE
TCLP
MEETS DISPOSAL CRITERIA FOR SCENARIO D

Once the waste type has been determined, the logic for sampling and analysis is followed to either eliminate or confirm the presence of organic, RCRA constituents (characteristic or listed organic compounds) in the waste. Tests for volatile organic compounds and semi-volatile organic compounds are performed on the waste. The example highlighted in Figure 2 shows that the tests for volatile organic compounds and semi-volatile organic compounds confirm the presence of characteristic organic compounds (D012 - D043) in the sludge.

The next set of tests shown in Figure 2 would be performed to determine if the waste is characteristic (ignitable, corrosive, or reactive) or contains toxic (RCRA Dcode) metals. EPA SW-846 [7] specifies analytical tests for ignitability, corrosivity, reactivity, and total metals. EPA SW-846 tests, a set of equivalent tests, or process knowledge could be used. The example highlighted in Figure 2 shows that the characteristics of ignitability, corrosivity, and reactivity are eliminated for the sludge, but the presence of a toxic metal other than mercury, chromium, or arsenic is confirmed in the sludge. At this point in the logic for sampling and analysis, enough information has been gathered to designate the waste as a RCRA hazardous waste.

Following designation, the waste will be managed according to one of the scenarios shown in Figure 1. For the highlighted example, it is assumed that the sludge waste stream requires incineration followed by stabilization prior to disposal at WIPP (Scenario D from Figure 1). The sampling and analysis logic indicates that an additional set of tests will be required to ascertain if the sludge is acceptable for incineration (shown as "INCIN TEST" in Figure 2). In addition, the treated waste must pass the Toxic Characteristics Leachate Procedure (TCLP) test. Overall, the sludge waste stream highlighted in Figure 2 will require the following tests: 1) radioassay, 2) headspace gas analysis, 3) real time radiography, 4) tests for volatile and semi-volatile organic compounds, 5) tests for ignitability, corrosivity, and reactivity, 6) tests for total metals, 6) tests for processing in the incinerator, and 7) TCLP tests.

It is assumed in this analysis that radioassay, headspace gas analysis, and real time radiography will be performed on every waste container in a waste stream. In addition, radioassay, real time radiography, and headspace gas analysis for methane and hydrogen do not contribute to the load for an analytical laboratory because they are performed at the generator site. The number of waste samples required for analysis using the other analytical methods depends on the homogeneity of the waste form, the precision of the analytical method, and the proximity of the suspected result to the regulatory limit of concern. Algorithms for calculating the number of samples required given the waste stream volume, the analytical test method, the homogeneity of the waste and the regulatory limit are being developed. These algorithms will be discussed in a separate paper. For this application, it is assumed that, independent of the analytical test method and the regulatory limit, ten samples are required for a sludge waste stream with a volume between one hundred and two hundred cubic meters. Also, it is assumed that once the sludge waste has been incinerated and solidified, only eight samples are required for the original volume.

## DATA QUALITY ASSESSMENT

The theoretical maximum value for sampling and analysis is derived assuming that no information about the waste stream under consideration exists. However, TRU waste inventories, both current and projected, have been reported with unknown degrees of accuracy in several databases and reports [8,9,10]. Characterization to date has relied primarily on "process knowledge" with a minimal amount of characterization based on sampling and analysis. Both process knowledge and sampling and analysis will be needed in the future to adequately characterize the inventory of TRU waste. It is not practical in terms of safety, cost, and schedule to sample every TRU waste package.

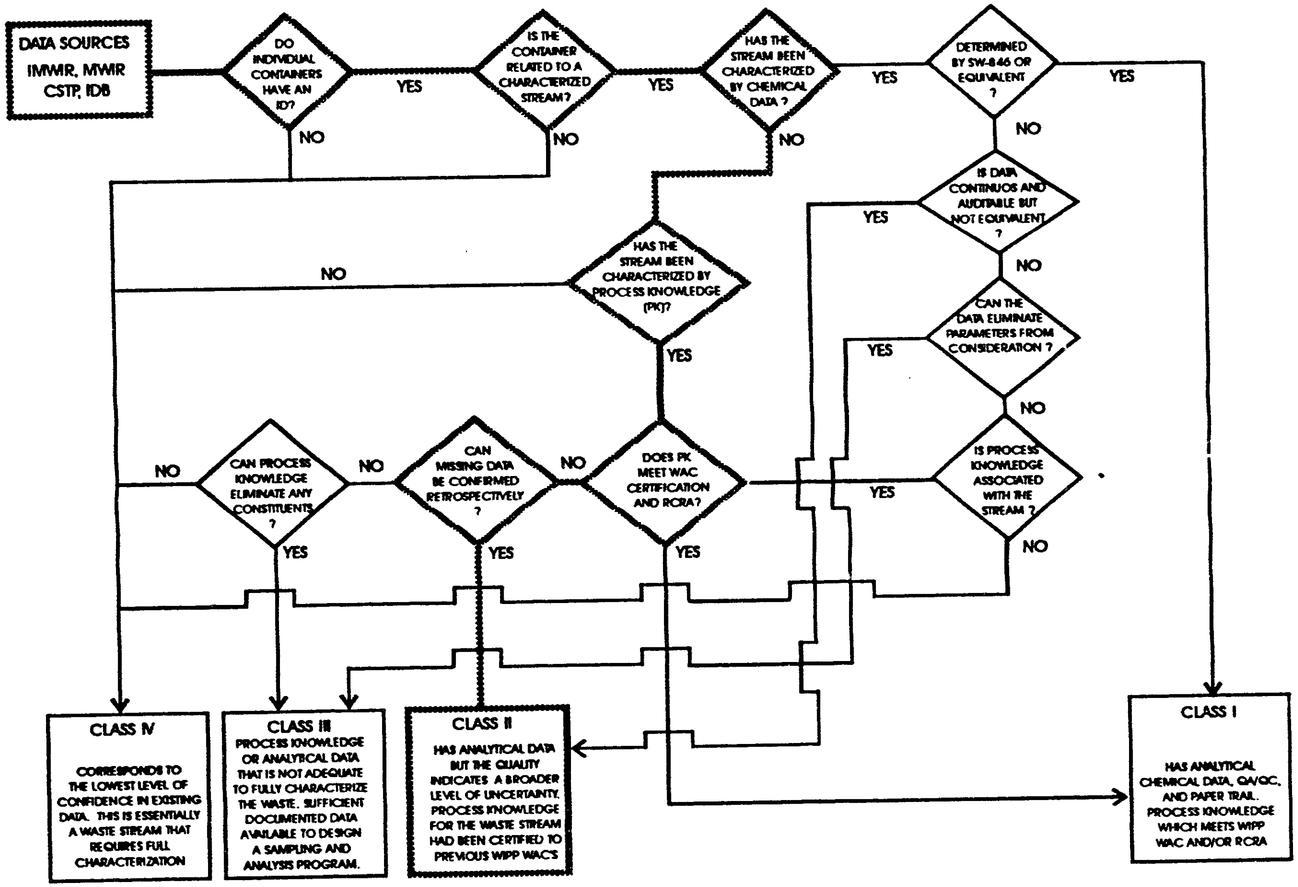
The amount of additional sampling and analysis that must be performed on the DOE TRU waste inventory depends on the degree of confidence in the characterization data that is currently available. As part of the technical approach for determining potential analytical laboratory load, the quality of the existing data for the TRU waste inventory will be determined. This is called "data quality assessment".

Figure 3 shows a procedure for data quality assessment. Information from each data source will be evaluated according to the procedure shown in Figure 3 and assigned a data quality category. Separate data quality categories can be assigned to individual parameters in the same waste stream or all waste stream parameters can be assigned one data quality category. Four quality categories have been developed for this application. Quality Category I ($Q_1$) represents the highest level of confidence in the data. $Q_1$ is assigned to waste streams that have essentially been fully characterized. The only future analytical effort for data assigned to $Q_1$ would be that required to confirm that the waste data has not deviated from its reported values. Quality Category IV ($Q_4$) represents the lowest level of confidence in the data or no data. A waste stream whose characterization data was determined to be $Q_4$ would require a full characterization program.

Waste characterization data assigned to Quality Category II ($Q_2$) would be expected to have substantial credibility but lack key features, either specific parameters, quality control program elements, or documentation. The most important feature of this category is that the data in question is documented and has continuity. The argument is that suspect data with documented continuity may be rendered usable by subsequent testing and confirmation. Characterization data falling into Quality Category III ($Q_3$) would provide little usable data to positively characterize a waste stream but could provide information for a focused design of a sampling and analysis program. In Figure 3, an example where the data available for the sludge waste stream falls into $Q_2$ is shown.

The quality categories discussed above have been assigned reduction factors that can be applied to the maximum theoretical value for sampling and analysis[11]. For example, if data in Quality Category II was assigned a reduction factor of 0.25,the amount of sampling and analysis required to confirm information assigned to Quality Category II would be twenty-five percent of the theoretical maximum value for sampling and analysis.

Figure 3. Data Quality Assessment


DATA SOURCES
IMWIR, MWIR
CSTP, IDB
DO INDIVIDUAL CONTAINERS HAVE AN ID?
YES
NO
IS THE CONTAINER RELATED TO A CHARACTERIZED STREAM?
YES
NO
HAS THE STREAM BEEN CHARACTERIZED BY CHEMICAL DATA ?
YES
NO
DETERMINED BY SW-846 OR EQUIVALENT ?
YES
NO
IS DATA CONTINUOS AND AUDITABLE BUT NOT EQUIVALENT ?
YES
NO
HAS THE STREAM BEEN CHARACTERIZED BY PROCESS KNOWLEDGE (PK)?
NO
YES
CAN THE DATA ELIMINATE PARAMETERS FROM CONSIDERATION ?
YES
NO
CAN PROCESS KNOWLEDGE ELIMINATE ANY CONSTITUENTS ?
NO
YES
CAN MISSING DATA BE CONFIRMED RETROSPECTIVELY ?
NO
YES
DOES PK MEET WAC CERTIFICATION AND RCRA?
NO
YES
IS PROCESS KNOWLEDGE ASSOCIATED WITH THE STREAM ?
YES
NO
CLASS IV
CORRESPONDS TO THE LOWEST LEVEL OF CONFIDENCE IN EXISTING DATA. THIS IS ESSENTIALLY A WASTE STREAM THAT REQUIRES FULL CHARACTERIZATION
CLASS III
PROCESS KNOWLEDGE OR ANALYTICAL DATA THAT IS NOT ADEQUATE TO FULLY CHARACTERIZE THE WASTE. SUFFICIENT DOCUMENTED DATA AVAILABLE TO DESIGN A SAMPLING AND ANALYSIS PROGRAM.
CLASS II
HAS ANALYTICAL DATA BUT THE QUALITY INDICATES A BROADER LEVEL OF UNCERTAINTY. PROCESS KNOWLEDGE FOR THE WASTE STREAM HAD BEEN CERTIFIED TO PREVIOUS WIPP WAC'S
CLASS I
HAS ANALYTICAL CHEMICAL DATA, QA/QC, AND PAPER TRAIL. PROCESS KNOWLEDGE WHICH MEETS WIPP WAC AND/OR RCRA

## CALCULATINGTHE ADJUSTED VALUE FOR SAMPLING AND ANALYSIS

Once the characterization data for a waste stream has been assigned a quality category, the theoretical maximum value for sampling and analysis can be adjusted to reflect the quality of the existing data. The best method for describing this calculation is to follow the sludge example discussed above. For the purposes of discussion, it is assumed that the sludge waste stream is generated at a rate of 105 $m^3$ (500 drums) per year for two years at which time generation of the waste is discontinued. It is also assumed that information showing the presence of Pb and the absence of any other metals in the sludge can be assigned to Quality Category II. All other characterization data associated with the sludge waste stream is assigned to the lowest quality category, $Q_4$. Further, it is assumed that all samples taken from the sludge waste stream must be handled in a glovebox while performing the analytical tests.

Following the logic shown in Figure 2 for the sludge waste stream, the headspace gas will be sampled for every container in the waste stream (500 containers per year for two years). Over the two-year generation period, 1000 analyses for volatile organic compounds on the headspace gas samples will be performed in an analytical laboratory. When waste generation stops, the headspace gas analyses are no longer required.

For an assumed sampling value of 10 samples/(100-200 $m^3$ of sludge), 10 sludge samples will be required for each of the analytical tests (volatile organic compounds, semi-volatile organic compounds, ignitability, corrosivity, reactivity, "INCIN TESTS") for the sludge waste stream. The total number of samples required each year would be 60/year, and an analytical laboratory would be required to perform 10 volatile organic compound, semi-volatile organic compound, ignitability, corrosivity, reactivity and "INCIN" tests each year.

Based on the stated assumptions, analytical data or process knowledge of Quality Level II indicates the presence of Pb and no other metals in the sludge. For Quality Category II, the number of sludge samples required to confirm the reported results would twenty-five percent of the theoretical maximum value. The theoretical maximum value is 10 samples/year. Consequently, the number of samples required to confirm the presence of Pb is 3 samples/year.

Once the sludge waste has been treated (incineration followed by stabilization), the treated waste form will have to pass the TCLP test. Assuming a sampling value of 8 samples/(100-200 $m^3$ of treated sludge), 8 samples of the final waste form would be required per year fcr two years. In addition, 8 TCLP tests would be performed in an analytical laboratory each year.

## CREATING A MATRIX FOR ANALYTICALTESTS REQUIRED

The number and types of analytical tests required for a waste stream will be stored in matrix format as shown in Figure 4. The columns in the matrices shown in Figure 4 represent media classes. A media class includes all samples that require laboratory preparation in a similar manner. For example, a media class might be defined as all samples that require dissolution in an acidic solution prior to analytical testing. This would include sludge samples and samples of miscellaneous trash. Another media class might require grinding before dissolution in an acidic solution. Samples of debris would fall into this media class. The media classes are further divided according to the activity level and type of radioactivity in the sample. For example, distinctions are made for samples that must be handled in a hot cell or a glove box rather than on a laboratory bench with a hood.

The rows in the matrix are defined by the types of tests that must be performed in an analytical laboratory as part of the management scenario for a waste stream. It is assumed that real time radiography, radioassay, headspace gas analyses for methane and hydrogen are performed at the generator site and are not part of the analytical load experienced by an outside laboratory. Following the logic in Figure 2, the types of tests required for a sludge waste stream are headspace gas analyses for volatile organic compounds and analysis of the raw

Figure 4. Analytical Matrices for Two Sludge Waste Streams

waste form for volatile and semi-volatile organic compounds, the characteristics of ignitability, corrosivity, and reactivity, total metals, and parameters of interest to the incinerator operator. In addition, TCLP tests are required on the treated waste form.

By storing values in the matrix format, the type of test, the type of sample preparation, and the type of space required in the analytical laboratory in order to process the samples are recorded. Figure 4 shows the values calculated above for the example sludge waste stream stored in matrix format. The figure also shows values calculated for a second sludge waste stream generated at the same site. The results stored in the matrices can be added in a number of ways to show the near-term, interim, and future analytical load for a facility. For example, the number of headspace gas samples that must be analyzed for volatile organic compounds in the first and second year is 1000 tests per year. The number of sludge samples that require acid dissolution in a glove box in the first and second year is 49 dissolutions per year (dissolutions are required for total metals, incinerator tests and TCLP's). The number of samples to be analyzed using atomic adsorption (the test for total metals) is 26 over the two-year period.

## SLUDGE 1

### YEAR 1

| | SOLIDS REQUIRING ACID DIGESTION | | |
|---|---|---|---|
| | HOT CELL | GLOVEBOX | BENCH |
| HS VOC | | | 500 |
| VOC | | 10 | |
| SEMI VOC | | 10 | |
| D001 | | 10 | |
| pH | | 10 | |
| D003 | | 10 | |
| TOTAL METALS | | 3 | |
| INCIN TEST | | 10 | |
| TCLP | | 8 | |

### YEAR 2

| | SOLIDS REQUIRING ACID DIGESTION | | |
|---|---|---|---|
| | HOT CELL | GLOVEBOX | BENCH |
| HS VOC | | | 500 |
| VOC | | 10 | |
| SEMI VOC | | 10 | |
| D001 | | 10 | |
| pH | | 10 | |
| D003 | | 10 | |
| TOTAL METALS | | 3 | |
| INCIN TEST | | 10 | |
| TCLP | | 8 | |

### YEAR 3

| | SOLIDS REQUIRING ACID DIGESTION | | |
|---|---|---|---|
| | HOT CELL | GLOVEBOX | BENCH |
| HS VOC | | | 0 |
| VOC | | 0 | |
| SEMI VOC | | 0 | |
| D001 | | 0 | |
| pH | | 0 | |
| D003 | | 0 | |
| TOTAL METALS | | 0 | |
| INCIN TEST | | 0 | |
| TCLP | | 0 | |

## SLUDGE 2

### YEAR 1

| | SOLIDS REQUIRING ACID DIGESTION | | |
|---|---|---|---|
| | HOT CELL | GLOVEBOX | BENCH |
| HS VOC | | | 500 |
| VOC | | 10 | |
| SEMI VOC | | 10 | |
| D001 | | 3 | |
| pH | | 10 | |
| D003 | | 3 | |
| TOTAL METALS | | 10 | |
| INCIN TEST | | 10 | |
| TCLP | | 8 | |

### YEAR 2

| | SOLIDS REQUIRING ACID DIGESTION | | |
|---|---|---|---|
| | HOT CELL | GLOVEBOX | BENCH |
| HS VOC | | | 500 |
| VOC | | 10 | |
| SEMI VOC | | 10 | |
| D001 | | 3 | |
| pH | | 10 | |
| D003 | | 3 | |
| TOTAL METALS | | 10 | |
| INCIN TEST | | 10 | |
| TCLP | | 8 | |

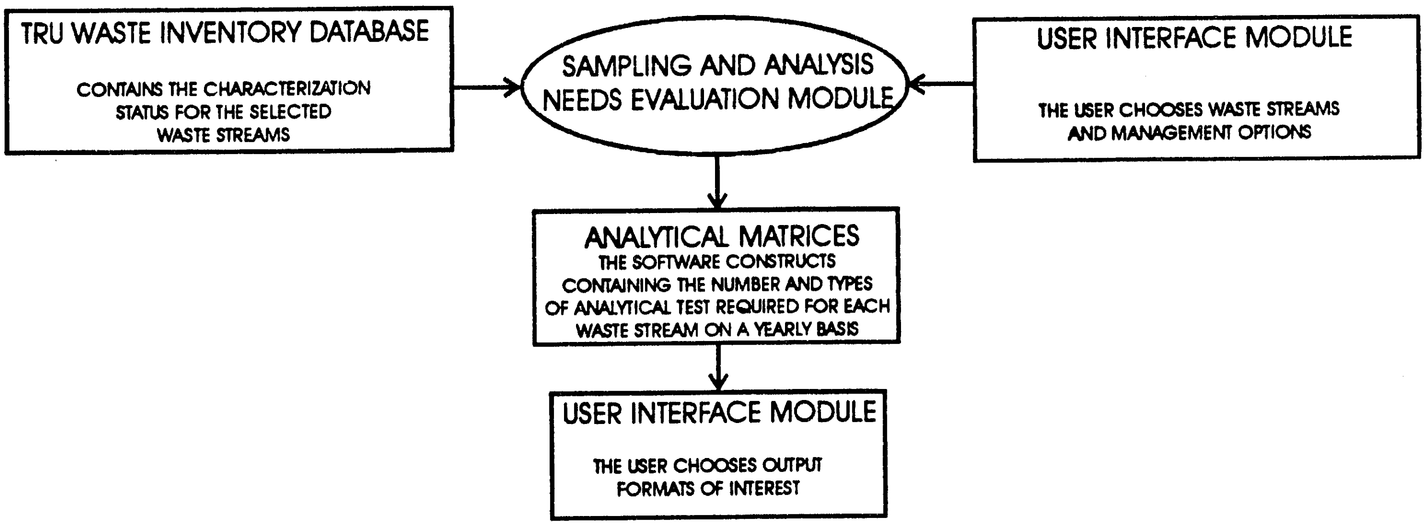
### YEAR 3

| | SOLIDS REQUIRING ACID DIGESTION | | |
|---|---|---|---|
| | HOT CELL | GLOVEBOX | BENCH |
| HS VOC | | | 0 |
| VOC | | 0 | |
| SEMI VOC | | 0 | |
| D001 | | 0 | |
| pH | | 0 | |
| D003 | | 0 | |
| TOTAL METALS | | 0 | |
| INCIN TEST | | 0 | |
| TCLP | | 0 | |

## AUTOMATINGTHE PROCESS

The strategy described in this paper for determining the number and type of analytical tests required for a waste stream in the DOE TRU waste inventory will be automated as shown in Figure 5. The baseline inventory and characterization status for DOE TRU waste streams will be stored in a project database. In particular, the project database will store the quality categories assigned to each piece of relevant data. The logic for sampling and analysis and algorithms for determining the number of samples required will be implemented in the sampling and analysis needs evaluation module. An interface module will be written allowing the user to choose an individual waste stream, groups of waste streams, site, or group of sites from the project database for analysis. The user will also choose the management scenario for analysis. Based on the choices made by the user, the sampling and analysis needs evaluation module will calculate the number of tests required, recording the values in matrix format. Another interface module will be provided allowing the user to summarize the information stored in matrix format as tabular or graphical representations of the analytical load over time. The automated software package illustrated in Figure 5 is the basis for performing "what-if" analysis to determine potential fluctuations in the analytical load.

Figure 5. Illustration of an Integrated Software Package Implementing the Strategy


TRU WASTE INVENTORY DATABASE
CONTAINS THE CHARACTERIZATION STATUS FOR THE SELECTED WASTE STREAMS
SAMPLING AND ANALYSIS NEEDS EVALUATION MODULE
USER INTERFACE MODULE
THE USER CHOOSES WASTE STREAMS AND MANAGEMENT OPTIONS
ANALYTICAL MATRICES
THE SOFTWARE CONSTRUCTS CONTAINING THE NUMBER AND TYPES OF ANALYTICAL TEST REQUIRED FOR EACH WASTE STREAM ON A YEARLY BASIS
USER INTERFACE MODULE
THE USER CHOOSES OUTPUT FORMATS OF INTEREST

## ACKNOWLEDGEMENTS

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