



**APPENDIX C9  
TRU WASTE CHARACTERIZATION USING  
ACCEPTABLE KNOWLEDGE**

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## APPENDIX C9 TRU WASTE CHARACTERIZATION USING ACCEPTABLE KNOWLEDGE



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### C9-1 Introduction

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The Resource Conservation and Recovery Act (RCRA) regulations codified in 40 CFR Parts 260 through 265, 268, and 270, and the New Mexico Hazardous Waste Management Regulations in Title 20 New Mexico Administrative Code, Chapter 4, Part 1, (20 NMAC 4.1) Subparts I through VI, Subpart VIII, and Subpart IX, authorize the use of acceptable knowledge as a method which can be used in appropriate circumstances by waste generators, or treatment, storage, or disposal facilities to make hazardous waste determinations. Acceptable knowledge is defined in *Waste Analysis: EPA Guidance Manual for Facilities That Generate, Treat, Store and Dispose of Hazardous Waste* (EPA 1994) to include process knowledge, waste analysis data, and facility records of analysis performed before the effective date of RCRA regulations. Acceptable knowledge, as an alternative to sampling and analysis, can be used to meet all or part of the waste characterization requirements under the RCRA (EPA 1994).

Acceptable knowledge is one of a number of techniques used to characterize transuranic (TRU) waste. It is used in conjunction with radiography, headspace gas sampling and analysis, and solidified waste sampling and analysis to meet the requirements of the Waste Analysis Plan (WAP). Acceptable knowledge is used in TRU waste characterization activities in three ways:

- To delineate TRU waste streams
- To determine if TRU debris wastes exhibit a toxicity characteristic (40 CFR §261.24)
- To determine if TRU wastes are listed (40 CFR §261.31)

Acceptable knowledge is confirmed using nondestructive techniques and sampling and analysis.

### C9-2 Reasons for Using of Acceptable Knowledge

The Environmental Protection Agency (EPA) (1994) describes four situations in which the use of acceptable knowledge is appropriate. Three of these situations are applicable to TRU waste characterization and are discussed below.

#### Waste Generating Processes are Well Documented

Waste generating processes from nonspecific sources are included in RCRA regulations at 40 CFR §261.31. The waste generated from these processes are known to contain certain hazardous constituents. Generators of these wastes are not required to perform sampling and analysis of their wastes; knowledge of the process used to generate the waste is required to make an accurate hazardous waste determination.



1 TRU wastes from nonspecific sources are spent solvent-contaminated wastes (i.e., EPA  
2 hazardous waste codes F001 through F005). Acceptable knowledge must be used to determine  
3 if these wastes meet the requirements for listing as a spent solvent. To be listed, it must be  
4 known if the solvent compound was used for its solvent properties, that is, to solubilize or  
5 mobilize other constituents. Examples of solvent use are degreasing, cleaning, use as diluents,  
6 extractants, and reaction and synthesis media. In addition, the solvent mixture must have  
7 originally contained more than 10 percent by volume of the solvents included under the F001  
8 through F005 listings.

9 Because listed wastes (i.e., wastes from nonspecific sources under 40 CFR §261.31) are well  
10 defined and are based on knowledge of the materials and processes that generate the waste,  
11 sampling, and analysis is not required to make a hazardous waste determination. Generators  
12 of TRU waste that meets the criteria included in 40 CFR §261.31 (F-listed wastes) must use  
13 acceptable knowledge to characterize their TRU waste.

#### 14 Health and Safety Risks

15 TRU waste presents serious health and safety risks to waste characterization personnel.  
16 Extensive measures are taken by the Department of Energy (DOE) to package this waste so that  
17 the potential for human exposure to ionizing radiation is limited. Packaging measures include  
18 multiple layers of plastic and shielding to reduce the potential exposure of alpha and gamma  
19 radiation, respectively. The breaching of confinement layers or increasing the potential for  
20 respirable particulates by size reduction (e.g., shredding or grinding) of TRU debris waste  
21 increases the health and safety risks associated with TRU waste management. The design of  
22 a data collection program that includes the use of acceptable knowledge allows characterization  
23 of TRU waste, while limiting radiation exposure to personnel and the environment.

#### 24 Physical Nature of the Waste

25 The TRU waste characterization requirements have been established using the EPA's Data  
26 Quality Objectives (DQO) process. The DOE employed this process to establish a defensible,  
27 cost-effective program to generate data for regulatory decision making. To make defensible  
28 decisions based on sampling and analytical data, a representative sample must be collected.  
29 The physical nature of TRU debris wastes (e.g., glass, metal, or combustible waste forms) does  
30 not lend itself to the collection and analysis of a representative sample.

31 To collect a representative sample of TRU debris waste, size reduction and compositing, along  
32 with extensive handling of the waste, would be required. During the process of size reduction,  
33 target volatile organic compounds (VOC) would be lost so that the final sample would not be  
34 representative of the initial waste. Size reduction of alpha-contaminated materials is in direct  
35 conflict with DOE's health and safety protocols for the management of TRU waste. Because the  
36 greatest risk of exposure to alpha-radiation is by inhalation, TRU waste packaging and handling  
37 operations are designed to minimize the potential for airborne particulates. Size reduction of  
38 TRU waste would increase the quantities of respirable particulates and increase the potential for  
39 release of radionuclides and human exposure. Because of the limited use of data obtained from  
40 sampling TRU debris waste, the increase in potential human exposure and the costs associated  
41 with facilities to sample and contain TRU waste is not justified.



1 The EPA (1994) suggests that swiping the surface of waste materials (e.g., metals or glass) may  
2 be an alternative to sampling debris wastes. The DQO process requires that the end use of the  
3 data be considered in developing sampling and analytical protocols. Swiping the surfaces of  
4 TRU waste materials would not provide a representative sample that the DOE could use to make  
5 hazardous waste determinations. For example, if VOCs are not detected on the surface of  
6 materials, the DOE could not classify the waste as nonhazardous. Many TRU debris wastes  
7 contain spent solvents, which are listed according to how the wastes were generated and not  
8 whether they contain a listed constituent. In addition, the DOE cannot determine if a waste  
9 exhibits a toxicity characteristic based on the concentration of a particular constituent present  
10 on surfaces of materials. Therefore, collecting surface swipes is not justified in light of the  
11 potential increased exposure to radiation. Collection and preparation of surface swipe samples  
12 would not be representative of the waste for the purpose of waste characterization, would be  
13 very costly, and would increase the potential exposure of personnel to radiation.

#### 14 C9-3 Acceptable Knowledge Documentation

15 It is the responsibility of each DOE TRU waste generator/storage site to develop a logical  
16 sequence of acceptable knowledge information that progresses from general facility information  
17 (TRU Waste Management Program Information) to more detailed waste-specific information  
18 (TRU Waste Stream Information). The consistent presentation of acceptable knowledge  
19 documentation among DOE sites in auditable records will allow Waste Isolation Pilot Plant  
20 (WIPP) personnel to verify the completeness and adequacy of acceptable knowledge for TRU  
21 waste characterization during the audit process.  
22

23 The following sections include the minimum information that each site must have to characterize  
24 TRU waste using acceptable knowledge. Because waste generating processes are site-specific,  
25 DOE sites may supplement the minimum required acceptable knowledge records with additional  
26 information (Supplemental Acceptable Knowledge Documentation). If the mandatory information  
27 is not available for a particular waste, then this waste will not be accepted for disposal at the  
28 WIPP facility based on acceptable knowledge alone. Sites may submit additional sampling and  
29 analytical data that may provide the required waste characterization information.

#### 30 TRU Waste Management Program Information

31 An overview of the TRU waste program provides an understanding of TRU waste management  
32 operations at each site. This overview, which will establish the basis for more detailed TRU  
33 waste stream information, must reveal an overall perspective of TRU waste management  
34 operations and serve as a guide to the waste stream-specific information.

35 TRU waste management program information must clearly define waste categorization schemes  
36 and terminology, provide a breakdown of the types and quantities of TRU waste that are  
37 generated and stored at the site, and describe how waste is tracked and managed at the site,  
38 including historical and current operations. Information related to TRU waste certification  
39 procedures and the types of documentation (e.g., waste profile forms) used to summarize  
40 acceptable knowledge must also be provided. The following information must be included as  
41 part of the acceptable knowledge record:

- 1 • Map of the site with the areas and facilities involved in TRU waste generation,  
2 treatment, and storage identified
- 3 • Facility mission description as related to TRU waste generation and management  
4 (e.g., nuclear weapons research may involve metallurgy, radiochemistry, and  
5 nuclear physics operations that result in specific waste streams)
- 6 • Description of the operations that generate TRU waste at the site (e.g., plutonium  
7 recovery, weapons design, or weapons fabrication)
- 8 • Waste identification or categorization schemes used at the facility (e.g., item  
9 description codes, content codes)
- 10 • Types and quantities of TRU waste generated, including historical generation  
11 through future projections
- 12
- 13 • Correlation of waste streams generated from the same building and process, as  
14 appropriate (e.g., sludge, combustibles, metals, and glass)
- 15 • Waste certification procedures for retrievably stored and newly generated wastes  
16 to be sent to the WIPP facility

17 TRU Waste Stream Information

18 For each TRU waste stream, sites must compile all process information and data that support  
19 the acceptable knowledge used to characterize that waste stream. The type and quantity of  
20 supporting documentation will vary by waste stream, depending on the process generating the  
21 waste and site-specific requirements imposed by DOE or state agencies. At a minimum, the  
22 waste process information must include:

- 23 • Area(s) and building(s) from which the waste stream was or is generated
- 24 • Waste stream volume and time period of generation (e.g., 100 standard waste  
25 boxes of retrievable stored waste generated from June 1977 through December  
26 1977)
- 27 • Waste generating process described for each building (e.g., batch waste stream  
28 generated during decommissioning operations of glove boxes)
- 29 • Process flow diagrams (e.g., a diagram illustrating glove boxes from a specific  
30 building to a size reduction facility to a container storage area)
- 31 • Material inputs or other information that identifies the chemical and radionuclide  
32 content of the waste stream and the physical waste form (e.g., glove box  
33 materials, chemicals and radionuclides handled during glove box operations, if  
34 applicable)

1 A summary must identify all sources of information. The basis and rationale for defining each  
2 waste stream based on the parameters of interest must be clearly summarized and traceable  
3 to referenced documents. Assumptions made in defining each waste stream also must be  
4 identified and justified.

5 Supplemental Acceptable Knowledge Documentation

6 Examples of additional documentation that may be used for acceptable knowledge include, but  
7 are not limited to, the following:

- 8 • Process design documents (e.g., Title II Design)
- 9 • Standard operating procedures that may include a list of raw materials or  
10 reagents, a description of the process or experiment generating the waste, and  
11 a description of wastes generated and how the wastes are managed at the point  
12 of generation
- 13 • Preliminary and final safety analysis reports and technical safety requirements
- 14 • Waste packaging logs
- 15 • Test plans or research project reports that describe reagents and other raw  
16 materials used in experiments
- 17 • Site databases (e.g., chemical inventory database for Superfund Amendments  
18 and Reauthorization Act Title III requirements)
- 19 • Information from site personnel (e.g., documented interviews)
- 20 • Standard industry documents (e.g., vendor information)
- 21 • Previous analytical data relevant to the waste stream, including results from  
22 fingerprint analyses, spot checks, or routine verification sampling
- 23 • Material Safety Data Sheets, product labels, or other product package information
- 24 • Sampling and analysis data from comparable or surrogate waste streams (e.g.,  
25 equivalent *nonradioactive materials*)
- 26 • Laboratory notebooks that detail the research processes and raw materials used  
27 in an experiment

28 The specific, relevant information must be identified and justification provided for its use (e.g.,  
29 identification of a toxicity characteristic). Supplemental documentation is not required but may  
30 be used, if available, to further document the rationale for the hazardous waste designations.  
31 Similar to required information, if discrepancies exist between supplemental information and the  
32 required documentation, then sites must include all potential hazardous waste codes to the  
33 subject waste stream. For example, if personnel interviews indicate that lead was part of the



1 input materials, then D008 must be designated in spite of the fact that no records of the use of  
2 lead exist in the required documentation. Sites must prioritize the sources of information used  
3 to assign hazardous waste codes in terms of accuracy of the information. Published documents  
4 and controlled databases are considered the most reliable information. Second priority will be  
5 given to unpublished data, internal procedures, and notes. Correspondence, such as  
6 memoranda, letters, telephone logs, and interviews are considered the least defensible. The  
7 pages from large documents, such as safety analysis reports, must be flagged with the relevant  
8 information noted.

#### 9 C9-4 Acceptable Knowledge Process

10 Consistency among DOE sites in using acceptable knowledge information to characterize TRU  
11 waste involves a three phase process: 1) compiling the minimum acceptable knowledge  
12 documentation in an auditable record, 2) confirming acceptable knowledge information using  
13 radiography and headspace-gas sampling and analysis and solidified waste sampling, and 3)  
14 auditing acceptable knowledge records. This section describes each phase of the process and  
15 specifies the procedures that sites must develop to implement the requirements for using  
16 acceptable knowledge.

17 Site personnel responsible for compiling, assessing, and resolving discrepancies associated with  
18 acceptable knowledge must have the following minimum qualifications and training:

- 19 • WIPP WAP, Waste Acceptance Criteria, and Quality Assurance Program Plan  
20 (QAPP) Requirements
- 21 • State and Federal RCRA regulations associated with solid and hazardous waste  
22 determinations
- 23 • Nonconformance process, including discrepancy resolution and reporting
- 24 • Site-specific procedures associated with waste characterization using acceptable  
25 knowledge

#### 26 Assembling an Acceptable Knowledge Record

27 Figure C9-1 provides an overview of the process for assembling acceptable knowledge  
28 documentation into an auditable record. The first step is to assemble all of the mandatory  
29 acceptable knowledge information and any supplemental information regarding the materials and  
30 processes that generate a specific waste stream. DOE sites must ensure the following criteria  
31 are met in establishing acceptable knowledge records:

- 32 • Acceptable knowledge information must be compiled in an auditable record,  
33 including a road map for all applicable information.
- 34 • The overview of the facility and TRU waste management operations in the context  
35 of the facility's mission must be correlated to specific waste stream information.



- 1           •       Correlations between waste streams, with regard to time of generation, waste  
2                   generating processes, and site-specific facilities must be clearly described.
- 3           •       A reference list must be provided that identifies documents, databases, Quality  
4                   Assurance protocols, and other sources of information that support the acceptable  
5                   knowledge information.

6       Container inventories for TRU waste currently in retrievable storage are then defined as waste  
7       streams by correlating the container identification to the mandatory acceptable knowledge  
8       information. For newly generated wastes, the rate and quantity of waste to be generated must  
9       be defined and procedures implemented to make hazardous waste determinations using  
10       acceptable knowledge prior to packaging the waste.

11       For all TRU wastes, sites must develop written procedures that describe how RCRA hazardous  
12       waste codes are assigned using acceptable knowledge information and how unacceptable  
13       wastes (e.g., reactive, ignitable, and corrosive RCRA-regulated hazardous wastes) are identified  
14       and segregated from certifiable TRU waste populations. Site-specific procedures must address  
15       the following elements:  
16

- 17           •       Sites must prepare a written procedure outlining the specific methodology used  
18                   to assemble acceptable knowledge records, including the origin of the  
19                   documentation, how it will be used, and any limitations associated with the  
20                   information (e.g., identify the purpose and scope of a study that included limited  
21                   sampling and analysis data).
- 22           •       To compile the required acceptable knowledge record, sites must assemble and  
23                   evaluate available documentation in the following priority: a) relevant information  
24                   from published documents and controlled databases, b) unpublished data,  
25                   c) internal procedures and notes, such as log books, and d) correspondence,  
26                   such as memoranda, letters, telephone logs, and interviews.
- 27           •       Sites must comply with Section C9-4 to identify hazardous wastes and assign the  
28                   appropriate hazardous waste codes to each waste stream.
- 29           •       Sites must describe the waste certification program and procedures that are used  
30                   to ensure unacceptable wastes are identified and segregated.
- 31           •       Sites must develop and implement a procedure(s) for the confirmation of  
32                   acceptable knowledge in accordance with Section C9-4.
- 33           •       Sites must provide a cross reference to the applicable waste summary category  
34                   group (i.e., S3000, S4000, and S5000) to verify all of the required confirmation  
35                   data has been evaluated and the proper hazardous waste codes have been  
36                   assigned.

37       The waste certification procedure(s) must describe the administrative controls used by the site  
38       to ensure that nonconforming items are documented and managed in accordance with site-

1 specific certification plans. The following minimum elements must be addressed in site-specific  
2 documentation associated with administrative controls:

- 3 • Identify the organization(s) responsible for compliance with administrative controls.
- 4 • Identify the oversight procedures and frequency of actions to verify compliance  
5 with administrative controls.
- 6 • Develop on-the-job training specific to administrative control procedures.
- 7 • Ensure that personnel may stop work if noncompliance with administrative  
8 controls is identified.
- 9 • Develop a nonconformance process that complies with the requirements in  
10 Section C8-13 of the WAP to document and establish corrective actions.
- 11 • As part of the corrective action process, assess the potential time frame of the  
12 noncompliance, the potentially affected waste population(s), and the  
13 reassessment and recertification of those wastes.

14 Sites must develop procedures that describe how acceptable knowledge information is evaluated  
15 and any discrepancies in documentation resolved. If different sources of information indicate  
16 different hazardous wastes are present, then sites must include all sources of information in its  
17 records and conservatively assign all potential hazardous waste codes. Discrepancies in  
18 acceptable knowledge documentation must be resolved by including all available information in  
19 the auditable records and assigning all hazardous waste codes indicated by all of these records  
20 to the subject waste. For example, if one record indicates that solvents were not part of a  
21 process, while another record indicates that 1,1,1-trichloroethane was used for cleaning parts,  
22 then the F001 hazardous waste code must be applied to the waste. No judgements may be  
23 made regarding the quality of the required documentation, and the assignment of hazardous  
24 waste codes must be tracked to all required documentation.

25 Sites must compile adequate documentation to demonstrate consistency in assigning hazardous  
26 waste codes and to defend and justify the use of acceptable knowledge in making hazardous  
27 waste determinations to independent auditors. The following are minimum baseline  
28 requirements/standards that site-specific procedures must include to ensure comparable and  
29 consistent identification of hazardous waste:

- 30 • Compile all of the required information in an auditable record.
- 31 • Review the required information to determine if the waste is listed under 40 CFR  
32 Part 261, Subpart D. Assign all listed hazardous waste codes.
- 33 • Review the required information to determine if the waste may contain hazardous  
34 constituents included in the toxicity characteristics specified in 40 CFR Part 261,  
35 Subpart C. If a toxicity characteristic contaminant is identified and is not included  
36 as a listed waste, assign the toxicity characteristic code. Unless data is available  
37 from the sampling and analysis of a representative sample of the waste stream





1 that demonstrates that the concentration of the constituent in the waste is less  
2 than the toxicity characteristic regulatory level, no judgement may be made  
3 regarding the concentration of the constituent. When analytical data is not  
4 available, the toxicity characteristic hazardous waste code for the identified  
5 hazardous constituent must be applied to the waste stream.

6 In the case of discrepancies in information, no judgement may be made regarding  
7 the quality of the information. Sites must ensure that all potential hazardous  
8 waste codes are assigned to the waste stream.

### 9 Confirmation of Acceptable Knowledge Information

10 Acceptable knowledge includes information regarding the physical form of the waste, the base  
11 materials composing the waste, and the process that generates the waste. Waste  
12 characterization (i.e., radiography, headspace-gas sampling and analysis, and solidified waste  
13 sampling and analysis) will be used to confirm acceptable knowledge information. Figure C-2  
14 illustrates the process sites will use to confirm acceptable knowledge.

15 All retrievably stored waste must be characterized using radiography to confirm the waste matrix  
16 code and certify compliance with the RCRA Waste Analysis Plan. If a site must repackage its  
17 retrievably stored waste, then visual examination of the waste during repackaging is used to  
18 confirm acceptable knowledge information rather than radiography.

19 For newly generated wastes, sites must have written procedures to document the confirmation  
20 of acceptable knowledge information with visual examination prior to or during waste packaging.  
21 The following minimum requirements must be addressed in site-specific procedures: 1) scope  
22 (i.e., waste streams) and purpose, 2) responsible organization(s), 3) administrative process  
23 controls, 4) material inputs to process, 5) process controls and range of operation that affect final  
24 hazardous waste determinations, 6) rate and quantity of the hazardous waste generated, 7) list  
25 of applicable operating procedures relevant to the hazardous waste determination,  
26 8) nonconformance reporting, 9) process knowledge verification sampling (i.e., headspace-gas  
27 sampling and/or solidified waste annual sample), and 10) reporting and records management.

28 Sites must establish procedures for reevaluating acceptable knowledge if radiography or visual  
29 examination results in the assignment of a different waste matrix code [e.g., Plastic/Rubber  
30 (S5310) versus Paper/Cloth (S5330)]. Site procedures must describe how the waste is  
31 reassigned, acceptable knowledge reevaluated, and appropriate hazardous waste codes  
32 assigned.

33 The base materials that compose TRU debris waste (e.g., lead, stainless steel, glass) are well  
34 established, and potential toxicity characteristics can be determined without destructive sampling  
35 and analysis. The waste matrix code is related to the base materials and waste generating  
36 process. In lieu of sampling and analytical data to the contrary, sites must assign the toxicity  
37 characteristic hazardous waste codes based on the presence of the constituent, regardless of  
38 the quantity or concentration. Radiography or visual examination must be used to confirm the  
39 waste matrix code identified using acceptable knowledge. Procedures must describe how  
40 discrepancies in the waste matrix code are recorded and changes to hazardous waste codes  
41 based on material composition are documented, as necessary. If a waste must be assigned to

1 a different waste matrix code based on radiography or visual examination, the following minimum  
2 steps must be taken to reevaluate acceptable knowledge:

- 3 • Review existing information based on the container identification number and  
4 document all differences in hazardous waste code assignments
- 5 • If differences exist in the hazardous waste codes that were assigned, reassess  
6 and document all required acceptable knowledge information (Section C9-3)  
7 associated with the new designation
- 8 • Reassess and document all sampling and analytical data associated with the  
9 waste
- 10 • Verify and document that the reassigned waste matrix code was generated within  
11 the specified time period, area and buildings, waste generating process, and that  
12 the process material inputs are consistent with the waste material parameters  
13 identified during radiography or visual examination



14 Record all changes to acceptable knowledge records

15 If discrepancies exist in the acceptable knowledge information for the reassigned  
16 waste matrix code, complete a nonconformance report (Appendix C8-13),  
17 document the segregation of this container, and define the corrective actions  
18 necessary to fully characterize the waste

19 Finally, radiography and visual examination procedures must include a list of nonconforming  
20 items that the operator must verify are not present in each container of waste (i.e., corrosives,  
21 ignitables, reactives, incompatible waste). Sites must establish and document administrative  
22 controls to ensure that nonconforming items or waste are segregated from certifiable populations.

23 Headspace-gas sampling and analysis must be conducted on all TRU waste to be sent to the  
24 WPP facility. Headspace-gas data will be used to confirm the presence or absence of VOCs  
25 identified using acceptable knowledge.

26 Sites must use acceptable knowledge to identify spent solvents associated with each TRU waste  
27 stream or waste stream lot. Headspace-gas data will be used to confirm acceptable knowledge  
28 concerning the presence or absence of F-listed solvents. Headspace-gas data may be used to  
29 assist in confirming the characterization of waste contaminated with F-listed solvents by the  
30 "mixture rule" (e.g., solvent-contaminated rags mixed with other wastes materials). Sites must  
31 provide documentation to support any determination that organic constituents are associated with  
32 packaging materials or other uses not consistent with solvent use. If the source of the detected  
33 solvents can not be identified, the appropriate spent solvent hazardous waste code will be  
34 conservatively applied to the waste stream.  
35

36 Hazardous wastes associated with S3000 and S4000 waste streams will be verified based on  
37 the results of the total analysis of a representative solidified waste sample. If discrepancies  
38 between the results obtained from solidified waste sampling and analysis and headspace-gas  
39 sampling and analysis exist (i.e., a VOC is detected in the solidified waste but not in the

1 headspace), the solidified waste data will be used to verify acceptable knowledge and assign  
2 hazardous waste codes.

3 Sites must confirm the assignment of spent solvent hazardous waste codes (40 CFR §261.31)  
4 by evaluating the average concentrations of each VOC detected in container headspace gas  
5 and/or solidified waste matrix using the upper 90 percent confidence limit ( $UCL_{90}$ ). The  $UCL_{90}$   
6 for the mean concentration must be compared to the program required quantitation limit (PRQL)  
7 for the constituent. If the  $UCL_{90}$  for the mean concentration exceeds the PRQL, sites must  
8 reevaluate their acceptable knowledge information and determine the potential source of the  
9 constituent.

10 If the source of the constituent is identified as a spent solvent used in the process or is  
11 determined to be the result of mixing a listed waste with a solid waste during waste packaging,  
12 then the site will either: 1) assign the applicable listed hazardous waste code to the entire waste  
13 stream, or 2) segregate the drums containing detectable concentrations of the solvent into a  
14 separate waste stream and assign applicable hazardous waste codes. Each site must  
15 document, justify, and consistently define waste streams and assign hazardous waste codes  
16 based on site-specific permit requirements and other state-enforced agreements.

17 To determine the mean concentration of solvent VOCs, all headspace-gas data and solidified  
18 waste data for a waste stream or waste stream lot (i.e., the portion of the waste stream that is  
19 characterized as a unit) will be used, including data qualified with a 'J' flag (i.e., less than the  
20 PRQL but greater than the method detection limit [MDL]) or qualified with a 'U' flag (i.e.,  
21 undetected). For data qualified with a 'U' flag, sites must use one-half the MDL in calculating  
22 the mean concentration. Because listed wastes are not defined based on concentration, sites  
23 may not remove hazardous waste codes assigned using acceptable knowledge if hazardous  
24 constituents are not detected in the headspace.

25 In many cases, TRU headspace gases and solidified waste matrices contain one or two  
26 constituents (e.g., carbon tetrachloride and 1,1,1-trichloroethane) at concentrations that are  
27 orders of magnitude higher than the other target analytes. In these cases, samples must be  
28 diluted to remain within the instrument calibration range. Sample dilution results in elevated  
29 MDLs. Only the concentrations of detected constituents will be used to calculate the mean for  
30 the purpose of assigning F-listed hazardous waste codes. Because the presence or absence  
31 of F-listed solvents can not be confirmed based on the artificially high MDLs that are caused by  
32 sample dilution, data flagged as 'U' and showing an elevated MDL will not be used in calculating  
33 the mean concentration.

34 Acceptable knowledge documentation provides primarily qualitative information that cannot be  
35 assessed according to specific data quality goals that are used for analytical techniques. Quality  
36 assurance objectives for analytical results are described in terms of precision, accuracy,  
37 completeness, comparability, and representativeness. Analytical results will be used to confirm  
38 the characterization of wastes based on acceptable knowledge (Section C9-4).

39 The data quality objectives for sampling and analysis techniques are provided in Appendix C8.  
40 To ensure that the acceptable knowledge process is consistently applied, sites must comply with  
41 the following data quality requirements for acceptable knowledge documentation:

- 1           •       Precision - Precision is the agreement among a set of replicate measurements  
2                    without assumption of the knowledge of a true value. The qualitative  
3                    determinations, such as compiling and assessing acceptable knowledge  
4                    documentation, do not lend themselves to statistical evaluations of precision.
  
- 5           •       Accuracy - Accuracy is the degree of agreement between an observed sample  
6                    result and the true value. The percentage of waste containers which require  
7                    reassignment to a new waste matrix code and/or designation of different  
8                    hazardous waste codes based on the reevaluation of acceptable knowledge and  
9                    sampling and analysis data will be reported as a measure of acceptable  
10                  knowledge accuracy.
  
- 11          •       Completeness - Completeness is an assessment of the number of waste streams  
12                  or number of samples collected to the number of samples determined to be  
13                  useable through the data validation process. The acceptable knowledge record  
14                  must contain 100 percent of the required information (Section C9-3). The  
15                  useability of the acceptable knowledge information will be assessed for  
16                  completeness during audits.
  
- 17          •       Comparability - Data are considered comparable when one set of data can be  
18                  compared to another set of data. Comparability is ensured through sites meeting  
19                  the training requirements and complying with the minimum standards outlined for  
20                  procedures that are used to implement the acceptable knowledge process. All  
21                  sites must assign hazardous waste codes in accordance with Section C9-4 and  
22                  provide this information regarding its waste to other sites who store or generate  
23                  a similar waste stream.
  
- 24          •       Representativeness - Representativeness expresses the degree to which sample  
25                  data accurately and precisely represent characteristics of a population.  
26                  Representativeness is a qualitative parameter that will be satisfied by ensuring  
27                  that the process of obtaining, evaluating, and documenting acceptable knowledge  
28                  information is performed in accordance with the minimum standards established  
29                  in Section C9-4. Sites also must assess and document the limitations of the  
30                  acceptable knowledge information used to assign hazardous waste codes (e.g.,  
31                  purpose and scope of information, date of publication, type and extent to which  
32                  waste parameters are addressed and limitations of information in identifying  
33                  hazardous wastes).

34       Each site must address quality control by tracking its performance with regard to the use of  
35       acceptable knowledge by: 1) assessing the frequency of inconsistencies among information, and  
36       2) documenting the results of acceptable knowledge confirmation through radiography,  
37       headspace-gas analyses, and solidified waste analyses. In addition, the acceptable knowledge  
38       process and waste stream documentation must be evaluated through internal assessments by  
39       quality assurance organizations and assessments by auditors external to the organization (i.e.,  
40       DOE/Carlsbad Area Office (CAO)).



1 DOE Site Audits of Acceptable Knowledge

2 The DOE/CAO will conduct an initial audit of each generator/storage site prior to certifying the  
3 site for shipment of TRU waste to the WIPP facility. This initial audit will establish an approved  
4 baseline that will be reassessed annually. The QAPP/RCRA portion of these audits will verify  
5 compliance with the requirements specified in the WAP and QAPP. The QAPP/RCRA audits will  
6 be used to ensure the consistent compilation, application, and interpretation of acceptable  
7 knowledge information throughout the DOE complex and to evaluate the completeness and  
8 defensibility of site-specific acceptable knowledge documentation related to hazardous waste  
9 determinations. Appendix C11 gives a description of the overall audit program and a sample  
10 checklist. Figure C9-3 includes the primary steps associated with the audit process of  
11 acceptable knowledge.

12 Audit plans will identify the scope of the audit, requirements to be assessed, participating  
13 personnel, activities to be audited, organizations to be notified, applicable documents, and  
14 schedule. Audits will be performed in accordance with written procedures and checklists. The  
15 audit checklists will include specific items associated with the compilation and evaluation of the  
16 required acceptable knowledge information.

17 Audit checklists must include all of the following elements for review during the audit:

- 18 • Documentation of the process used to compile, evaluate, and record acceptable  
19 knowledge is available and implemented;
- 20 • Personnel qualifications and training are documented;
- 21 • All of the required acceptable knowledge documentation specified in Section C9-3  
22 has been compiled in an auditable record;
- 23 • A procedure exists for assigning hazardous waste codes to waste streams in  
24 accordance with Section C9-4;
- 25 • A procedure exists for resolving inconsistencies in acceptable knowledge  
26 documentation in accordance with Section C9-4;
- 27 • A procedure exists for confirming acceptable knowledge information through:  
28 a) radiography or visual examination, b) headspace gas sampling and analysis,  
29 and c) solidified waste sampling in accordance with Section C9-4; and
- 30 • Results of other audits of the TRU waste characterization programs at the site are  
31 available in site records.

32 Members of the audit team will be knowledgeable regarding the required acceptable knowledge  
33 information, RCRA regulations and EPA guidance regarding the use of acceptable knowledge  
34 for waste characterization, RCRA hazardous waste determinations, and the WAP and QAPP  
35 requirements. Audit team members will be independent of all TRU waste management  
36 operations at the site being audited.

1 Auditors will evaluate all documents associated with the evaluation of the acceptable knowledge  
2 documentation for at least one debris waste stream and one solidified waste stream during the  
3 audit. For these waste streams, auditors will review all procedures and associated processes  
4 developed by the site for documenting the process of compiling acceptable knowledge  
5 documentation; correlating information to specific waste inventories; assigning hazardous waste  
6 codes; and identifying, resolving, and documenting discrepancies in acceptable knowledge  
7 records. The adequacy of acceptable knowledge procedures and processes will be assessed  
8 and any deficiencies in procedures documented in the audit report.

9 Auditors will review the acceptable knowledge documentation for selected waste streams for  
10 logic, completeness, and defensibility. The criteria that will be used by auditors to evaluate the  
11 logic and defensibility of the acceptable knowledge documentation include completeness and  
12 traceability of the information, consistency of application of information, clarity of presentation,  
13 degree of compliance with Appendix C9 of the WAP with regard to acceptable knowledge  
14 confirmation data, nonconformance procedures, and oversight procedures. Auditors will evaluate  
15 compliance with written site procedures for developing the acceptable knowledge record. A  
16 completeness review will evaluate the availability of the minimum required TRU waste  
17 management and TRU waste stream information (Section C9-3). Records will be reviewed for  
18 correlation to specific waste streams and the basis for making hazardous waste determinations.  
19 Auditors will verify that sites include all required information and conservatively include all  
20 potential hazardous waste codes indicated by the acceptable knowledge records. All deficiencies  
21 in the acceptable knowledge documentation will be included in the audit report.

22 Auditors will verify and document that sites use administrative controls and follow written  
23 procedures to make hazardous waste determinations for newly-generated and retrievably stored  
24 wastes. Auditors will review procedures used by the sites to confirm acceptable knowledge  
25 information using radiography or visual examination and headspace gas sampling and analysis  
26 and solidified waste sampling and analysis. Procedures to document changes in acceptable  
27 knowledge documentation and hazardous waste code assignments to specific waste streams  
28 also will be evaluated for compliance with the WAP.

29 After the audit is complete, the DOE/CAO will provide the site with preliminary results at a close-  
30 out meeting. The DOE/CAO will prepare a final audit report that includes all observations and  
31 findings identified during the audit. Sites must respond to all audit findings and identify corrective  
32 actions. Audit results will be available at DOE/CAO for review by regulatory agencies, and  
33 copies will be provided upon request. If acceptable knowledge procedures do not exist, the  
34 minimum required information is not available, or findings of noncompliance are identified  
35 associated with hazardous waste determinations, the DOE/CAO will not grant the site waste  
36 characterization and certification authority for the subject waste. Waste stream characterization  
37 and certification authority may be revoked or suspended if findings during subsequent annual  
38 audits indicate a lack of compliance with approved acceptable knowledge procedures. Waste  
39 characterization and certification authority will not be reinstated until the site demonstrates all  
40 corrective actions have been implemented and the program is reassessed by the DOE/CAO.

41 The National TRU Program disseminates information regarding TRU waste characterization  
42 requirements and program status through the TRU Waste Characterization Interface Working  
43 Group. Sites use the CAO electronic bulletin board to disseminate information to other generator  
44 sites regarding TRU waste streams, RCRA compliance, and operational and programmatic

1 issues, methods development, and waste characterization information, including the application  
2 of acceptable knowledge. WIPP personnel are provided the required waste characterization  
3 information prior to waste acceptance at WIPP and also will conduct audits at least annually.  
4 WIPP will maintain an operating record for review during regulatory agency audits. Regulatory  
5 agencies may also review information during generator site audits. The NMED will be notified  
6 regarding any site's failure to implement corrective actions associated with hazardous waste  
7 determinations.

#### 8 C9-5 Confirmation of Acceptable Knowledge

9 Prior to notifying a site that a waste stream can be shipped and accepted at the WIPP facility,  
10 the DOE/CAO will review the Waste Stream Profile Forms and associated data packages to  
11 ensure that radiography, and headspace-gas data confirm hazardous waste determinations made  
12 using acceptable knowledge. Sites must provide all of the required data associated with waste  
13 stream characterization, including radiography or visual examination results, headspace gas  
14 sampling and analysis, and solidified waste sampling and analysis. In addition, sites will  
15 designate the assigned hazardous waste codes for the waste stream on the waste profile form.  
16 The data packages will be evaluated as illustrated in Figure C9-2 and compared to the  
17 hazardous waste codes specified on the waste profile form. The DOE/CAO will review  
18 information provided by the sites to ensure that changes to hazardous waste codes are identified  
19 and justified based on data and that hazardous waste codes are included in the Part A of the  
20 WIPP permit application. As part of the reconciliation of DQOs (Appendix C8, Section C8-11),  
21 sites are required to track and report changes to hazardous waste determinations. If data  
22 consistently indicates discrepancies with acceptable knowledge information, the DOE/CAO will  
23 require sites to increase sampling, reassess the materials and processes that generate the  
24 waste, and resubmit waste stream profile information. Until discrepancies are resolved, shipment  
25 of the waste stream to the WIPP will be prohibited. Consistent nonconformances by a site in  
26 implementing and documenting WAP and QAPP requirements will result in the termination of a  
27 site's waste characterization and waste certification authority.

28 Any drum with unresolved discrepancies associated with hazardous waste determinations will  
29 not be shipped to the WIPP facility until the discrepancies are resolved. Sites must reassess the  
30 materials and processes that generate the waste, including headspace-gas sampling and  
31 analysis, radiography or visual examination, and solidified waste sampling and analysis. All  
32 shipments of the subject waste stream will cease until the corrective action(s), as necessary,  
33 have been implemented and the discrepancy resolved. The DOE/CAO will notify the New Mexico  
34 Environment Department (NMED) when the certification status of a waste stream at a site is  
35 revoked. If the site does not comply with the corrective actions associated with the hazardous  
36 waste determination, which are specified during the nonconformance process, the DOE/CAO will  
37 notify the NMED prior to accepting the subject waste at the WIPP facility.

#### 38 C9-6 Summary

39 Acceptable knowledge is used in conjunction with other waste characterization techniques to  
40 delineate waste streams, identify listed wastes from nonspecific and specific sources in  
41 accordance with 40 CFR §261.31, and determine the toxicity characteristics associated with TRU  
42 debris wastes. Acceptable knowledge is a key component in properly making hazardous waste  
43 determinations under RCRA. The physical form and the associated increased health and safety

1 risks associated with obtaining a representative sample of TRU debris wastes, clearly justify the  
2 use of acceptable knowledge to make hazardous waste determinations. Acceptable knowledge  
3 information is confirmed using nondestructive techniques and sampling and analysis.

4 The proper assignment of listed hazardous waste codes relies on knowledge of the materials and  
5 processes that generated the waste and not on the concentration of constituents. Nuclear  
6 weapons production resulted in a variety of wastes contaminated with spent solvents used for  
7 cleaning and degreasing (i.e., hazardous waste codes F001-F005). Acceptable knowledge  
8 documentation must be used to identify these TRU wastes.

9 To ensure consistency in the use and interpretation of acceptable knowledge information, sites  
10 must compile the minimum required information (Section C9-3) in an auditable record. Sites  
11 must develop and implement written procedures that describe the compilation, use, and  
12 confirmation of acceptable knowledge. In addition, sites must demonstrate through compliance  
13 with written procedures that discrepancies in information will be documented and that hazardous  
14 waste codes will be conservatively applied.

15 The DOE/CAO will audit DOE sites to initially grant TRU waste certification authority to each site.  
16 The DOE/CAO will conduct audits at least annually thereafter to verify compliance with approved  
17 plans and procedures. Sites will implement corrective action plans that address all audit  
18 findings. Waste stream characterization and certification authority will be revoked if trends of  
19 consistent noncompliance with the WAP and QAPP are identified by the DOE/CAO at a site.

20 The DOE/CAO will review waste stream profile forms and associated data packages to ensure  
21 that radiography and headspace gas data confirm acceptable knowledge and that the correct  
22 hazardous waste codes have been assigned to each waste stream. If complete and adequate  
23 information is not provided by the generator regarding the hazardous waste determinations, then  
24 the waste will not be authorized for shipment to and disposal at the WPP facility.



**FIGURES**

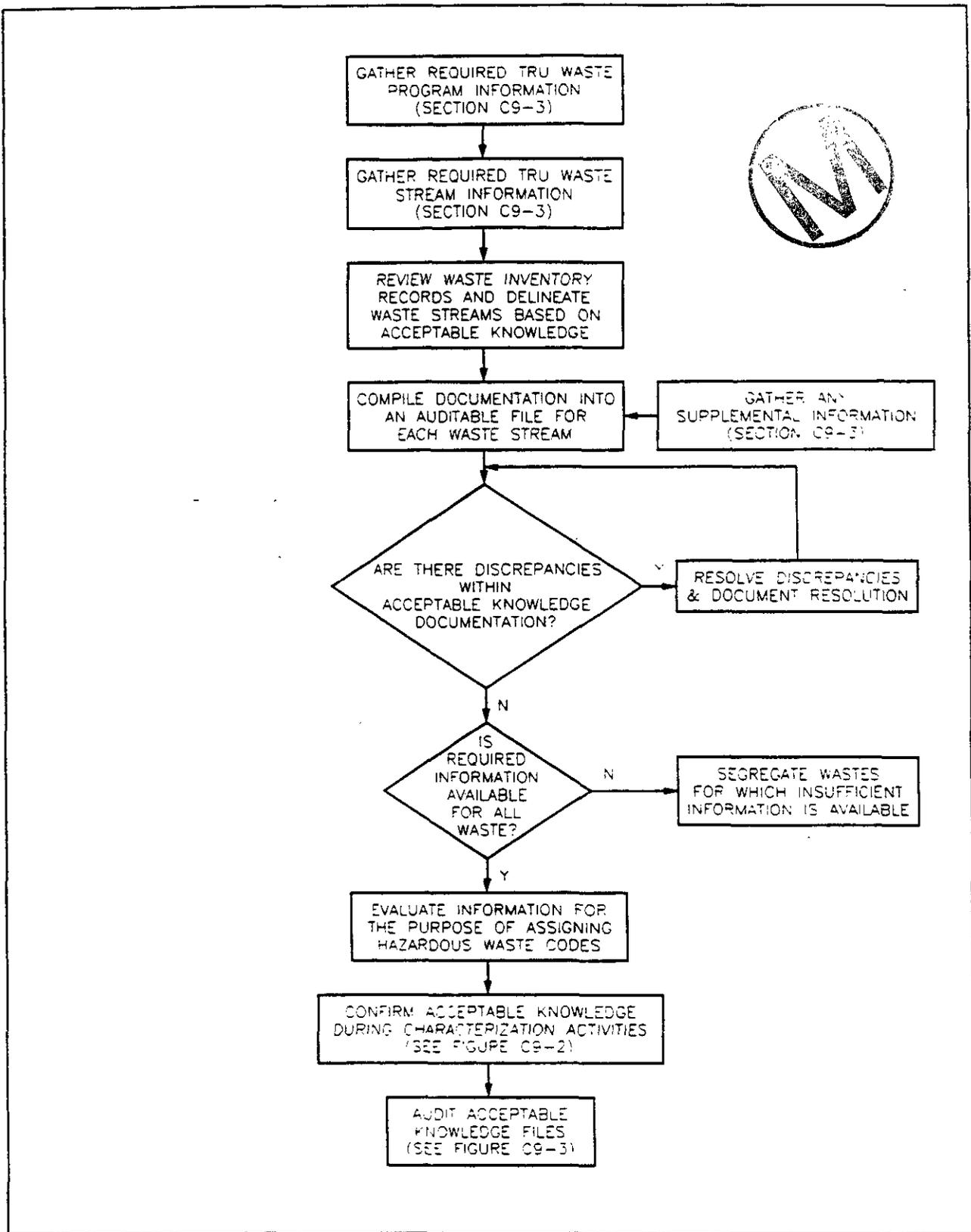


Figure C9-1  
Compilation of Acceptable Knowledge Documentation

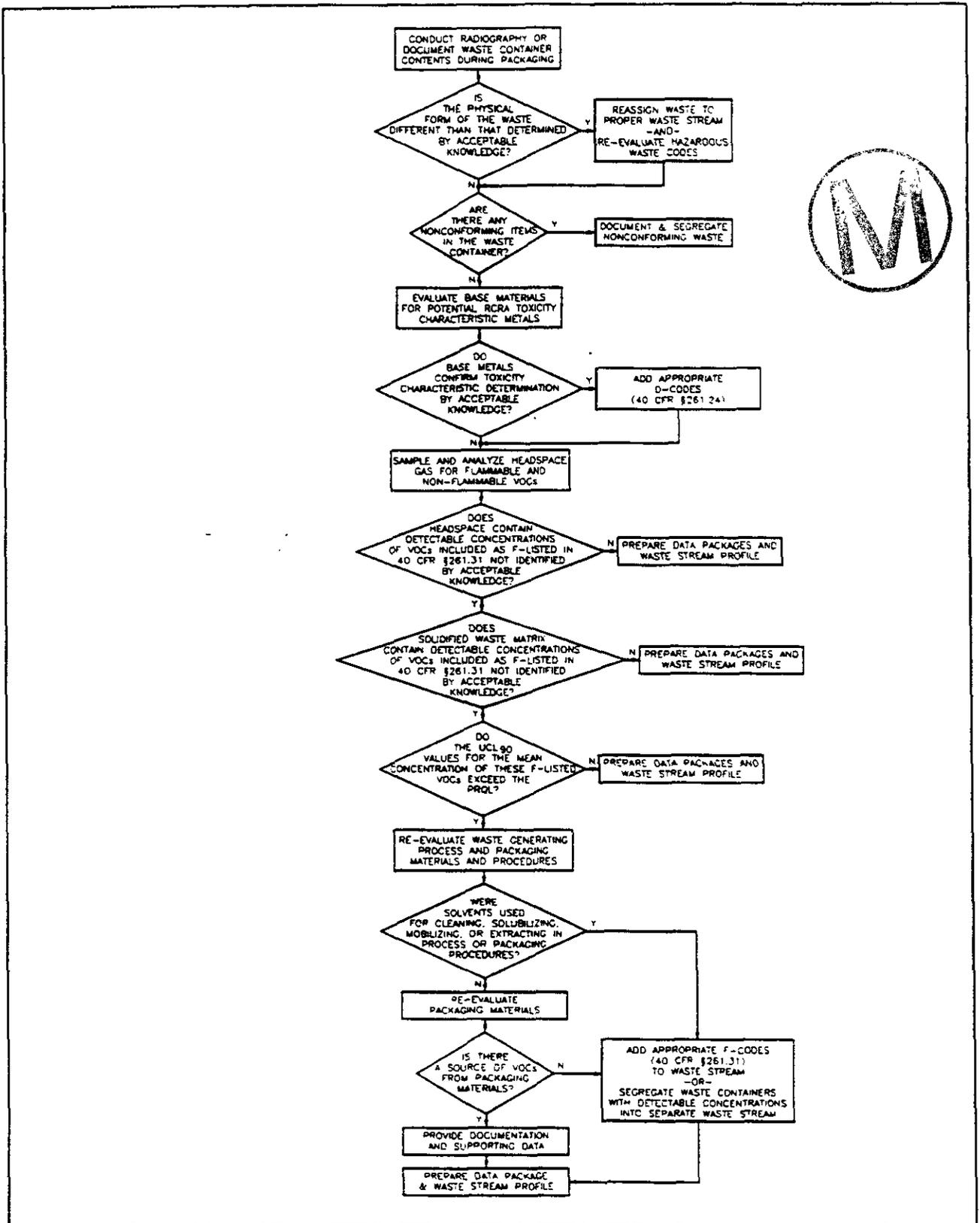


Figure C9-2  
Confirmation of Acceptable Knowledge

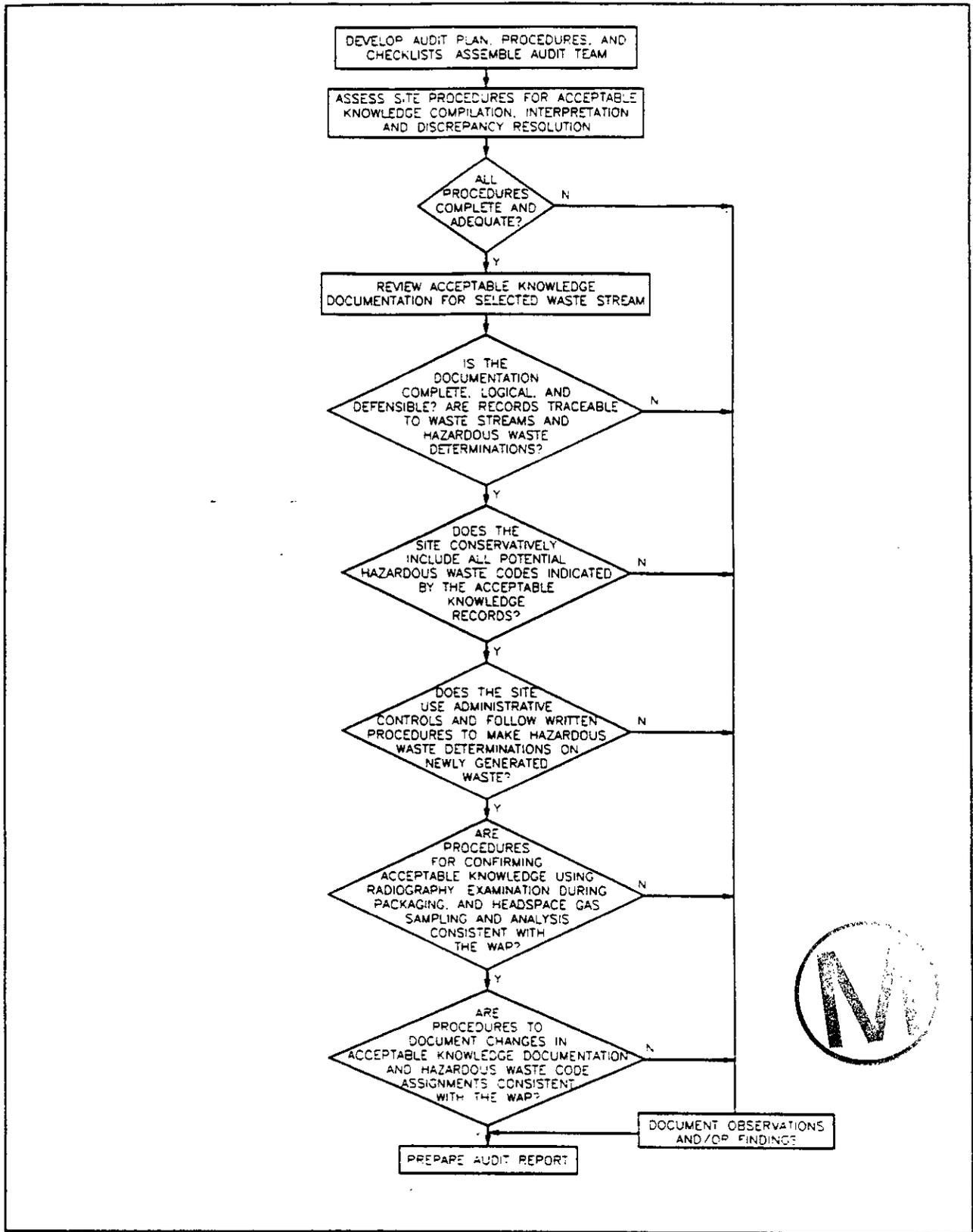


Figure C9-3  
Acceptable Knowledge Auditing