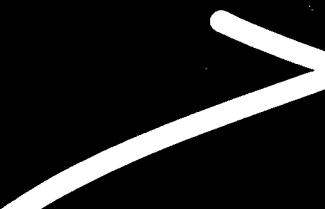
Publications Desktop Guide

Survival



MASTER

UMTRA/TAC
June 1995

DISCLAIMER

DISCLAIMER

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LIST OF ACRONYMS

Acronym	Definition
APM	assistant project manager
DAD	detailed activity description
DID	deliverable item description
DOE	U.S. Department of Energy
DOE/AL	U.S. Department of Energy/Albuquerque Operations
DOE/HQS	U.S. Department of Energy/Headquarters
LAN	local area network
NRC	Nuclear Regulatory Commission
OSTI	Office of Scientific and Technical Information
PDM	Publications Department Manager
QA	quality assurance
SOP	standard operating procedure
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action
UPDCC	UMTRA Project Document Control Center

1.0 INTRODUCTION

1.1 PURPOSE OF THE DESKTOP SURVIVAL GUIDE

This guide has been prepared to document and simplify the writing, reviewing, and production process for the Uranium Mill Tailings Remedial Action (UMTRA) Project Technical Assistance Contractor (TAC) staff and to provide specific answers concerning the content, style, and format of UMTRA Project documents. The goal of the UMTRA Project document preparation process is to deliver to the U.S. Department of Energy (DOE) high-quality documents that meet the following requirements:

- The document meets the expressed needs of the client.
- The technical content is accurate and consistent.
- The writing is clear.
- The document is well organized.
- The use of capitalization, abbreviations, numbers, and other details of style is consistent and in accordance with DOE requirements.

An UMTRA Project document is usually the product of a team effort. As such, Project documents are susceptible to problems such as inaccurate or contradictory data, poor organization, and inconsistent style. A document review process has been established to ensure that TAC documents are accurate, consistent, and well organized. The editing process applies standard rules for style and format, spelling, grammar, punctuation, and sentence structure to make the document stylistically consistent and easier to read. This guide sets forth the rules to be applied to UMTRA Project documents.

Conformance to the standards established in this guide will result in documents that reflect elements of total quality by providing accurate, adequate, and consistent information and using an orderly and logical presentation of that information in the document.

This entire guide is a *living* document. Periodically, revisions and new materials will be distributed for inclusion. As holder of this guide, you are responsible for its maintenance. Comments on existing materials and suggestions for new materials that might be added are welcome. Such comments should be directed to the Publications Department manager (PDM).

1.2 ORGANIZATION

This guide is organized to allow the user to complete the steps to deliver a document in their proper sequence. Major sections are as follows:

- Section 2 includes document descriptions of all formal document produced by the TAC for the Project. In order to determine the specific steps required for a document, it is critical that the user understand the types of documents the TAC produces, their relationships to each other, and their particular review and production needs.

- Section 3 is an overview of the document production/review process, including direction from TAC management, the general process description and flowchart, an activities matrix for quick reference, and the roles and responsibilities of each member of a document team.

- Section 4 provides detailed descriptions of each non-production step of the flowchart. The non-production steps include the planning, writing, and review process; quality assurance (QA) activities, and sign-off and delivery activities. This section also describes the content and processing of the sign-off folder, including checklists, sign-off forms, contents, signature and delivery requirements.

- Section 5 covers the production (Publications) steps of the flowchart. It summarizes what happens to a document once it is turned into the Publications Department. It includes procedures and sample forms for use in requesting graphics, word processing, and technical editing support.

- Section 6 provides information on long-term maintenance of a document once it has been delivered. It includes descriptions and procedures for using the on-line Pubtracker and DocTrak systems. These systems allow checking on the progress of a current document and locating or identifying completed documents. Section 6 also describes the handling of camera-ready originals and the copies of documents required by the UMTRA Project Document Control Center (UPDCC).

- Appendix A is a complete Project Style Guide. This guide documents specific format, content, organization, and style requirements for UMTRA TAC documents. It also includes sections on grammar, word usage, preparation of graphics, preparation of presentation material, using and documenting references, and other helpful reference material. It should be used as a tool to help you improve your writing and document organization skills.

- Appendix B covers the new (7/95) base mapping requirements and procedures. As the Ground Water Project grew in size and importance, it became apparent that the existing AutoCAD maps were not sufficiently defensible. The initiative to improve the quality of the site base maps is on-

going. Their use in Project documents and their maintenance are covered in this appendix.

- Appendix C is the UMTRA Project Document Control System Manual. The UPDCC has published this manual to assist you in using the resources available in the center and understanding the critical nature of the records produced on the Project.

- Appendix D is for your use in filing the Publications Department's FYIs. These little one- or two-page information sheets are designed to improve your writing skills and answer troublesome grammar and organization questions. This appendix contains those FYIs issued to date on the Project.

2.0 DOCUMENT DESCRIPTIONS

Table 2.1 describes documents produced by the TAC. It is provided to assist Project document team members in developing the document.

3.0 DOCUMENT PRODUCTION/REVIEW PROCESS

3.1 LETTER AUTHORIZATION

Figure 3.1 Letter authorization

TO: TAC Personnel

FROM: RNelson DNB for RAN

DATE: June 20, 1995

SUBJECT: Document Production Process

In March 1994, a new document production process was introduced to the TAC . The new process differed from the old in that the emphasis was placed on more detailed planning and in stronger management involvement at the start of the process. Document reviews were also moved up in the process and were limited to fewer individuals and to a prescribed scope. While the process appears to be long and burdensome at first glance, it will actually speed document preparation by reducing rework and result in better quality documents.

Document sponsors may take a graded approach to the process. Short documents, documents written by a single individual, documents prepared for in-house use, documents that do not have a major impact on DOE activities, or documents that are undergoing only minor revisions as a result of client review may go through an abbreviated process. When an abbreviated process is used, the process must be described in a memorandum from the document sponsor, through the sponsor's Assistant Project Manager (APM), to the QA Department. The APM will be the approving authority.

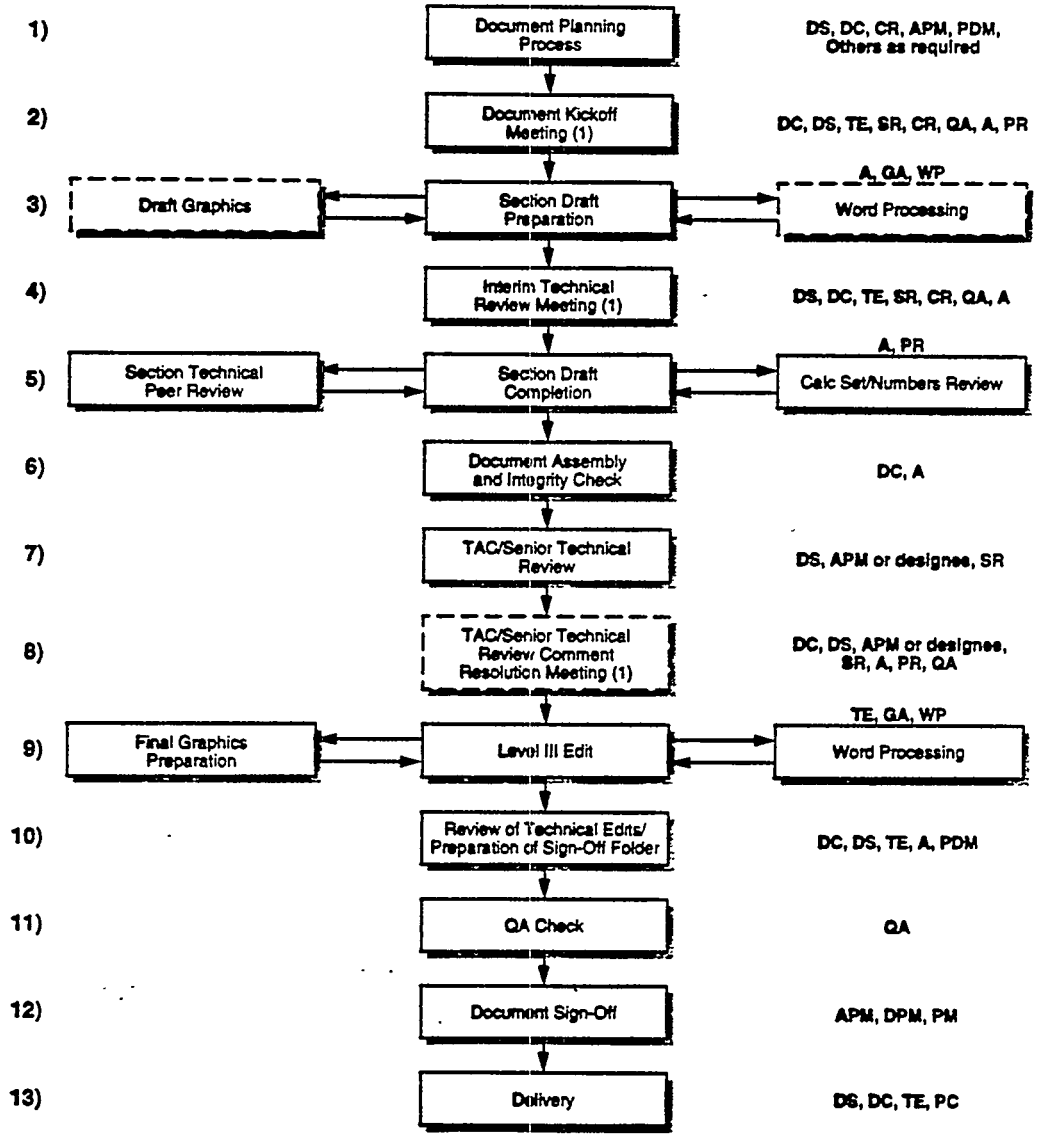
This is no different than any other procedure; for it to work, it must be followed. Following the process is the responsibility of each document team member. This letter authorizes the QA Department to track the process an ensure compliance. As part of the sign-off package delivered to Management when a document is ready for signature and transmittal, the QA Department will prepare a QA checklist indicating compliance with the steps of the process and receipt of the various products of the process.

This process will not be issued as a standard operating procedure (SOP) at this time, but is incorporated in the Publications Department Desktop Guide.

3.2 PROCESS DESCRIPTION

Figure 3.2 is a flow chart for the document production process. Although the process appears long and complex, it actually reduces the time required to produce documents (by eliminating or greatly reducing rework time) and improves the quality of the documents. Because the DOE is involved from preliminary planning through review and comment resolution steps, the document will likely fulfill the DOE's needs.

Figure 3.2
Document Production/Review Process



MAC: NON-SITE/STYLE AND FORMAT/DOCPROD-REVPROC

A graded approach to the process may be used. Obviously, not all documents require extensive review. Short documents, documents that are part of a well-defined series, documents written by a single individual, or documents that do not have a major impact on activities may go through an abbreviated process, with the approval of the appropriate APM.

Table 3.1 is a detailed activity matrix. It lists participants, activities, and products for each step of the flow. The products listed on the matrix must be completed and on file in the QA Department or be available in the sign-off folder before the document can be delivered.

3.3 DOCUMENT TEAM

3.3.1 Document sponsor

The document sponsor may be an APM, a technical manager, or a site manager, depending on the document. The document sponsor has overall management responsibility for delivery to the client and meeting technical quality, cost, and schedule goals. Although some of the following steps may be delegated, the document sponsor must ensure and is accountable for their completion. The document sponsor

- Directs the document planning process and conducts required planning meetings.
  - Prepares the Records of Decisions and Action Items for planning meetings.
  - Prepares the Deliverable Item Description (DID) for the document (only if the document is the only or a first of its type; e.g., the first of several water sampling and analysis plans).
  - Meets with the appropriate technical manager(s) or APMs to identify the document coordinator, authors, peer reviewers, and senior technical reviewer.
  - Notifies document team of assignment.
  - Prepares the formal Task Plan and Work Authorization.
  - Ensures assignments for the technical staff are entered into TAS and coordinated with other priorities.
- Participates in the document kickoff meeting to ensure that all participants understand the purpose/goals, audience, and schedule requirements of the document.

Table 3.1 Document Production/Review Process Activity Matrix

Step No.	Participants	Activities	Products
1)	Document Sponsor,* Assistant Project Manager, Client Representative, Document Coordinator, Publications Manager, and Others as required	<u>Document Planning Process</u> • Define purpose of document • Define document audience • Assign authors, peer reviewers, senior • technical reviewer, and technical editor • Establish target completion date • Define task plan and work authorizations • Prepare annotated outline • Prepare schedule and milestones • Identify potential issues, problem areas, technical challenges, data requirements	1) Record of decisions and action items 2) Deliverable Item Description (DID)** 3) Notification of Assignments 4) Task Plan and Work Authorization 5) Annotated outline 6) Schedule and milestones 7) Detailed Activity Description (DAD)**
2)	Document Sponsor, Document Coordinator,* Technical Editor, Senior Technical Reviewer, Client Representative, Quality Assurance Representative, Authors, Peer Reviewers	<u>Document Kickoff Meeting</u> • Review task plan and work authorizations • Review annotated outline and correct as necessary • Review schedule and milestones • Identify potential issues, problem areas, technical challenges, data requirements	1) Record of decisions and action items 2) Revised annotated outiine, if necessary

3)	Authors,* Graphic Artists, Word Processors	<u>Section Draft Preparation</u>
		• Prepare first draft of assigned sections
		  • Text
		  • Tables
		  • Figures
		  • Appendixes
		  • References
		• Complete analysis in support of conclusions and recommendations
		• Coordinate with graphics and word processing as needed for preparation of draft
			1) Preliminary draft section
			2) Calculation sets

Table 3.1 Document Production/Review Process Activity Matrix (Continued)

Step No.	Participants	Activities	Products
4)	Document Sponsor, Document Coordinator,* Technical Editor, Senior Technical Reviewer, Client Representative, Quality Assurance Representative, Authors	Interim Technical Review Meeting • Review progress of individual sections • Address technical issues • Redirect efforts if necessary • Address schedule issues if necessary • Review proposed recommendations and conclusions	1) Record of decisions and action items
5)	Authors,* Peer Reviewers***	Section Draft Completion and Peer Review • Complete section drafts • Complete calculation set(s) • Review section drafts for technical accuracy, compliance with technical standards and procedures, and meeting of technical goals • Review all numbers used in text, calculations, formulas, tables, and graphics against source data for consistency and accuracy	1) Completed draft section 2) Peer Reviewer's Quality Checklist 3) Checked calculation sets 4) Checked graphics
6)	Document Coordinator,* Authors	Document Assembly and Integrity Check • Assemble document sections • Verify that all sections are in and complete (references are cited and listed, draft figures and tables and present, appendixes are present, and Quality Checklists are attached) • Review entire compiled document for consistency and conformance to annotated outline and purpose; resolve problems as necessary with authors	1) Compiled draft document

Table 3.1 Document Production/Review Process Activity Matrix (Continued)

Step No.	Participants	Activities	Products
7)	Document Sponsor,* Assistant Project Manager or his designee, Senior Technical Reviewer*	TAC/Senior Technical Review • Review compiled document for technical content, adherence to the annotated outline, readability, meeting technical goals, meeting document purpose, consistency within sections	1) Senior Technical Reviewer Quality Checklist 2) Deliverable Review Request and Record
8)	Document Sponsor, Document Coordinator,* Technical Editor, Senior Technical Reviewer, Client Representative, Quality Assurance Representative, Authors*	TAC/Senior Technical Review Comment Resolution Meeting • Resolve conflicting comments • Address and resolve technical problems and concerns • Incorporate comments into draft document	1) Record of decisions and action items 2) Revised draft document 3) Completed Deliverable Review Request and Record form
9)	Technical Editor, Graphics Artists, Word Processors	Preparation for Publication • Perform Level IV (substantive) edit on entire document • Complete final graphics • Complete final word processing, formatting, and preparation of front and back matter • Resolve problems with authors or document coordinator • Proof all copy • Prepare camera-ready originals • Produce and bind one copy for editing review and sign-off	1) Edited, clean draft document 2) Technical Editor's Quality Checklist

Table 3.1 Document Production/Review Process Activity Matrix (Concluded)

Step No.	Participants	Activities	Products
10)	Document Coordinator,* Technical Editor, Publications Manager, Authors, Document Sponsor	Publication/Edit Review and Preparation of Sign-off Folder • Review edited text, tables, and graphics to be sure editing changes have not affected technical content • Q/C review of edit • Write cover letter and prepare delivery transmittal form (Sponsor) • Compile contents of sign-off folder (document, comment/response documents, document transmittal form)	1) Edited, clean, reviewed draft document 2) Cover letter 3) Sign-off folder
11)	Quality Assurance Representative*	Quality Assurance Check • Review document QA file and associated comment/response documents to ensure compliance with quality procedures and standards and to verify incorporation of required changes from comments • Prepare QA Checklist.	1) Quality Assurance Checklist
12)	Project Manager,*** Deputy Project Manager,*** and Assistant Project Manager***	Document Sign-off • Sign	1) Approved document transmittal form
13)	Document Sponsor, Document Coordinator, Technical Editor, Production Clerk	Delivery • Produce and deliver required copies to client • Produce and deliver required copies to the UPDCC • Forward copies of all other documentation to the UPDCC.	

* Document preparation responsibility
** The DID and DAD are prepared only for the first document of a type; e.g., only once for all Water Sampling and Analysis Plans.
*** Review signature only

- Participates in the interim technical review meeting to ensure that all participants are on track with preparation of the document and to assist in resolving any technical, philosophical, or schedule issues.

- Conducts a full cover-to-cover review of the compiled document at the TAC/senior technical review level, and completes a Deliverable Review Request and Record form for the document.

- Participates in the TAC senior technical review comment resolution meeting (if required) to discuss and resolve conflicting comments, technical problems, or other concerns.

- Prepares cover letter and document transmittal form.

- Assembles sign-off package and monitors it through the approval process.

- Delivers required copies to the client.

- Delivers all backup documentation to the UPDCC.

3.3.2 Client representative(s)

The client representative(s) would usually be either the DOE site manager for a site-related document or another DOE representative for programmatic documents. The client representative(s) is invited to

- Participate in the document planning process, providing direction on the development of the purpose and audience definitions, development of the annotated outline, and on the required schedule.

- Participate in the document kickoff meeting, providing direction on the potential issues, problem areas, technical challenges, and data requirements.

- Participate in the interim technical review meeting, providing direction and input into the resolution of philosophical or technical issues.

- Participate in the TAC/senior technical review comment resolution meeting (if required), providing input into resolution of philosophical or technical issues.

3.3.3 Document coordinator

The document coordinator

- Conducts the document kickoff meeting. With the document sponsor, assists in preparation of the annotated outline and schedule and milestones.

  - Prepares the Record of Decisions and Action Items for the kickoff meeting.

  - Reviews the formal annotated outline.

  - Reviews the schedule and milestones chart.

  - Obtains signatures on all required documentation.

  - Forwards copies of all required documentation to team members.

  - Sets up document working file (notebook).

- Conducts the interim technical review meeting.

  - Prepares the Record of Decisions and Action Items for the interim technical review meeting.

  - Forwards copies to all team members.

- Assembles document sections and checks sections for presence of

  - References, figures, tables, appendixes, peer review Deliverable Review Request and Record form, quality checklists, and signed calculation sets.

- Reviews compiled document for consistency and conformance to annotated outline and purpose.

- Resolves problems with authors.

- Provides the document sponsor and senior technical reviewer with a copy of the compiled draft document and a Deliverable Review Request and Record form.

- Conducts the TAC/senior technical review comment resolution meeting (if required).

  - Prepares the Record of Decisions and Action Items for the TAC/senior technical review comment resolution meeting.

  - Forwards copies to all team members.

- Directs and coordinates revisions resulting from the senior technical review.

- Compiles draft document after incorporation of TAC/senior technical review comments.

- Verifies that all TAC review and senior technical reviewer comments have been addressed, both in the document sections and on the Deliverable Review Request and Record form.

- Prepares document for transmittal to Publications.

- Provides technical assistance to Publications during the document production process.

  - Answers or obtains answers to questions regarding text or graphics content.

  - Provides information on document version, revision, binding, number of copies, etc.

- Reviews technical editor's markups and camera-ready document to be sure editorial changes have not affected technical content.

- Delivers one copy of the document and the backup materials to the document sponsor for sign-off folder preparation.

- MONITORS DOCUMENT PROGRESS, SCHEDULE, AND MILESTONES THROUGHOUT THE PROCESS.

- PROVIDES REMINDERS TO ALL TEAM MEMBERS WHEN MILESTONES ARE APPROACHING.

- ADVISES ALL TEAM MEMBERS OF CHANGES IN SCHEDULE OR SCOPE.

3.3.4 Peer reviewers

The peer reviewers are selected by the document sponsor and appropriate technical managers to provide review of specific sections of the document, based upon their expertise. One peer reviewer will be assigned to each section. The peer reviewers

- Review section drafts for technical accuracy, compliance with technical standards and procedures, and meeting of technical goals.

- Review all numbers used in text, calculations, formulas, tables, and graphics against source data for consistency and accuracy.

- Resolve any problems with the author.

- Prepare a Deliverable Review Request and Record form.

- Sign off on calculation sets.

3.3.5 Senior technical reviewer

The senior technical reviewer is assigned by the document sponsor and the appropriate APM. This individual may be a technical manager or another senior level technical person. The senior technical reviewer

- Attends the document kickoff meeting.
- Attends the interim technical review meeting.
- Conducts a comprehensive cover-to-cover review of the compiled document.
  - Reviews the document for technical content, adherence to the annotated outline, readability, meeting technical goals, meeting the stated document purpose, consistency within sections and from section to section.
  - Completes the Deliverable Review Request and Record form.
- Participates in the TAC/senior technical review comment resolution meeting (if required).

3.3.6 Authors

The document section authors are selected by the document sponsor and technical managers or APM during the document planning process. Selection is based on the technical requirements of the section. Authors

- Attend the document kickoff meeting.
- Prepare the first draft of the assigned section, adhering to UMTRA Project style requirements and using the best available resources and techniques.
  - Prepare the draft figures, tables, text, and appendixes.
  - Compile the list of references used in the section.
  - Verify that all references cited are available in the UPDCC or identify their location.
  - Proof all draft figures, tables, and text to ensure changes are made correctly.
  - Arrange for permission to use copyrighted material, if needed.
  - Prepare calculation sets for all numbers used in the section.

- Coordinate with the PDM for graphics and word processing support in preparing the first drafts and revisions.

- Attend the interim review meeting.

  - Address technical issues and problems encountered.
  - Review progress of section and communicate schedule problems, if any.
  - Summarize conclusions and recommendations

- Respond to peer reviewer comments and make changes in section, as necessary.

- Respond to document coordinator for problem resolution during document compilation.

- Attend the TAC/senior technical review comment resolution meeting (if required).

- Incorporate section changes required from the various reviews.

- WORK TO MEET ESTABLISHED SCHEDULES AND MILESTONES.

- ADVISE THE DOCUMENT COORDINATOR OF ANY SCHEDULE OR PREPARATION PROBLEMS.

3.3.7 Quality assurance representative

The QA representative is assigned by the QA manager to monitor the progress of a specific document and ensure that the production process is followed and the document receives a satisfactory review. He/she also ensures that all reviewer comments have been addressed and that the document is ready for transmittal to the client.

The QA representative

- Attends the document planning and kickoff meetings.

- Sets up and maintains a QA file for each document and is copied on all meeting products.

- Reviews the sign-off folder contents to verify its completeness.

- Prepares and signs the QA checklist and signs the document transmittal request form.

3.3.8 Publications Department Manager

The PDM ensures that the document production steps of the process are followed.

The PDM

- Attends the document planning meeting to assist in the planning and scheduling of the document.
- Assigns the responsible Technical Editor.
- Monitors the progress of the document through the Publications group and ensures that adequate resources are available to prepare the document for transmittal.
- Negotiates schedule and resource conflicts with the document sponsors and coordinators.
- Reviews the sign-off folder copy for compliance with document format, style, and editing standards and signs the sign-off folder.

3.3.9 Technical editor

The assigned technical editor is the coordinator of the document once it enters the Publications Department. This individual is responsible for coordination of editing, word processing, and graphics input to the document through the production process.

The technical editor

- Attends the kickoff meeting and all interim review meetings to ensure understanding of the purpose and audience of the document and to remain aware of any programmatic or technical issues being addressed by the document.
- Arranges for and monitors graphics, word processing, and production work during the internal draft and final production.
- Performs the appropriate level of edit (see Appendix A) on the document to ensure it is grammatically correct and complies with the standard format. Proofs all word processing and graphics work.
- Updates Pubtracker and DocTrak during appropriate phases of document production.
- Advises the document coordinator of document progress and problems, if any.

- Meets with authors and document coordinator to resolve questions identified during the edit process.
- Arranges production of the sign-off folder copy and of delivery copies of the document.
- Maintains camera-ready originals in the technical editing files.

4.0 THE WRITING/REVIEW PROCESS

4.1 PLANNING

4.1.1 The planning process

Step 1 of the document review process, planning, is the responsibility of the document sponsor (the person under whose direction a document is being created and who has budgeting and schedule tracking responsibility).

The document planning process begins when the document sponsor identifies the need to prepare a new or revised document (either by direction of the client or presence of the deliverable in the Project plan). The sponsor should initially involve the appropriate APM in selecting a document coordinator. Once selected, the coordinator, sponsor, and client representative meet to define the following:

- Purpose of the document.
- Audience.
- Schedule and milestones (with the help of the PDM and other appropriate technical managers).
- Target completion date.
- Identify document team members and define team assignments (with the help of the appropriate technical managers).
- Annotated outline (including graphics, maps, tables, and appendixes).
- Potential issues, problem areas, technical challenges, and data requirements.

Document sponsors and coordinators should pull in whatever resources are required to adequately define and plan the document. This critical phase of document development will make or break the entire process.

Products

During the planning process, the following products will be generated:

- Records of decisions and action items. These required records of meetings or other conversations may take the form of memorandums or ccmail messages to document team members.

- DID (see Figure 4.1). For recurring documents, DIDs are typically available for the document team to begin the planning process.
- Task Plan and Work Authorization.
- Annotated outline.
- Schedule and milestones chart.
- DAD (see Figure 4.2). DADs provide additional information for the major activities required to prepare thedocument, including the scope of each activity, the schedule duration and logic constraints, the estimated staff resources needed, special considerations, and references required to complete the activity.

Copies of each of these products should be sent to each document team member, to the UPDCC, and especially to the assigned QA representative. When the QA representative reviews the document file during the sign-off review, **these products must be in the file for delivery to proceed.**

4.1.2 Kickoff meeting

Step 2, the document kickoff meeting, begins the document development phase. The document coordinator is responsible for this step. The meeting should include the document sponsor, document coordinator, technical editor, senior technical reviewer, client representative, QA representative, authors, and peer reviewers that were identified during the planning process.

The purposes of the meeting are to review the task plan and work authorizations, review the annotated outline and correct as necessary, review the schedule and milestones, identify potential issues, problem areas, technical challenges, and data requirements, and make specific task assignments. **It is critical that each team member leave this meeting with a clear understanding of the purpose, audience, schedule, and technical requirements of the document.**

Products

As a result of the kickoff meeting, the document coordinator is responsible for preparing the following products:

- Record of decisions and action items.
- Revised annotated outline, if necessary.

Again, these products must be sent to all team members and must be in the QA document file for the document to proceed to delivery.

Figure 4.1
Deliverable Item Description Form

DELIVERABLE ITEM DESCRIPTION	IDENTIFICATION	
	PROJECT	UMTRA
TITLE:	DELIV. REF.	
	DATE	
DESCRIPTION/PURPOSE:		
APPLICATION/INTENDED AUDIENCE:		
CONTENT:		
PREPARATION REQUIREMENTS:		
REFERENCES:		

MAC: NONSITE: STYLE AND FORMAT/TACMGTPL

Figure 4.2
Detailed Activity Description Form

DETAILED ACTIVITY DESCRIPTION			IDENTIFICATION	
			PROJECT	UMTRA
TITLE:			TASK	
			WBS	
			DATE	
SCOPE OF WORK:				
DURATION AND LOGIC:				
RESOURCES:				
DISCIPLINE	QTY	SCOPE/BASIS		
RESOURCES: COMMENTS/REMARKS:				
SPECIAL CONSIDERATIONS:				
REFERENCES:				

MAC. NONSITE: STYLE AND FORMAT/TACACTN2

4.1.3 Scheduling and resource planning

Scheduling and developing milestones for a document are dependent on many variables including the complexity of the document, the level of revision required, and the workloads of the various document team members. Following are some general guidelines to help you in establishing a schedule:

- Work backward from your required delivery date.
- Allow at least three days for the QA check, document sign-off, and delivery. This little cushion will allow you to fix minor problems without missing your delivery deadline.
- Allow a minimum of one week for each review cycle. For larger or more complex documents, one week for peer review and two weeks for senior technical review would be more appropriate.
- Allow a minimum of two weeks for the Level IV technical edit and final word processing and graphics preparation. For larger or more complex documents and during heaving workload cycles, three to four weeks should be allowed. Figure 4.3 is an estimating worksheet that can be used to help you in determining budget and schedule requirements for the Publications Department. If you have any questions, seek the help of the PDM.
- Allow a minimum of one week per review cycle to address review comments and modify the document accordingly. Again, for larger and more complex documents, more time should be allowed.
- Allow a minimum of one week to assemble the document and perform an integrity check prior to senior technical review.
- Allow one week to prepare draft graphics and send the document through a word processing cycle.
- Schedule your interim technical review meeting approximately one-half way through the section draft preparation step (Steps 3 and 4).
- Now, if you are down to two days to actually write the document, you need to renegotiate the delivery date.

In all cases, technical managers must be involved in resource selection and planning.

4.2 WRITING

After the annotated outline is approved, authors assigned to the document will complete subsections according to the contents of the outline (Step 3). During the development of the first draft, the authors perform an important quality

Figure 4.3
PUBLICATIONS TIME ESTIMATING WORKSHEET

DATE OF ESTIMATE:_____ PROJECTED START WORK DATE:_____
SITE:_____ SURF. BUDGET_____ GW BUDGET_____
DOCUMENT:_____

VERSION:_____ REVISION:_____ DATE DUE TO CLIENT:_____
TEXT PAGES:_____ TABLE PAGES:_____ GRAPHICS:_____ TOTAL PAGES:_____
DOCUMENT SPONSOR:_____ DOCUMENT COORDINATOR:_____

WORD PROCESSING	HOURS
ORIGINAL ENTRY OR INITIAL FORMATTING & CLEANUP (ALLOW 1) 6 PAGES/HOUR FOR TEXT X 100% OF TEXT PAGES = 4 PAGES/HOUR FOR TABLES X 100% OF TABLE PAGES =	
MAJOR REVISION OF ENTIRE DOCUMENT (ALLOW 1) 6 PAGES/HOUR FOR TEXT X 100% OF TEXT PAGES = 4 PAGES/HOUR FOR TABLES X 100% OF TABLE PAGES =	
MODERATE REVISION OF DOCUMENT (ALLOW 1) 10 PAGES/HOUR FOR TEXT X 50% OF TEXT PAGES = 10 PAGES/HOUR FOR TABLES X 50% OF TABLE PAGES =	
MINOR REVISION/PROOFING CORRECTIONS (ALLOW 2) 15 PAGES/HOUR FOR TEXT X 20% OF TEXT PAGES = 15 PAGES/HOUR FOR TABLES X 20% OF TABLE PAGES =	
TOTAL WORD PROCESSING HOURS	
EDITING	
INITIAL LEVEL IV (SUBSTANTIVE) EDIT (ALLOW 1) 6 PAGES/HOUR X 100% OF ALL PAGES =	
MAJOR REVISION LEVEL IV EDIT (ALLOW 1) 6 PAGES/HOUR X 50% OF ALL PAGES =	
MINOR REVISION INTEGRITY CHECK (ALLOW 1) 12 PAGES /HOUR X 20% OF ALL PAGES =	
INITIAL PROOFING (ALLOW 1) 12 PAGES/HOUR X 100% OF ALL PAGES =	
MAJOR REVISION PROOFING (ALLOW 1) 12 PAGES/HOUR X 50% OF ALL PAGES =	
MINOR REVISION PROOFING (ALLOW 2) 12 PAGES/HOUR X 20% OF ALL PAGES =	
TOTAL EDITING HOURS	

GRAPHICS	
INITIAL SETUP GRAPHICS (ALLOW 1) 3 HOURS/PAGE X 100% OF SIMPLE DIGITIZED DRAWINGS = 5 HOURS/PAGE X 100% OF COMPLEX DIGITIZED DRAWINGS = 20 HOURS/PAGE X 100% OF AUTOCAD DRAWINGS =	
MAJOR REVISION (ALLOW 1) 1 HOUR/PAGE X 100% OF ALL DIGITIZED DRAWINGS = 8 HOURS/PAGE X 100% OF ALL AUTOCAD DRAWINGS =	
MODERATE REVISION (ALLOW 1) 1/2 HOUR/PAGE X 50% OF ALL DIGITIZED DRAWINGS = 4 HOURS/PAGE X 50% OF ALL AUTOCAD DRAWINGS =	
MINOR REVISION/PROOFING CHANGES (ALLOW 2) 1/2 HOUR/PAGE X 20% OF ALL DIGITIZED DRAWINGS = 1 HOUR/PAGE X 20% OF ALL AUTOCAD DRAWINGS =	
TOTAL GRAPHICS HOURS	
PRODUCTION	8
TOTAL PUBLICATIONS HOURS	

control function by making decisions on technical content and value. Their participation in the kickoff and review meetings is also critical to ensure that everyone is working from the same base of understanding.

When the assigned section preliminary draft is ready for peer review, the author completes the calculation set and a Deliverable Review and Request form. All three items are turned over to the assigned peer reviewer. Upon completion of the peer review, the author addresses the peer reviewer's comments and obtains his/her approval on the Deliverable Review and Request form.

When the peer reviewer's comments have been addressed, the section is turned over to the document coordinator for compilation and an integrity check prior to review. Authors should remain active in the process throughout the review phase. Changes resulting from review comments should be made by the original authors to ensure that errors are not introduced.

Products

During this initial writing phase, authors will produce the following products:

- Keyed or hand-written text. (Word processing support is available through the Publications Department [see Section 5.1.2]. If Publications is unable to key new text, they will arrange for outside services or a department secretary to do original keying.)

- Keyed or hand-written draft tables. (Again, see Publications for word processing support.)

- Draft graphics. (Graphics support is available through the Publications Department [see Section 5.1.1]. Authors should attempt to use existing graphics or modify existing graphics whenever possible. The Graphics Coordinator will gladly assist in determining what is available.)

- Calculation set (SOPs 17.1.1, Analysis of Data and Compilation of the Site Characterization Appendix; and 17.1.2, Compilation of Design Calculations).

- Reference list for all references cited in the subsection. This list should be complete and should follow the format provided in Section 6.4 of the UMTRA TAC Style and Format Guidelines (Appendix A).

4.3 REVIEW

Major, in-depth internal reviews of the document occur early in this process. Steps 4 through 8 include a series of reviews and comment resolution meetings. These frequent checks are important in the TAC environment because of the many technical disciplines required to prepare a document, stakeholders whose interests must be protected, and reviewers who will comment from different perspectives.

Peer reviewers and a senior technical reviewer are assigned to the document during the planning phase. The senior technical reviewer should be present at all team meetings and take an active role in defining the document requirements. It is as critical to the success of the document that the reviewers understand its scope and purpose as it is that the authors understand.

The number of reviewers is limited. Only one peer reviewer is assigned for each technical section and no more than three senior reviewers (including the document sponsor, the appropriate APM or his/her designee, and the assigned senior technical reviewer) are assigned to do a cover-to-cover review. Each reviewer is responsible for a comprehensive review and is given very detailed review directions.

4.3.1 Interim technical review meeting

Step 4, the interim technical review meeting, provides an opportunity to reinforce the team's understanding of the document purpose and goals, to deal with any schedule or resource issues, and to identify and resolve technical issues that arise during the course of document preparation. It should be held approximately halfway through the section draft preparation phase. At the time the meeting is held, authors should have identified the assumptions and conclusions they will use in their sections, the graphics, tables, and data needed to support their conclusions, and any problems or technical issues they have encountered.

At the conclusion of this meeting, the document coordinator should prepare a record of decisions and action items and forward copies to all team members and the QA file.

4.3.2 Peer review

As the name implies, a peer reviewer is an individual in the same discipline as the original section author. Upon completion of the author's section, the author prepares a Deliverable Review Request and Record form (Figure 4.4), attaches it to the section and the completed calculation set, and submits them to the assigned peer reviewer. The peer reviewer performs the following tasks:

- Checks the section for technical accuracy and applicability (are the assumptions correct; do the data support any conclusions given, etc.).
- Checks the attached calculation set and verifies all numbers used in the text.
- Initials the Calculation Set review form.
- Checks any figures and tables for accuracy and to ensure consistency with text.

Figure 4.4 Deliverable Review Request and Record

JE JACOBS ENGINEERING GROUP INC.
ALBUQUERQUE OPERATIONS

PAGE _ OF _

DELIVERABLE REVIEW REQUEST AND RECORD

REVIEW LEVEL:

TECH MGR ☐ TAC ☐ RED TEAM (OPT) ☐ SECOND INTERNAL (OPT) ☐

DOCUMENT TITLE:_____

WBS CONTROL NUMBER:_____

REVIEWER:_____ COMPLETE REVIEW BY:_____

REVIEW FOR: ☐ DISCIPLINE ☐ TOTAL REVIEW ☐ # OF COMMENTS _____

REVIEW REQUESTED BY:_____ DATE: _____

REVIEWER'S SIGNATURE _____ DATE:_____ ☐ APPROVED ☐ APPROVED AS NOTED ☐ NOT APPROVED* ☐ NOT REVIEWED *INDICATE REASON(S) BELOW	CONCURRENCE IN COMMENT INCORPORATION REVIEWER'S SIGNATURE _____ DATE:_____ ☐ APPROVED ☐ APPROVED AS NOTED ☐ NOT APPROVED* ☐ NOT REVIEWED *INDICATE REASON(S) BELOW
COMMENTS:*	COMMENT DISPOSITION:

*PLEASE ATTACH ADDITIONAL PAGES AS NECESSARY OR ATTACH SPECIFIC DOCUMENT PAGES WITH COMMENTS NOTED ON THEM.

Figure 4.4 (Concluded)

JACOBS ENGINEERING GROUP INC.
ALBUQUERQUE OPERATIONS

PAGE _ OF _

DELIVERABLE REVIEW REQUEST AND RECORD

TITLE OF DOCUMENT:_____ DATE:___/___/___

REVIEWER'S COMMENTS	DISPOSITION

- Completes the Deliverable Review and Request and Record form for the section.

Any comments noted by the peer reviewer must be addressed by the author before the section is submitted to the document coordinator. The author must also complete the Comment Disposition section of the Deliverable Review Request and Record form and submit that form to the document coordinator with his/her completed section.

4.3.3 Document assembly and integrity check

Upon receipt of all sections of the document, the document coordinator assembles the sections and prepares the document for senior technical review. During this process, the document coordinator

- Checks each section to be sure that all text, figures, tables, appendixes, and references are present.

- Assembles and reviews the document as a whole for missing or duplicate information and the correct sequence, numbering, and call-outs of figures, tables, and appendixes.

- Resolves any questions with the various authors.

- Prepares Deliverable Review Request and Record forms and copies of the document for senior technical reviewer and the document sponsor and appropriate APM.

If time and budget permit, the document coordinator may wish to submit the document to Publications for a word processing cycle (see Section 5.1.2).

4.3.4 Senior technical review

Copies of the document are provided to the document sponsor and the appropriate APM, and they are invited to review and comment. However, the required critical reviewer at this step is the assigned senior technical reviewer. This review should be a comprehensive, cover-to-cover review of the document and should answer the following questions:

- Is the document technically sound and accurate?

- Are the document's purpose and conclusions clearly stated?

- Does the document fulfill its stated purpose?

- Does the document adequately support its stated conclusions?

- Does the document meet the client's need and is it within the scope defined during the planning process?

- Are there gaps or inconsistencies that affect the integrity of the conclusions?

- Is the document readable and understandable by its intended audience?

- Are there any political or philosophical red flags raised by or in the document that should be addressed?

During the senior technical review, the reviewer completes the Deliverable Review Request and Record form and returns it with the document to the document coordinator.

4.3.5 Senior technical review comment resolution meeting

As noted in Figure 3.2, this step is optional. This meeting should be held only if the senior reviewers' comments cannot be easily addressed by each section author.

When comments have been addressed, the document coordinator should return the amended document and the Deliverable Review Request and Record form to the senior reviewers for concurrence in comment incorporation.

4.3.6 Products

All of the various Deliverable Review Request and Record forms generated during the review of the document should be maintained in the document coordinator's file and forwarded to the document sponsor for inclusion in the sign-off folder. These forms will become part of the permanent UPDCC file.

4.4 QUALITY ASSURANCE

Step 11 is the final check of the document process and sign-off folder before document delivery. A QA representative is active throughout document process, ensuring that the correct steps are followed and documented. At this step, the QA representative reviews the compiled sign-off folder and the QA Department document file for the following items:

QA document file

- Copies of the DID, the DADs, schedule and milestones chart, and the annotated outline.

- Copies of records of decision and action items for each meeting held during the process.

Sign-off folder

- Bound copy of the document.
- Transmittal letter.
- Copies of all Deliverable Review Request and Record forms, approved and signed by the appropriate reviewers.
- Completed deliverable receipt.
- Completed and signed Technical Editing Quality Checklist (see Section 5.2.2).
- Outgoing Correspondence Transmittal Form, signed by the appropriate individuals (see Section 4.5).
- **If the process has not been followed, a letter from the document sponsor, through the appropriate APM, to the project manager and deputy project manager, authorizing bypass of some or all of the steps.**

Upon completion of the review, the QA representative completes the QA Checklist (Figure 4.5), inserts it into the sign-off folder, and signs and dates the Outgoing Correspondence Transmittal form.

The QA Department manager may also choose to review selected documents at this time.

4.5 SIGN-OFF AND DELIVERY

The final two non-production steps of the process are sign-off and delivery. These steps begin when the assigned technical editor returns a bound sign-off copy of the document and the Technical Editing Checklist to the document coordinator. At this point, the document has been reviewed, thoroughly edited, and formatted according to the UMTRA TAC Style Guide (Appendix A).

4.5.1 Sign-off

The document coordinator assembles the document and associated Deliverable Review Request and Record forms and quality checklist and delivers them to the document sponsor for preparation of the sign-off folder.

The document sponsor prepares the transmittal letter for his/her signature to the appropriate DOE Client Representative. The transmittal letter should include specific information regarding what is expected of the client for document review and return. If the document is final, draft transmittal letters and instructions may also be included.

Figure 4.5 Quality Assurance Checklist

The document sponsor also prepares the Outgoing Correspondence Transmittal (Figure 4.6) to attach to the front cover of the folder, and the Deliverable Receipt form (Figure 4.7). Department secretaries are available to help in setting up the folder.

The document sponsor assembles the folder and either carries it or monitors it through the sign-off process. Approval signatures are required by the following (in the order stated):

- Appropriate site manager and/or technical manager (usually the document sponsor).
- PDM.
- Appropriate APM.
- QA manager
- Deputy project manager
- Project manager

When all approval signatures have been obtained, the folder will be returned to the document sponsor.

4.5.2 Delivery

The sponsor requests the required number of copies for delivery and internal distribution from the assigned technical editor. The technical editor will also request the UPDCC copies and will return the bound copies to the document sponsor. **Note: The cover letter should indicate the number of copies being delivered. In some cases, if the client wants to look at the document before final delivery, only one or two copies will be delivered. If a document is final, all copies should be delivered.**

Bound copies and the sign-off folder are then returned to the Project secretary for delivery to the client.

Figure 4.6 Outgoing Correspondence Transmittal

JACOBS ENGINEERING GROUP INC.
ALBUQUERQUE OPERATIONS

OUTGOING CORRESPONDENCE TRANSMITTAL

FROM: _____

TO: Project Manager

THROUGH: Deputy Project Manager

DELIVERABLE
DUE DATE: _____

SUBJECT: _____

NOTES: _____

_____

CONCURRENCES:

☐ APM, Site Management	_____	DATE _____
☐ APM, Management Services	_____	DATE _____
☐ APM, Technical Services	_____	DATE _____
☐ Deputy Manager, Tech. Services	_____	DATE _____
☐ Quality Assurance Manager	_____	DATE _____
☐ Public Affairs Manager	_____	DATE _____
☐ Publications Manager	_____	DATE _____
☐ Regulatory Compliance Manager	_____	DATE _____
☐ Data Management & Assessment Manager	_____	DATE _____
☐ Characterization & Remedial Design Manager	_____	DATE _____
☐ Contracts Manager	_____	DATE _____
☐ Lead Project Engineer	_____	DATE _____
☐ Site Manager ( )	_____	DATE _____
☐ Site Manager ( )	_____	DATE _____
☐ Site Manager ( )	_____	DATE _____
☐	_____	DATE _____
☐	_____	DATE _____
☐	_____	DATE _____
☐	_____	DATE _____

JEG-AL-AD-3 (7/93)

PATH: L:\FL3_01\FORM_JEG\JEGALAD3.DRW

Figure 4.7 Deliverable Receipt

JE JACOBS ENGINEERING GROUP INC.
ALBUQUERQUE OPERATIONS

DELIVERABLE RECEIPT

CONTRACT DE-AC04-91AL62350

TO: Projects Integration and Control

The following deliverable was submitted to the UMTRA Project Office:

Deliverable/Title _____

☐ Surface ☐ Groundwater

Type

☐ TAC Action Memo

☐ Planned (Check one of the following 3)

☐ Contract Deliverable Task No._____ TAM No._____
☐ Task Plan - Listed Deliverable Task No._____ TAM No._____
☐ Task Plan - General Deliverable Task No._____ TAM No._____

☐ Unplanned Task No._____ TAM No._____

Category

☐ Draft ☐ Draft Final ☐ Final

Revision #_____ Version #_____

Scheduled Delivery Date _____

Actual Delivery Date _____

_____
Task/Site Manager

5.0 DOCUMENT PRODUCTION

5.1 INTERNAL DRAFT PREPARATION

To reduce costly rework, the Publications Department does not become heavily involved in the document production and review process until all reviews and rewrites have been completed. Publications resources, however, are available to the section authors and document coordinators for draft word processing and draft graphics production only.

To request either word processing or graphics support, a Publications Request form (Figure 5.1) should be prepared, attached to the text, table, or figure markups, and submitted to the PDM. If Publications is unable to handle a request at the time it is submitted, the PDM will arrange for outside support.

5.1.1 Graphics

Figures can be accepted either in the form of pencil sketches, markups of existing figures, photos, or data for plotting. Authors are urged to use or modify existing graphics wherever possible to reduce costs. The graphics coordinator and graphic artists are available at any time (by phone or by visit) to assist in design and development of original figures and to locate existing figures for modification.

Nearly all production graphics are now prepared in Adobe Illustrator. However, the graphics staff does continue to support dual-platforms and many other software packages. Any questions about graphics capabilities should be addressed to the graphics coordinator.

Graphics prepared at this time will only be checked by the graphics coordinator for conformance to standards. No editing of preliminary graphics will be done.

Graphics personnel are also responsible for the preparation of site maps and AutoCAD-based figures. Requirements and procedures for development or use of base maps are contained in Appendix B.

5.1.2 Word processing

Word processing can be accepted either in hard copy or digital form. All text and table files will be converted to Microsoft Word 6.0. However, they may be submitted in Word, Word Perfect, Lotus 1-2-3, Quattro Pro, or Excel. At this point in the process, Publications will also accept partial or incomplete sections and will provide digital files to the authors if requested.

During the initial draft preparation phase, text and tables will only be keyed, formatted, and spell-checked. No editing will be provided until the full document is turned over to Publications for sign-off preparation.

Figure 5.1 Publications Services Request Form

UMTRA TAC

PUBLICATIONS REQUEST FORM

To be filled out by Document Coordinator

*Please submit all **text, graphics, and tables,** with this request attached, to **Judy Jones, Manager of Publications.***

Document Coordinator _____ Phone No. _____

Editor _____ Phone No. _____

Date submitted to Publications _____ Date required back to coordinator _____ Date due to client _____

Document preparation under ❑ UMTRA Surface Project ❑ UMTRA Ground Water Project

UMTRA site name _____ WBS number ___ (G or S) _ _ _ _ _ _ UMTRA site number _ _

Document Title _____

Document preparation for ❑ Peer review ❑ TAC/senior review ❑ Signoff ❑ Publication

Document level ❑ Presentation ❑ Internal draft ❑ Draft ❑ Preliminary final ❑ Final ❑ Publication

Level of work required ❑ Word Processing ❑ Edit ❑ Graphics

For Graphics only ❑ Mac/PC figure ❑ AutoCAD figure ❑ Poster ❑ Slide ❑ Overhead ❑ Other _____

Important Notice

If you are supplying a diskette, please label the diskette, explain the contents, file format, and program used.

Special instructions _____

_____

_____

To be completed by Technical Editor	To be completed by Brit Harvey, Graphics Coordinator
Text sections attached _____	Number and type of graphics attached _____
Estimated/actual editing work time _____/_____	_____
Estimated/actual word processing work time _____/_____	Estimated work time _____
Assigned technical editor _____	Actual work time _____
Assigned word processor _____	Assigned graphic artist _____

5.2 PREPARATION OF SIGN-OFF COPY

Steps 9 and 10 of the document production process are completed by Publications Department staff. At Step 9, the assigned technical editor assumes responsibility for coordinating the document through final preparation. A substantive edit is performed, graphics are finalized, and final word processing and formatting, production, and assembly occur. The technical editor works very closely with the document coordinator and authors to ensure that errors are not introduced and to answer questions that arise during the substantive edit. The technical editor also coordinates word processing and graphics preparation and final document production and assembly.

Documents ready for sign-off preparation should be submitted with a Publications Request form (Figure 5.1) to the PDM. Graphics should be left with text. The technical editor will submit them to graphics for final preparation. Only complete documents will be accepted at this time, unless negotiated with the PDM. To maintain the document's integrity and eliminate rework, no digital copies will be released once the document has been edited and formatted.

During final preparation, the document coordinator will be asked to review a copy of the camera-ready document and the technical editor's markups to ensure that no errors are introduced into the document (Step 10).

Upon approval of the document coordinator, the technical editor will arrange for production of the sign-off copy and prepare the Technical Editing Quality Checklist (Figure 5.2). The sign-off copy and checklist will be returned to the document coordinator.

When the sign-off process is complete and the document is ready for delivery, the technical editor will coordinate production of the required delivery and UPDCC copies.

Formats and standards for text, tables, and graphics are contained in Appendix A, UMTRA TAC Document Style Guide. The style guide also describes the editing process in detail.

Figure 5.2 Technical Editing Quality Checklist

Instructions: The technical editor will answer the following questions, sign the checklist, and return it to the document coordinator with the sign-off copy of the document.

Document title:		Revision:____, Version:___, Date:_____
Surface:____ Ground Water:_____		Site:
Document sponsor:	Document coordinator:	Technical editor:
Quality Item	Response	Comment
1. What was the level of edit performed on this document? (Integrity check, Level 1, Level 2, Level 3, Level 4). If lower than Level 3, state why.		
2. Is the purpose of this document clearly stated? Has the purpose been met?		
3. Are the conclusions clearly stated in the document? Are they supported in text?		
4. Does the document flow smoothly from one topic to another? Is the style consistent throughout?		
4. Are all required sections of the document present? If not, why not?		
5. Have all author's changes and editorial changes been incorporated and proofread?		
6. Have UMTRA TAC style and format guidelines been followed throughout? If not, why not?		
7. Are all tables, figures, appendixes, and plates cited in text? Are they in the correct order? Are they on the TOC?		
8. Have all acronyms used in text been defined? Are they all on the Acronyms list?		
9. Have all references cited in text been verified? Are they all on the reference list?		
10. Have all headers, footers, and section headings been checked?		
11. Is the document editorially correct and ready for delivery?		
Signature:_____ Date:_____		

6.0 DOCUMENT MAINTENANCE

6.1 DOCUMENT TRACKING SYSTEMS

Two on-line systems have been developed to assist the TAC in tracking current document development (Pubtracker) and to provide information on the status and location of completed documents (DocTrak). Both systems are available to anyone with access to the Local Area Network (LAN), either through Windows or DOS.

6.1.1 Pubtracker

Pubtracker was developed to track and status the workload for the Publications Department. The system is used to plan for resources, monitor document progress, establish a document history, establish priorities during heavy workload times, budget, report on the status of active documents, and remind managers of documents that are due in Publications.

Pubtracker is maintained by the PDM and technical editors on a weekly basis. Information is gathered by way of meetings, TAILS, budget and planning documentation, and verbal or written notification by authors, document sponsors, or document coordinators.

Reports are normally run weekly for review by technical managers and site managers. Reports may be sorted and printed by numerous fields including site, document type, sponsor, coordinator, reviewer, technical editor, and various due dates.

Pubtracker is available on-line by entering PT or PTX from DOS or clicking the Pubtracker icon from Windows.

6.1.2 DocTrak

DocTrak was developed to status completed documents that have been delivered to the client. This system is relatively new. It is available to all TAC users to verify that they have the current version of a document; to identify the version, revision, and volume numbers that are current; and to determine the location(s) of copies of completed documents.

The DocTrak data base is updated as required by the word processor, as requested by the technical editor. Reports are run on request. The system is primarily an on-line system for quick access to information.

The DocTrak data base includes the document number, version/revision/volume numbers, superseded document numbers, document types, titles, site names, delivery dates, vendor file names, file location, number of copies to the UPDCC, and the Office of Scientific and Technical Information (OSTI) delivery date.

Data are available on-line by entering DT or DTX from DOS or clicking the DocTrak icon from Windows.

6.2 CAMERA-READY ORIGINALS

Camera-ready originals of all deliverables processed through the Publications Department are filed in the technical editing area for the current plus one fiscal year. At the end of the fiscal year, two-year-old camera-ready originals are boxed and sent to the UPDCC for archival.

Additional copies of documents can be requested by completing a Production Work Order (Figure 6.1) and submitting it to the production clerk.

6.3 DOCUMENT CONTROL COPIES

When the request for final delivery copies is received from the document sponsor, the technical editor also requests an additional six unbound copies of the document for the UPDCC. See Appendix A for UPDCC distribution information.

After delivery of the document, copies of all correspondence, review forms, checklists, other sign-off folder contents, and backup information should also be forwarded to the UPDCC by the document sponsor, document coordinator, and QA representative for inclusion in the document file.

Figure 6.1 Production Work Order

Uranium Mill Tailings Remedial Action Project
Technical Assistance Contractor

REPRODUCTION WORK ORDER

DATE ORDERED:_____ ORDERED BY:_____

DATE REQUIRED:_____ TIME REQUIRED: _____AM _____PM

NUMBER OF ORIGINALS:_____ COPIES PER ORIGINAL:_____

DOCUMENT TITLE:_____

WBS CODE:_____ SITE NO._____ COPIER USER NO. _____

CHECK REQUIREMENTS:

- ☐ TWO-SIDED
- ☐ SINGLE-SIDED
- ☐ STAPLE
- ☐ CLIP/BAND
- ☐ THREE-HOLE PUNCH
- ☐ THREE-RING BINDER
- ☐ COMB BIND
- ☐ OTHER: _____

ORIGINALS TO:_____ DISTRIBUTE COPIES TO:_____

SPECIAL INSTRUCTIONS:_____

_____

_____

DOE/AL/62350-12
REV. 0

STYLE AND FORMAT GUIDELINES FOR TECHNICAL ASSISTANCE CONTRACTOR UMTRA PROJECT DOCUMENTS

June 1995

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REV. 0

STYLE AND FORMAT GUIDELINES FOR TECHNICAL ASSISTANCE CONTRACTOR UMTRA PROJECT DOCUMENTS

June 1995

Prepared for
U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico

Prepared by
Jacobs Engineering Group Inc.
Albuquerque, New Mexico

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LIST OF ACRONYMS

Acronym	Definition
AL	DOE Field Office, Albuquerque
ASTM	American Society for Testing and Materials
DAD	detailed activity description
DID	deliverable item description
DOE	U.S. Department of Energy
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
LAN	local area network
LTSP	long-term surveillance plan
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
QA	quality assurance
RAP	remedial action plan
SI	International System of Units
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action

1.0 INTRODUCTION

The purpose of these guidelines is to ensure that documents prepared by the Uranium Mill Tailings Remedial Action (UMTRA) Project Technical Assistance Contractor (TAC) meet U.S. Department of Energy (DOE) standards. The TAC's goal is to produce high-quality documents that adhere to professional standards of technical accuracy, consistency, and understandability.

The guidelines outlined in this document are based on rules of style developed by the DOE and published in the DOE Field Office, Albuquerque (AL), Correspondence Manual and General Information (DOE, 1991). The Gregg Reference Manual is an additional source of information for rules of grammar and style (Sabin, 1989).

As a rule, these guidelines apply to any technical document prepared for the DOE as part of the TAC's contractual obligation. For example, documents to be released as UMTRA documents with a DOE number are governed by these guidelines. These guidelines also apply to memos and letters prepared by the TAC for the DOE when the correspondence is to be printed on DOE stationery. However, exceptions are acceptable in some instances. For example, TAC correspondence issued on Jacobs letterhead and brief, less formal documents submitted as enclosures or attachments to correspondence are not required to adhere to these guidelines. In addition, news-oriented documentation from the Public Affairs Department follows Associated Press style guidelines rather than the DOE or Gregg manuals. Regardless of the style used, each document should be technically correct, grammatically correct, internally consistent, and well written.

2.0 DOCUMENT ORGANIZATION

During the document planning process, the document's purpose, content, scope, and audience are determined and communicated to authors and reviewers. Once the authors understand the requirements, they are prepared to start organizing the document. A document's structure should be logical, and that logic should be clear to the reader. Sections 2.1 through 2.3 describe several methods for document planning.

2.1 LINEAR OUTLINE

Linear outlines are the most common document planning device. They are generally organized as follows:

DOCUMENT TITLE

I. First-level heading (major section or chapter heading)
   A. Second-level heading
      1. Third-level heading
      2. Third-level heading
   B. Second-level heading
      1. Third-level heading
      2. Third-level heading
      3. Third-level heading
   C. Second-level heading
      1. Third-level heading
      2. Third-level heading

The title describes the document's subject matter. It should be fairly short (preferably no more than 12 words). First-level headings broadly define the contents of a section or chapter. Second- and third-level headings define in more specific detail the contents of subsections. All subsection (second- and third-level) headings must fall within the scope of the higher-level heading under which they appear.

Once an outline is prepared and annotated, it can be evaluated to see whether it is structurally sound. A procedure called the structured-text evaluation procedure (STEP) (Baker, 1994) can be applied to each group of parallel headings (that is, all first-level headings [I, II, III] or all second-level headings [A, B, C]). Each group of parallel headings (called modules) must pass the following five tests to be structurally sound (Baker, 1994):

- Inclusion test — Make sure all appropriate items are included in the module.
- Exclusion test — Make sure all inappropriate items are excluded from the module.

- Hierarchy test — Make sure the items in the module are hierarchically parallel. Move inappropriate items to the appropriate level.

- Sequence test — Make sure the items in the module are arranged in some kind of logical sequence. For example, in TAC baseline risk assessments, third-level headings in Section 5.0, Toxicity Assessment, are arranged alphabetically. Other sequences might be qualitative, quantitative, or chronological.

- Language test — Make sure the items in the module are grammatically parallel. Rewrite headings if necessary to make them parallel.

The structure of a document should be obvious to readers so that they may develop their own "mental map" of the document to follow as they read. This reinforces and increases their comprehension of the document's contents (Baker, 1994).

2.2 NONLINEAR OUTLINE

Another way to develop a document's structure is to use a less rigid, nonlinear outline (Rubens, 1992). In nonlinear outlining, the author writes the main topic in a circle or oval in the center of a page. From the main topic, the author draws related secondary topics radiating from the main topic like the spokes of a wheel. Tertiary topics radiate from secondary topics, and so on. When it's time to begin writing, the topics are transferred to index cards; the cards are then arranged on a story board according to the relationships shown in the drawing. To begin fleshing the document out, notes can be written on the cards or new cards added if necessary. Using the nonlinear outline, multiple authors can quickly and easily brainstorm, develop topics for discussion, and visualize the relationships among them.

2.3 PYRAMID MODEL OF ORGANIZATION

A third approach for organizing text before the writing process starts is to apply a pyramid model of organization (Moody, 1990):

- Identify the point of the document or section (the top of the pyramid). The writer must be able to identify and encapsulate the most important point of any document, even complex ones.

- Determine how the point of the document or section will be supported in the text (the middle of the pyramid). Establish a few major categories for clarifying and justifying the point.

- Include data to document the legitimacy of the arguments set forth (the bottom of the pyramid). Numerous pages of detailed data (for example, tables) can be placed at the end of the document in an appendix.

This technique accomplishes two objectives: it reinforces the purpose of the document and it provides a starting point for overcoming writer's block. The pyramid model can then be used to build the text when the author begins writing in earnest. If the author is working from an outline, the pyramid model can be applied at any level of organization, from the document as a whole to sections, subsections, and paragraphs.

2.4 GENERAL WRITING GUIDELINES

UMTRA Project authors should strive for clarity and conciseness in their writing style. The following guidelines will help authors write clearly and precisely:

- Keep the document's purpose and readership in mind. Most UMTRA Project documents must be written simply enough to be understood by the general public.

- Use strong, concrete language: verbs (the strongest part of speech) and nouns. Avoid using adjectives and adverbs, which often connote opinion rather than stating fact.

- Try to keep sentences under 25 words (about two and one-half typed lines of text).

- Use simple sentences (consisting of one independent clause) as much as possible. Compound sentences (consisting of two independent clauses) or complex sentences (consisting of one independent clause plus one or more dependent clauses) are acceptable under the following circumstances:

  - The main subject and the verb are not too far apart.
  - The sentence stays within the 25-word limit.

- Be consistent in the use of verb tenses. This is particularly important in executive summaries. Changing tenses makes the writer look indecisive.

- Use the active voice in most cases.

- Put statements in positive, rather than negative, form.

Most writing principles are guidelines, not binding rules. It is acceptable to deviate from them, provided the author understands why and deviation is necessary for clarity and flow.

2.4.1 Paragraph headings

During the writing process, a helpful organizational technique is to break up large blocks of text by inserting paragraph headings. This technique helps writers keep their thoughts focused. It also helps writers find and eliminate instances of repetitive text, because it emphasizes what the contents of each section should be.

Paragraph headings also help the readers. They can scan the pages, in the same way newspaper readers scan headlines, to find the information they need.

2.4.2 Bullets

When a sentence contains a list of items, consider using bullets to present the list more clearly and to give it prominence. A bulleted list also breaks up gray blocks of text, making the page lighter and more attractive.

Each item in a list of bulleted items begins with the same part of speech (for example, all nouns or all verbs). If verbs are used, they all take the same form (for example, present tense, past tense, or present participle). The overall construction of all the items should be similar as well. For example, if the first item is a complete sentence, all the items should be complete sentences.

Items in a bulleted list can be subdivided by using indented hyphens. The hyphenated items need not be parallel to the bulleted items, but they should be parallel to each other.

Example:

The baseline risk assessment consisted of the following steps:

- Data evaluation.
  - Combining data from various site investigations.
  - Comparing sample results with background and tailings source data.
  - Selecting chemical data for use in the risk assessment.
- Exposure assessment.
  - Characterizing exposure settings.
  - Identifying exposure pathways.
  - Quantifying exposure.
- Toxicity assessment.

- Identifying critical toxicity values.
- Evaluating noncarcinogenic effects.
- Evaluating carcinogenic effects from radionuclides and chemical carcinogens.

- Risk characterization.

  - Quantifying risks from outputs of toxicity and exposure assessments.
  - Combining risks across exposure pathways and multiple contaminants.
  - Characterizing uncertainties.

In bulleted listings, the first word of each item begins with a capital letter, and each item ends with a period.

2.5 LEVELS OF EDIT

The audience for a document determines how rigorous the editing should be. A document that will be reviewed by an important and critical audience needs a thorough edit. A document that will be widely distributed or one that will be a prototype needs a thorough edit. A document that might be cited by regulatory agencies must be thoroughly edited. A thorough edit results in clarity of all elements of the document.

On the other hand, a document that will remain in-house; one that will be read by a small, knowledgeable, and noncritical audience; or a document that is in internal draft form requires an edit that simply results in completeness, consistency in format, and grammatical correctness.

Following are the elements of various levels of edit, from the least stringent through the most. Also listed are the estimated times required to perform the level of edit given. These editorial productivity standards were developed by Writers, Inc., working with the National Commission on Productivity.

Proofreading

The technical editor will

- Check copy against original or edited text for conformity to text.

Rate of Productivity: 20 pages per hour; 160 pages per day

Integrity check

The technical editor will answer the following questions:

- Does the document include all necessary sections; e.g., the executive summary, appendixes, front matter, back matter, and attachments?

- Are figures referenced in the order in which they appear? Do they correspond to the text that has been written about them? Are copies present of all figures called out in the text?

- Are tables referenced in the order in which they appear? Do they correspond to the text that has been written about them? Are copies present of all tables called out in the text?

- Are appendixes referenced in the order in which they appear? Do they correspond to the information that has been given about them in the text?

- Are all references cited in the text listed in the reference section? Are all references listed in the reference section cited in the text?

- Have DOE Orders, regulations, laws, references to other sections of the text, etc., been verified?

- Are acronyms used in the text defined on the list? Are acronyms that are defined on the list used in the text?

Rate Productivity: 20 pages per hour; 160 pages per day

Level 1 (Simple Edit)

Together with performing an integrity check, the technical editor will mark

- Typographical errors and misspellings (other than variants).

- Sentence fragments.

- Internally inconsistent headings and nonstandard pagination.

- Errors in sequencing tables and figures.

- Misalignment or incorrect orientation of figures and tables.

- Nonstandard elements of style (format).

- Inaccessible references (inadequate information precludes finding the document).

- Violation of policy or copyright laws.

Rate of Productivity: 10 pages per hour; 80 pages per day

Level II (Sentence Edit)

In addition to the corrections for the Integrity Check and the Level I edit, the technical editor will mark

- Subject/verb disagreements and other grammatical errors.
- Internal inconsistencies in acronyms, hyphenation, abbreviations, etc.
- Nonstandard word use and punctuation.
- Misplaced modifiers.

Rate of Productivity: 6 pages per hour; 48 pages per day

Level III Paragraph Edit)

In addition to the corrections marked above, the technical editor will mark

- Sentence problems, including
  - Overly complex sentences.
  - Incomplete comparisons.
  - Faulty parallelism.
- Wordiness and overuse of passive voice.
- Figures and tables that do not communicate their message (they are unclear).

Rate of Productivity: 4 pages per hour; 32 pages per day

Level IV (Substantive)

In addition to the corrections listed above, the technical editor will mark

- Overall organization of document.
- Inconsistencies between numbers cited in text and numbers cited in tables.
- Unclear or poorly organization paragraphs.
- Inconsistencies in technical content. Note: The editors will flag technical inconsistencies for the author to resolve. Technical content is the responsibility of the author. The editor may or may not spot inconsistencies (look at this as just another pair of eyes).

Rate of Productivity: 3 pages per hour; 24 pages per day

Each document that is to be sent to the client requires at least a Level 3 edit before it leaves this office. However, in most cases, a substantive edit will be performed.

The technical editor will also read your document and answer the following questions:

- What is the purpose of this document? Is the purpose stated clearly? Has the purpose been met?
- Who is the audience for this document? Is the writing level appropriate for the audience?
- What are the conclusions required in this document? Are they stated clearly? Are they supported in text?
- Does the document flow smoothly from one topic to another? Is the style consistent throughout?

The technical editor also coordinates and proofs all word processing, coordinates and edits graphics, assembles and checks camera-ready originals, and coordinates production.

3.0 STANDARD DOCUMENT FORMAT

3.1 DOCUMENT NUMBERING SYSTEM

The TAC's document numbering system is based on DOE Order 1430.2B, *Scientific and Technical Information Management Program*. The TAC document numbering system applies to all newly written and revised TAC documents delivered to the DOE UMTRA Project.

3.1.1 Exceptions

Environmental impact statements (EIS) and environmental assessments (EA) are exempt from the standard UMTRA Project document numbering system. DOE Headquarters assigns numbers for these documents.

3.1.2 Document numbers and stages

Document number structure

Document numbers consist of the agency/contract number followed by numeric characters assigned sequentially by the technical editor. Beneath the document number is a revision number indicating whether the document is being submitted to the DOE for the first time (Rev. 0), the second time (Rev. 1), and so on.

Example: DOE/AL/62350-107
REV. 0

This information appears on the cover and title page and in a footer on every page of a document.

Document stages

TAC documents delivered to the DOE UMTRA Project can be submitted in one of four stages: draft, preliminary final, final, or published. Most UMTRA Project documents are delivered as final documents (with internal draft versions identified by a series of version numbers in the document footer). Remedial action plans (RAP) are submitted in all four stages; the cover and title page designate the stage of the RAP. Other types of documents (for example, baseline risk assessments) are delivered as draft and final documents. A series of revision numbers may be assigned within a stage if the document sponsor or the DOE wants the document resubmitted with changes before advancing to a subsequent stage. Covers and title pages do not reflect the document stage of these documents to eliminate revision cycles if possible.

Each stage and revision constitutes an official version of the document. Once a document in a given stage has been officially delivered to the DOE, that stage is archived by Word Processing.

Internal changes

A document may be changed internally several times before it is officially delivered to the DOE UMTRA Project. To identify rounds of changes made to a document during internal review cycles, the initial version of a document is identified as "VER. 1." Substantive internal changes result in a new version number.

Changes are recorded in a change history page and may also be sidebarred or redlined in the text.

Definitions

Internal changes—Changes made by internal TAC staff. Internal revisions are recorded in the change history page and can be either major or minor revisions. The document is assigned a new version number for major internal revisions. The version number appears in footer only. For minor revisions, only the date in the footer changes.

Examples:	DOE/AL/62350-1 REV. 0, VER. 1	18 NOVEMBER 1995 (initial version) 040D1SX.DOC (DOC)
	DOE/AL/62350-1 REV. 0, VER. 2	4 DECEMBER 1995 (major changes) 040D2SX.DOC (DOC)
	DOE/AL/62350-1 REV. 0, VER. 2	12 DECEMBER 1995 (minor changes) 040D2SX.DOC (DOC)

Major changes—Changes to a document that significantly alter that document's nature or intent. The technical editor assesses the significance of the changes. Major changes require a new version number.

Minor changes—Changes to a document that do not significantly alter the document's nature or intent. Some examples of minor changes would include the correction of spelling errors (and similar editorial corrections), reformatting of text and attachment materials, etc. The technical editor assesses the significance of the changes. Minor changes are recorded in a document's change history page with the date of the minor change included. The changes can be sidebarred or redlined for reviews.

External revisions

A document is officially delivered to the DOE after the sign-off and transmittal process is complete (JEG, n.d.). The DOE may revise the document at this time.

If the document was submitted as a final, or was submitted as a draft but is remaining in the draft stage, the revision number is increased.

Definition

External revisions—Revisions made by agencies such as the DOE, U.S. Nuclear Regulatory Commission (NRC), U.S. Environmental Protection Agency (EPA), states, tribes, public, etc. External revisions are recorded in the change history page and in the cover, title page, and footer. Revisions can be sidebarred or redlined for reviews.

Examples:	DOE/AL/62350-107 REV. 1, VER. 1	19 DECEMBER 1994 040F1SX.DOC (DOC)
	DOE/AL/62350-107 REV. 2, VER. 1	25 APRIL 1995 040F2SX.DOC (DOC)
	DOE/AL/62350-107 Rev. 3, Ver. 1	12 NOVEMBER 1995 040F3SX.DOC (DOC)

When a document is designated as draft, preliminary final, or final and it advances to a new publication stage (for example, draft to preliminary final), any revision numbers assigned at the previous stage revert to Rev. 0 at the new stage, and the first internal preliminary final version is called "Ver. 1." Changes are tracked as in the draft stage.

Figure 3.1 summarizes the TAC document numbering system.

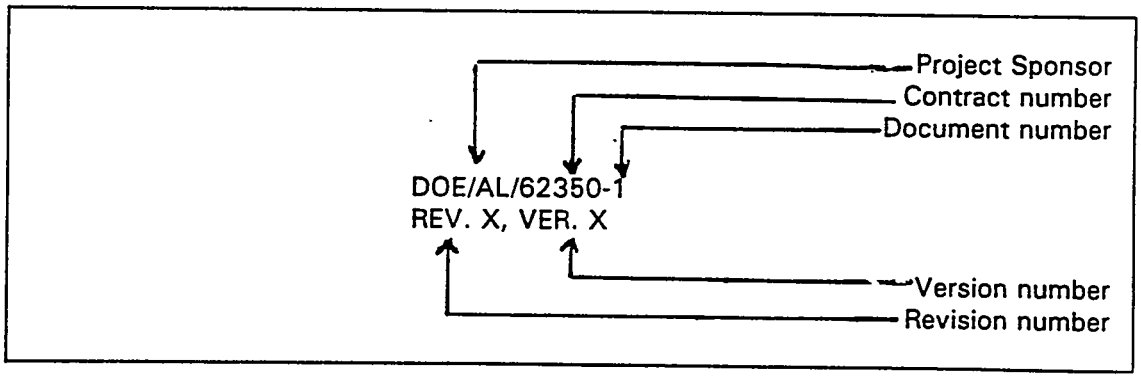


FIGURE 3.1 SUMMARY OF TAC DOCUMENT NUMBERING SYSTEM

3.2 COVERS

All UMTRA Project documents are published with one of two standard covers that carry a DOE logo and an UMTRA Project logo. Ivory covers are used for UMTRA Surface Project documents, and gray covers are used for UMTRA Ground Water Project documents. The logos are preprinted in blue ink on the

cover stock. For each document, the word processing operator sets the document number, title, date, and other pertinent information in the appropriate typeface, font size, and format. This information is copied onto the preprinted covers when the document is reproduced (Figure 3.2).

3.2.1 Inside front cover information

To classify document availability, the TAC includes one of the following two statements in the inside cover of each document to ensure appropriate distribution.

Intended for public release

Documents intended for public release are widely available to the public through the National Technical Information Service. Most UMTRA Project documents are intended for public release. These documents include the following statement on the inside front cover (see Figure 3.3):

Not intended for public release

Documents not intended for public release are available only to the DOE and its contractors through the Office of Scientific and Technical Information. These documents usually contain sensitive information that should not be widely distributed (for example, audit information). They include the following statement on the inside front cover (see Figure 3.4):

3.3 FRONT MATTER

The front matter in a standard UMTRA Project document consists of a title page, summary (optional), table of contents, list of figures, list of tables, list of acronyms, and change history page.

3.3.1 Title page

The first page of a document is the title page. It contains the document number and revision number in the upper right corner, the title centered on the page in all caps, and the month and year of publication in initial caps. The title page also includes the DOE UMTRA Project name, DOE UMTRA Project location, and the DOE contractor (Figure 3.5).

If a new document supersedes a previously published report, a statement to that effect appears on the title page. The statement identifies the number of the superseded report; for example, "This document supersedes document number UMTRA-DOE/AL-050010.0000."

The title page has no page number.

DOE/AL/62350-65
REV. 0

BASELINE RISK ASSESSMENT OF GROUND WATER CONTAMINATION AT THE URANIUM MILL TAILINGS SITE NEAR RIVERTON, WYOMING

September 1994

FIGURE 3.2 SAMPLE COVER

INTENDED FOR PUBLIC RELEASE

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.

Number of pages in this report:

DOE and DOE contractors can obtain copies of this report from:

Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(615) 576-8401

This report is publicly available from:

National Technical Information Service
Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

FIGURE 3.3 PUBLIC RELEASE STATEMENT

NOT INTENDED FOR PUBLIC RELEASE

This report has been reproduced from the best available copy.

Number of pages in this report:

For availability contact:

Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(615) 576-8401

FIGURE 3.4 RESTRICTED STATEMENT

DOE/AL/62350-65
REV. 0
↑
Document number

BASELINE RISK ASSESSMENT OF GROUND WATER CONTAMINATION AT THE URANIUM MILL TAILINGS SITE NEAR RIVERTON, WYOMING ← Title

September 1994 ← Date

Prepared for
U.S. Department of Energy
UMTRA Project
Albuquerque, New Mexico ← Client

Prepared by
Jacobs Engineering Group Inc.
Albuquerque, New Mexico ← Contractor

FIGURE 3.5 SAMPLE TITLE PAGE

3.3.2 Summary

A summary (which may be called an executive summary or citizens' summary) is optional. It may be included as part of the front matter (beginning on a right-hand page). A summary condenses the document in a self-contained package. It includes information on the nature and purpose of an investigation, a brief discussion of the results, and conclusions or recommendations. Its pages are numbered ES-1, ES-2, etc., for executive summaries or CS-1, CS-2, etc., for citizens' summaries.

3.3.3 Table of contents

In the table of contents, major section titles are listed in all caps. Subsections are indented, and titles are listed with the first word initial-capped (Figure 3.6). The pages are numbered with lowercase roman numerals (i, ii, iii, etc.).

Attachments or appendixes to a document are listed at the end of the table of contents in all capital letters. Each attachment or appendix contains its own front matter, if required.

3.3.4 List of figures and tables

The list of figures (Figure 3.7) starts on a new page immediately after the table of contents. Plates are listed at the end of the list of figures. If the list of figures is short (up to one-half of a page), the list of tables can start on the same page. The page numbering continues with lowercase roman numerals.

3.3.5 List of acronyms

A list of acronyms contains all the acronyms used in the document, listed alphabetically, and their definitions. The list is single-spaced, and the page numbering continues with lowercase roman numerals.

3.3.6 Change history page

The change history page documents revisions made by TAC staff and external clients (Figure 3.8). Sidebarred or redlined text may be used in a document to identify areas of change listed in the change history page. The change history page immediately follows the list of tables; the page numbering continues with lowercase roman numerals. The change history page is removed before copies of the document are delivered to the DOE and is filed with the camera-ready originals after delivery.

3.4 PAGE AND TEXT FORMAT

The following standards are to be used in setting up page format.

TABLE OF CONTENTS

FIGURE 3.6 SAMPLE TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

FIGURE 3.7 SAMPLE LIST OF FIGURES AND TABLES

CHANGE HISTORY

Document version	Date	Pages/comments
Rev. 0, Ver. 1	11/18/92	Initial version.
Rev. 0, Ver. 2	12/4/92	Major revisions. TAC review and editing changes.
	12/8/92	Changed title page and pages i, 4-5, and 6-9.
Rev. 1, Ver. 1	12/18/92	Changed pages i through iii; 1-1 through 1-4; 1-6; 1-8; 2-4 through 2-7; 3-1 through 3-11; 4-7; 5-6; 5-15; and 6-20. Added pages 2-8 through 2-14. NRC changes.

FIGURE 3.8 SAMPLE CHANGE HISTORY PAGE

3.4.1 Font

The standard font for UMTRA Project documents is Swiss Roman or an equivalent font (for example, Universal), point size 11. Most documents predating December 1991 are printed in Letter Gothic 12 type. Existing documents in Letter Gothic 12 should not be changed to Swiss Roman 11 unless the entire document will be revised and reprinted.

3.4.2 Paragraph format

Text is single-spaced in most UMTRA Project documents. However, documents prepared for publication in the *Federal Register* (for example, a finding of no significant impact) are double-spaced. Text is left-justified.

3.4.3 Headings

Headings—titles of the various divisions of the report—represent the organization of the report and allow the author to present the narrative in a clear and logical sequence. They are designed to make it easier for the reader to grasp the nature of the material, its organization, and the relationship of its various parts. When the headings are assembled, as on the contents page, they provide an outline of the report.

Heading styles can vary with the type of document, need for cross-referencing, and number of subheading levels required.

Most UMTRA Project documents are prepared using the arabic-decimal style method. Figure 3.9 shows a sample of the arabic-decimal method. Some documents, intended primarily for public audiences, may not have any paragraph numbering.

Major sections are numbered 1.0, 2.0, etc. The section number and title are centered at the top of the page. The title is typed in all caps. The number and title are bold.

All subsection numbers are set at the left margin, with the title following. At the first subsection level (for example, 3.2), the title is typed in all caps and bold. At the second subsection level (for example, 3.2.2), the title is typed with only the first letter of the word capitalized, and the title is underlined. The number and title are bold. The text begins two lines below the subsection title. It is indented to a block format (Figure 3.9).

Numbered subsections are not permitted beyond three numbers (for example, Section 3.2.4). Indented bullet listings or unnumbered, underlined section titles may be used to identify further subparagraphs (Figure 3.9).

TITLE OF DOCUMENT
TWO LINES
SECTION TITLE

1.0 LEVEL 1 HEADING

A level 1 heading introduces a major section of the report such as a Summary, Introduction, or Conclusions. It begins at the top of an odd-numbered page. It is typed in all caps, centered, and boldfaced.

1.1 LEVEL 2 HEADING

Level 2 headings describe topics that are secondary to the main section. If Level 2 headings are used, there should be two or more. A Level 2 heading is typed in all caps, flush left, and boldfaced.

1.2 LEVEL 2 HEADING

Level 2 text.

1.2.1 Level 3 heading

Level 3 headings describe details of the secondary topics. Level 3 headings are typed with the first word initial capped and the rest lowercase (except proper nouns), flush left, underlined, and boldfaced.

1.2.2 Level 3 heading

Level 3 text.

Level 4 heading

Level 4 headings are similar to level 3 headings but are not numbered. Further subdivisions of topics are indicated by bullets.

DOE/AL/62350-##
REV. #, VER. #
DATE
FILENAME

1-1

FIGURE 3.9 SAMPLE ARABIC-DECIMAL METHOD

3.4.4 Text callouts

In text callouts for other sections and for figures, tables, appendixes, and attachments, words such as "Section," "Figure," and "Table" are initial-capped. Figures and tables usually appear on the first page immediately after their first callout is mentioned in the text, in order of callout.

In some cases, documents contain so many figure or table pages that the standard practice of placing them within the text, after their first callout, interrupts the flow of the text. In those cases, the document coordinator should request that all figures and tables be placed at the end of each section (for example, Data Analysis and Retrieval Tool [DART] tables).

3.4.5 Page numbering

Pages are usually numbered by section (1-1, 1-2, 1-3; 2-1, 2-2; 3-1, . . .). In very short documents (under 20 to 25 pages), pages may be numbered consecutively (-1-, -2-, -3-. . .).

3.4.6 Headers and footers

The page design includes a header and footer. The header identifies the document title in the upper left corner and the appropriate major section title in the upper right corner. The footer contains the document number (including revision number and version number) in the lower left corner and the date and document file name in the lower right corner. The use of headers and footers within documents simplifies document retrieval. The header and footer are set in 7-point type.

3.4.7 Use of numbers in text and tables

Power of 10 notation

A column of numbers in tables may be expressed by dividing each number by a multiple of ten and displaying the multiple as a power of 10, either as 10 plus a superscript (scientific notation) or as E and a number on the line (computer notation). In the following example, all numbers in each row are equal.

37,000	3.7×10^{4}	3.7E+04
3,700	3.7×10^{3}	3.7E+03
370	3.7×10^{2}	3.7E+02
37	3.7×10^{1}	3.7E+01
3.7	3.7×10^{0}	3.7E+00
0.37	3.7×10^{-1}	3.7E-01
0.037	3.7×10^{-2}	3.7E-02
0.0037	3.7×10^{-3}	3.7E-03
0.00037	3.7×10^{-4}	3.7E-04

A column of numbers that share the same power of 10 is often displayed by centering the power of 10 above the column. To avoid ambiguity in UMTRA Project documents, authors who wish to use tables containing power of 10 factors are to construct them so that displayed numbers in columns *are to be multiplied* by any power of 10 factor in the column heading to arrive at the represented number. Thus, if the displayed number in a column is 92 and the factor in the column heading is (10^3), the represented number is 92,000. When a unit of measure is included with a 10 factor, write the 10 factor first, followed by the unit of measure, both enclosed in parentheses and centered under the column head. Thus, (10^3 m) indicates that the number in the column represents 1000 m, and a displayed number of 240 in the column therefore represents 240,000 m.

Accuracy of numbers

Although some numbers are exact (e.g., 42 wells on a site, or 60 seconds per minute), most numbers in technical documents are estimates and are therefore not 100 percent accurate. The way these inexact numbers are reported provides the reader with an indication of their accuracy and eliminates the need to qualify every reported number as "approximate." All digits reported for a number should be true except for the digit located furthest to the right, which is estimated and is therefore somewhat in doubt. For example, if the distance to the nearest town is reported as 46 miles (mi), the educated reader will realize that this distance is only accurate to within a mile or so.

In some contexts, numbers may be rounded to less accuracy for reporting. However, one should never communicate more accuracy for a number than is supportable. For example, one often rounds a decimal number to the nearest whole number for simplicity when such rounding is immaterial to the document. Examples include reporting a 1-mile radius of the site (instead of a 1.0-mi radius) or a 36-foot (ft) borehole depth (instead of the 35.8-ft borehole depth recorded on the boring logs). On the other hand, reporting that 5,681,227 pounds (lb) of tailings were moved from a site is unsupportable if the scale at the weigh station is accurate only to the nearest 1000 pounds. The number should be reported as 5,681,000 lb, or even as 5,680,000 lb.

When reporting a number, remember that a reader will interpret all non-zero digits and zeroes that fall between non-zero digits as significant (real and meaningful). Leading and trailing zeroes follow these two rules:

- Leading zeroes are not significant (e.g., 0.032, 0.0005)

- Trailing zeroes to the right of the decimal point are considered significant (e.g., 59.30, 0.800. Therefore, use trailing zeroes after a decimal point to imply accuracy only (e.g., do not change a laboratory result from 14 milligrams per liter [mg/L] to 14.0 mg/L).

- Trailing zeroes in a whole number are generally assumed not to be significant (e.g., 68,200, 4000). In cases where one or more of the trailing zeroes is meaningful, this must be communicated in words or context. For example, a reported distance of 120 mi implies an accuracy of approximately ± 10 mi. If in reality the distance is 120 ± 1 mi, this increased accuracy can be communicated if needed by words or through the metric conversion, as discussed below.

English/metric unit conversions

Numbers are presented in reports in both English and metric units. The metric unit represents the value of the quantity in the international system of units (SI), or order-of-magnitude multiples or submultiples of the SI unit. Conversion is generally accomplished by multiplication or division by a conversion factor. The conversion factor should represent an exact number or contain several more digits of accuracy than the quantity being converted. The American Society of Testing and Materials (ASTM) Standard for Metric Practice (ASTM, 1984) recommends seven digits of accuracy for conversion factors. The ASTM Standard also contains conversion factors for all commonly used quantities, which are included in this document as Attachment 1.

The proper procedure is to multiply or divide the quantity by the conversion factor and then round the result to an appropriate number of significant digits. Occasionally a conversion requires more than one mathematical operation. In such cases, rounding is done at the completion of the last operation. Intermediate results should not be rounded.

Accuracy in unit conversions

In all conversions, the number of significant digits retained should be such that the English quantity and its metric equivalent express a comparable level of accuracy. As a general rule, this is accomplished by rounding the calculated conversion to the same number of significant figures as the original number. For example, 1700 mi is converted to kilometers (km) by multiplication of the quantity 1700 mi by the conversion factor 1.609347, producing the result 2735.8899 km. This result should be rounded to 2700 km so that the English and metric representations of length have the same number of significant figures.

The appropriate number of significant digits of a unit conversion can be more precisely determined if the author can realistically quantify the uncertainty associated with the original number (e.g., 1700 ± 100 mi). Multiplication of both the quantity and its uncertainty by the conversion factors will identify the location of the estimated digit in the conversion. In the example, (1700 ± 100 mi) * 1.609347 = 2735.8899 ± 160.9347 km. Since the uncertainty is of the order of magnitude of 100, the digit "7" in the conversion 2735.8899 is

doubtful and thus represents the last significant digit. Therefore, the appropriate conversion is 2700 km.

As a second example, 865 ft might in one context represent 865 ± 1 ft and in another context 865 ± 5 ft. Conversion from feet to meters requires multiplication by the conversion factor 0.3048000. The more precise estimate 865 ± 1 ft converts to 263.6520 ± 0.3048 m. Noting the uncertainty, this result should be rounded to 263.7 m. The less precise estimate 865 ± 5 ft converts to 263.6520 ± 1.5240, suggesting rounding to 264 m.

As a final example, 120 mi should be converted to 190 km if the original measurement of 120 miles is only accurate to the nearest 10 miles. However, if by coincidence the actual distance is 120 to the nearest mile or so, then the conversion would be 193 km. The additional significant digit in the conversion clarifies the ambiguity of the trailing zero.

Rounding of numbers

The following rules for rounding are advocated by the ASTM and should be used for reporting data in UMTRA Project reports.

- When the first digit to be discarded is less than 5, the last digit retained is unchanged (e.g., to three significant places 89.248 becomes 89.2).

- When the first digit to be discarded is greater than 5, or if it is a 5 followed by at least one digit greater than zero, then the last digit retained is increased by one (e.g., to three significant places the numbers 89.278 and 89.258 both round to 89.3).

- When the first digit to be discarded is equal to 5 followed only by zeroes, the last retained digit is increased by one if it is an odd number (1,3,5,7,9); for even digits no adjustment is made. (e.g., 89.25 rounds to 89.2 but 89.35 rounds to 89.4).

3.5 TABLES

3.5.1 Introduction

Statistical facts, comparative data, and similar information are usually more comprehensible when presented in tabular form. Fully developed tables present data concisely and facilitate rapid comparison and interpretation. They collect statistics that would lose emphasis if spread out in the text and supply information for ready reference and comparison. Tables should be self-contained, self-explanatory, and as simple as possible. Most important, tables should be unified; that is, they should display one subject with distinctness and not be weighed down with unnecessary details.

The general structure for a simple table is as follows:

Structure of a simple table

	Column spanner		Column spanner	
Stub head	Column head	Column head	Column head	Column head
Row head	XXX[a]	XXX.XX	XXX	XXX.XX
Row head	XXX	XXX.X	XXX	XX.XX
Row head	XXX	X.XX	XXX	X.XXX

[a]The XXXs denote entries in the field of the table.

3.5.2 Numbering

Tables are numbered according to the section in which they appear, then by sequence. For example, if Section 2.0 of a document contains four tables, they are numbered 2.1 through 2.4.

3.5.3 Title

The table title follows the table number on the same line and is centered above the table in bold type. The first word of the title is initial-capped. If the title runs over to a second line, the words on the second line begin immediately below the first letter of the first line of the title.

3.5.4 Column headings and entries

Column headings are centered above the columns in bold type. Column entries of text are set flush left. Column entries of numerical values are aligned by decimal point. The first word of each column heading and column entry is initial-capped. Remaining words are lowercase.

3.5.5 Footnotes

Table footnotes may be cited in the stub head, column heads, row heads, and field entries. Footnotes to the title are discouraged. Lowercase superscript letters are used as footnote indicators, and alphabetical order is followed—reading left to right—first across the column headings and then across each horizontal line of the body. The footnote indicators are superscript unless they occur alone; if the footnote indicator constitutes the complete entry, it is set in the same point size as the body type. Footnote text is generally punctuated as sentences, and paragraph style is used. Footnotes are always placed below the table cutoff rule; thus, if a table covers several pages, the footnotes are given on the last page.

3.5.6 Citations

If a table is taken from another publication, the table must cite the source, even if the table is restyled or retyped.

3.6 FIGURES

3.6.1 Numbering and title

As is the case with tables, figures are numbered according to the section in which they appear, then by sequence.

The Graphics staff applies the figure number and title on each graphic. Each graphic, with the correct figure number and title, should be included in the document when it goes to the Publications Services Department. The word processing operator inserts a page with the figure number and title in the appropriate place within the document.

3.6.2 Content

Where applicable, figures must include scales, a north arrow, and a legend.

Figures taken from other sources must refer to the original source. References on figures must be included in the document reference list. Original figures generated by the TAC do not need to be referenced. A figure may also include reference to U.S. Geological Survey map(s). Map references are not included in the reference list.

Section 4.0 contains more detailed information about UMTRA Project figures.

3.7 LIST OF CONTRIBUTORS

A list of contributors precedes the references section of a document. It allows contributors to be recognized for their participation in the preparation and production of a document.

3.8 REFERENCES

References are placed in the last section of a document. The list is typed in a single-spaced flush left hanging paragraph, with two returns between each reference. The list is alphabetized according to the last name of the first author. Section 5.0 contains specific format information and examples of reference citations and lists.

3.9 BACK MATTER

3.9.1 Attachments

Attachments are stand-alone documents that contain additional necessary information not included in the main text. Attachments to RAPs are stand-alone reports often printed as separately bound volumes. RAP attachments are identified by arabic numerals (for example, Attachment 3). As with the main text, the pages in these attachments are numbered by section.

For smaller documents, attachments are printed and bound with the main text. Each attachment is edited as a new document. It has its own front matter and references section, and acronyms are defined in the text upon first occurrence. It is preferable to identify these attachments by letters (for example, Attachment A). The pages are then numbered by letter (for example, A-1, A-2, A-3 . . .).

3.9.2 Appendixes

Appendixes are appended to attachments or text and are identified by letters (for example, Appendix A). An appendix contains material to support the information in its attachment or in the main text. Such information is often presented as tables, letters, forms, or computer printouts of raw data. Typically, appendixes stand alone as complete documents. The pages are generally numbered consecutively; however, they may be numbered by appendix letter (A-1, A-2, A-3, etc.).

Each appendix is as self-contained as possible. It may include its own table of contents, list of figures, and list of tables; its pages, figures, and tables are numbered separately from those in the main text. The text follows the format of the main text except when it is a direct reproduction of material from another document. Such material need not be retyped for inclusion in an appendix if clear, readable copies can be made from the original document.

Although there are no official restrictions on the length and number of appendixes in environmental documents, UMTRA Project documents do not contain material added simply because there is no other convenient place for it. The included appendixes must be needed to support the main text, and they must not be unnecessarily long or complicated.

3.9.3 Glossaries

Some UMTRA Project documents have a glossary after the main text and before the attachments. The glossary contains the unfamiliar terms used in the document; however, writers must be careful not to let its existence keep them from explaining their ideas clearly. Readers cannot be expected to use the

glossary extensively; they will usually rely on the text to keep them informed when difficult ideas are discussed.

Terms in the glossary are presented in alphabetical order, flush left. Each definition begins on the same line as the term but indented 20 spaces. Terms that require more room than the 20-space indent allows are continued on the following line. A blank carriage return separates each complete item. Examples of some terms as they would appear in the glossary follow:

aquitard	An underground layer of earth or rock that retards ground water flow.
compliance strategy	The ground water remediation method used to meet the proposed EPA ground water standards.
denitrification	A microbial reaction that causes the removal of nitrate from water by converting the nitrate to nitrogen.
fracture zones	Cracks in bedrock caused by geologic forces. Fractures can conduct ground water flow.
hydraulic conductivity	A description of an aquifer's capability to transport ground water.

Arguments over which words to include and which to omit arise surprisingly often when glossaries are being compiled. The following types of words are to be included:

- Words and phrases that are not defined in dictionaries for general use.
- Words whose dictionary definitions leave the reader unsure of the meaning intended in the text. There are several reasons why this confusion can occur:
  - Because the text uses the word in an unusual sense.
  - Because the dictionary gives so many meanings that it is not clear which meaning the text intends.
  - Because the dictionary definition, although referring to the intended meaning, is inadequate.
  - Because the intended meaning is a restriction of the dictionary definition.
- Words adequately defined in dictionaries but of such importance to the project that the reader ought to have ready access to their meanings.

The following types of words are to be omitted:

- Words whose meanings are usually understood by educated persons.
- Words used only once in the text and defined where they are used.

3.10 SINGLE- AND DOUBLE-SIDED REPRODUCTION

Most UMTRA Project documents are reproduced double-sided. In those cases, the first page of a major section (page 3-1, for example) must begin on the right-hand page. If the previous section ends on an even-numbered page, the first page of the new section automatically falls on the right-hand side. However, if the previous section ends on an odd-numbered page (2-13, for example), word processing or the editor must add a blank page 2-14 to fall on the left-hand side. Page 3-1 will then begin on the right-hand side when the document is reproduced.

The technical editor orders DOE copies, in-house copies, and copies for the UMTRA Project Document Control Center. Document Control receives six unbound copies of each deliverable. These copies are distributed to the following:

- Office of Scientific and Technical Information (2 copies)
- Remedial Action Program Information Center (1 copy)
- Atomic Museum (1 copy)
- Active file (1 copy)
- GJPO Transfer file (1 copy)

3.11 BINDING

RAPs and long-term surveillance plans (LTSP) are delivered to the DOE in three-ring binders. National Environmental Policy Act documents (such as EAs and EISs) that are ready for publication are sent to a printing vendor for perfect binding. Other documents are spiral-bound unless the requester asks for three-ring binders. Document Control copies are not bound.

4.0 ILLUSTRATIONS

4.1 INTRODUCTION

Illustrations can add significantly to the understanding of a scientific publication. Much thought and careful planning should go into the processing of technical illustrations, because the quality of the illustrations affects both the substance and the aesthetics of the publication. Authors are therefore responsible for submitting clear, complete draft illustrations to the document coordinator.

Four points should be considered in planning illustrations: 1) purpose, 2) accuracy, 3) readers' ease of use and comprehension, and 4) effective reproduction.

The purpose of illustrations should be clear. Illustrations should be included whenever they substantially increase the understanding of the text.

The rough draft should receive sufficient review before submittal to the Graphics staff to ensure its accuracy.

Readers' ease of use and comprehension are increased when illustrations are arranged logically. For example, before-and-after comparisons are most effective when placed on the same page. Whenever possible, illustrations should be created in portrait (vertical) format so that the reader does not have to turn the document.

Effective reproduction depends on the legibility of the illustration. Information not necessary to the understanding of an illustration should be omitted so that pertinent information is more legible. Also, solid black shapes do not reproduce well and should be avoided; when possible, use grey scales or patterns.

4.2 FORMAT

Standard (8.5- by 11-inch) figures for UMTRA Project documents are prepared by computer in full-page format. Margins surround the figure, one inch on a side. When appropriate, figures include a north arrow, scales in English units and in the International System of Units (SI), surface water or ground water flow direction, and a legend explaining any symbols, shaded or cross-hatched areas, or icons used on the figure. The file path and file name are placed within the margin in the lower left corner.

Figures are numbered by the author or coordinator and are in sequence according to the section in which they appear (Figure 1.1, 1.2, etc.).

Whenever possible, figures are merged with the text to create a fully integrated document. The figure number and title are stacked in the upper left corner in initial caps, flush left, with the number stacked above the title. The legend is

surrounded by a border. Major features are labeled with initial-capped, bold letters. Secondary features are labeled with initial-capped, normal-weight letters. Figure 4.1 shows a sample figure. Table 4.1 is a list of standard symbols to be used in figures.

When a hand-drawn figure is created, Graphics first electronically scans the figure, then creates a computer-generated figure that meets current graphic standards. The figure is assigned a file name, and future revisions are made to the electronic figure.

4.3 CITATIONS

If a figure is taken from another work, a citation acknowledging the source is placed near the drawing. The wording of the citation differs, depending on the circumstances, as follows:

- Figures reproduced as is from the original work.

  Example: From Shawe et al., 1968.

  Note: Copyright permission may be needed.

- Figures scanned or traced from another source without modification.

  Example: Redrawn from Shawe et al., 1968.

- Figures scanned or traced from another source, then modified.

  Example: Modified from Shawe et al., 1968.

- Figures created using data (as in a table) from another source.

  Example: Data from Shawe et al., 1968.

4.4 USE OF COLOR

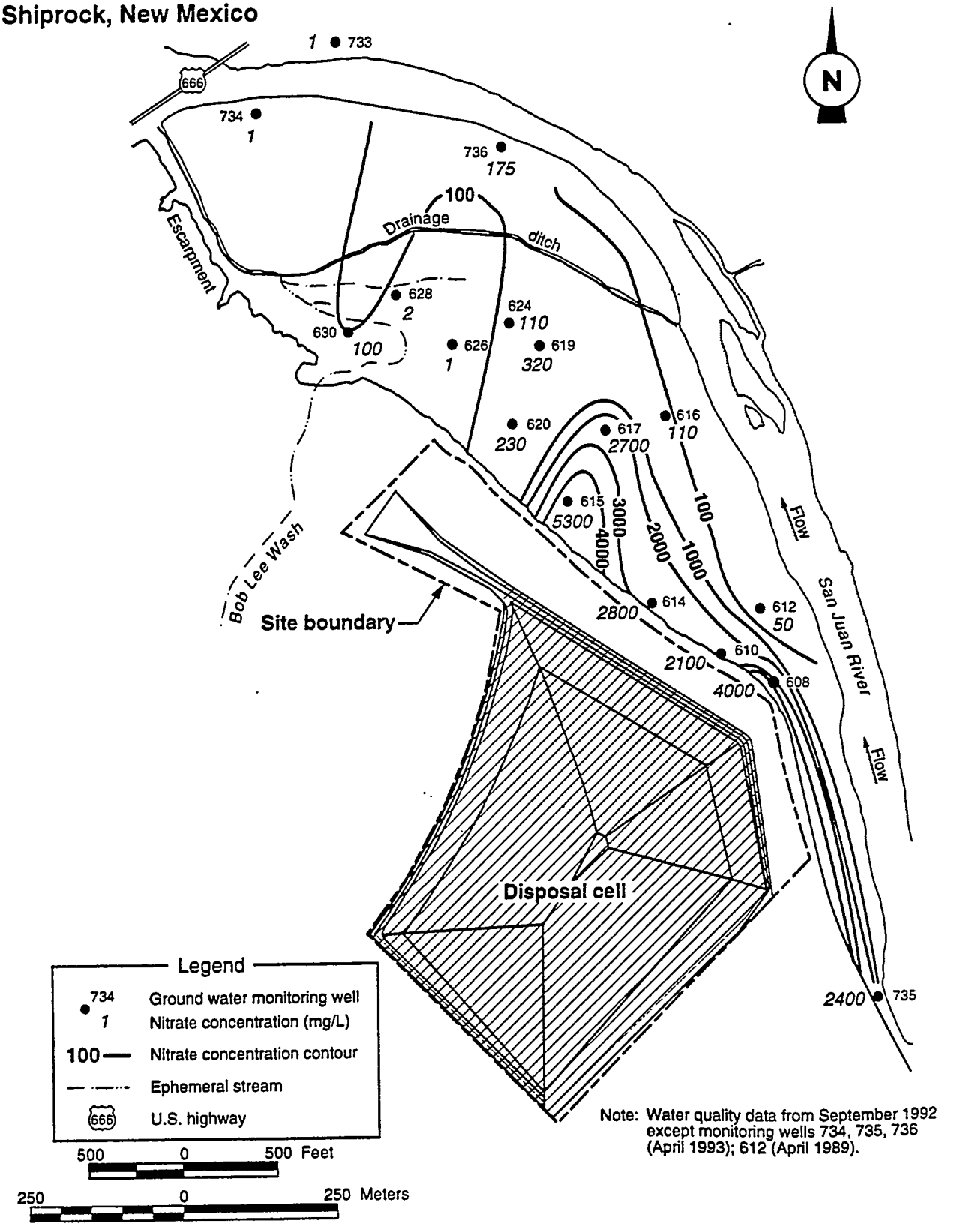
The Joint Committee on Printing, U.S. Congress, has established DOE regulations on color printing. The head of any department or independent office has the responsibility to ensure that all multicolor printing (two or more colors, with black counting as one) contributes demonstrably toward achieving a greater fulfillment of the end purpose of the document in which multicolor is included.

Demonstrably valuable multicolor printing includes the following:

- Maps and technical diagrams where additional color is necessary for clarity.

- Object identification (medical specimens, diseases, plants, flags, uniforms).

Figure 4.1
Sample Figure
Shiprock, New Mexico



Note: Water quality data from September 1992 except monitoring wells 734, 735, 736 (April 1993); 612 (April 1989).

Table 4.1
Graphics Symbols

DOE well (Shallow)

DOE well (Deep)

Domestic well

Water supply well

Surface water sampling location

Background well

Point of compliance well

Decommissioned well

Monitor well (shallow-decommissioned)

Proposed monitor well

Sediment sampling location

Fish sampling

Vegetation sampling location

Special well

Special well (Shallow)

Special well (Active-deep)

Special well (Decommissioned)

Special well

Test areas

Proposed monitor well and boring

Borehole

Abandoned borehole

Proposed monitor well/ Data logger location

Existing well, Data logger location

Stilling Well

Spring

Interstate highway

U.S. highway

State highway

Indian service route

Farm-to-market

Callout 8pt reg. Mountain

Ground water elevation

Gravel pit

Quarry/Mine

Building

Residence

Flowing well

Seep

Paved road

Dirt road

Indian service route

8pt U/l callout Railroad

8pt U/l oblique callout River or creek

8pt U/l oblique callout Ephemeral stream

9 pt Bold U/l County line

8 pt Bold U/l (50% gray) Indian reservation

Standard arrow line #13 arrowhead .7pt black line

8 PT BOLD UC Designated site boundary

12 pt Bold Oblique U/l State line

Site location disposal cell

Site location processing site

Rad

Wildlife

Hiking

Forest

Parks, Recreation sites and Monuments

Fire

Nesting

Handicap

Nuclear

Airport related

Gas/Oil well

Haz waste

Recreation

Patterns

Alluvium

River/pond/lake

Concrete

Shale/silt

Gravel

Shale w/ sandstone

Disposal cell

Tailings pile

Tailings pond

Marsh

Sandstone/sand

Siltstone

Rock-granitic

Earth

Limestone

- Publications for safety programs, fire prevention, savings bonds programs, and competitive areas of personnel recruiting.

- Areas wherein clearly identifiable savings in costs can be soundly predicated on multicolor use.

- Printing for programs required by law, when relative success or failure depends on the degree of public response that can be logically attributed to the number of colors planned and the manner in which they are proposed to be used.

- Storyboards or presentations for public scrutiny.

A site or task manager must write a memorandum, to accompany the reproduction request or order, authorizing the use of color printing for individual illustrations that are to be printed in color in a document that is printed in black and white.

Multicolor printing that ordinarily will not be approved because it does not meet the "demonstrably valuable" criteria includes, but is not limited to, the following:

- Use of additional color primarily for decorative effect.

- Use of additional color in lieu of effective layout and design.

- Excessive use of additional color (that is, many colors when two or three will fulfill the need, three colors when two are adequate, or two colors when one is adequate).

- Inclusion of multiple colors without careful, competent advance planning that recognizes the contribution of the color to the end purpose.

4.5 DRAWINGS

Drawings can focus on details or relationships that a photograph cannot capture. A drawing can emphasize a setting, object, or phenomenon and omit excessive details. Requirements for creating and using drawings follow.

- Draw the different parts of an object or setting in proportion to one another, unless it is indicated that certain parts are enlarged.

- When a sequence of drawings is used to illustrate a process, arrange them from left to right or from top to bottom; the drawings may be numbered for added clarity.

- Label parts in the drawings so that text references to them are clear.

- When illustrating a subsystem, show its relationship to the larger system of which it is a part.

- Place a zero before all decimal points that are not preceded by another number (for example, 0.12).

- Label two or more separate parts of a composite drawing with (a), (b), (c). These letters are placed under the image area.

4.6 GRAPHS AND CHARTS

Graphs and charts, like tables, present numerical data in visual form. However, they have several advantages over tabular or text data because trends, movements, distributions, and cycles are more readily apparent. By providing a means for ready comparison, a graph or chart often shows a significance in the data not otherwise immediately apparent. However, although they present relationships in a more comprehensible form than tables, they are less accurate.

The types of graphs and charts most commonly used are line graphs, bar charts, and pie charts. They can be produced in two- or three-dimensional format.

4.6.1 Line graphs

The line graph, the most widely used of all graphs, shows the relationship between sets of numbers by means of points plotted in relation to axes drawn at right angles (Figure 4.2). Once plotted, the points are connected to form a continuous line or surface, thus accenting the relationship between the sets of figures. The following guidelines should be followed when preparing line graphs:

- Include a legend that lists and explains symbols when necessary.

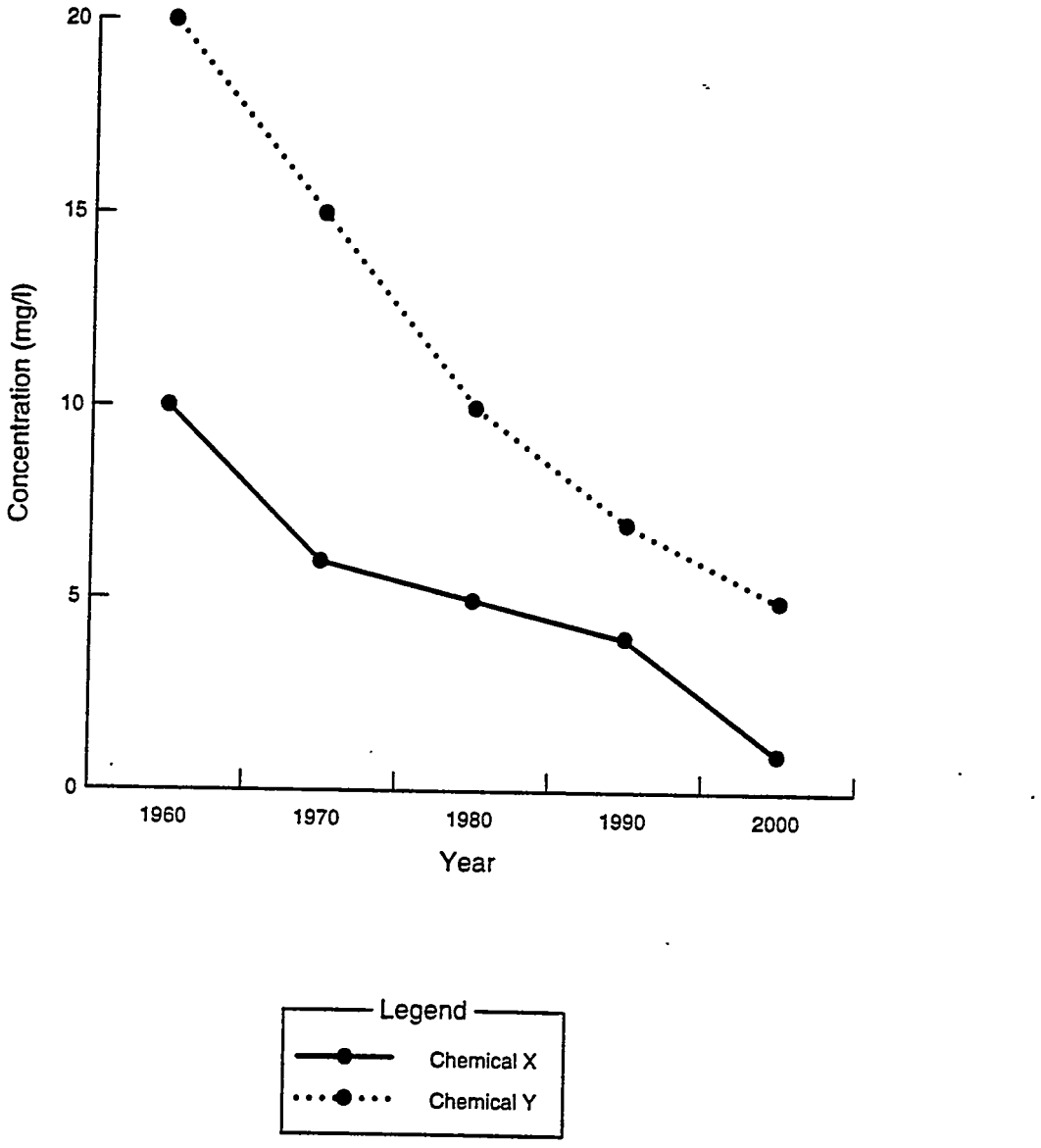
- Arrange the ordinate (vertical scale) in units normally increasing from the bottom to the top. Place the caption for this scale vertically along the axis, reading toward the illustration.

- Arrange the abscissa (horizontal scale) in units normally increasing from left to right. Place the caption for this scale horizontally along the axis. A caption is not necessary if the units on this scale represent years or months.

- Scale the vertical and horizontal axes so that the data being illustrated essentially fill the area of the graph. The curve can be kept free of distortion if the scales maintain a constant ratio with each other.

- If two or more graphs are used to compare data, the scales of that series of graphs should usually be identical so that visual comparisons are not distorted, even though the area of the graph may not be filled in all instances.

Figure 4.2
Sample Line Graph



- Keep grid lines to a minimum so that curved lines stand out. Because precise values are often shown in a table of data accompanying a graph, detailed grid lines are usually unnecessary.

- Place a zero before all decimal points that are not preceded by another number (for example, 0.12).

- SI units are strongly encouraged. The English equivalent may be placed in parentheses.

4.6.2 Bar charts

Bar charts consist of horizontal or vertical bars of equal width but scaled in length to represent some quantity (Figure 4.3). They are commonly used to show 1) quantities of the same item at different times, 2) quantities of different items for the same time period, or 3) quantities of the different parts of an item that make up the whole. The bars on a bar chart must be wider than the spaces separating them.

4.6.3 Pie charts

A pie chart presents data as wedge-shaped sections of a circle. The circle represents 100 percent of some quantity, with the wedges representing the various ways in which the whole is divided (Figure 4.4).

When constructing a pie chart, note the following:

- Keep in mind that the complete 360-degree circle is equivalent to 100 percent; therefore, each percentage point is equivalent to 3.6 degrees.

- Make the relative percentages as clear as possible (begin at the 12 o'clock position and sequence the wedges clockwise, from largest to smallest).

- Shade the wedges clockwise from light to dark (if shading is desired).

- Keep all labels horizontal and give the percentage values of each wedge.

- Check to see that all wedges, as well as percentage values given for them, add up to 100 percent.

4.7 PHOTOGRAPHS (CONTINUOUS-TONE MATERIAL)

If the actual appearance of an object is necessary to a document, a photograph should be used. Photographs are useful for showing objects or phenomena that are new or unusual; that are at a particular stage of development; or that exhibit wear, damage, or the significance of a particular setting (Figure 4.5). When selecting photographs, consider the camera angle carefully so that the

Figure 4.3
Sample Bar Chart

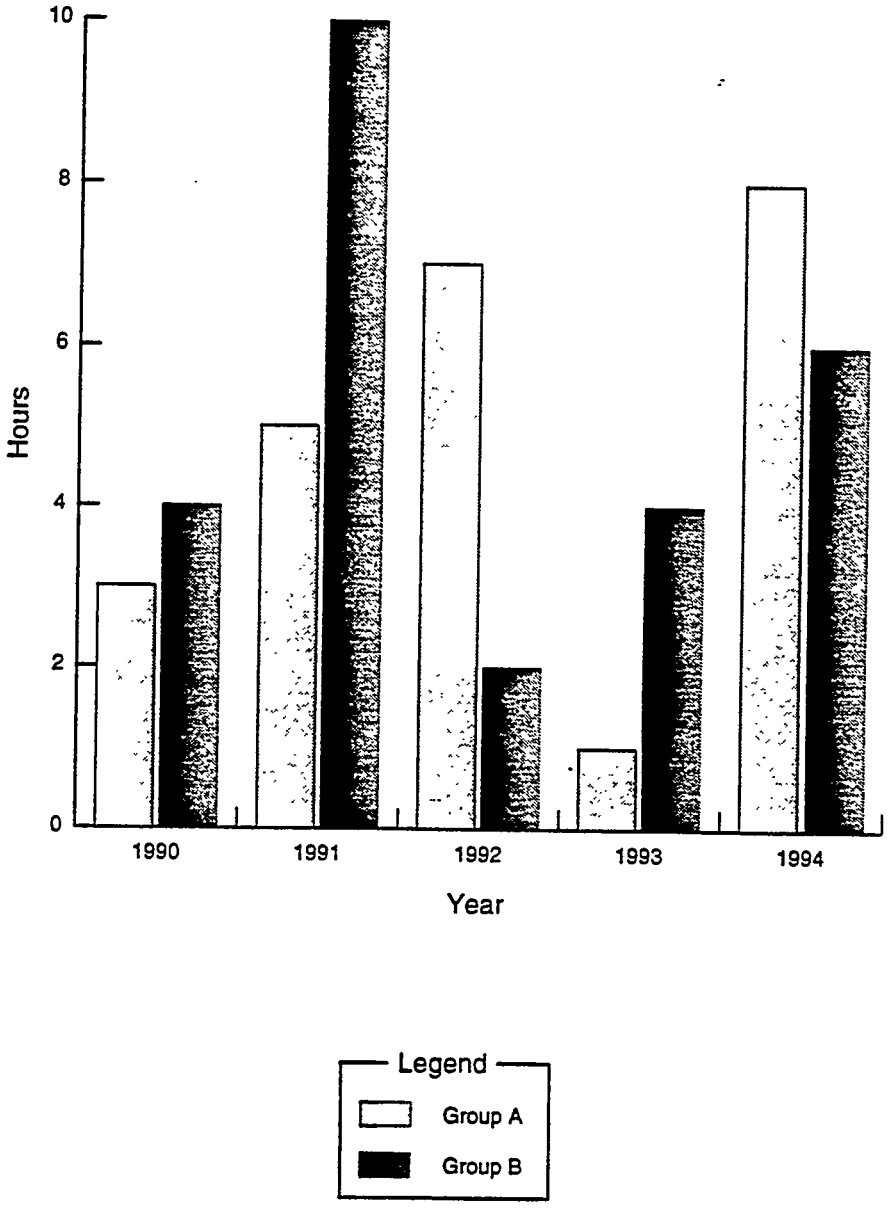


Figure 4.4
Sample Pie Chart

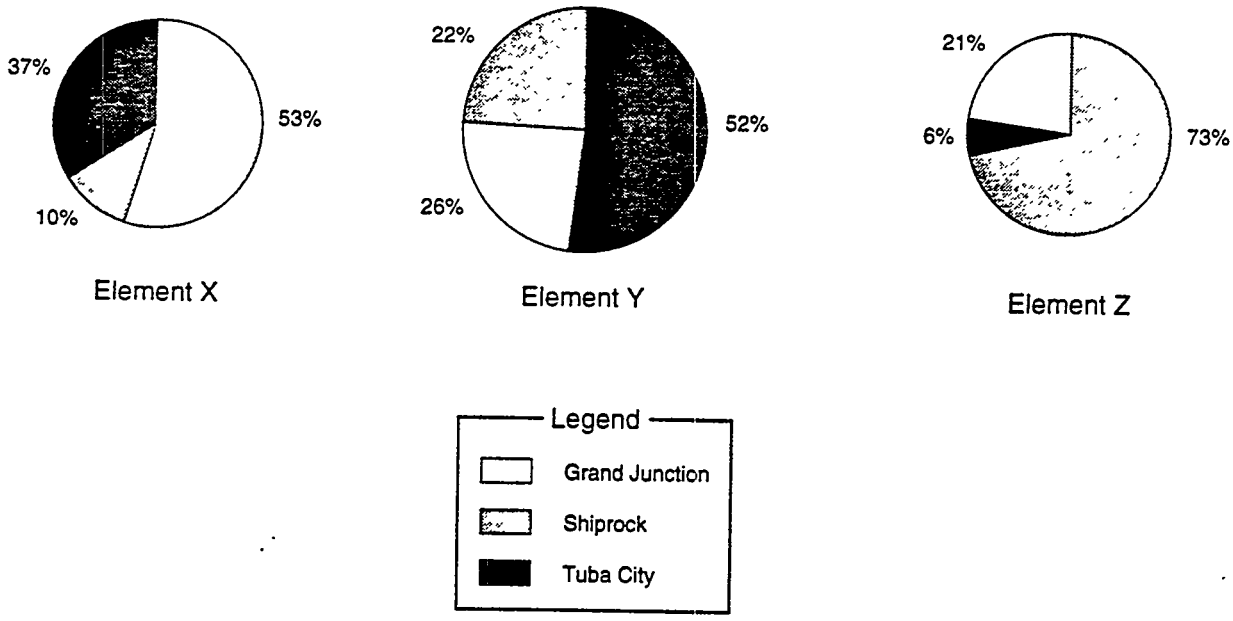


Figure 4.5
Sample Halftone Photograph

photograph shows only what is essential. When submitting photographs, keep the following in mind:

- Submit high-contrast glossy black and white photographs. Do not submit color photographs unless permission has been granted for multicolor printing. (If only a color photograph is available, it can be printed in black and white with some loss of resolution.) The Graphics Department can create black-and-white halftones to ensure high resolution reproduction.

- To show how part labels are to read and where they are to be placed, attach to the photograph a photocopy showing the callouts and any necessary instructions. Do not mark on the image areas of a photograph.

- If the orientation of a photograph is not obvious, indicate the top.

- Plan the photograph so that it can be placed upright on the page and viewed by the reader without turning the document.

- When appropriate, place a familiar object, such as a ruler or other scale, in the foreground to show relative size; in safety- and equipment-related photographs, include properly attired personnel (for example, badge, safety glasses, hard hat, protective clothing) in equipment photographs.

- If the photograph is to be cropped for an area of interest, mark the crop lines with a wax pencil at the edges of the photograph. Do not draw a line directly across a photograph.

- Protect the photographs with heavy paper, cardboard, or glassine folders.

- Never fold or crease photographs.

A photo can be electronically scanned in the computer and placed directly into a document.

4.8 MAPS

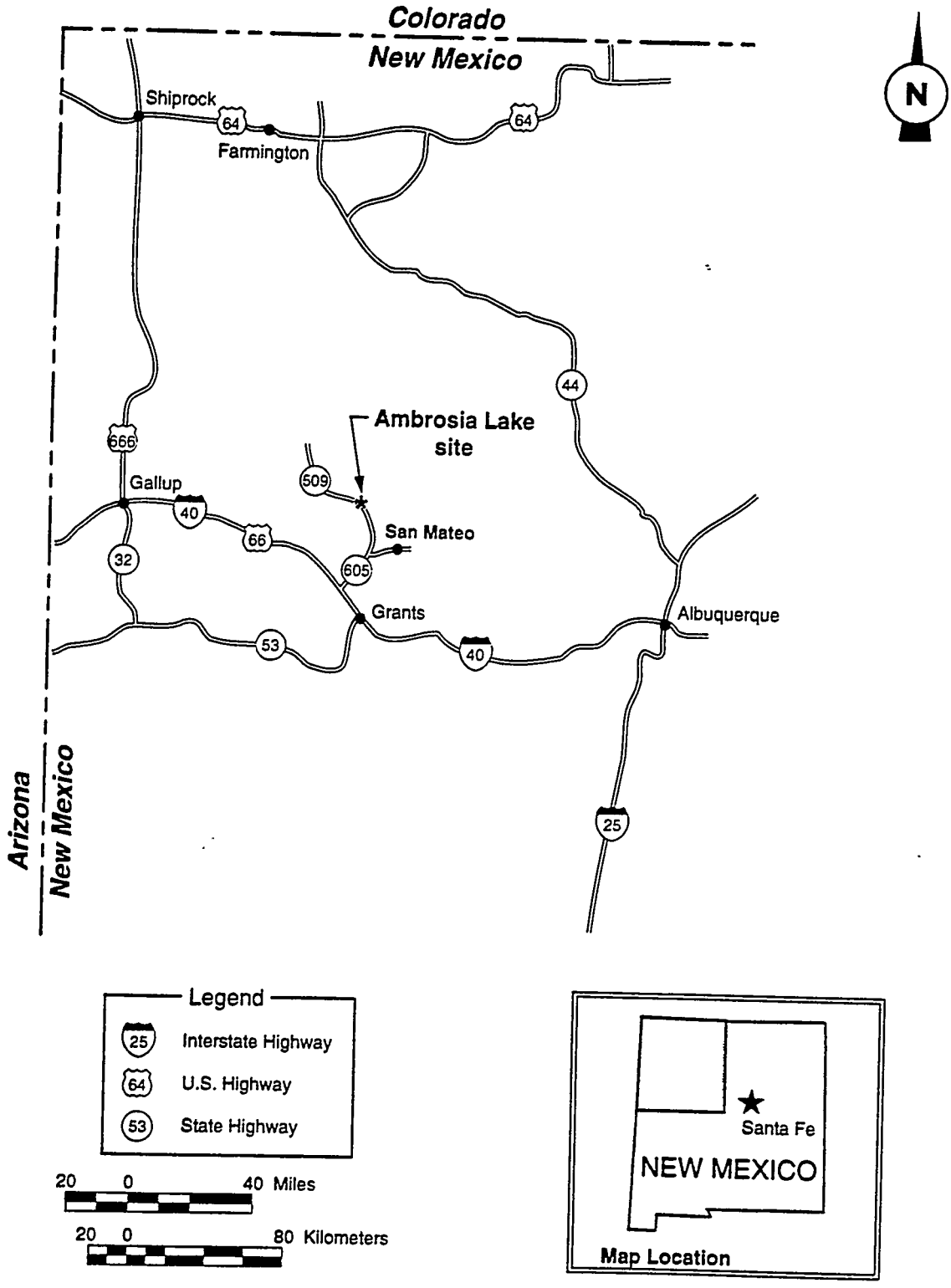
Maps are used to show specific geographic features of an area (roads, mountains, rivers) or to show information according to geographic distribution (population, housing, manufacturing centers) (Figure 4.6).

Bear these points in mind when using maps in a publication:

- Label the map clearly.

- Ensure that all boundaries within the map are clearly identified. Eliminate unnecessary boundaries.

Figure 4.6
Sample Map
Ambrosia Lake, New Mexico



- Eliminate unnecessary information. For example, if population is important, do not include mountains, roads, or rivers.

- Include a scale in English and SI units to give the reader an indication of the map's proportions.

- Indicate which direction is north (true north unless grid north or magnetic north is more useful). North should be toward the top of the map, or to the left if at all possible. It is rarely acceptable to point north to the right side of the page, or to point it down.

- Show the features to be emphasized by shading, dots, crosshatching, or appropriate symbols when color reproduction cannot be used.

- Include a legend for the different shadings or symbols.

- Place maps as close as possible to the portion of the text that refers to them.

In some cases, the Graphics Department can scan a topographic map and place it in a document. Once scanned, the map itself cannot be manipulated. However, callouts and symbols can be created and placed on top of the topographic base.

If time allows, a topographic map of a similar figure can be computer-digitized using AutoCAD. Due to the extensive time required to produce such figures, a direct scan may be a more viable option.

4.9 TOPOGRAPHIC MAPS (AutoCAD)

AutoCAD is used to achieve results such as complete accuracy to scale. When defensibility of a document is primary, AutoCAD is the most appropriate tool in the graphic arena.

Commonly, digitized from a USGS map and set to state-plane coordinates, an AutoCAD-generated map is ideal for plotting well locations and other features that experience frequent changes or movement. Due to the time-intensive nature of AutoCAD work, it is suggested that a thorough review of the desired results be undertaken to establish the proper platform (Mac or AutoCAD). The graphics coordinator and AutoCAD operator are available to help with that decision.

4.10 OVERHEAD TRANSPARENCIES FOR PRESENTATIONS

Overheads, slides, and other presentation materials may be produced by the graphics group. Following are guidelines to assist in their development:

- Length

  - Ideally, your presentation will be no longer than 15 minutes; 20 minutes is the absolute maximum suggested length.

- Number of overheads or slides

  - Too many overheads and slides usually means you're trying to say too much in the time allowed; too few, and you lose your audience. A good staring point is one every 30-45 seconds. One a minute is acceptable. (If you've taken much longer than a minute per overhead or slide, it's likely that it has too much information on it.)

- Content

  - Remember the 7 x 7 rule: a maximum of 7 lines of text per overhead or slide with 7 words per line.

  - Use phrases, not complete sentences. Your overhead or slide should highlight what you're saying with key words or phrases.

  - Rough out all of your overheads and slides on paper, then strike out excessive verbiage - BE TOUGH!

  - If you use acronyms, it is a good idea to explain them verbally.

- Text

  - To aid in visibility/readability, use medium or large text (no less than 14 point). This is only possible if there are few enough words.

  - Remember that visuals are your way of adding interest to your presentation. They're there to reinforce key points. Avoid the distraction of long blocks of text.

  - Be sure that each overhead or slide has just one point, one purpose. If you ask yourself, "What's the point of this?" and come up with more than one answer, you probably need more than one overhead or slide. Create as many as are necessary so that each has its own point.

  - Let your drafts sit for a day or two after you've finished them. Then go back to them and read objectively for clarity, grammar, and content. Feel free to use our editing resources whenever possible to help with the organization, writing, and review.

- Standards

  - Use abbreviations when you can, as long as they're consistent and understandable to your audience.

- During the presentation...

  - Use note cards to jog your memory. Don't depend on the slide to tell you all you want to say, and DON'T READ THE SLIDE TO THE AUDIENCE! You really shouldn't need to read what is on the screen.

  - Stand to the right or left of the screen, checking to see that your audience can see it. (Walking around the front of the room can be annoying to your audience.)

  - Speak clearly and concisely.

  - Maintain good eye contact with the members of your audience. Talk to them with your voice and with your eyes.

  - If a member of the audience asks a question, repeat that question to the whole group before beginning your answer. This serves two purposes:

    - It ensures that everyone in the room has heard the question.
    - It gives you time to formulate an answer.

- After the presentation...

  - Express your appreciation to the audience for their interest.

- Some pet peeves reported by audiences:

  - Rambling on and on.
  - Jingling change in pockets.
  - Speaking too softly.
  - Talking in a monotone.
  - Speaking too quickly - or too slowly.
  - Talking to the screen instead of to the audience.

5.0 REFERENCE LISTS FOR UMTRA PROJECT DOCUMENTS

The UMTRA Project is a federal government project. Sources of information used or generated in conjunction with UMTRA Project work must be available to individuals and agencies upon request. Therefore, UMTRA Project references must be as informative as possible. This section provides guidelines to follow in using text citations and in compiling reference lists.

References enable the author to present supporting evidence for statements and enable the reader to find those supporting documents easily. However, if a publication does not require references, the author should not feel obligated to include them for the sake of formality. The purpose of references is to guide readers to the cited publications; therefore, it is better that an author (if in doubt) provide editors with too much information than with not enough. References in documents prepared by authors will be styled according to these guidelines.

References should not be cited in abstracts. In addition, in citing internal and classified data, a cited document should be as readily available to the reader as the document in which the citation appears.

UMTRA Project guidelines for citing nonlegal materials and for preparing reference lists are based on the *Gregg Reference Manual* (Sabin, 1989) and the *Chicago Manual of Style* (University of Chicago Press, 1982). These guidelines are available in the technical editing office. For legal, statutory, and regulatory citations, the UMTRA Project relies on *The Bluebook: A Uniform System of Citation* (Harvard Law Review Association, 1991), available in the office of the UMTRA Project legal counsel.

5.1 RESPONSIBILITIES

5.1.1 Author

The author's responsibilities are as follows:

- Supplying references that are accurate and complete (for example, seeing that titles, names of journals [including section, series, and part designations when applicable], and numbers, such as volume and inclusive pages, are correct); ensuring that all units of a corporate author are listed in the same sequence as shown on the original work; including the publishing company, location, and date of publication; and providing a double-spaced list of all references in alphabetical order.

- Making certain that the text citations match those in the reference list.

- Obtaining permission in writing from the publisher and author of any copyrighted material, if necessary, for use in a final publication and keeping the letters on file in the UMTRA Project Document Control Center. Refer to Section 5.2 for details on use of copyrighted material.

- Supplying appropriate credit lines. Credit should be given to all sources of information in a document.

- Resolving any problems regarding text citations or references (incomplete or missing references, inconsistencies between text citations and references) brought to his or her attention by the technical editor.

5.1.2 Technical editor

The technical editor's responsibilities are as follows:

- Cross-checking all text citations with references to ensure that each citation has a reference and all references are cited.

- Informing the author of any incomplete or missing references or inconsistency between a text citation and its reference.

- Verifying the spelling of names of publishers, institutions, and universities.

- Ensuring that each entry is consistent with others of the same type and presented in the recommended sequence and format.

5.2 USE OF COPYRIGHT MATERIAL

The *Copyright Act* of 1976 (17 USC §§101-118, 201-205, 301-305, 401-412, 501-510, 601-603, 701-710, 801-810 *et seq.*) sets forth guidelines for obtaining permission to use copyrighted materials (text, figures, tables, photographs, etc.) in other publications. In general, permission is not required if the material cited or quoted is used for academic or research purposes, for criticism or news reporting, or for nonprofit purposes (Rubens, 1992).

In most cases, UMTRA Project documents do not require permission to cite or quote copyrighted materials. However, permission should be obtained if the portion of a copyrighted work being cited constitutes a majority of the work as a whole. The author should write to the publisher; permission may need to be granted by the original author as well (Rubens, 1992). If the TAC requests permission, it may not use the material until permission is granted. All documentation related to the request must be filed in Document Control.

5.3 TEXT CITATIONS

5.3.1 Nonlegal materials

In citing a publication in the text, list the author's name(s) or agency first, then the year of publication. If more than one reference carries the same author and year, add a lowercase "a," "b," "c," and so on, to the year, according to the

sequence each citation appears in the text. The references should be listed according to the lowercase letter assigned in the text citation.

Example: (DOE, 1989)
(DOE, 1991a; 1991b)

For publications with two authors, the text citation lists both last names and the year.

Example: (Ackerman and Rush, 1984)

For publications with more than two authors, the text citation lists the main author, followed by "et al." (the abbreviation for the Latin phrase *et alia*, meaning "and others").

Example: (Dillon et al., 1978)

5.3.2 Legal materials

Legal citations enable readers to find references to laws, statutes, regulations, and other legal materials. UMTRA Project guidelines for legal text citations and references have been developed to be compatible with other documents and reports, to convey a sense of professionalism, and to enable a reader to refer to the original statute, regulation, or case in an appropriate library.

For federal statutes that have been codified (for example, the *Uranium Mill Tailings Radiation Control Act*), the *United States Code* is the appropriate source to cite.

Examples: 42 USC §7901 *et seq.* (for the statute as a whole)
42 USC §7901.3 (for a specific section of the statute)

For final, codified rules and regulations, cite the *Code of Federal Regulations*, including the appropriate year. Keep in mind that each year, regulations are not officially codified until July 1 of each year.

Examples: 10 CFR Part 40 (1994) (for the regulation as a whole)
40 CFR §192.12 (1994) (for a particular provision)

In text, cite subparts in one of the following ways:

40 CFR §192.02 (a-c)
40 CFR §192.02 (Subparts A through C)

In citing proposed rules and regulations that have not been codified and other administrative notices appearing in the *Federal Register*, use the following text citation format:

Examples: 52 FR 36000 (1987)
55 FR 45591 (1990)

If a statute, regulation, or other legal source is commonly known by its title, consider using the title in the text and add the legal citation in parentheses.

Example: ...in the *Atomic Energy Act* (42 USC §2011 *et seq.*), the DOE has...

5.4 PREPARATION OF REFERENCES

Each reference should include as much information about the publication as possible to allow a reader to easily locate the material cited. A reference must, at a minimum, provide the author's name, the year of publication, the title of the publication, the publisher or agency that published the document, and the city and state of publication. The titles of books, technical documents, conference proceedings, periodicals, etc. should be italicized.

Examples: Terzaghi, K., and R. B. Peck, 1967. *Soil Mechanics in Engineering Practice*, John Wiley and Sons, New York, New York.

Mitchell, J. K., 1976. *Fundamentals of Soil Behavior*, John Wiley and Sons, New York, New York.

When a U.S. government agency is the publisher, the reference should include other pertinent information, such as the publication's document number and the name of the project office responsible for the publication.

Example: DOE (U.S. Department of Energy), 1993. *Technical Approach to Groundwater Restoration*, DOE/AL/62350-20, prepared by the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

When the referenced source is an article in a periodical, the reference should include the periodical's volume number, series number, and page numbers. Articles, theses, chapters of books, sections of documents, and unpublished reports should be placed in quotation marks; the title of the periodical or book in which the text appears should follow in italics. References for periodicals do not need to include a city and state of publication.

Example: Bornhauser, M., 1958. "Gulf Coast Tectonics," in *American Association of Petroleum Geologists Bulletin*, Vol. 42, No. 2, pp. 339-370.

5.4.1 Reference list

A reference list contains all references cited in the text. The author should keep a current list of references as the document is written, rather than tracking them

down afterward. The author should also be careful to add or delete references in the reference list, as necessary, when text is added or deleted.

When citations have the same author or agency, but different years of publication, list the most recent year first in the reference list. A single author (Jones, 1984) should be listed before the same author paired with another (Jones and Brown, 1984). Two authors (Jones and Brown, 1984) should be listed before the main author and others (Jones et al., 1984).

Information based on personal communications must be listed in the references and backed up by a copy of the communication (letter, memo, record of telephone conversation, or other evidence of communication). The copy should be on file in the UMTRA Project Document Control Center.

When listing a reference for unpublished data, calculations, studies, and correspondence prepared by the TAC or other UMTRA Project participants, specify the material at "UPDCC File Location No. _____, Albuquerque, New Mexico." TAC authors are responsible for ensuring that such data are on file in the center and for obtaining the file location number from the UMTRA Project Document Control Center.

Do not cite documents, studies, data, and other sources of information that are not readily available through the UMTRA Project Document Control Center. The DOE and other government agencies must have access to references that were used to prepare TAC documents.

5.4.2 Examples of references

The following pages provide examples of references. Each is followed by its appropriate text citation. The Technical Editing staff has developed a master reference list, which is available to all TAC staff on the local area network (LAN). Contact the Technical Editing staff for instructions on accessing the list.

Nonlegal sources

Books

Bouwer, H., 1978. *Groundwater Hydrology*, McGraw Hill Book Company, Inc., New York, New York.
(Bouwer, 1978)

Freeze, R. A., and J. A. Cherry, 1979. *Groundwater*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
(Freeze and Cherry, 1979)

Articles in periodicals

Aldon, E. F., 1981. "Long-Term Plant Survival and Density Data from Reclaimed Southwestern Coal Mine Spoils," in *The Great Basin Naturalist*, Vol. 51, No. 3, pp. 271-273.
(Aldon, 1981)

Ames et al. (L. L. Ames, J. E. McGarrah, and B. A. Walker), 1983. "Sorption of Trace Constituents from Aqueous Solutions Onto Secondary Minerals II, Radium," in *Clays and Clay Minerals*, Vol. 31, No. 5, pp. 335-342.
(Ames et al., 1983)

Evans et al. (R. D. Evans, J. H. Harley, W. Jacobi, A. S. McLean, W. A. Mills, and C. G. Stewart), 1981. "Estimate of Risk from Environmental Exposure to Radon-222 and Its Decay Products," in *Nature*, Vol. 290, No. 5802, pp. 98-100.
(Evans et al., 1981)

UMTRA Project publications prepared by the TAC

DOE (U.S. Department of Energy), 1993. *UMTRA Project Office Quality Assurance Program Plan*, DOE/AL/62350-76, Revision 5, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
(DOE, 1993)

U.S. government agency publications

EPA (U.S. Environmental Protection Agency), 1989. *Statistical Analysis of Groundwater Monitoring Data at RCRA — Final Guidance*, EPA/530-SW-89-026, EPA Office of Solid Waste, Waste Management Division, Washington, D.C.
(EPA, 1989)

NRC (U.S. Nuclear Regulatory Commission), 1984. *Radon Attenuation Handbook for Uranium Mill Tailings Cover Design*, NUREG/CR-3533, U.S. Nuclear Regulatory Commission, Washington, D.C.
(NRC, 1984)

NRC (U.S. Nuclear Regulatory Commission), 1983. *Guidance for Disposal of Uranium Mill Tailings: Long-Term Stabilization of Earthen Cover Materials*, prepared by Oak Ridge National Laboratory, Oak Ridge, Tennessee, for the U.S. Nuclear Regulatory Commission, Washington, D.C.
(NRC, 1983)

Reports

NCRP (National Council on Radiation Protection and Measurements), 1984. *Exposure From the Uranium Series With Emphasis on Radon and Its Daughters*, NCRP Report 77, Bethesda, Maryland.
(NCRP, 1984)

ICRP (International Commission on Radiological Protection), 1977. *Limits for Intake of Radionuclides by Workers*, ICRP Publication 30, Pergamon Press, Elmsford, New York.
(ICRP, 1977)

Symposium papers

Shepherd, T. A., and J. A. Cherry, 1980. "Contaminant Migration in Seepage From Uranium Mill Tailings Impoundments, an Overview," in *Symposium on Uranium Mill Tailings Management*, Fort Collins, Colorado, November 24-25, 1980, pp. 299-331.
(Shepherd and Cherry, 1980)

DOE Orders

Order 5000.3B, *Occurrence Reporting and Processing of Operations Information*, draft, September 24, 1991, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
(DOE Order 5000.3B) (1991)

Publications prepared by outside agency

NGDC/NOAA (National Geophysic Data Center/National Oceanic and Atmospheric Administration), 1980. *Climates of the States*, prepared by Gale Research Company, Detroit, Michigan, for the NGDC/NOAA, U.S. Department of Commerce, Washington, D.C.
(NGDC/NOAA, 1980)

Conference proceedings

Markos, G., and K. J. Bush, 1984. "Application of Geochemical Modeling to Solute Transport Modeling of Contaminant Migration Away from Uranium Mill Tailings," in *Proceedings of the Sixth Annual Symposium on Management of Uranium Mill Tailings, Low-Level Waste, and Hazardous Waste*, organized by Colorado State University, Civil Engineering Department, Geotechnical Engineering Program, September 16-20, 1984, Fort Collins, Colorado.
(Markos and Bush, 1984)

Personal communication

Fike, R., 1993. Montrose District, Bureau of Land Management, personal communication with M. Gawthrop-Cooper, Jacobs Engineering Group Inc., UPDCC File Location No. 16.15.2.1, Albuquerque, New Mexico, 9 June 1993.

Correspondence

Holonich, J., 1993. Letter from NRC to Albert R. Chernoff, UMTRA Project Office. Subject: Construction review visits to the Falls City, Texas, site. UPDCC File Location No. 20.13.4.2.7, Item NRC/UMT/1293-0062, Albuquerque, New Mexico, 23 December 1993.

5.4.3 Legal sources

United States Code

42 USC §7901 *et seq.*, *Uranium Mill Tailings Radiation Control Act*, November 8, 1978.
(42 USC §7901 *et seq.*)

42 USC §4321 *et seq.*, *National Environmental Policy Act*, January 1, 1970.
(42 USC §4321 *et seq.*)

Code of Federal Regulations

10 CFR Part 40, *Domestic Licensing of Source Materials*, U.S. Nuclear Regulatory Commission (1994).
(10 CFR Part 40 (1994))

40 CFR Part 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*, U.S. Environmental Protection Agency (1994).
(40 CFR Part 192 (1994))

Federal Register

52 FR 36000, "Standards for Remedial Actions at Inactive Uranium Processing Sites; Proposed Rule," September 24, 1987.
(52 FR 36000 (1987))

55 FR 45591, "Custody and Long-Term Care of Uranium and Thorium Mill Tailings Disposal Sites," October 30, 1990.
(55 FR 45591 (1990))

57 FR 54374, "Notice of Intent to Prepare a Programmatic Environmental Impact Statement on the Ground Water Restoration Phase of the Uranium Mill Tailings Remedial Action Project," November 18, 1992. (57 FR 54374 (1992))

6.0 RULES OF STYLE AND GRAMMAR

6.1 ELEMENTARY PRINCIPLES OF GOOD WRITING STYLE

The following sections describe a few standard principles of good writing and some of the pitfalls to avoid.

6.1.1 Sentence structure

Sentences are divided into four types:

- Simple—consisting of one independent clause.
- Compound—consisting of at least two independent clauses.
- Complex—consisting of one independent clause plus at least one dependent clause.
- Compound/complex—consisting of two independent clauses and at least one dependent clause.

In general, simple sentences and tightly written complex sentences are easiest to understand. Good writing almost always contains a good mix of simple and complex sentences that tie thoughts together in a rational way.

Compound sentences can be easy to understand, but they tend to lack force. Compound/complex sentences tend to be long; for this reason, they are often too convoluted to understand easily. They also are the most likely to contain grammatical errors.

Weak/passive construction

Avoid starting sentences with "there is" and similar constructions. Find the real subject and move it to the beginning of the sentence. The sentence will usually become shorter and crisper in the process.

Weak	Better
There will be no permanent drainage or interceptor ditches located on the site.	No permanent drainage or interceptor ditches will be located on the site.
There are three problem areas that have been identified at the site.	Three problems have been identified at the site.

There have been no earthquakes recorded within 65 km of the site of magnitude 3.0 or greater.	No earthquakes of magnitude 3.0 or greater have been recorded within 65 km of the site.

Overuse of nouns and prepositional phrases

Convert nouns and other parts of speech to verbs whenever appropriate.

Weak	Better
This section *provides a description of* the issues associated with . . .	This section *describes* the issues associated with . . .
Measurements of the rates of drawdown and recovery during well purging *will be taken*. . .	The rates of drawdown and recovery during well purging *will be measured*. . .
This information will be used as a reference *in the evaluation and selection of* compliance strategies, *in risk assessments, and in predictions of future* contaminant migration for each site.	This information will be used *to evaluate and select* compliance strategies, *assess risk,* and *predict* contaminant migration for each site.
Salt flow toward the river incisions caused *the deflation and collapse of* these anticlines . . .	Salt flow toward the river incisions caused these anticlines *to deflate and collapse* . . .

Overuse of compound and compound/complex sentences

Avoid overusing compound sentences and compound/complex sentences. These kinds of sentences can become too long and convoluted for easy comprehension, especially when they deal with highly technical issues. It may be preferable to use two separate sentences.

Compound sentence	Better
The uranium solutions were treated by solvent extraction to concentrate and recover the uranium, and the solids were dumped in what became the tailings pile.	The uranium solutions were treated by solvent extraction to concentrate and recover the uranium. The solids were then dumped in what became the tailings pile.

Compound/complex sentence	Better
Several constituents were detected at least once in the contaminated ground water, but they were either not analyzed for in background or they had an insufficient number of measurements above detection with which to perform an inferential statistical comparison of background to plume well concentrations.	Several constituents were detected at least once in the contaminated ground water. However, an inferential statistical comparison of background levels to plume well concentrations could not be performed for these constituents, because some were not analyzed for background levels and others had an insufficient number of measurements above detection levels.

6.1.2 Dangling modifiers

Make sure that modifiers in introductory clauses are attached to the correct subject.

Incorrect	Correct
In developing the standards, three objectives were identified.	In developing the standards, the EPA identified three objectives.
Prior to conducting an inspection, the following steps must be taken.	Prior to conducting an inspection, auditors must take the following steps.
After conducting the remediation, the sites would be reclaimed . . .	After remediation, the sites would be reclaimed . . .

6.1.3 Essential and nonessential dependent clauses

Use "that" to introduce a clause essential to the sense of a sentence. Use "which" to introduce nonessential clauses; use a comma before "which."

That	Which
A battery *that has lost its charge* is useless.	This battery, *which has lost its charge*, is useless.
"that has lost its charge" is an *essential* clause. Without it, the sentence doesn't make sense.	"which has lost its charge," is a *nonessential* clause. Without it, the sentence still makes sense. The nonessential clause merely provides additional information.

Using "which" instead of "that" in essential clauses is no longer considered incorrect; however, the distinction between the two is often useful for the reader, because slight ambiguities in meaning may result otherwise. For example, the following sentences have a subtle difference in meaning:

The mill area contained the mill facilities, water retention ponds, and two ore storage areas that were demolished during Phase I.	The mill area contained the mill facilities, water retention ponds, and two ore storage areas, which were demolished during Phase I.

In the first column, the clause "that were demolished . . ." refers only to the two ore storage areas. In the second column, the use of "which" preceded by a comma sets off the nonessential clause. This construction implies that everything mentioned earlier was demolished–the mill facilities, the ponds, and the storage areas.

It's often a good idea to convert a nonessential clause into a separate sentence if the original sentence is long.

Single sentence	Two sentences
Table 2.2 is an annual listing of budgeted and projected funding, which shows an increase in funding levels from FY1989 through FY1992 with a rapid decrease projected from FY1993 through FY1997.	Table 2.2 is an annual listing of budgeted and projected funding. It shows an increase in funding levels...

6.1.4 Parallel construction

Parallel concepts should be expressed in parallel form, both in bullet listings (refer to Section 2.3.2) and in sentences. This also applies for elements of a sentence that follow paired conjunctions such as "both . . . and," "either . . . or," "neither . . . nor," and "not only . . . but also."

Incorrect	Correct
Well water is used for showering, cleaning, cooking, and to water gardens and livestock.	Well water is used for showering, cleaning, cooking, and watering gardens and livestock.
Potential problems include higher mortality, reduced growth, inhibited reproduction, and the population balance could shift.	Potential problems include higher mortality, reduced growth, inhibited reproduction, and population imbalances.

Chronic exposure to elevated fluoride causes both dental mottling and the bones to become brittle.	Chronic exposure to elevated fluoride causes both dental mottling and skeletal brittleness.

6.1.5 Wordiness

Many common phrases and expressions, while not grammatically incorrect, are excessively wordy. One of the worst offenders is the phrase "it should be noted that" and similar constructions. Simply stating the information should be sufficient; delete these phrases from the text. To emphasize the information, try starting a new paragraph at that point in the text instead:

It should be noted that it is highly unlikely that any usable minerals are present beneath the disposal site . . .	It is highly unlikely that any usable minerals are present beneath the disposal site . . .

The following is a list of wordy phrases and their alternatives.

Wordy	Better
provide a description of (a summary)	describe summarize
undertake an assessment of (a review)	assess review
perform an analysis of	analyze
in the vicinity of (in close proximity to)	near
the conclusion of the team was	the team concluded
in a timely manner (an expeditious manner)	promptly
for a period of 2 months	for 2 months
the question as to whether (whether or not)	whether
in the near future	soon
at the present time	now
a large number of	many
the majority	most
on a daily basis (weekly, annual)	daily (weekly, annually)
each of the wells	each well

a total of eight	eight
due to the fact that	because
future plans	plans
initial preparation	preparation
final outcome	outcome
end result	result
gray in color	gray
rough in appearance	rough

6.1.6 Tricky plural forms

The following list shows words commonly used in UMTRA Project documents that have tricky plural forms. Remember that when the plural form of one of these words is used as the subject of a sentence, it takes a plural verb.

Singular form	Plural form
addendum	addendums
appendix	appendixes
basis	bases
criterion	criteria
datum	data
land	lands
maximum	maximums
medium	media (for advertising and communications) mediums (for other plurals)
memorandum	memorandums
minimum	minimums
phenomenon	phenomena
status	statuses
stratum	strata
waste	wastes

6.1.7 Commonly confused words

ciability	quality or state of being able; the power to perform
capaty	ability to contain; maximum power output (elec.)
accede	to give consent; to give in to a demand
exceed	to surpass
accept	to receive willingly
except	to exclude or leave out
activate	to make active
actuate	to put into mechanical action
adapt	to adjust (verb)
adept	proficient (adjective)
addition	the result of adding
edition	the whole number of copies published at one time
adherence	steady attachment
adherents	followers
adverse	acting in opposition
averse	disinclined
advise (v)	to give counsel or advice
advice (n)	recommendation given
affect	to influence or change
effect	to bring about (verb); a result of an influence (noun)
all ready	completely ready
already	previously
all right	satisfactory; there is no such word as *alright*
all together	in a body (The group is all together.)
altogether	entirely (You are altogether right.)
allude	to refer to indirectly
refer	to mention something specifically
allusion	an indirect reference
delusion	an error of judgment
illusion	an error of vision

almost	nearly (adverb)
most	greatest in quantity, extent, or degree
alternate	to occur in successive turns (verb); one who alternates with another (noun)
alternative	a substitute or second choice (noun)
amount	refers to bulk or mass
number	refers to individuals or units
and/or	use this form only when there are three possible selections: either one, or the other, or both.
appraise	to set a value on
apprise	to inform, to notify
approximately	nearly correct or exact
about	does not suggest near accuracy
assay	to analyze for specific components (verb); an examination or determination as to characteristics (noun)
essay	to try, to attempt
assure	to convince or guarantee; takes a direct object (usually a person or group of persons)
ensure	to make certain
insure	to guard against loss
auger	a tool for boring through soil, wood, etc. (noun)
augur	to give promise of; predict the future (verb)
beside	at the side of
besides	in addition to
biannual	twice a year; synonymous with semiannual
biennial	every 2 years
cite	to refer to by way of example, authority, or proof
sight	a view
site	a place
collected	brought together in a group; assembled
combined	act or mix together
	Note: These should never be used with the word together; that is, collected together or combined together.

compare to (v)	to assert a likeness
compare with (v)	to analyze for similarities and differences
contrast (v)	denotes differences; used with "with."
contrast (n)	depending upon context, can be used with "between," "of," "to," and "with."
complement	something that completes; one of two mutually completing parts
compliment	flattery or praise
compose	to form the substance of
comprise	to contain in whole; encompass; consist of (use in active voice as a transitive verb)
include	to contain in part (introduces a partial list)
consensus	means the general opinion; therefore, "consensus of opinion" is redundant and should be avoided.
continual	occurring in steady, rapid succession; implies a close prolonged recurrence
continuous	without interruption; implies an unbroken flow
currently	now, at this time
presently	immediately, shortly (presently does not mean at the present moment.
customer	one who purchases a commodity or service
client	one who uses the services of a lawyer or other professional person
discreet	prudent, cautious
discrete	separate, detached
e.g. (L: *exempli gratia*)	for example: to be used when the list is not complete, but is only a sampling of items.
i.e. (L: *id est*)	that is: to be used when the list is inclusive; no other options exist.
elude	to evade (use with allude)
eminent	distinguished, high in rank, noteworthy
imminent	about to occur, impending
extrapolate	to infer or estimate unknown information by extending or projecting known information
interpolate	to insert or introduce between other things or parts

farther	greater distance
further	additional degree, time, or quality
fewer	a smaller number; modifies units or individuals
less	a smaller quantity ; modifies collective nouns, mass nouns, or nouns denoting an abstract whole
forword (n)	a preface
forward (adj)	brash
forward (v)	to advance
infer	to deduce, guess, conclude
imply	to suggest
inside of	"of" is redundant and should be omitted (if expression refers to time, substitute "within"
its	third-person singular possessive pronoun
it's	contraction of "it is" or "it has"
shall	an auxiliary verb used to express a mandate
will	an auxiliary verb used to express simple future tense
percent	one part in a hundred; used with a number
percentage	an indeterminate part; never used with a number
personal	individual, private (adjective)
personnel	the staff of an organization (noun)
precede	to go before
proceed	to begin or continue an action or process
principal	head or chief (noun); highest or best (adjective)
principle	basic truth, law, or assumption
rational	reasonable (adjective)
rationale	basis, explanation (noun)
stationary	not moving; fixed (adjective)
stationery	writing material (noun)
that	a relative pronoun that introduces an essential clause—one that specifically defines or limits a description and is necessary for full comprehension of a sentence (do not set off with commas)
which	a relative pronoun that introduces a nonessential clause (do set off with commas)

there	in that place
their	third-person plural possessive pronoun
they're	contraction of "they are"
whose	the possessive form of "who"
who's	contraction of "who is" or "who has"
your	second person possessive
you're	contraction of "you are"

6.2 ELEMENTARY RULES OF GRAMMAR

6.2.1 Subject/verb agreement

The subject and verb must agree in number and person.

The *report is* due tomorrow.
The *reports are* due tomorrow.

If the subject consists of two or more words joined by *and*, the verb is plural.

The editor and the engineer *are* going over the report together.
Ms. Duncan and her assistant *are* coming to the meeting.

If two or more subjects connected by *and* refer to the same person or thing, the verb is singular.

Our president and chief executive officer, Ellen Jones, *is* speaking at a conference next week.

When the subject is tied to another noun by *along with*, *as well as*, or *together with*, use only the subject in determining number.

Mr. Smith, as well as his assistant, *is* coming to the meeting.

When two subjects are joined by *either . . . or* or *neither . . . nor*, the verb should agree with the subject closest to it.

Neither the boss nor the *secretaries know* where the manual is.
Neither the secretaries nor the *boss knows* where the manual is.

Indefinite pronouns such as *each*, *everybody*, *everyone*, *anybody*, *someone* are always singular and take a singular verb.

Each committee member *has* her own copy of the proposal.
Each of the committee members *has* her own copy of the proposal.
Everybody wants to take a break.

Collective nouns (*team, group, committee*) are usually singular.

The *committee is* meeting this afternoon at three o'clock.

Some words that appear singular are plural; some words that appear plural are singular.

No *news is* good news.
The *data are* being processed.

Remember that *data, criteria, phenomena, strata,* and *media* are always plural.

Words or phrases separating the subject and verb do not alter the number of the verb, nor do inverted sentence patterns that delay the subject.

All of the department members, but especially Mr. Gibson, *feel* that the proposal is poorly organized.

Near the drilling site *is* a small *village*.

Near the drilling site *are* two small *villages*, a resort *area*, and a large, man-made *lake*.

What *does* the *committee* say about the plans for excavation?

What *do* the *engineers* consider to be the best plan?

When a linking verb (*is, feels, seems*) joins singular and plural nouns, the verb should be consistent in number with the subject.

Our major *problem is* laws concerning pollution.
Laws concerning pollution *are* our major problem.

6.2.2 Pronoun/antecedent agreement

The rules for pronoun/antecedent agreement correspond with those of subject/verb agreement. First, find the antecedent; second, determine its person, number and gender. Make sure your pronoun agrees with its antecedent.

The *editor* has made *his* changes.
The *editors* have made *their* changes.

- Compound subjects.

The *editor* and the *engineer* have made *their* changes.

- *Along with, together with, as well as.*

  David, together with his wife, will bring *his* own car.

- *Either . . . or, neither . . . nor.*

  Neither the boss nor the *secretaries* have taken *their* lunch break.
  Neither the secretaries nor the *boss* has taken *her* lunch break.

- Indefinite pronouns.

  Each employee has *his* duties to perform.
  Everyone here has received *his* paycheck.

- Collective nouns.

  The research *team* has submitted *its* proposal.

- Singular, plural words.

  The *phenomena* are being described by *their* usual characteristics.

6.2.3 Pronoun case

The English language has three cases: nominative, objective, and possessive. Case is the form a noun or pronoun takes to denote its use, and its relation to other words, in the sentence. Case is seldom a problem with nouns, but determining the proper case for pronouns can be a challenge. The following summarizes pronoun case:

Nominative	Objective	Possessive
I (sing.)	me	my, mine
we (pl.)	us	our(s)
you	you	your(s)
he, she, it (sing.)	him, her, it	his, her(s), its
they (pl.)	them	their(s)
who	whom	whose

- Compound construction.

  Mr. Johnson and *I* have finished the weekly status report.
  Please return the report to Mr. Johnson and *me*.

- *More than* plus personal pronoun.

  My husband loves football more than *I*. (more than I love football)
  My husband loves football more than *me*. (more than he loves me)

- *Who* and *whom*.

  Ms. Wilson is the engineer *who* sent us this fine report.
  Ms. Wilson is the engineer *whom* we praised.
  She is the employee in *whom* we have the greatest trust.

  Be careful not to confuse the correct use of *who* and *whom* within the clause in which it appears.

  Mr. Anderson is the person *whom* we believe. (*Whom* is the object of the verb *believe* and takes the objective case.)

  Mr. Anderson is the person *who* we believe can do the job. (This is correct usage. If *we believe* is dropped from the sentence, it becomes clear that *who* is the subject of *can do* and, as a subject, must take the nominative case.)

6.2.4 Pronoun reference

- Avoid ambiguous pronoun reference.

  Jane has known Mary since *she* was a child.
  When John saw the president, *he* didn't know where *he* was going.

- Avoid broad pronoun reference.

  The proposal includes an abstract, an outline, and a bibliography. *This* was especially well done.

  The Supreme Court acted decisively on the Gideon case after the accused had spent time in a Florida jail for a crime he had not committed, *which* is typical of American justice.

- Avoid hidden pronoun reference.

  I didn't want to work for IBM because *they* wanted me to wear a uniform.
  Because they lost 5 pounds in 2 days, *it* was considered a great success.

6.3 ELEMENTARY RULES OF CONSISTENCY

Consistency in points of style contributes to the quality and readability of UMTRA Project documents. The following paragraphs provide guidance on capitalization, abbreviations, and numerals. Whenever possible, these guidelines adhere to points of style determined by the DOE (DOE, 1991).

6.3.1 Capitalization

The following guidelines provide some standards to follow to achieve uniformity in capitalization. Two main rules govern the use of capital letters: 1) proper nouns, titles, and first words of sentences are capitalized, and 2) common nouns are not capitalized unless they have gained the status of proper nouns.

Proper nouns

Proper nouns (and most derivatives of proper nouns) are capitalized.

Example: Texas; Texan

Common nouns

Common nouns that form an essential part of a proper name or a title are capitalized. A common noun used alone as a substitute for a proper name is not capitalized.

Examples: Gunnison County; the county
Colorado River; the river
Colorado Department of Public Health and Environment; the department

Exceptions: The following nouns and adjectives referring to federal government units or agencies are always capitalized:

U.S. Congress, the Congress, the 93rd Congress

the U.S. Senate, the U.S. House of Representatives; the Senate, the House

the U.S. Department of Defense; the Department

the U.S. Army, the U.S. Navy, the U.S. Air Force; the Army, the Navy, the Air Force

A common noun that is used as a well-known short form of a specific proper name is capitalized.

Examples: the United States; the States
the Navajo Nation; the Nation

Titles

Publications and documents — Capitalize all words in titles of publications and documents except *a, an, the, at, by, for, in, of, on, to, up, and, as, but, if, or,* and *nor*. However, if one of these words begins the title, it is capitalized. Capitalize and italicize the titles of newspapers, magazines, and other periodicals (*Washington Post, Federal Register*).

Types of documents (RAPs, EAs, etc.) are not capitalized when they are referred to in a generic sense. When giving the title of a specific document, however, use capital letters and italicize.

Examples: Final remedial action plans for several sites were published . . .

the Falls City final remedial action plan

Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Falls City, Texas

Environmental Assessment of the Proposed Remedial Action at the Gunnison Uranium Mill Tailings Site, Gunnison, Colorado

Department names and job positions — Capitalize the name of a specific department or group in an organization.

Examples: the Quality Assurance Department
the Regulatory Oversight and Compliance Support Group
the Site Management Department

Within the TAC and DOE, capitalize the titles Project Manager and Deputy Project Manager. Do not capitalize titles that refer to the following:

- A job position that can be held by a number of people (for example, site hydrologist).
- A management position on a par organizationally with other managers.

Examples: TAC health physicist
UMTRA TAC assistant project manager
UMTRA DOE site manager
the Quality Assurance manager

Names of regions and geographic features

Capitalize names of regions and geographic features when used as proper names. Do not capitalize descriptive terms used to denote mere direction or position.

Examples: the North Atlantic States

the Gulf States

the West, the Midwest

north, south, east, west; northerly, northern, northward; eastern region, north-central region; western Colorado

Scientific names

The name of a phylum, class, order, family, or genus is capitalized; the name of a species is not capitalized, even if the species name is derived from a proper noun. The genus and species are italicized. The corresponding common name is capitalized only when a proper noun or a derivative of a proper noun is part of the common name.

Examples: Common name: white ash
Scientific name: *Fraxinus americanus*

Common name: tree-of-heaven
Scientific name: *Ailanthus altissima*

Common name: Japanese knotweed
Scientific name: *Polygonum cuspidatum*

Geologic terms

Formal geologic terms are capitalized (Devonian System, Pliocene Series, San Rafael Group, Morrison Formation, Fayetteville Shale). Structural terms (arch, syncline, anticline, dome, uplift) are not capitalized, even when preceded by a proper name (Cincinnati arch, Cedar Creek anticline, Ozark uplift).

Physiographic terms

Physiographic terms that are preceded by a proper name are capitalized (Bighorn Basin, Half Dome). The general terms "province" and "section," when used in a common-noun sense, are not capitalized. Other terms are proper names and are capitalized.

6.3.2 Project-specific rules

Capitalize the word "Project" in the term "UMTRA Project." Avoid using the word "Project" by itself; use the full term "UMTRA Project" whenever possible.

Example: Exposures of UMTRA Project personnel to RRM shall be kept as low as reasonably achievable.

6.4 ABBREVIATIONS

The use of established abbreviations is acceptable in UMTRA Project documents. Some well-established abbreviations (such as personal or military titles, expressions of time, or other well-known abbreviations) need not be spelled out. In general, an abbreviation is capitalized and hyphenated as in the original word or phrase. Most abbreviations (other than those for units of measure) are followed by a period after each element.

Examples: Mr., Mrs., Ms., Lt., Col., M.D., Ph.D., a.m., p.m., i.e., e.g., Co., Inc.

Less well-known abbreviations should be spelled out upon first occurrence. The abbreviation then follows in parentheses. Abbreviations used in tables should be spelled out in the table or in a footnote if the abbreviation has not been spelled out previously in text.

General rules of UMTRA Project acronym usage

The use of established acronyms is acceptable in UMTRA Project documents. Acronyms should be spelled out upon first occurrence. The term should be written out in full, followed by the acronym in parentheses. If a term is used only once in a document, its acronym does not need to be defined.

After an acronym has been used the first time, it should be used throughout the rest of the document unless the acronym appears in the title of a section or subsection. Spell the acronym in such cases.

Incorrect	Correct
2.2 LTSP	2.2 LONG-TERM SURVEILLANCE PLAN
3.1.1 NC processing site	3.1.1 North Continent processing site

Attachments and appendixes to a document are considered stand-alone documents. Acronyms are spelled out upon first occurrence.

Plural acronyms — Acronyms are made plural by adding a small "s" without an apostrophe (RAPs). If at first occurrence the term is spelled out in plural form, it is followed by the singular form of the acronym, in parentheses, to establish the basic acronym.

Example: Final remedial action plans (RAP) for three sites were completed. . .

List of UMTRA Project acronyms — A list of acronyms and post office codes commonly used in UMTRA Project documents is available on the LAN.

6.4.1 Units of measure

Abbreviations for units of measure should be used only with figures. In a general use of a unit of measure within text, the unit of measure is spelled out. Periods are not used in units of measure.

Examples: 50 m; 17.2 mL; 9.09 pCi/L; 201 pCi/m^2s.
The disposal cell is several kilometers west of the river.

International System of Units — SI unit letter symbols use lowercase roman type, unless the unit name is derived from a proper name (for example, "W" for Watt). The exception is the letter "L" for liter. The same form is used for singular and plural. A space is used between a figure and the abbreviated symbol. If original measurements are given in English units, SI units are calculated and follow the English unit equivalent in parentheses. Otherwise, only the SI unit is given.

The standard abbreviations for SI length, weight, and capacity are as follows:

Length		Weight		Capacity	
km	kilometer	kg	kilogram	kL	kiloliter
hm	hectometer	hg	hectogram	hL	hectoliter
dam	dekameter	dag	dekagram	daL	dekaliter
m	meter	dg	decigram	L	liter
dm	decimeter	cg	centigram	dL	deciliter
cm	centimeter	mg	milligram	cL	centiliter
mm	millimeter	µg	microgram	mL	milliliter

The standard prefixes for multiples and submultiples of SI units are as follows:

E exa	(10^{18})	d deci	(10^{-1})
P peta	(10^{15})	c centi	(10^{-2})
T tera	(10^{12})	m milli	(10^{-3})
G giga	(10^{9})	µ micro	(10^{-6})

M mega	(10^6)	n nano	(10^{-9})
k kilo	(10^3)	p pico	(10^{-12})
h hecto	(10^2)	f femto	(10^{-15})
da deka	(10)	a atto	(10^{-18})

English — When original units of English length, weight, and measure are used in UMTRA Project documents, they should precede their SI equivalents in parentheses. The following forms are used when these units are abbreviated.

Length		Weight		Capacity	
ac	acre	gr	grain	pt	pint
ft	foot	dr	dram	qt	quart
yd	yard	oz	ounce	gal	gallon
mi	mile	lb	pound	pk	peck
				bu	bushel
				bbl	barrel

Squared and cubed measurements are written with the appropriate superscript number following the abbreviation.

Examples:

cm^2	square centimeter
ft^2/s	square foot per second
yd^3	cubic yard
pCi/m^2s	picocuries per square meter per second

Do not abbreviate *inch*, *gram*, *hour*, *day*, and *year*. Spell these units of measure out in all instances.

6.4.2 Geographic terms

The term "United States" is abbreviated, without a space, when used as an adjective. It is always spelled out when used as a noun.

Examples: the U.S. government; the U.S. Department of Energy
physical divisions of the United States

In the address portion of correspondence, on an envelope, or in a table, the U.S. Postal Service's two-letter abbreviations for states and the District of Columbia may be used. Within text, spell out state names.

6.5 NUMERALS

The use of numbers in a publication should be consistent. The following rules cover the most common uses of numbers:

- Write out numbers from one to nine except when used with units of measurement, money, and time; use numerals for all numbers of two digits or more.

  Examples: two times the amount; five recommendations
  2 miles; 5 hours

- Round numbers and indefinite expressions are spelled out.

  Example: a thousand and one reasons

- Except in legal documents, avoid repeating in numerals a number that has been spelled out.

- Numbers of 10 or greater are expressed in figures within a sentence. Numbers indicating units of measure, time, money, percentages, and mathematical computations are always expressed in figures.

  Examples: Within the site boundaries, 12 monitor wells are located . . .
  8 by 12 inches; 7 meters
  9 years
  $3
  5 percent
  multiplied by 3; divided by 6

- Spell out a number at the beginning of a sentence.

  Example: Twelve monitor wells are located upgradient . . .

- When a series of related numbers appears in a sentence and some are more than and some are less than nine, use all numerals; for example, "The company hired 11 employees in 1992 but laid off 5 of them in 1993."

- Use numerals in dates, time, streets, and zip codes.

- In decimal numbers of less than 1.0, always use a zero before the decimal point; for example, 0.35 ft (not .35 ft), 0.85 percent (not .85 percent).

- Use numerals in tables and charts.

- Use numerals for serial numbers, equipment numbers, and report numbers.

- Use numerals when referring to page numbers, volume numbers, and parts.

- Use commas in numbers with more than four digits (except for serial numbers, order numbers, etc.): 60,000, but 6000. However, in tables that contain numbers of both more and less than four digits, use commas throughout: 60,000 and 5,000.

  Examples: 1056 vicinity properties
  33,000 yd^3 of tailings

Numbers starting with 1 million that end in four or more zeroes should be expressed in text by combining figures and words.

Examples: 200 million years ago
$1 billion

- When numbering upcoming phrases in text, use 1), 2), not (1), (2).

- Spell out fractions unless they are used with specific units of measure; for example, roughly one-third of the drawings are on a 1.5-inch scale.

- Use the following style to specify latitude and longitude:

  latitude 77°08'06"E.
  longitude 49°26'14"N.

6.5.1 Isotopes

In text, write uranium-238, instead of ^{238}U. In tables, write U-238; tables use the superscript form only when there is no room for the longer form.

6.5.2 Cross references

A reference in a document to another of its parts is put in parentheses: "the previous discussion of removal methods (Section 6.3.4)." Cross references may also appear as simple statements: "Section 6.3.4 discusses this topic in detail."

6.6 PUNCTUATION

6.6.1 Period

The most common uses of a period are to indicate the end of a declarative or mildly imperative sentence and to note an abbreviated form of a word.

A period is used with numerals or letters identifying items in a displayed list.

Example: Engineering considerations include the following:

1. Screenwell design.

2. Hydraulic characteristics.
3. Use of fine-mesh screening.

However, most lists in UMTRA Project documents are displayed with bullets. Use numerals or letters only if the sequence of the listed items is significant or if one or more of the listed items is called out elsewhere in the document.

6.6.2 Comma

Of all punctuation marks, the comma indicates the shortest pause in sentence structure or in the flow of thought (or if read aloud, in the flow of speech).

Main clauses

A comma separates two main clauses when they are linked by the coordinating conjunctions *and, but, or, nor, for,* or the connectives *so* and *yet.*

Example: The plant was constructed in wartime to produce weapon-grade enriched uranium by the gaseous diffusion process, and its primary function is still uranium enrichment.

Introductory elements

A comma follows an adverb clause used as an introductory element.

Example: When mathematicians speak of a boundary, they are usually referring to the boundary of some geometrical region.

A comma follows a long phrase used as an introductory element.

Examples: From its limited mission as part of the World War II Manhattan Project, ORNL has emerged as a diversified center of energy research and development. (Prepositional phrase.)

Working within the constraints of the existing plant site, we tried to identify the opportunities for improvement. (Participial phrase.)

A comma ordinarily follows introductory transitional expressions, such as *for example, in fact, however, therefore,* and *on the other hand.*

Example: Quality assurance is employed in many fields. For example, it is essential in scientific and technical work.

Items in a series

Commas separate words, phrases, and clauses in a series of more than two such items. Do not omit the comma before the final *and* or *or.*

Example: The installation conducts research in fusion energy, fission energy, and solar energy.

If the series contains items with internal punctuation, semicolons are used instead of commas.

Parenthetical and miscellaneous elements

Commas set off parenthetical words, phrases, or clauses.

Example: Nuclear power, although a controversial energy source, is considered essential by the DOE.

6.6.3 Semicolon

A semicolon signifies a more distinct break in a flow of thought than does the comma.

The semicolon separates two main clauses that are not linked by a coordinating conjunction (and, but, or, nor, for).

Example: Neutrons are the key to the new frontier of applied nuclear energy; their behavior needs to be fully understood.

The semicolon separates main clauses that are linked by conjunctive adverbs (such as *however*, *thus*, and *therefore* and conjunctive transitional phrases such as *in fact*, *for example*, and *in contrast*). Use of a comma instead of a semicolon in these constructions is incorrect.

A semicolon is used to separate one main clause from another having elliptical (missing) elements; a comma is used in place of the missing elements.

Example: John's presentation was extremely long; his colleague's, quite brief.

6.6.4 Colon

Like the semicolon, the colon is almost equal to a full stop. Its use is often based on style or author taste. It is used to direct attention to what follows.

A colon may be used to separate two main clauses when the second explains or amplifies the first.

Example: The symbol identifier is defined in cards 4 and 5: 4-C could be used to identify Y-12 colorimetric data.

The colon can introduce a summary, an appositive, or a quotation, but it is most commonly used to introduce a series.

Example: The following parameters were chosen for investigation: a welding speed of 6 rpm, a welding force of 667 N, and an upset distance of 0.5 mm.

Note: A colon should be used if the terms *as follows* or *the following* immediately precede the enumerated items or if the introducing clause is incomplete without such items.

Example: The steps are as follows:

- Place identical compounds . . .

Note: If an explanatory series follows an introductory clause that does not express a complete thought (usually ends with a verb or a preposition), do not use a colon to introduce the series. This is true whether the series appears in sentence form or in list form.

Examples: The deliverables scheduled for the month of June include six BLRAs, three WSAPs, one SOWP, and three programmatic documents.

The deliverables scheduled for the month of June include

- Six BLRAs.
- Three WSAPs
- One SOWP.
- Three programmatic documents.

6.6.5 Apostrophe

The main uses of the apostrophe are to form the possessive case, to mark omission of letters in contractions, and to indicate plurals.

6.6.6 Possessives

Singular nouns and indefinite pronouns that do not end in *s* form the possessive by adding an apostrophe and an *s*.

Example: a man's shoe
Dante's poems
one's choice

Singular nouns ending in *s* form the possessive by adding *'s* if the *s* is to be pronounced as an extra syllable.

Examples: Keats's odes
Brunton compass's declination

However, if an extra syllable is awkward to pronounce, add the apostrophe only and omit the second *s*.

Examples: Ulysses' ship
New Orleans' restaurants

Plural nouns that end in *s* form the possessive by adding an apostrophe only.

Example: girls' bonnets
the Joneses' car

Personal pronouns never require an apostrophe, even though the possessive case ends in *s*: his, hers, its, ours, theirs.

The possessive of acronyms and abbreviations without periods is formed by adding *'s*.

Example: the DOE's travel plans
the NRC's comments

6.6.7 Contractions

An apostrophe is used to indicate omitted letters or numbers in contracted words or dates: haven't, don't, isn't, it's, o'clock, class of '92, and hurricane of '62. However, the use of contractions in technical writing is discouraged.

Plurals

The plurals of letters and abbreviations with periods are formed by adding an apostrophe and an *s*: Ph.D.'s.

6.6.8 Dash

En dash

An en dash, which is longer than a hyphen and shorter than an em dash, is used to indicate continuing (or inclusive) dates, times, or reference numbers.

Examples:

1991-92	9 a.m.-3 p.m.
April-September	pp. 27-42

If the first of the two related figures or expressions is preceded by the word *from* or *between*, the en dash is replaced by words such as *to* or *and* (for example, from 1975 to 1979; between 9 a.m. and 3 p.m.).

The en dash replaces the hyphen in a compound modifier if one element of the modifier consists of two words or of a hyphenated word.

Examples: Knoxville-Oak Ridge residents
quasi-public-quasi-judicial committee

Em dash

The em dash provides a more emphatic separation of words in a sentence than do any of the punctuation marks used to set off material (that is, comma, semicolon, colon, and parentheses). Usually used in pairs, like parentheses, em dashes set off information. Care should be taken not to overuse them.

An em dash or a pair of dashes may be used to set off a parenthetical element that requires emphasis or contains internal commas.

Examples: Oak Ridge National Laboratory—one of the nation's most extensive and diverse scientific research facilities—is a leader in the field of nonnuclear as well as nuclear energy research and development.

Numerical control systems—whether hard- or soft-wired—do not always provide the flexibility and initial low cost often required in the early stages of a development effort.

The em dash can be used to separate an introductory list from the main part of the sentence that explains the series.

Example: Flameless atomic absorption, laser-induced fluorescence, sodium fluoride flame fusion fluorometry, and isotope dilution mass spectrometry—these methods are used to analyze rocks, sediments, and soils for uranium.

6.6.9 Solidus (slash)

In technical writing, the solidus is most often used as a substitute for "per" in expressions and abbreviated units of measure. This form is often overused, resulting in multipart abbreviations that add unnecessary complexity to a document (in part because of the requirement to convert English units to SI units). These multipart abbreviations usually consist of a unit of length, volume, or weight (often previously spelled out and abbreviated in the document) plus a unit of time.

Example: 15 ft per year (ft/year) (5 m per year [(m/year])

If the unit of time is the same in both the English and SI units, the following form is much simpler:

Example: 15 ft (5 m) per year

It is generally preferable to spell out *per* in text. However, the solidus may be used in tables to save horizontal space.

The solidus is sometimes used to indicate options; however, better usage would be to replace the solidus with whatever is meant (for example, *or, and, with,* or *in conjunction with*).

Examples: Gel-sphere-pac fuel was developed primarily for refabrication/recycle fuel systems.

Gel-sphere-pac was developed primarily *for refabrication and recycle fuel systems.*

Note: Options are often indicated by the *and/or* construction. This usage, however, is discouraged.

6.6.10 Signs of enclosure

Parentheses

Parentheses set off parenthetical, additional, or explanatory matter (an acronym, word, phrase, or entire sentence) and have the effect of minimizing the importance of this matter.

Example: The thorium-uranium recycle facility (TURF) was constructed (except for cell windows, manipulators, and other small items) for remote fuel reprocessing and fabrication.

Brackets

Brackets may be used to set off editorial comments or corrections in quoted material.

Example: Theoretical research in solid state physics is generally planned to compliment [sic] the experimental programs of the division.

Brackets are also used to enclose an acronym, word, phrase, or other parenthetical matter appearing within a broader statement set off by parentheses.

Ellipses

An ellipsis (that is, three spaced periods) indicates an omission that occurs in the middle of a sentence.

Example: Modification . . . to eliminate angular dispersions is an important improvement.

To indicate an omission that follows a complete sentence, use four spaced periods. The first period, which is the sentence period, immediately follows the last word of the sentence.

Example: Modification of the annular continuous chromatograph to eliminate angular dispersions is an important improvement. . . . [and] will permit study of separations that are not suitable for colorimetric analysis.

If the end of a sentence is omitted, use four spaced periods. The first word of the next sentence has an initial capital letter.

Example: Modification of the . . . chromatograph is.. . . important . . . . New capabilities made possible by this modification will permit study of separations that are not suitable for colorimetric analysis.

6.7 HYPHENATION

One-syllable words and bisyllabic or multisyllabic words of five or fewer letters (for example, "area") are never divided. In addition, words are not divided in the following circumstances:

- At the ends of more than two consecutive lines.
- Between a one- or two-letter syllable and the rest of the word (*ammoni-a* or *be-havior*).
- When the last word in a paragraph would force a portion of the word on the next line.
- When the last word on a page would force a portion of the word onto the next page.
- When the word is an abbreviation or contraction.

Avoid separating words or abbreviations that are closely related, such as the elements of dates and of proper names, groups of initials and surnames, and abbreviated titles and surnames.

Examples: 1 January 1991; Mr. Smith

When it is necessary to divide a date, the year may be carried over to the next line. When it is necessary to divide a name, the surname may be carried over to the next line only if both the first and last names are used.

6.8 LIST OF COMMONLY USED STYLE GUIDES, MANUALS, AND DICTIONARIES

The following is a list of commonly used style manuals and reference guides.

- *The Elements of Style*, William Strunk, Jr. and E. B. White, third edition, Macmillan Publishing Company, Inc., 1979. Known as the "little book," it's considered the classic guide for good writing style.

- *Webster's Ninth New Collegiate Dictionary*, Merriam-Webster, Inc., 1986. The UMTRA Project standard for spellings, definitions, and hyphenations.

- *The Synonym Finder*, Rodale Press, Inc., 1978. An excellent resource for synonyms.

- *Dictionary of Scientific and Technical Terms*, fourth edition, McGraw-Hill, 1989. The standard for scientific and technical spellings, definitions, and hyphenation.

- *Environment, Safety and Health Thesaurus/Dictionary*, U.S. Department of Energy, Office of Scientific and Technical Information, 1991. The DOE standard for environment, safety, and health terminology and acronyms.

- *Glossary of Geology*, third edition, American Geological Institute, 1987. The standard for geological spellings, definitions, and hyphenations.

- *The Gregg Reference Manual*, sixth edition, McGraw-Hill Book Company, 1989. An excellent reference for usage.

- *The New York Public Library Writer's Guide to Style and Usage*.

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DOE ORDERS

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8.0 LIST OF CONTRIBUTORS

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9.0 GLOSSARY

9.1 PUBLISHING TERMS

abstract	A summary (usually one page or less) that gives the reader a concise profile of what a document says and does (including any conclusions reached). Abstracts may be informative, indicative, or descriptive.
addendum	One or more pages of text, figures, or tabular material used to supplement a document.
author	The writer and/or originator of a document.
back matter	Material following the text, such as an index, appendix, or distribution list.
callout	Word or phrase used in text to refer to a table or figure, or to identify a table, illustration, or reference.
camera-ready copy	Final text and artwork ready for printing.
caption	Heading or title of a table or illustration.
cover	Front binding of a document that protects the text pages and is reproduced on heavy, protective paper called cover stock.
distribution	A list of recipients authorized to receive a document.
document	Any record of information, such as proposals, books, papers, drawings, maps, photographs, or other documentary materials, regardless of physical form or characteristics, made or received by the TAC.
draft	A preliminary or rough copy of a document before preparation of a master or typing of a final copy.

draft information	The preliminary phase of a document for review and comment issued in support of developing the final information.
drawing master	Original artwork from which reproductions are made.
executive summary	A brief description of the text in more detail than an abstract. It is intended to be a comprehensive overview of the purpose, basic background, and conclusions of a report.
foldout	Oversized illustration or table that is folded to fit within the trim size of a document.
format	Shape, size, style, and general appearance of a document; format is determined by typeface, margins, headings, spacings, and binding.
front matter	Printed matter preceding the main text; includes the title page, preface or foreword, summary, acknowledgments, and contents.
heading	Word or words identifying specific divisions or paragraphs and differentiated in some manner from standard text.
index	A work tool that enables the reader to find pertinent information in a document.
jargon	Specialized language of a particular profession. It is a verbal shorthand, useful for expressing complex ideas.
legend	A key that appears on an illustration, chart, or table to explain the symbols, colors, or designs used.
manual	A document in the form of a book that contains a plan, procedures, or both.
oral presentation	Any briefing, congressional testimony, conference, or convention presentation or speech, whether made within the TAC or outside its confines.

perfect binding	Binding method that features a wraparound paper cover to allow a title to be printed on the spine.
preface	An author's own statement about his or her work. It usually contains methodology, history of research, acknowledgments, and permissions granted.
speech/article	A speech, article, poster session, display, viewgraph, photograph, slide, or video presentation prepared as a new document and used as the basis of an oral or written presentation to the public (for example, journal, symposium, or conference) and cleared for unrestricted dissemination to the public.
spine	The binding edge of a book, connecting the front and back covers.
spiral binding	Type of binding in which a cylindrical spiral of metal or plastic is wound through holes punched in the edges of pages.
style	Rules of consistency in punctuation, capitalization, word division, spelling, and other details of expression.
subscript	Character or symbol printed partly below the base line of the text.
summary	A comprehensive statement that covers the main points of a paper, speech, or article in a cumulative or sequential fashion.
superscript	Character or symbol printed partly above the letters in a line of text.
technical editor	A person responsible for editing and coordinating the production of technical documents.
technical paper	A thoroughly documented and detailed presentation/article. It may be the completed information previously reported in an abstract or summary.

visual aid	A poster session, display, viewgraph, photograph, slide, or video presentation. This includes a written narrative of an oral presentation and a copy of the visual aids to be used in the oral presentation.

9.2 UMTRA PROJECT PUBLICATIONS TERMS

change history	A page in a TAC document that records major and minor changes to the narrative sections and attachments or appendixes of a document, until the document is published. Information in the change history directs readers to those areas of the document that have been revised. Sidebarred or redlined text may be used in a document to identify areas of change listed in the change history page.
contract deliverable	Information prepared under a prime contract. Release of such information must be consistent with any rules established by the customer responsible for the program.
controlled document	A copy of a document that is assigned a unique copy number to control its accountability and ensure prompt update when revised. Controlled documents must be signed for by assigned custodians and must be returned to a Document Control Center for reassignment at the time of the custodian's transfer of responsibilities or termination of employment.
controlled manual	A document issued by the TAC for internal use only consisting of mandatory TAC policies, requirements, and procedures directing the daily operations of TAC.
copy control number	A unique series number assigned to each individual copy of a document contained in a specific controlled document distribution.
correspondence	A written communication between organizations or between divisions within an organization. Typically, it takes the form of a letter or memorandum, together with any appropriate attachments or enclosures.

correspondence system	A method for reporting, tracking, and archiving unclassified scientific, technical, engineering, and related information transmitted in a letter or memorandum using a unique prefix number.
document coordinator	The person responsible for the physical creation of the document (for example, compiling and managing the production of a document).
document number	A unique number assigned to a document.
document sponsor	The site or task manager under whose direction a document is being created and who has budgeting and schedule tracking responsibility.
document team	The team of people designated to prepare a document's content (text and graphics). These people include authors, a graphic illustrator, and a technical editor.
external	Any person, organization, or company outside the TAC.
Office of Scientific and Technical Information	The DOE organization responsible for directing the DOE scientific and technical information program and operating the national information center that manages, publishes, and disseminates scientific, technical, and practical energy information acquired from worldwide sources.
planning index	A planning tool that cross-references document sections and subjects. Its use helps authors and the document coordinator locate all discussions on specific subjects so that consistent and appropriate corrections or changes can be made throughout the document.
supporting document	A text-type, informal, working engineering document that describes, defines, reports, or certifies activities, requirements, specifications, procedures, or results of engineering activities that support operation of on-site facilities.

UMTRA Project master reference list	A list of references commonly used on the UMTRA Project, including their correct format and citation, for use by the authors to streamline the preparation of the overall document reference list.

9.3 GRAMMATICAL TERMS

adjective	A word, phase, or clause that modifies the meaning of a noun or a pronoun.
adverb	A word, phase, or clause that modifies the meaning of a verb, an adjective, or another adverb.
clause	A group of related words that contains a subject and predicate. An *independent* clause (also known as a *main clause* or *principal clause*) expresses a complete thought and can stand alone as a sentence. A *dependent* clause (also known as a *subordinate clause*) does not express a complete thought and cannot stand alone as a sentence.
essential (or restrictive) clause	A dependent clause that cannot be omitted without changing the meaning of the main clause.
nonessential (or nonrestrictive) clause	A dependent clause that adds descriptive information but could be omitted without changing the meaning of the main clause.
dangling modifier	A modifier that is attached either to no word in a sentence or to the wrong word.
modifier	A word, phrase, or clause that qualifies, limits, or restricts the meaning of a word.
noun	The name of a person, place, object, idea, quality, or activity.
prefix	A letter, syllable, or word added to the beginning of a word to change its meaning.

pronoun	A word used in place of a noun.
sentence	A group of words representing a complete thought and containing a subject and a verb (predicate) along with any complements and modifiers.
simple sentence	A sentence consisting of one independent clause.
compound sentence	A sentence consisting of two or more independent clauses.
complex sentence	A sentence consisting of one independent clause and one or more dependent clauses.
compound-complex sentence	A sentence consisting of two independent clauses and one or more dependent clauses.
verb	A word used to express action or state of being.
voice	The property of a verb that indicates whether the subject acts or is acted upon. A verb is in the *active voice* when its subject is the doer of the act. A verb is in the *passive voice* when its subject is acted upon.

ATTACHMENT 1
ASTM METRIC CONVERSION CHARTS

ALPHABETICAL LIST OF UNITS

Factors with an asterisk (*) are exact

(Symbols of SI units given in parentheses)

To convert from	to	Multiply by
abampere	ampere (A)	1.000 000*E+01
abcoulomb	coulomb (C)	1.000 000*E+01
abfarad	farad (F)	1.000 000*E+09
abhenry	henry (H)	1.000 000*E−09
abmho	siemens (S)	1.000 000*E+09
abohm	ohm (Ω)	1.000 000*E−09
abvolt	volt (V)	1.000 000*E−08
acre foot[13]	cubic metre (m^3)	1.233 489 E+03
acre[13]	square metre (m^2)	4.046 873 E+03
ampere hour	coulomb (C)	3.600 000*E+03
angstrom	metre (m)	1.000 000*E−10
are	square metre (m^2)	1.000 000*E+02
astronomical unit	metre (m)	1.495 979 E+11
atmosphere, standard	pascal (Pa)	1.013 250*E+05
atmosphere, technical (= 1 kgf/cm^2)	pascal (Pa)	9.806 650*E+04
bar	pascal (Pa)	1.000 000*E+05
barn	square metre (m^2)	1.000 000*E−28
barrel (for petroleum, 42 gal)	cubic metre (m^3)	1.589 873 E−01
board foot	cubic metre (m^3)	2.359 737 E−03
British thermal unit (International Table)[14]	joule (J)	1.055 056 E+03
British thermal unit (mean)	joule (J)	1.055 87 E+03
British thermal unit (thermochemical)	joule (J)	1.054 350 E+03
British thermal unit (39°F)	joule (J)	1.059 67 E+03
British thermal unit (59°F)	joule (J)	1.054 80 E+03
British thermal unit (60°F)	joule (J)	1.054 68 E+03
Btu (International Table)·ft/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.730 735 E+00
Btu (thermochemical)·ft/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.729 577 E+00
Btu (International Table)·in/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.442 279 E−01
Btu (thermochemical)·in/(h·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	1.441 314 E−01
Btu (International Table)·in/s·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	5.192 204 E+02
Btu (thermochemical)·in/(s·ft^2·°F) (thermal conductivity)	watt per metre kelvin [W/(m·K)]	5.188 732 E+02
Btu (International Table)/h	watt (W)	2.930 711 E−01
Btu (International Table)/s	watt (W)	1.055 056 E+03
Btu (thermochemical)/h	watt (W)	2.928 751 E−01

[13] The U.S. Metric Law of 1866 gave the relationship, 1 metre equals 39.37 inches. Since 1893 the U.S. yard has been derived from the metre. In 1959 a refinement was made in the definition of the yard to bring the U.S. yard and the yard used in other countries into agreement. The U.S. yard was changed from 3600/3937 m to 0.9144 m exactly. The new length is shorter by exactly two parts in a million.

At the same time it was decided that any data in feet derived from and published as a result of geodetic surveys within the U.S. would remain with the old standard (1 ft = 1200/3937 m) until further decision. This foot is named the U.S. survey foot.

All conversion factors for units of land measure in these tables referenced to this footnote are based on the U.S. survey foot and the following relationships: 1 fathom = 6 feet; 1 rod (pole or perch) = 16½ feet; 1 chain = 66 feet; 1 mile (U.S. statute) = 5280 feet.

[14] The Fifth International Conference on the Properties of Steam in 1956 defined the calorie (International Table) as 4.1868 J. Therefore, the exact conversion for Btu (International Table) is 1.055 055 852 62 E+03 J.

To convert from	to	Multiply by
Btu (thermochemical)/min	watt (W)	1.757 250 E+01
Btu (thermochemical)/s	watt (W)	1.054 350 E+03
Btu (International Table)/ft^2	joule per square metre (J/m^2)	1.135 653 E+04
Btu (thermochemical)/ft^2	joule per square metre (J/m^2)	1.134 893 E+04
Btu (International Table)/(ft^2·s)	watt per square metre (W/m^2)	1.135 653 E+04
Btu (International Table)/(ft^2·h)	watt per square metre (W/m^2)	3.154 591 E+00
Btu (thermochemical)/(ft^2·h)	watt per square metre (W/m^2)	3.152 481 E+00
Btu (thermochemical)/(ft^2·min)	watt per square metre (W/m^2)	1.891 489 E+02
Btu (thermochemical)/(ft^2·s)	watt per square metre (W/m^2)	1.134 893 E+04
Btu (thermochemical)/(in^2·s)	watt per square metre (W/m^2)	1.634 246 E+06
Btu (International Table)/(h·ft^2·°F) (thermal conductance)[15]	watt per square metre kelvin [W/(m^2·K)]	5.678 263 E+00
Btu (thermochemical)/(h·ft^2·°F)(thermal conductance)[15]	watt per square metre kelvin [W/(m^2·K)]	5.674 466 E+00
Btu (International Table)/(s·ft^2·°F)	watt per square metre kelvin [W/(m^2·K)]	2.044 175 E+04
Btu (thermochemical)/(s·ft^2·°F)	watt per square metre kelvin [W/(m^2·K)]	2.042 808 E+04
Btu (International Table)/lb	joule per kilogram (J/kg)	2.326 000*E+03
Btu (thermochemical)/lb	joule per kilogram (J/kg)	2.324 444 E+03
Btu (International Table)/(lb·°F) (heat capacity)	joule per kilogram kelvin [J/(kg·K)]	4.186 800*E+03
Btu (thermochemical)/(lb·°F) (heat capacity)	joule per kilogram kelvin [J/(kg·K)]	4.184 000*E+03
Btu (International Table)/ft^3	joule per cubic metre (J/m^3)	3.725 895 E+04
Btu (thermochemical)/ft^3	joule per cubic metre (J/m^3)	3.723 402 E+04
bushel (U.S.)	cubic metre (m^3)	3.523 907 E−02
calorie (International Table)[14]	joule (J)	4.186 800*E+00
calorie (mean)	joule (J)	4.190 02 E+00
calorie (thermochemical)	joule (J)	4.184 000*E+00
calorie (15°C)	joule (J)	4.185 80 E+00
calorie (20°C)	joule (J)	4.181 90 E+00
calorie (kilogram, International Table)	joule (J)	4.186 800*E+03
calorie (kilogram, mean)	joule (J)	4.190 02 E+03
calorie (kilogram, thermochemical)	joule (J)	4.184 000*E+03
cal (thermochemical)/cm^2	joule per square metre (J/m^2)	4.184 000*E+04
cal (International Table)/g	joule per kilogram (J/kg)	4.186 800*E+03
cal (thermochemical)/g	joule per kilogram (J/kg)	4.184 000*E+03
cal (International Table)/(g·°C)	joule per kilogram kelvin [J/(kg·K)]	4.186 800*E+03
cal (thermochemical)/(g·°C)	joule per kilogram kelvin [J/(kg·K)]	4.184 000*E+03
cal (thermochemical)/min	watt (W)	6.973 333 E−02
cal (thermochemical)/s	watt (W)	4.184 000*E+00
cal (thermochemical)/(cm^2·s)	watt per square metre (W/m^2)	4.184 000*E+04
cal (thermochemical)/(cm^2·min)	watt per square metre (W/m^2)	6.973 333 E+02
cal (thermochemical)/(cm^2·s)	watt per square metre (W/m^2)	4.184 000*E+04
cal (thermochemical)/(cm·s·°C)	watt per metre kelvin [W/(m·K)]	4.184 000*E+02
cd/in^2	candela per square metre (cd/m^2)	1.550 003 E+03
carat (metric)	kilogram (kg)	2.000 000*E−04
centimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+03
centimetre of water (4°C)	pascal (Pa)	9.806 38 E+01
centipoise (dynamic viscosity)	pascal second (Pa·s)	1.000 000*E−03
centistokes (kinematic viscosity)	square metre per second (m^2/s)	1.000 000*E−06
chain[15]	metre (m)	2.011 684 E+01
circular mil	square metre (m^2)	5.067 075 E−10
clo	kelvin square metre per watt (K·m^2/W)	2.003 712 E−01
cup	cubic metre (m^3)	2.365 882 E−04
curie	becquerel (Bq)	3.700 000*E+10
darcy[16]	square metre (m^2)	9.869 233 E−13
day	second (s)	8.640 000*E+04

[15] In ISO 31 this quantity is called *coefficient of heat transfer.*
[16] The darcy is a unit for measuring permeability of porous solids.

To convert from	to	Multiply by
day (sidereal)	second (s)	8.616 409 E+04
degree (angle)	radian (rad)	1.745 329 E−02
degree Celsius	kelvin (K)	$T_K = t_{°C} + 273.15$
degree centigrade	[see 3.4.2]	
degree Fahrenheit	degree Celsius (°C)	$t_{°C} = (t_{°F} - 32)/1.8$
degree Fahrenheit	kelvin (K)	$T_K = (t_{°F} + 459.67)/1.8$
degree Rankine	kelvin (K)	$T_K = T_{°R}/1.8$
°F·h·ft²/Btu (International Table) (thermal resistance)[17]	kelvin square metre per watt (K·m²/W)	1.761 102 E−01
°F·h·ft²/Btu (thermochemical) (thermal resistance)[17]	kelvin square metre per watt (K·m²/W)	1.762 280 E−01
°F·h·ft²/[Btu (International Table)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.933 471 E+00
°F·h·ft²/[Btu (thermochemical)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.938 113 E+00
denier	kilogram per metre (kg/m)	1.111 111 E−07
dyne	newton (N)	1.000 000*E−05
dyne·cm	newton metre (N·m)	1.000 000*E−07
dyne/cm²	pascal (Pa)	1.000 000*E−01
electronvolt	joule (J)	1.602 19 E−19
EMU of capacitance	farad (F)	1.000 000*E+09
EMU of current	ampere (A)	1.000 000*E+01
EMU of electric potential	volt (V)	1.000 000*E−08
EMU of inductance	henry (H)	1.000 000*E−09
EMU of resistance	ohm (Ω)	1.000 000*E−09
ESU of capacitance	farad (F)	1.112 650 E−12
ESU of current	ampere (A)	3.335 6 E−10
ESU of electric potential	volt (V)	2.997 9 E+02
ESU of inductance	henry (H)	8.987 554 E+11
ESU of resistance	ohm (Ω)	8.987 554 E+11
erg	joule (J)	1.000 000*E−07
erg/(cm²·s)	watt per square metre (W/m²)	1.000 000*E−03
erg/s	watt (W)	1.000 000*E−07
faraday (based on carbon-12)	coulomb (C)	9.648 70 E+04
faraday (chemical)	coulomb (C)	9.649 57 E+04
faraday (physical)	coulomb (C)	9.652 19 E+04
fathom[13]	metre (m)	1.828 804 E+00
fermi (femtometre)	metre (m)	1.000 000*E−15
fluid ounce (U.S.)	cubic metre (m³)	2.957 353 E−05
foot	metre (m)	3.048 000*E−01
foot (U.S. survey)[13]	metre (m)	3.048 006 E−01
foot of water (39.2°F)	pascal (Pa)	2.988 98 E+03
ft²	square metre (m²)	9.290 304*E−02
ft²/h (thermal diffusivity)	square metre per second (m²/s)	2.580 640*E−05
ft²/s	square metre per second (m²/s)	9.290 304*E−02
ft³ (volume; section modulus)	cubic metre (m³)	2.831 685 E−02
ft³/min	cubic metre per second (m³/s)	4.719 474 E−04
ft³/s	cubic metre per second (m³/s)	2.831 685 E−02
ft⁴ (second moment of area)[18]	metre to the fourth power (m⁴)	8.630 975 E−03
ft/h	metre per second (m/s)	8.466 667 E−05
ft/min	metre per second (m/s)	5.080 000*E−03
ft/s	metre per second (m/s)	3.048 000*E−01
ft/s²	metre per second squared (m/s²)	3.048 000*E−01
footcandle	lux (lx)	1.076 391 E+01
footlambert	candela per square metre (cd/m²)	3.426 259 E+00
ft·lbf	joule (J)	1.355 818 E+00
ft·lbf/h	watt (W)	3.766 161 E−04
ft·lbf/min	watt (W)	2.259 697 E−02
ft·lbf/s	watt (W)	1.355 818 E+00
ft-poundal	joule (J)	4.214 011 E−02
g, standard free fall	metre per second squared (m/s²)	9.806 650*E+00

[17] In ISO 31 this quantity is called *thermal insulance* and the quantity *thermal resistance* has the unit K/W.
[18] This is sometimes called the moment of section or area moment of inertia of a plane section about a specified axis.

To convert from	to	Multiply by
gal	metre per second squared (m/s^2)	1.000 000*E−02
gallon (Canadian liquid)	cubic metre (m^3)	4.546 090 E−03
gallon (U.K. liquid)	cubic metre (m^3)	4.546 092 E−03
gallon (U.S. dry)	cubic metre (m^3)	4.404 884 E−03
gallon (U.S. liquid)	cubic metre (m^3)	3.785 412 E−03
gallon (U.S. liquid) per day	cubic metre per second (m^3/s)	4.381 264 E−08
gallon (U.S. liquid) per minute	cubic metre per second (m^3/s)	6.309 020 E−05
gallon (U.S. liquid) per hp·h (SFC, specific fuel consumption)	cubic metre per joule (m^3/J)	1.410 089 E−09
gamma	tesla (T)	1.000 000*E−09
gauss	tesla (T)	1.000 000*E−04
gilbert	ampere (A)	7.957 747 E−01
gill (U.K.)	cubic metre (m^3)	1.420 654 E−04
gill (U.S.)	cubic metre (m^3)	1.182 941 E−04
grade	degree (angular)	9.000 000*E−01
grade	radian (rad)	1.570 796 E−02
grain	kilogram (kg)	6.479 891*E−05
grain/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	1.711 806 E−02
gram	kilogram (kg)	1.000 000*E−03
g/cm^3	kilogram per cubic metre (kg/m^3)	1.000 000*E+03
gf/cm^2	pascal (Pa)	9.806 650*E+01
hectare	square metre (m^2)	1.000 000*E+04
horsepower (550 ft·lbf/s)	watt (W)	7.456 999 E+02
horsepower (boiler)	watt (W)	9.809 50 E+03
horsepower (electric)	watt (W)	7.460 000*E+02
horsepower (metric)	watt (W)	7.354 99 E+02
horsepower (water)	watt (W)	7.460 43 E+02
horsepower (U.K.)	watt (W)	7.457 0 E+02
hour	second(s)	3.600 000*E+03
hour (sidereal)	second (s)	3.590 170 E+03
hundredweight (long)	kilogram (kg)	5.080 235 E+01
hundredweight (short)	kilogram (kg)	4.535 924 E+01
inch	metre (m)	2.540 000*E−02
inch of mercury (32°F)	pascal (Pa)	3.386 38 E+03
inch of mercury (60°F)	pascal (Pa)	3.376 85 E+03
inch of water (39.2°F)	pascal (Pa)	2.490 82 E+02
inch of water (60°F)	pascal (Pa)	2.488 4 E+02
in^2	square metre (m^2)	6.451 600*E−04
in^3 (volume)[19]	cubic metre (m^3)	1.638 706 E−05
in^3 (section modulus)[19]	metre cubed (m^3)	1.638 706 E−05
in^3/min	cubic metre per second (m^3/s)	2.731 177 E−07
in^4 (second moment of area)[18]	metre to the fourth power (m^4)	4.162 314 E−07
in/s	metre per second (m/s)	2.540 000*E−02
in/s^2	metre per second squared (m/s^2)	2.540 000*R−02
kayser	1 per metre (1/m)	1.000 000*E+02
kelvin	degree Celsius (°C)	$t_{°C} = T_K - 273.15$
kilocalorie (International Table)	joule (J)	4.186 800*E+03
kilocalorie (mean)	joule (J)	4.190 02 E+03
kilocalorie (thermochemical)	joule (J)	4.184 000*E+03
kilocalorie (thermochemical)/min	watt (W)	6.973 333 E+01
kilocalorie (thermochemical)/s	watt (W)	4.184 000*E+03
kilogram-force (kgf)	newton (N)	9.806 650*E+00
kgf·m	newton metre (N·m)	9.806 650*E+00
$kgf·s^2/m$ (mass)	kilogram (kg)	9.806 650*E+00
kgf/cm^2	pascal (Pa)	9.806 650*E+04
kgf/m^2	pascal (Pa)	9.806 650*E+00
kgf/mm^2	pascal (Pa)	9.806 650*E+06
km/h	metre per second (m/s)	2.777 778 E−01
kilopond (1 kp = 1 kgf)	newton (N)	9.806 650*E+00
kW·h	joule (J)	3.600 000*E+06
kip (1000 lbf)	newton (N)	4.448 222 E+03
kip/in^2 (ksi)	pascal (Pa)	6.894 757 E+06

[19] The exact conversion factor is 1.638 706 4*E-05.

To convert from	to	Multiply by
knot (international)	metre per second (m/s)	5.144 444 E−01
lambert	candela per square metre (cd/m^2)	1/π *E+04
lambert	candela per square metre (cd/m^2)	3.183 099 E+03
langley	joule per square metre (J/m^2)	4.184 000*E+04
light year	metre (m)	9.460 55 E+15
litre[20]	cubic metre (m^3)	1.000 000*E−03
lm/ft^2	lumen per square metre (lm/m^2)	1.076 391 E+01
maxwell	weber (Wb)	1.000 000*E−08
mho	siemens (S)	1.000 000*E+00
microinch	metre (m)	2.540 000*E−08
micron	metre (m)	1.000 000*E−06
mil	metre (m)	2.540 000*E−05
mile (international)	metre (m)	1.609 344*E+03
mile (U.S. statute)[13]	metre (m)	1.609 347 E+03
mile (international nautical)	metre (m)	1.852 000*E+03
mile (U.S. nautical)	metre (m)	1.852 000*E+03
mi^2 (international)	square metre (m^2)	2.589 988 E+06
mi^2 (U. S. statute)[13]	square metre (m^2)	2.589 998 E+06
mi/h (international)	metre per second (m/s)	4.470 400*E−01
mi/h (international)	kilometre per hour (km/h)	1.609 344*E+00
mi/min (international)	metre per second (m/s)	2.682 240*E+01
mi/s (international)	metre per second (m/s)	1.609 344*E+03
millibar	pascal (Pa)	1.000 000*E+02
millimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+02
minute (angle)	radian (rad)	2.908 882 E−04
minute	second (s)	6.000 000*E+01
minute (sidereal)	second (s)	5.983 617 E+01
oersted	ampere per metre (A/m)	7.957 747 E+01
ohm centimetre	ohm meter (Ω·m)	1.000 000*E−02
ohm circular-mil per foot	ohm metre (Ω·m)	1.662 426 E−09
ounce (avoirdupois)	kilogram (kg)	2.834 952 E−02
ounce (troy or apothecary)	kilogram (kg)	3.110 348 E−02
ounce (U.K. fluid)	cubic metre (m^3)	2.841 307 E−05
ounce (U.S. fluid)	cubic metre (m^3)	2.957 353 E−05
ounce-force	newton (N)	2.780 139 E−01
ozf·in	newton metre (N·m)	7.061 552 E−03
oz (avoirdupois)/gal (U.K. liquid)	kilogram per cubic metre (kg/m^3)	6.236 021 E+00
oz (avoirdupois)/gal (U.S. liquid)	kilogram per cubic metre (kg/m^3)	7.489 152 E+00
oz (avoirdupois)/in^3	kilogram per cubic metre (kg/m^3)	1.729 994 E+03
oz (avoirdupois)/ft^2	kilogram per square metre (kg/m^2)	3.051 517 E−01
oz (avoirdupois)/yd^2	kilogram per square metre (kg/m^2)	3.390 575 E−02
parsec	metre (m)	3.085 678 E+16
peck (U.S.)	cubic metre (m^3)	8.809 768 E−03
pennyweight	kilogram (kg)	1.555 174 E−03
perm (0°C)	kilogram per pascal second square metre [kg/(Pa·s·m^2)]	5.721 35 E−11
perm (23°C)	kilogram per pascal second square metre [kg/(Pa·s·m^2)]	5.745 25 E−11
perm·in (0°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.453 22 E−12
perm·in (23°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.459 29 E−12
phot	lumen per square metre (lm/m^2)	1.000 000*E+04
pica (printer's)	metre (m)	4.217 518 E−03
pint (U.S. dry)	cubic metre (m^3)	5.506 105 E−04
pint (U.S. liquid)	cubic metre (m^3)	4.731 765 E−04
point (printer's)	metre (m)	3.514 598*E−04
poise (absolute viscosity)	pascal second (Pa·s)	1.000 000*E−01
pound (lb avoirdupois)[21]	kilogram (kg)	4.535 924 E−01

[20] In 1964 the General Conference on Weights and Measures reestablished the name litre as a special name for the cubic decimetre. Between 1901 and 1964 the litre was slightly larger (1.000 028 dm^3); in the use of high-accuracy volume data of that time interval, this fact must be kept in mind.

[21] The exact conversion factor is 4.535 923 7*E-01.

To convert from	to	Multiply by
pound (troy or apothecary)	kilogram (kg)	3.732 417 E−01
lb·ft² (moment of inertia)	kilogram square metre (kg·m²)	4.214 011 E−02
lb·in² (moment of inertia)	kilogram square metre (kg·m²)	2.926 397 E−04
lb/ft·h	pascal second (Pa·s)	4.133 789 E−04
lb/ft·s	pascal second (Pa·s)	1.488 164 E+00
lb/ft²	kilogram per square metre (kg/m²)	4.882 428 E+00
lb/ft³	kilogram per cubic metre (kg/m³)	1.601 846 E+01
lb/gal (U.K. liquid)	kilogram per cubic metre (kg/m³)	9.977 633 E+01
lb/gal (U.S. liquid)	kilogram per cubic metre (kg/m³)	1.198 264 E+02
lb/h	kilogram per second (kg/s)	1.259 979 E−04
lb/hp·h (SFC, specific fuel consumption)	kilogram per joule (kg/J)	1.689 659 E−07
lb/in³	kilogram per cubic metre (kg/m³)	2.767 990 E+04
lb/min	kilogram per second (kg/s)	7.559 873 E−03
lb/s	kilogram per second (kg/s)	4.535 924 E−01
lb/yd³	kilogram per cubic metre (kg/m³)	5.932 764 E−01
poundal	newton (N)	1.382 550 E−01
poundal/ft²	pascal (Pa)	1.488 164 E+00
poundal·s/ft²	pascal second (Pa·s)	1.488 164 E+00
pound-force (lbf)[22]	newton (N)	4.448 222 E+00
lbf·ft	newton metre (N·m)	1.355 818 E+00
lbf·ft/in	newton metre per metre (N·m/m)	5.337 866 E+01
lbf·in	newton metre (N·m)	1.129 848 E−01
lbf·in/in	newton metre per metre (N·m/m)	4.448 222 E+00
lbf·s/ft²	pascal second (Pa·s)	4.788 026 E+01
lbf·s/in²	pascal second (Pa·s)	6.894 757 E+03
lbf/ft	newton per metre (N/m)	1.459 390 E+01
lbf/ft²	pascal (Pa)	4.788 026 E+01
lbf/in	newton per metre (N/m)	1.751 268 E+02
lbf/in² (psi)	pascal (Pa)	6.894 757 E+03
lbf/lb (thrust/weight [mass] ratio)	newton per kilogram (N/kg)	9.806 650 E+00
quart (U.S. dry)	cubic metre (m³)	1.101 221 E−03
quart (U.S. liquid)	cubic metre (m³)	9.463 529 E−04
rad (absorbed dose)	gray (Gy)	1.000 000*E−02
rem (dose equivalent)	sievert (Sv)	1.000 000*E−02
rhe	1 per pascal second [1/(Pa·s)]	1.000 000*E+01
rod[13]	metre (m)	5.029 210 E+00
roentgen	coulomb per kilogram (C/kg)	2.58 E−04
second (angle)	radian (rad)	4.848 137 E−06
second (sidereal)	second (s)	9.972 696 E−01
shake	second (s)	1.000 000*E−08
slug	kilogram (kg)	1.459 390 E+01
slug/ft·s	pascal second (Pa·s)	4.788 026 E+01
slug/ft³	kilogram per cubic metre (kg/m³)	5.153 788 E+02
statampere	ampere (A)	3.335 640 E−10
statcoulomb	coulomb (C)	3.335 640 E−10
statfarad	farad (F)	1.112 650 E−12
stathenry	henry (H)	8.987 554 E+11
statmho	siemens (S)	1.112 650 E−12
statohm	ohm (Ω)	8.987 554 E+11
statvolt	volt (V)	2.997 925 E+02
stere	cubic metre (m³)	1.000 000*E+00
stilb	candela per square metre (cd/m²)	1.000 000*E+04
stokes (kinematic viscosity)	square metre per second (m²/s)	1.000 000*E−04
tablespoon	cubic metre (m³)	1.478 676 E−05
teaspoon	cubic metre (m³)	4.928 922 E−06
tex	kilogram per metre (kg/m)	1.000 000*E−06
therm (European Community)[23]	joule (J)	1.055 06 E+08
therm (U.S.)[23]	joule (J)	1.054 804*E+08

[22] The exact conversion factor is 4.448 221 615 260 5*E+00.

[23] The therm (European Community) is legally defined in the Council of the European Communities Directive 80/181/EC of December 20, 1979. The therm (U.S.) is legally defined in the *Federal Register*, Vol 33, No. 146, p. 10756, of July 27, 1968. Although the European therm, which is based on the International Table Btu, is frequently used by engineers in the U.S., the therm (U.S.) is the legal unit used by the U.S. natural gas industry.

To convert from	to	Multiply by
ton (assay)	kilogram (kg)	2.916 667 E−02
ton (long, 2240 lb)	kilogram (kg)	1.016 047 E+03
ton (metric)	kilogram (kg)	1.000 000* E+03
ton (nuclear equivalent of TNT)	joule (J)	4.184 E+09[24]
ton of refrigeration (= 12 000 Btu/h)	watt (W)	3.517 E+03
ton (register)	cubic metre (m^3)	2.831 685 E+00
ton (short, 2000 lb)	kilogram (kg)	9.071 847 E+02
ton (long)/yd^3	kilogram per cubic metre (kg/m^3)	1.328 939 E+03
ton (short)/yd^3	kilogram per cubic metre (kg/m^3)	1.186 553 E+03
ton (short)/h	kilogram per second (kg/s)	2.519 958 E−01
ton-force (2000 lbf)	newton (N)	8.896 444 E+03
tonne	kilogram (kg)	1.000 000* E+03
torr (mmHg, 0°C)	pascal (Pa)	1.333 22 E+02
unit pole	weber (Wb)	1.256 637 E−07
W·h	joule (J)	3.600 000* E+03
W·s	joule (J)	1.000 000* E+00
W/cm^2	watt per square metre (W/m^2)	1.000 000* E+04
W/in^2	watt per square metre (W/m^2)	1.550 003 E+03
yard	metre (m)	9.144 000* E−01
yd^2	square metre (m^2)	8.361 274 E−01
yd^3	cubic metre (m^3)	7.645 549 E−01
yd^3/min	cubic metre per second (m^3/s)	1.274 258 E−02
year (365 days)	second (s)	3.153 600* E+07
year (sidereal)	second (s)	3.155 815 E+07
year (tropical)	second (s)	3.155 693 E+07

[24] Defined (not measured) value.

CLASSIFIED LIST OF UNITS

To convert from	to	Multiply by
ACCELERATION		
ft/s^2	metre per second squared (m/s^2)	3.048 000*E−01
free fall, standard (g)	metre per second squared (m/s^2)	9.806 650*E+00
gal	metre per second squared (m/s^2)	1.000 000*E−02
in/s^2	metre per second squared (m/s^2)	2.540 000*E−02
ANGLE		
degree	radian (rad)	1.745 329 E−02
minute	radian (rad)	2.908 882 E−04
second	radian (rad)	4.848 137 E−06
grade	degree (angular)	9.000 000*E−01
grade	radian (rad)	1.570 796 E−02
AREA		
acre[3]	square metre (m^2)	4.046 873 E+03
are	square metre (m^2)	1.000 000*E+02
barn	square metre (m^2)	1.000 000*E−28
circular mil	square metre (m^2)	5.067 075 E−10
darcy[16]	square metre (m^2)	9.869 233 E−13
ft^2	square metre (m^2)	9.290 304*E−02
hectare	square metre (m^2)	1.000 000*E+04
in^2	square metre (m^2)	6.451 600*E−04
mi^2 (international)	square metre (m^2)	2.589 988 E+06
mi^2 (U.S. statute)[13]	square metre (m^2)	2.589 998 E+06
yd^2	square metre (m^2)	8.361 274 E−01
BENDING MOMENT OR TORQUE (see 3.4.4)		
dyne·cm	newton metre (N·m)	1.000 000*E−07
kgf·m	newton metre (N·m)	9.806 650*E+00
ozf·in	newton metre (N·m)	7.061 552 E−03
lbf·in	newton metre (N·m)	1.129 848 E−01
lbf·ft	newton metre (N·m)	1.355 818 E+00
BENDING MOMENT OR TORQUE PER UNIT LENGTH		
lbf·ft/in	newton metre per metre (N·m/m)	5.337 866 E+01
lbf·in/in	newton metre per metre (N·m/m)	4.448 222 E+00
CAPACITY (See VOLUME)		
DENSITY (See MASS PER UNIT VOLUME)		
ELECTRICITY AND MAGNETISM[25]		
abampere	ampere (A)	1.000 000*E+01
abcoulomb	coulomb (C)	1.000 000*E+01
abfarad	farad (F)	1.000 000*E+09
abhenry	henry (H)	1.000 000*E−09
abmho	siemens (S)	1.000 000*E+09
abohm	ohm (Ω)	1.000 000*E−09

[25] ESU means electrostatic cgs unit. EMU means electromagnetic cgs unit.

To convert from	to	Multiply by
abvolt	volt (V)	1.000 000*E−08
ampere hour	coulomb (C)	3.600 000*E+03
EMU of capacitance	farad (F)	1.000 000*E+09
EMU of current	ampere (A)	1.000 000*E+01
EMU of electric potential	volt (V)	1.000 000*E−08
EMU of inductance	henry (H)	1.000 000*E−09
EMU of resistance	ohm (Ω)	1.000 000*E−09
ESU of capacitance	farad (F)	1.112 650 E−12
ESU of current	ampere (A)	3.335 6 E−10
ESU of electric potential	volt (V)	2.997 9 E+02
ESU of inductance	henry (H)	8.987 554 E+11
ESU of resistance	ohm (Ω)	8.987 554 E+11
faraday (based on carbon-12)	coulomb (C)	9.648 70 E+04
faraday (chemical)	coulomb (C)	9.649 57 E+04
faraday (physical)	coulomb (C)	9.652 19 E+04
gamma	tesla (T)	1.000 000*E−09
gauss	tesla (T)	1.000 000*E−04
gilbert	ampere (A)	7.957 747 E−01
maxwell	weber (Wb)	1.000 000*E−08
mho	siemens (S)	1.000 000*E+00
oersted	ampere per metre (A/m)	7.957 747 E+01
ohm centimetre	ohm metre (Ω·m)	1.000 000*E−02
ohm circular-mil per foot	ohm metre (Ω·m)	1.662 426 E−09
statampere	ampere (A)	3.335 640 E−10
statcoulomb	coulomb (C)	3.335 640 E−10
statfarad	farad (F)	1.112 650 E−12
stathenry	henry (H)	8.987 554 E+11
statmho	siemens (S)	1.112 650 E−12
statohm	ohm (Ω)	8.987 554 E+11
statvolt	volt (V)	2.997 925 E+02
unit pole	weber (Wb)	1.256 637 E−07

ENERGY (Includes WORK)

British thermal unit (International Table)[14]	joule (J)	1.055 056 E+03
British thermal unit (mean)	joule (J)	1.055 87 E+03
British thermal unit (thermochemical)	joule (J)	1.054 350 E+03
British thermal unit (39°F)	joule (J)	1.059 67 E+03
British thermal unit (59°F)	joule (J)	1.054 80 E+03
British thermal unit (60°F)	joule (J)	1.054 68 E+03
calorie (International Table)	joule (J)	4.186 800*E+00
calorie (mean)	joule (J)	4.190 02 E+00
calorie (thermochemical)	joule (J)	4.184 000*E+00
calorie (15°C)	joule (J)	4.185 80 E+00
calorie (20°C)	joule (J)	4.181 90 E+00
calorie (kilogram, International Table)	joule (J)	4.186 800*E+03
calorie (kilogram, mean)	joule (J)	4.190 02 E+03
calorie (kilogram, thermochemical)	joule (J)	4.184 000*E+03
electronvolt	joule (J)	1.602 19 E−19
erg	joule (J)	1.000 000*E−07
ft·lbf	joule (J)	1.355 818 E+00
ft-poundal	joule (J)	4.214 011 E−02
kilocalorie (International Table)	joule (J)	4.186 800*E+03
kilocalorie (mean)	joule (J)	4.190 02 E+03
kilocalorie (thermochemical)	joule (J)	4.184 000*E+03
kW·h	joule (J)	3.600 000*E+06
therm (European Community)[23]	joule (J)	1.055 06 E+08
therm (U.S.)[23]	joule (J)	1.054 804*E+08
ton (nuclear equivalent of TNT)	joule (J)	4.184 E+09[24]
W·h	joule (J)	3.600 000*E+03
W·s	joule (J)	1.000 000*E+00

To convert from	to	Multiply by
ENERGY PER UNIT AREA TIME		
Btu (International Table)/(ft²·s)	watt per square metre (W/m²)	1.135 653 E+04
Btu (International Table)/(ft²·h)	watt per square metre (W/m²)	3.154 591 E+00
Btu (thermochemical)/(ft²·s)	watt per square metre (W/m²)	1.134 893 E+04
Btu (thermochemical)/(ft²·min)	watt per square metre (W/m²)	1.891 489 E+02
Btu (thermochemical)/(ft²·h)	watt per square metre (W/m²)	3.152 481 E+00
Btu (thermochemical)/(in²·s)	watt per square metre (W/m²)	1.634 246 E+06
cal (thermochemical)/(cm²·min)	watt per square metre (W/m²)	6.973 333 E+02
cal (thermochemical)/(cm²·s)	watt per square metre (W/m²)	4.184 000*E+04
erg/(cm²·s)	watt per square metre (W/m²)	1.000 000*E−03
W/cm²	watt per square metre (W/m²)	1.000 000*E+04
W/in²	watt per square metre (W/m²)	1.550 003 E+03
FLOW (See MASS PER UNIT TIME or VOLUME PER UNIT TIME)		
FORCE		
dyne	newton (N)	1.000 000*E−05
kilogram-force	newton (N)	9.806 650*E+00
kilopond (kp)	newton (N)	9.806 650*E+00
kip (1000 lbf)	newton (N)	4.448 222 E+03
ounce-force	newton (N)	2.780 139 E−01
pound-force (lbf)[22]	newton (N)	4.448 222 E+00
lbf/lb (thrust/weight [mass] ratio)	newton per kilogram (N/kg)	9.806 650 E+00
poundal	newton (N)	1.382 550 E−01
ton-force (2000 lbf)	newton (N)	8.896 444 E+03
FORCE PER UNIT AREA (See PRESSURE)		
FORCE PER UNIT LENGTH		
lbf/ft	newton per metre (N/m)	1.459 390 E+01
lbf/in	newton per metre (N/m)	1.751 268 E+02
HEAT		
Btu (International Table)·ft/(h·ft²·°F) (thermal conductivity)	watt per metre kelvin [(W/(m·K)]	1.730 735 E+00
Btu (thermochemical)·ft/(h·ft²·°F) (thermal conductivity)	watt per metre kelvin [(W/(m·K)]	1.729 577 E+00
Btu (International Table)·in/(h·ft²·°F) (thermal conductivity)	watt per metre kelvin [(W/(m·K)]	1.442 279 E−01
Btu (thermochemical)·in(h·ft²·°F) (thermal conductivity)	watt per metre kelvin [(W/(m·K)]	1.441 314 E−01
Btu (International Table)·in/(s·ft²·°F) (thermal conductivity)	watt per metre kelvin [(W/(m·K)]	5.192 204 E+02
Btu (thermochemical)·in/(s·ft²·°F) (thermal conductivity)	watt per metre kelvin [(W/(m·K)]	5.188 732 E+02
Btu (International Table)/ft²	joule per square metre (J/m²)	1.135 653 E+04
Btu (thermochemical)/ft²	joule per square metre (J/m²)	1.134 893 E+04
Btu (International Table)/(h·ft²·°F) (thermal conductance)[15]	watt per square metre kelvin [(W/(m²·K)]	5.678 263 E+00
Btu (thermochemical)/(h·ft²·°F)(thermal conductance)[15]	watt per square metre kelvin [(W/(m²·K)]	5.674 466 E+00
Btu (International Table)/(s·ft²·°F)	watt per square metre kelvin [(W/(m²·K)]	2.044 175 E+04
Btu (thermochemical)/(s·ft²·°F)	watt per square metre kelvin [(W/(m²·K)]	2.042 808 E+04
Btu (International Table)/lb	joule per kilogram (J/kg)	2.326 000*E+03
Btu (thermochemical)/lb	joule per kilogram (J/kg)	2.324 444 E+03
Btu (International Table)/(lb·°F) (heat capacity)	joule per kilogram kelvin [(J/(kg·K)]	4.186 800*E+03
Btu (thermochemical)/(lb·°F) (heat capacity)	joule per kilogram kelvin [(J/(kg·K)]	4.184 000*E+03

To convert from	to	Multiply by
Btu (International Table)/ft^3	joule per cubic metre (J/m^3)	3.725 895 E+04
Btu (thermochemical)/ft^3	joule per cubic metre (J/m^3)	3.723 402 E+04
cal (thermochemical)/(cm·s·°C)	watt per metre kelvin [(W/(m·K)]	4.184 000*E+02
cal (thermochemical)/cm^2	joule per square metre (J/m^2)	4.184 000*E+04
cal (thermochemical)/(cm^2·min)	watt per square metre (W/m^2)	6.973 333 E+02
cal (thermochemical)/(cm^2·s)	watt per square metre (W/m^2)	4.184 000*E+04
cal (International Table)/g	joule per kilogram (J/kg)	4.186 800*E+03
cal (thermochemical)/g	joule per kilogram (J/kg)	4.184 000*E+03
cal (International Table)/(g·°C)	joule per kilogram kelvin [(J/kg·K)]	4.186 800*E+03
cal (thermochemical)/(g·°C)	joule per kilogram kelvin [(J/(kg·K)]	4.184 000*E+03
cal (thermochemical)/min	watt (W)	6.973 333 E−02
cal (thermochemical)/s	watt (W)	4.184 000*E+00
clo	kelvin square metre per watt (K·m^2/W)	2.003 712 E−01
°F·h·ft^2/Btu (International Table) (thermal resistance)[17]	kelvin square metre per watt (K·m^2/W)	1.761 102 E−01
°F·h·ft^2/Btu (thermochemical) (thermal resistance)[17]	kelvin square metre per watt (K·m^2/W)	1.762 280 E−01
°F·h·ft^2/[Btu (International Table)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.933 471 E+00
°F·h·ft^2/[Btu (thermochemical)·in] (thermal resistivity)	kelvin metre per watt (K·m/W)	6.938 113 E+00
ft^2/h (thermal diffusivity)	square metre per second (m^2/s)	2.580 640*E−05

Length

angstrom	metre (m)	1.000 000*E−10
astronomical unit	metre (m)	1.495 979 E+11
chain[13]	metre (m)	2.011 684 E+01
fathom[13]	metre (m)	1.828 804 E+00
fermi (femtometre)	metre (m)	1.000 000*E−15
foot	metre (m)	3.048 000*E−01
foot (U.S. survey)[13]	metre (m)	3.048 006 E−01
inch	metre (m)	2.540 000*E−02
light year	metre (m)	9.460 55 E+15
microinch	metre (m)	2.540 000*E−08
micron	metre (m)	1.000 000*E−06
mil	metre (m)	2.540 000*E−05
mile (international nautical)	metre (m)	1.852 000*E+03
mile (U.S. nautical)	metre (m)	1.852 000*E+03
mile (international)	metre (m)	1.609 344*E+03
mile (U.S. statute)[13]	metre (m)	1.609 347 E+03
parsec	metre (m)	3.085 678 E+16
pica (printer's)	metre (m)	4.217 518 E−03
point (printer's)	metre (m)	3.514 598*E−04
rod[13]	metre (m)	5.029 210 E+00
yard	metre (m)	9.144 000*E−01

Light

cd/in^2	candela per square metre (cd/m^2)	1.550 003 E+03
footcandle	lux (lx)	1.076 391 E+01
footlambert	candela per square metre (cd/m^2)	3.426 259 E+00
lambert	candela per square metre (cd/m^2)	3.183 099 E+03
lm/ft^2	lumen per square metre (lm/m^2)	1.076 391 E+01

Mass

carat (metric)	kilogram (kg)	2.000 000*E−04
grain	kilogram (kg)	6.479 891*E−05
gram	kilogram (kg)	1.000 000*E−03
hundredweight (long)	kilogram (kg)	5.080 235 E+01
hundredweight (short)	kilogram (kg)	4.535 924 E+01

To convert from	to	Multiply by
kgf·s²/m (mass)	kilogram (kg)	9.806 650*E+00
ounce (avoirdupois)	kilogram (kg)	2.834 952 E−02
ounce (troy or apothecary)	kilogram (kg)	3.110 348 E−02
pennyweight	kilogram (kg)	1.555 174 E−03
pound (lb avoirdupois)[21]	kilogram (kg)	4.535 924 E−01
pound (troy or apothecary)	kilogram (kg)	3.732 417 E−01
slug	kilogram (kg)	1.459 390 E+01
ton (assay)	kilogram (kg)	2.916 667 E−02
ton (long, 2240 lb)	kilogram (kg)	1.016 047 E+03
ton (metric)	kilogram (kg)	1.000 000*E+03
ton (short, 2000 lb)	kilogram (kg)	9.071 847 E+02
tonne	kilogram (kg)	1.000 000*E+03
MASS PER UNIT AREA		
oz/ft²	kilogram per square metre (kg/m²)	3.051 517 E−01
oz/yd²	kilogram per square metre (kg/m²)	3.390 575 E−02
lb/ft²	kilogram per square metre (kg/m²)	4.882 428 E+00
MASS PER UNIT CAPACITY (See MASS PER UNIT VOLUME)		
MASS PER UNIT LENGTH		
denier	kilogram per metre (kg/m)	1.111 111 E−07
lb/ft	kilogram per metre (kg/m)	1.488 164 E+00
lb/in	kilogram per metre (kg/m)	1.785 797 E+01
tex	kilogram per metre (kg/m)	1.000 000*E−06
MASS PER UNIT TIME (Includes FLOW)		
perm (0°C)	kilogram per pascal second square metre [kg/(Pa·s·m²)]	5.721 35 E−11
perm (23°C)	kilogram per pascal second square metre [kg/(Pa·s·m²)]	5.745 25 E−11
perm·in (0°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.453 22 E−12
perm·in (23°C)	kilogram per pascal second metre [kg/(Pa·s·m)]	1.459 29 E−12
lb/h	kilogram per second (kg/s)	1.259 979 E−04
lb/min	kilogram per second (kg/s)	7.559 873 E−03
lb/s	kilogram per second (kg/s)	4.535 924 E−01
lb/(hp·h) (SFC, specific fuel consumption)	kilogram per joule (kg/J)	1.689 659 E−07
ton (short)/h	kilogram per second (kg/s)	2.519 958 E−01
MASS PER UNIT VOLUME (Includes DENSITY and MASS CAPACITY)		
grain/gal (U.S. liquid)	kilogram per cubic metre (kg/m³)	1.711 806 E−02
g/cm³	kilogram per cubic metre (kg/m³)	1.000 000*E+03
oz (avoirdupois)/gal (U.K. liquid)	kilogram per cubic metre (kg/m³)	6.236 021 E+00
oz (avoirdupois)/gal (U.S. liquid)	kilogram per cubic metre (kg/m³)	7.489 152 E+00
oz (avoirdupois)/in³	kilogram per cubic metre (kg/m³)	1.729 994 E+03
lb/ft³	kilogram per cubic metre (kg/m³)	1.601 846 E+01
lb/in³	kilogram per cubic metre (kg/m³)	2.767 990 E+04
lb/gal (U.K. liquid)	kilogram per cubic metre (kg/m³)	9.977 633 E+01
lb/gal (U.S. liquid)	kilogram per cubic metre (kg/m³)	1.198 264 E+02
lb/yd³	kilogram per cubic metre (kg/m³)	5.932 764 E−01
slug/ft³	kilogram per cubic metre (kg/m³)	5.153 788 E+02
ton (long)/yd³	kilogram per cubic metre (kg/m³)	1.328 939 E+03
ton (short)/yd³	kilogram per cubic metre (kg/m³)	1.186 553 E+03
POWER		
Btu (International Table)/h	watt (W)	2.930 711 E−01

To convert from	to	Multiply by
Btu (International Table)/s	watt (W)	1.055 056 E+03
Btu (thermochemical)/h	watt (W)	2.928 751 E−01
Btu (thermochemical)/min	watt (W)	1.757 250 E+01
Btu (thermochemical)/s	watt (W)	1.054 350 E+03
cal (thermochemical)/min	watt (W)	6.973 333 E−02
cal (thermochemical)/s	watt (W)	4.184 000*E+00
erg/s	watt (W)	1.000 000*E−07
ft·lbf/h	watt (W)	3.766 161 E−04
ft·lbf/min	watt (W)	2.259 697 E−02
ft·lbf/s	watt (W)	1.355 818 E+00
horsepower (550 ft·lbf/s)	watt (W)	7.456 999 E+02
horsepower (boiler)	watt (W)	9.809 50 E+03
horsepower (electric)	watt (W)	7.460 000*E+02
horsepower (metric)	watt (W)	7.354 99 E+02
horsepower (water)	watt (W)	7.460 43 E+02
horsepower (U.K.)	watt (W)	7.457 0 E+02
kilocalorie (thermochemical)/min	watt (W)	6.973 333 E+01
kilocalorie (thermochemical)/s	watt (W)	4.184 000*E+03
ton of refrigeration (= 12 000 Btu/h)	watt (W)	3.517 E+03

Pressure or Stress (Force per Unit Area)

atmosphere, standard	pascal (Pa)	1.013 250*E+05
atmosphere, technical (= 1 kgf/cm^2)	pascal (Pa)	9.806 650*E+04
bar	pascal (Pa)	1.000 000*E+05
centimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+03
centimetre of water (4°C)	pascal (Pa)	9.806 38 E+01
dyne/cm^2	pascal (Pa)	1.000 000*E−01
foot of water (39.2°F)	pascal (Pa)	2.988 98 E+03
gf/cm^2	pascal (Pa)	9.806 650*E+01
inch of mercury (32°F)	pascal (Pa)	3.386 38 E+03
inch of mercury (60°F)	pascal (Pa)	3.376 85 E+03
inch of water (39.2°F)	pascal (Pa)	2.490 82 E+02
inch of water (60°F)	pascal (Pa)	2.488 4 E+02
kgf/cm^2	pascal (Pa)	9.806 650*E+04
kgf/m^2	pascal (Pa)	9.806 650*E+00
kgf/mm^2	pascal (Pa)	9.806 650*E+06
kip/in^2 (ksi)	pascal (Pa)	6.894 757 E+06
millibar	pascal (Pa)	1.000 000*E+02
millimetre of mercury (0°C)	pascal (Pa)	1.333 22 E+02
poundal/ft^2	pascal (Pa)	1.488 164 E+00
lbf/ft^2	pascal (Pa)	4.788 026 E+01
lbf/in^2 (psi)	pascal (Pa)	6.894 757 E+03
psi	pascal (Pa)	6.894 757 E+03
torr (mmHg, 0°C)	pascal (Pa)	1.333 22 E+02

Radiation Units

curie	becquerel (Bq)	3.700 000*E+10
rad	gray (Gy)	1.000 000*E−02
rem	sievert (Sv)	1.000 000*E−02
roentgen	coulomb per kilogram (C/kg)	2.58 E−04

Speed (See Velocity)

Stress (See Pressure)

Temperature

degree Celsius	kelvin (K)	$T_K = t_{°C} + 273.15$
degree Fahrenheit	degree Celsius (°C)	$t_{°C} = (t_{°F} - 32)/1.8$
degree Fahrenheit	kelvin (K)	$T_K = (t_{°F} + 459.67)/1.8$
degree Rankine	kelvin (K)	$T_K = T_{°R}/1.8$
kelvin	degree Celsius (°C)	$t_{°C} = T_K - 273.15$

To convert from	to	Multiply by
TIME		
day	second (s)	8.640 000*E+04
day (sidereal)	second (s)	8.616 409 E+04
hour	second (s)	3.600 000*E+03
hour (sidereal)	second (s)	3.590 170 E+03
minute	second (s)	6.000 000*E+01
minute (sidereal)	second (s)	5.983 617 E+01
second (sidereal)	second (s)	9.972 696 E−01
year (365 days)	second (s)	3.153 600*E+07
year (sidereal)	second (s)	3.155 815 E+07
year (tropical)	second (s)	3.155 693 E+07
TORQUE (See BENDING MOMENT)		
VELOCITY (Includes SPEED)		
ft/h	metre per second (m/s)	8.466 667 E−05
ft/min	metre per second (m/s)	5.080 000*E−03
ft/s	metre per second (m/s)	3.048 000*E−01
in/s	metre per second (m/s)	2.540 000*E−02
km/h	metre per second (m/s)	2.777 778 E−01
knot (international)	metre per second (m/s)	5.144 444 E−01
mi/h (international)	metre per second (m/s)	4.470 400*E−01
mi/min (international)	metre per second (m/s)	2.682 240*E+01
mi/s (international)	metre per second (m/s)	1.609 344*E+03
mi/h (international)	kilometre per hour (km/h)[26]	1.609 344*E+00
VISCOSITY		
centipoise (dynamic viscosity)	pascal second (Pa·s)	1.000 000*E−03
centistokes (kinematic viscosity)	square metre per second (m^2/s)	1.000 000*E−06
ft^2/s	square metre per second (m^2/s)	9.290 304*E−02
poise	pascal second (Pa·s)	1.000 000*E−01
poundal·s/ft^2	pascal second (Pa·s)	1.488 164 E+00
lb/(ft·h)	pascal second (Pa·s)	4.133 789 E−04
lb/(ft·s)	pascal second (Pa·s)	1.488 164 E+00
lbf·s/ft^2	pascal second (Pa·s)	4.788 026 E+01
lbf·s/in^2	pascal second (Pa·s)	6.894 757 E+03
rhe	1 per pascal second [1/(Pa·s)]	1.000 000*E+01
slug/(ft·s)	pascal second (Pa·s)	4.788 026 E+01
stokes	square metre per second (m^2/s)	1.000 000*E−04
VOLUME (Includes CAPACITY)		
acre-foot[13]	cubic metre (m^3)	1.233 489 E+03
barrel (oil, 42 gal)	cubic metre (m^3)	1.589 873 E−01
board foot	cubic metre (m^3)	2.359 737 E−03
bushel (U.S.)	cubic metre (m^3)	3.523 907 E−02
cup	cubic metre (m^3)	2.365 882 E−04
fluid ounce (U.S.)	cubic metre (m^3)	2.957 353 E−05
ft^3	cubic metre (m^3)	2.831 685 E−02
gallon (Canadian liquid)	cubic metre (m^3)	4.546 090 E−03
gallon (U.K. liquid)	cubic metre (m^3)	4.546 092 E−03
gallon (U.S. dry)	cubic metre (m^3)	4.404 884 E−03
gallon (U.S. liquid)	cubic metre (m^3)	3.785 412 E−03
gill (U.K.)	cubic metre (m^3)	1.420 654 E−04
gill (U.S.)	cubic metre (m^3)	1.182 941 E−04
in^3 [see footnote 19]	cubic metre (m^3)	1.638 706 E−05
litre [see footnote 20]	cubic metre (m^3)	1.000 000*E−03
ounce (U.K. fluid)	cubic metre (m^3)	2.841 307 E−05

[26] Although speedometers may read km/h, the SI unit is m/s.

To convert from	to	Multiply by
ounce (U.S. fluid)	cubic metre (m^3)	2.957 353 E−05
peck (U.S.)	cubic metre (m^3)	8.809 768 E−03
pint (U.S. dry)	cubic metre (m^3)	5.506 105 E−04
pint (U.S. liquid)	cubic metre (m^3)	4.731 765 E−04
quart (U.S. dry)	cubic metre (m^3)	1.101 221 E−03
quart (U.S. liquid)	cubic metre (m^3)	9.463 529 E−04
stere	cubic metre (m^3)	1.000 000*E+00
tablespoon	cubic metre (m^3)	1.478 676 E−05
teaspoon	cubic metre (m^3)	4.928 922 E−06
ton (register)	cubic metre (m^3)	2.831 685 E+00
yd^3	cubic metre (m^3)	7.645 549 E−01
VOLUME PER UNIT TIME (Includes FLOW)		
ft^3/min	cubic metre per second (m^3/s)	4.719 474 E−04
ft^3/s	cubic metre per second (m^3/s)	2.831 685 E−02
gallon (U.S. liquid)/(hp·h)(SFC, specific fuel consumption)	cubic metre per joule (m^3/J)	1.410 089 E−09
in^3/min	cubic metre per second (m^3/s)	2.731 177 E−07
yd^3/min	cubic metre per second (m^3/s)	1.274 258 E−02
gallon (U.S. liquid) per day	cubic metre per second (m^3/s)	4.381 264 E−08
gallon (U.S. liquid) per minute	cubic metre per second (m^3/s)	6.309 020 E−05
WORK (See ENERGY)		

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UMTRA PROJECT DOCUMENT CONTROL SYSTEM MANUAL

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UMTRA PROJECT
DOCUMENT CONTROL SYSTEM
MANUAL

September 1994

U.S. Department of Energy
Uranium Mill Tailings Remedial Action (UMTRA)
Project Office
Albuquerque Operations Office
Albuquerque, New Mexico 87108

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LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ANSI	American National Standards Institute
DOE	U.S. Department of Energy
NARA	National Archives and Records Administration
NMA	National Micrographics Association
OSTI	Office of Scientific and Technical Information
PDCC	Project Document Control Center
PDCS	Project Document Control System
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action
UPAFC	UMTRA Project Administrative Files Collection

1.0 PURPOSE

This manual defines the Project Document Control System (PDCS) operated by the U.S. Department of Energy (DOE) Uranium Mill Tailings Remedial Action (UMTRA) Project Office. The purpose of the PDCS is to provide an active and continuing program for acquiring, controlling, retaining, retrieving, retiring, and disposing of all UMTRA Project documents. The PDCS also provides guidance and coordination in transferring documents by various UMTRA Project document control centers to a central location.

2.0 SCOPE

The UMTRA PDCS shall encompass all centers maintained by Project participants that contain documents gathered and received as part of the effort to support the UMTRA Project. The Project Document Control Center (PDCC) maintained by the UMTRA Project Office in Albuquerque, New Mexico, shall be the principal document control center, providing administrative and procedural guidance to the various centers within the system, and shall coordinate the handling and disposition of all UMTRA Project documents among all Project participants. The system shall exclude company-specific accounting, procurement, contractual, personnel, or legal documents, or other personal correspondence.

A separate records collection, the UMTRA Project Administrative Files Collection (UPAFC), will be maintained by the UMTRA Project Office. Records held in this collection will include those dealing with internal DOE matters such as contracts, personnel, budgeting, funding, and any other documents that are either of a sensitive nature or are not appropriate for handling by contract personnel.

Document control centers maintained by the states and tribes in conjunction with the UMTRA Project shall not be governed by this manual; however, states and tribes are encouraged to use the UMTRA PDCS manual as guidance while establishing, maintaining, and safeguarding UMTRA Project documents. Finally, to remain current with Project direction and requirements, the contents herein shall be reviewed and updated annually, or as significant changes warrant.

3.0 DEFINITIONS

The following definitions and related acronyms will be used throughout this document.

3.1 ACTIVE STORAGE

Active storage is the disposition of documents in current use for reference and action. Active storage locations are usually those in the immediate proximity of the various Project participants.

3.2 CERTIFICATION DOCUMENTS

Certification documents certify that a site meets U.S. Environmental Protection Agency standards before a license is issued by the Nuclear Regulatory Commission.

3.3 CONTROLLED PROJECT DOCUMENT

A controlled UMTRA Project document is usually one subject to frequent revision and controlled through the use of a limited release system. The document is issued using unique identifiers assigned to specific individuals. As revisions are made, holders of the document are notified of and provided with the revisions. Upon receiving a controlled document, the holder shall sign a receipt acknowledgment form and return the form to the organization responsible for the control of the document. Holders are also notified when the document becomes obsolete.

3.4 CORRESPONDENCE

Correspondence includes general and site-related letters, memoranda, and similar documentation concerned with the administration and operation of the UMTRA Project.

3.5 CORRESPONDENCE CONTROL NUMBER

A correspondence control number is used by the UMTRA PDCC to identify and locate active correspondence materials.

3.6 DRAWINGS AND SPECIFICATIONS

Documents that graphically portray the details of engineering, design, and construction of Project remedial action are referred to as drawings. Descriptive narrative that explains drawings and related details is called a specification.

3.7 FIELD DATA

Field data include calculations, logs, test results, drilling records, and other documents.

3.8 MAPS

Maps can be topographic, boundary survey, geologic, city, or any other maps used for engineering design, field work, site reconnaissance, and similar work.

3.9 MICROFILM PROGRAM

The microfilm program is performed by the UMTRA PDCCs to convert inactive records to microforms and transfer the corresponding paper records to records holding areas.

3.10 NONRECORDS

Nonrecords are library and museum material made or acquired and preserved solely for reference or exhibition purposes, extra copies of documents preserved only for convenience of reference, and stocks of publications and of processed documents not included in the definition of records.

3.11 OFFICIAL RECORDS

See Section 3.12, Records.

3.12 PERMANENT RECORDS

Permanent records are appraised by the National Archives and Records Administration (NARA) as having sufficient historical or other value to warrant continued preservation by the federal government beyond the time they are needed for administrative, legal, or fiscal purposes. They are sometimes called archival records.

3.13 PERSONAL PAPERS

Personal papers are documentary materials belonging to an individual that are not used to conduct Project business. They are related solely to an individual's own affairs or used exclusively for that individual's convenience. Personal papers must be clearly designated as such and kept separate from the Project records.

3.14 PHOTOGRAPHS

Photographs are aerial and land-based photographs, other than informal snapshots, used for reference and documentation requirements of sites and vicinity properties.

3.15 PRESENTATION DOCUMENTS

Presentation documents are copies of papers, speeches, and verbal presentations dealing with subjects pertinent to the UMTRA Project that are given at symposia, meetings, and briefings.

3.16 PROJECT DOCUMENT

An UMTRA Project document is one concerning the activities performed by the UMTRA Project Office and all Project participants. UMTRA Project documents describe, direct, guide, or instruct on matters regarding Project administration, general management, and technology. The documents may be written, oral, or pictorial and may be produced on various media (paper, video tape, audio tape, film, computer disc or tape, etc.).

3.17 PROJECT DOCUMENT CONTROL CENTERS

PDCCs are facilities operated by various UMTRA Project participants responsible for administering, maintaining, and controlling Project documents.

3.18 PROJECT DOCUMENT CONTROL SYSTEM

The PDCS organizes the acquisition, control, retention, retrieval, retirement, and disposition of all relevant information (as identified in Section 2.0, Scope) generated or obtained during the course of UMTRA Project work.

3.19 PROJECT DOCUMENT INDEX NUMBER

A Project document index number is used by the UMTRA PDCC to integrate correspondence documents into the PDCS files.

3.20 PROJECT PARTICIPANTS

Project participants include the DOE UMTRA Project Offices in Albuquerque, New Mexico, and Grand Junction, Colorado, prime contractors, selected subcontractors, and other entities employed by the UMTRA Project to provide information. Project participants will be issued a unique Project participant identifier for use with UMTRA PDCC procedures (see Section 3.0 of Appendix B, Correspondence Control).

3.21 RECORDS

Records are books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics, made or received by an agency of the United States government under federal law or in connection with the transaction of public business. They are preserved or appropriated for preservation by an agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations, or other activities of the government or because of the informational value of data in them.

3.22 RECORDS HOLDING AREAS

Records holding areas are used solely to store noncurrent records that are not suitable for transfer to a records center or archives for economic, high security, routine maintenance, retrieval for reference, or other reasons.

3.23 REFERENCE DOCUMENTS

Reference documents are resource materials, other than correspondence, UMTRA Project reports, maps, drawings, and photographs, used for research and reference.

3.24 REFERENCE LOCATION NUMBER

A reference location number is used by a PDCC to identify and locate active reference materials.

3.25 REGULATORY COMPLIANCE DOCUMENTS

Regulatory compliance documents include correspondence, reference material, maps, presentation materials, drawings, specifications, photographs, and microfilm concerning site licensing, certifications, and surveillance and maintenance.

3.26 REPORTS

Reports are divided into three categories:

Contract deliverables/Technical Assistance Contractor

Reports generated for the UMTRA Project by the Technical Assistance Contractor (TAC) numbered with the prefix UMTRA-DOE/AL for 1984-1992 reports and with the prefix DOE/AL/62350 for reports published since 1992.

Contract deliverables/other contractors/subcontractors

Reports generated for the UMTRA Project as contract deliverables by all contractors and subcontractors other than the TAC. These reports carry numbers assigned by the issuing contractor/subcontractor.

All other reports

Yearly, monthly, weekly status/progress reports, travel and telephone reports, white papers, etc., which may or may not be numbered.

3.27 SURVEILLANCE AND MAINTENANCE DOCUMENTS

Surveillance and maintenance documents are records needed to monitor and control UMTRA Project sites after construction is completed, both before and

after certification and licensing. Such documents include, but are not limited to, environmental impact statements, remedial action plans; water, air and soil sampling records; specifications; as-built drawings; completion reports; deeds; licenses; insurance policies; photographs; repair reports; and all related correspondence.

3.28 UMTRA PROJECT DOCUMENT CONTROL CENTER

The UMTRA PDCC is the principal document control center in Albuquerque, New Mexico, staffed by employees of the TAC and reporting jointly to the TAC Project Manager and the UMTRA Project Manager or their designated representatives.

3.29 VICINITY PROPERTY

A vicinity property can be commercial, industrial, residential, or open land that has been contaminated with residual radioactive materials. The materials may have been used in construction or they may have been spread by wind or water from the processing site.

3.30 VICINITY PROPERTY DOCUMENTS

All the documentation pertaining to vicinity property certification is contained in case files. Case files are defined as packages of information concerned with transactions that have a definite beginning and ending point in time; such files are maintained for each vicinity property.

4.0 ORGANIZATION

The UMTRA PDCS functions under the authority of the DOE and is subject to all DOE orders and government regulations pursuant to records management (see Section 13.0).

The UMTRA PDCS comprises three functional categories: Project Participant Document Control Centers, the UMTRA PDCC, and a designated permanent archives center. The UMTRA PDCC shall serve as the primary control for the system, assimilating and integrating all documents received from Project participants and ensuring their proper disposition. Figure 4.1 illustrates the relationships among the system components and identifies each stage in acquiring, classifying, transferring, and retiring Project documents.

The UPDCC reports through channels to the head of the DOE Records Management Division in Washington, D.C. (Figure 4.2).

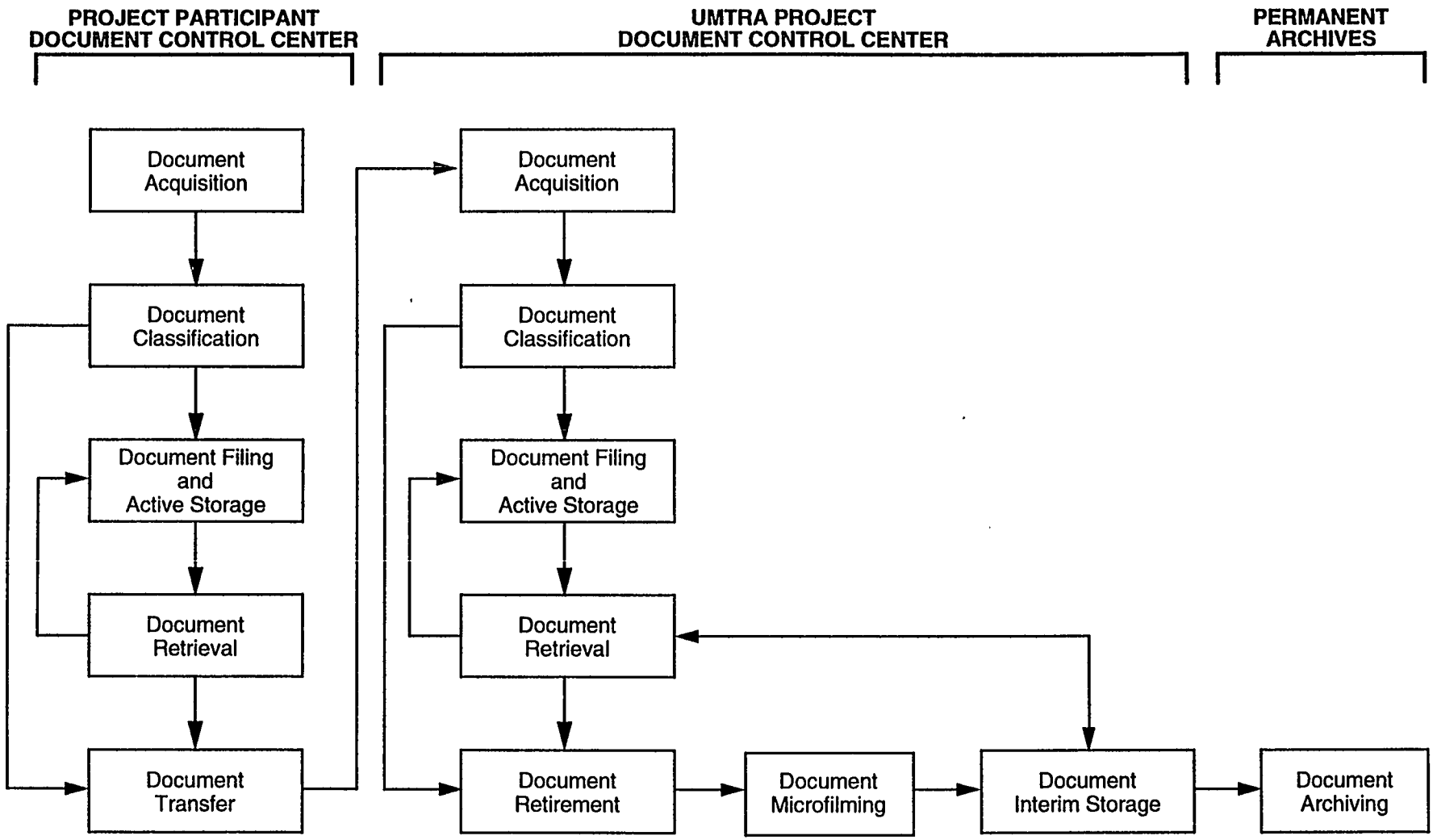


FIGURE 4.1
UMTRA PROJECT DOCUMENT CONTROL SYSTEM FLOW PROCESS

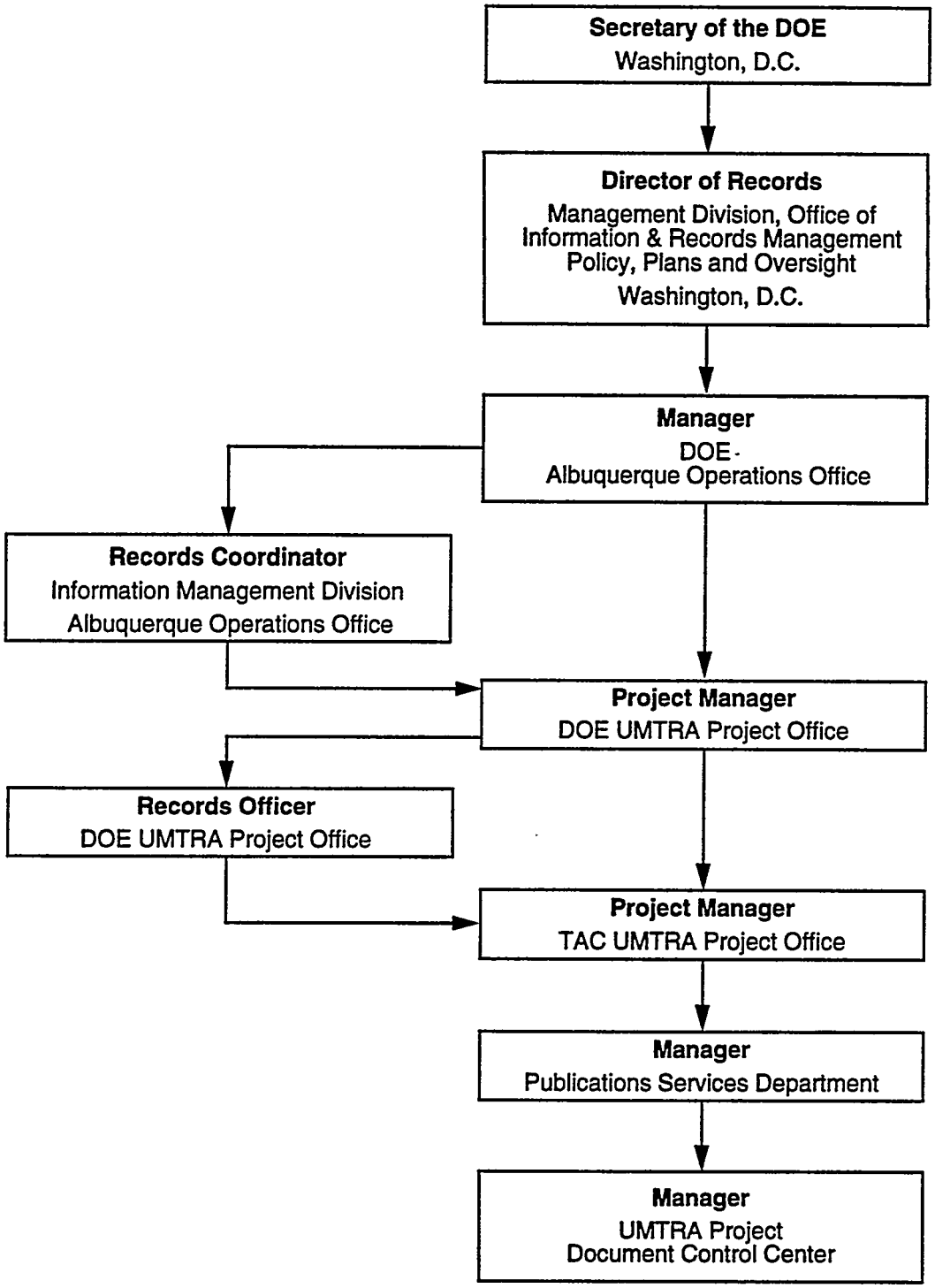


FIGURE 4.2
UPDCC ORGANIZATIONAL RELATIONSHIPS

5.0 RESPONSIBILITIES

The responsibilities for managing, maintaining, and coordinating the activities associated with the PDCS are divided among the UMTRA Project Office, TAC, and other UMTRA Project participants as described below.

5.1 UMTRA PROJECT OFFICE

The UMTRA Project Manager, or a designated representative, shall review and approve all procedures and policies governing the UMTRA PDCS and ensure that the necessary interface among Project participants is established and maintained. The UMTRA Project Manager shall delegate the authority for administering the UMTRA PDCS and the responsibility for providing guidance to the PDCCs to the TAC and its authorized personnel.

5.2 TECHNICAL ASSISTANCE CONTRACTOR

The TAC's Assistant Project Manager for Technical Services shall ensure the efficient operation of the UMTRA PDCC. The Assistant Project Manager for Technical Services shall also provide support and guidance to the UMTRA Project Office in the operation of the UMTRA PDCS by recommending changes, improvements, policies, and procedures.

The manager of the UMTRA PDCC shall develop and implement standard operating procedures, report on the operation of the UMTRA PDCC, train UMTRA Project staff members annually on the use of the UMTRA PDCC, and recommend improvements or changes to the PDCS. The UMTRA PDCC manager shall update the PDCS Manual annually, or as significant changes warrant.

5.3 PROJECT PARTICIPANTS

Project participants shall routinely transfer UMTRA Project documents to the UMTRA PDCC according to the provisions described herein. Project participants involved in the administration of documents will meet prior to the annual revision and issuance of the UMTRA PDCS Manual to resolve any problems with and recommend any changes or enhancements to the UMTRA PDCS.

6.0 DOCUMENT ACQUISITION AND TRANSMITTAL

Staff members of all UMTRA Project participants shall transmit all Project-related documents in accordance with the following provisions.

6.1 CORRESPONDENCE

All UMTRA Project correspondence received through the mail or by hand delivery shall be directed to the responsible PDCC for processing before being delivered to the addressee.

6.2 REFERENCE DOCUMENTS

Reference materials obtained for research and reference purposes, especially those cited in contractor reports substantiating decisions and designs, shall be made available to the responsible PDCC for processing.

One copy of all reference documents cited in a document generated by an UMTRA Project participant shall be forwarded to the UMTRA PDCC, unless such materials are already resident within the center, or unless such materials are clearly cited in the document as being available at another location. A complete citation, including precise information on where a document can be obtained for use, shall be submitted to the PDCC if the document is unavailable. (See "Style and Format Guidelines for Technical Assistance Contractor UMTRA Project Documents" for guidance on preparing citations.)

6.3 PRESENTATION DOCUMENTS

Presentation materials shall be forwarded to the responsible PDCC immediately following use.

6.4 MAPS

Maps acquired for research and reference, especially those cited in reports substantiating decisions and designs, shall be made available to the responsible PDCC.

6.5 DRAWINGS AND SPECIFICATIONS

Drawings and specifications generated by UMTRA Project participants shall be submitted to the responsible PDCC prior to release for review or approval. These documents shall be separated from other Project documents for individual processing.

6.6 PHOTOGRAPHS

Photographs produced by UMTRA Project participants shall be provided to the responsible PDCC. All photographs shall be separated from other Project documents for individual processing.

6.7 REGULATORY COMPLIANCE DOCUMENTS

At the time a site is licensed, all regulatory compliance documents (site licensing, certification, and surveillance and maintenance documents), which may include correspondence, reference documents, maps, presentation materials, drawings and specifications, photographs, and microfilm, shall be transferred to the UMTRA PDCC.

7.0 DOCUMENT CLASSIFICATION, INDEXING, AND LOGGING

All documents generated or acquired by UMTRA Project participants shall be classified and uniquely identified by the UMTRA PDCC according to the appropriate procedure as specified for each document category.

7.1 CORRESPONDENCE

Correspondence documents received by each UMTRA Project participant, including certification and surveillance and maintenance documents, shall be stamped to indicate the date received. The documents will be identified as personal papers, reference materials, or official UMTRA Project records (see Section 3.0, Definitions). Routing slips and transmittal letters (nonrecords) that add no information to the transmitted materials will be removed and destroyed. Each document received by the UMTRA PDCC that is determined to be an official UMTRA Project record shall be assigned a unique correspondence control number (if the sender has not already done so) according to the convention described in Appendix B, Correspondence Control, and an UMTRA Project document index number to be used in filing the document by subject. Correspondence control numbers and index numbers will be placed on the first page of each document. In addition, a correspondence control log shall be maintained as described in Appendix B.

Vicinity property documents shall be assembled as case files. Each file folder shall be marked with the official property number. Documents received by the responsible PDCC regarding vicinity properties shall otherwise be processed in the same manner as correspondence.

7.2 REFERENCE DOCUMENTS

Upon receiving a reference document, the PDCC shall prepare an index card recording information about the document and assign a reference location number for filing and retrieval by category, as described in Appendix C, Reference Document Control.

Index cards shall be filed alphabetically by title in card files. Additional index cards may be prepared for cross-referencing by author, report number, and other pertinent information. The UMTRA PDCC shall maintain a reference document control log as described in Appendix C.

A library check-out card shall be prepared by the UMTRA PDCC for each reference document. The card shall contain the title, author, and reference location number. A pocket to hold the library card shall be affixed to the reference document along with a label placed on the exterior of the document noting the reference location number.

7.3 PRESENTATION DOCUMENTS

PDCCs shall maintain a file of all formal papers given by UMTRA Project staff members. Audiovisual materials used with such papers will not be stored or maintained by PDCCs and will be the sole responsibility of the staff members presenting the paper.

7.4 DRAWINGS AND SPECIFICATIONS

Project participants shall include on each drawing or specification, at a minimum, the following information:

- Title of drawing.
- Drawing/specification number.
- Project or site.
- Date of preparation.
- Revision number.
- Vicinity property number (if applicable).
- Vicinity property address (if applicable).
- Prepared by: _____.

Drawings and specifications shall be logged by the originating UMTRA Project participant so that they can be retrieved by title, drawing number, site, vicinity property number, and address (if applicable).

7.5 PHOTOGRAPHS

All photographs produced by UMTRA Project contractors shall be marked by the individual responsible for the photography with the subject, site, vicinity property number (if applicable), date, and other pertinent facts.

7.6 VIDEOTAPES

Videotapes shall be identified with a unique number and, if more than one copy is available, a copy number. Each tape will have a title and a date. A brief description of the contents of each videotape will appear on the front cover of the video holder.

8.0 DOCUMENT FILING AND STORAGE

Documents shall be filed in storage containers suitable for the size, retrieval requirements, and security of each document. Adequate space shall be allotted for storage to ensure that documents are not defaced, torn, or damaged.

8.1 CORRESPONDENCE

Correspondence, including vicinity property case files, certification documents, and surveillance and maintenance documents, shall be filed chronologically according to subject, in either a general or site-specific file. A document involving more than one subject or site shall be reproduced and placed in each file for which index numbers are assigned.

8.2 REFERENCE DOCUMENTS

Reference documents shall be filed or shelved by discipline, then by sequential number (see Appendix C, Reference Document Control).

8.3 PRESENTATION DOCUMENTS

Presentation documents shall be filed in a separate file maintained specifically for these types of documents.

8.4 MAPS

U.S. Geological Survey topographic maps shall be filed by site, then alphabetically by title (usually place or area), in containers suitable for the size, retrieval requirements, and security of each map.

8.5 DRAWINGS AND SPECIFICATIONS

Drawings and specifications shall be filed by site, then by the method (such as title, drawing number, etc.) by which they are most commonly accessed.

8.6 PHOTOGRAPHS

Site or vicinity property photographs shall be filed by site and subject in storage facilities suitable for the size, retrieval requirements, and security of each document.

8.7 REGULATORY COMPLIANCE DOCUMENTS

At the time a site is licensed, all regulatory compliance documents residing in the UMTRA PDCC shall be removed, integrated with similar material received from outside PDCCs and UMTRA Project participants, and filed and stored in containers separate from other Project documents.

8.8 MICROFILM

Microfilm shall be filed in a location separate from all other documents. Original camera film shall be stored in accordance with American National Standards Institute (ANSI) 1.43-1981, "Practice for Storage of Processed Safety Photographic Film." Duplicate copies of microfilms shall be available in the PDCC. Microfilmed documents shall be filed in microfilm cabinets by subject index number.

8.9 DOSIMETRY RECORDS

Personnel exposure dose records concerning or documenting radiation or exposure dose to UMTRA Project individuals due to alpha, beta, gamma, or neutron radiation monitors or by estimates based on other radiation dose instruments shall be treated as confidential records and housed in a file cabinet that is locked at all times when records are not in use. These records will be maintained in the PDCC.

8.10 VIDEOTAPES

Videotapes shall be placed in standard 8-inch x 4-3/4-inch plastic containers and filed as they are received in numerical sequence on shelving especially provided for such media.

8.11 NONRECORDS

UMTRA PDCCs are not required to maintain inventories of extra copies of UMTRA Project documents that have been transmitted to the DOE's Office of Scientific and Technical Information (OSTI) in accordance with DOE Order 1430.2B. Documents produced in quantity to respond to a heightened public interest issue or to respond to staff requests more rapidly will be delivered to the responsible PDCC for storage and dissemination. The PDCC will inventory bulk quantities of documents and monitor supplies on hand for reordering purposes.

9.0 DOCUMENT INTEGRITY AND SECURITY

The following procedures apply to ensure the integrity and security of UMTRA Project documents, yet permit controlled access to the documents.

9.1 AUTHORITY

Access to documents in each PDCC shall be controlled through personnel staffing the center.

9.2 DOCUMENT NUMBERING

- Project document control numbers shall appear in the upper right corner of all UMTRA Project-related documents or in an otherwise prominent area on documents of unusual dimensions or format.

- Project document control numbers shall be assigned before a document is duplicated to ensure that the number appears on all copies.

9.3 DOCUMENT LOGGING

The UMTRA PDCC shall record assigned PDC numbers on a logging sheet that supplies certain information about the document bearing the number (see Appendix B, Section 1.0). Logging systems may be computerized.

9.4 BORROWING DOCUMENTS FROM PROJECT DOCUMENT CONTROL CENTERS

- Documents shall not be removed from PDCCs without the knowledge and approval of PDCC personnel.

- Only duplicate copies of a document shall be removed from a PDCC, unless otherwise authorized by PDCC personnel.

- Documents on loan from a PDCC shall not be transferred between individuals without notifying the PDCC of the exchange.

- Documents on loan from a PDCC shall be logged on an outcard that is filed in the document's location. The borrower's name, document title, location code, date of the document, and the date on which the document is loaned shall also be logged in a computerized data base. Documents borrowed for 2 months will be recalled and replaced in the files.

9.5 SECURITY

- All documents shall be stored in facilities protected from dirt, dust, fire, water, weather damage, and theft to the extent practicable.

- File cabinets or rooms housing UMTRA Project documents shall be securely locked at all times when PDCC personnel are not present.

- A file category will be present in the UMTRA Project document index titled "Controlled Documents." This file will contain current listings of departments and/or individuals who have been issued controlled documents.

10.0 DOCUMENT RETRIEVAL

The following procedures apply in retrieving and removing documents from a PDCC:

- UMTRA Project participants requiring a document from a PDCC may retrieve material in one of two ways:

  - By placing a request for a specific document with PDCC personnel, who shall retrieve the material.

  - By browsing through file materials to locate needed information.

  Documents removed from the files for use within the PDCC will be replaced by PDCC personnel only. Individuals wishing to remove documents from the PDCC for short durations will be assisted by PDCC personnel in completing check-out cards.

- Project participants shall return borrowed correspondence documents within 2 months of initial check-out. Documents used for prolonged periods will require duplicate copies to be made. TAC staff should refer to Jacobs Engineering Group *Albuquerque Operations Manual*, standard operating procedure 6.2.5, for more detailed procedures for borrowing documents.

- Access by non-Project participants to any or all documents within the UMTRA PDCS shall be governed by the Freedom of Information and Privacy Acts, which will be administered by the UMTRA Project Manager.

- Project participants shall return photographic materials no later than 2 weeks after initial check-out.

- Vicinity property files may be accessed by vicinity property staff members without the assistance of PDCC personnel. Vicinity property staff members will not place any materials in vicinity property case files until they have been logged onto the UMTRA PDCS correspondence data base. Special outcards for use only by vicinity property staff members will be used to denote the removal of vicinity property materials by these individuals, who will be responsible for maintaining and protecting borrowed materials in a peripheral location in accordance with procedures specified in the PDCS Manual.

11.0 DOCUMENT MICROFILMING

The UMTRA PDCC shall arrange and monitor the microfilming of all pertinent documents received and generated by the UMTRA Project, according to the process described in Appendix D, Microfilming Specifications. All documents transmitted to the UMTRA PDCC shall be reviewed to integrate them into the files, eliminate duplicates, and determine a microfilming schedule.

12.0 DOCUMENT RETIREMENT

The UMTRA PDCC shall inventory and develop a document disposition schedule in conformance with DOE Order 1324.2A for all UMTRA Project documents, assigning retention periods and retirement instructions for long-term disposition. Inventories and schedules will be reviewed annually to ensure that all records in the collection are covered by disposition schedules. UMTRA PDCC staff will attend scheduling and disposition training classes sponsored by NARA at least once a year to ensure that disposition schedules are in conformance with the most recent policies and regulations.

Throughout the life of the UMTRA Project, inactive paper records may be microfilmed and the paper documents held in records holding areas to keep space requirements for active records at a minimum. Original microfilm will be stored in an environmentally controlled storage facility separate from the PDCCs. Duplicate copies of microfilm shall be kept in each contractor's document control center for active reference. Documents shall be reviewed for disposition scheduling at the time they are microfilmed and before they are retired to records holding areas. Paper documents shall be moved to records holding areas based on destruction date schedules; that is, all documents with destruction dates that are exactly the same shall be boxed together. Each box shall have a unique number that shall appear on the outside of the carton.

13.0 REFERENCES

The references provided below were used as guidelines in the preparation of this manual and shall be referred to, or complied with, as necessary, in the implementation of the UMTRA PDCS.

13.1 DEPARTMENT OF ENERGY ORDERS

ORDER 1324.2A	*Records Disposition.*
ORDER 1324.3	*Files Management.*
ORDER 1324.4	*Micrographics Management.*
ORDER 1324.5	*Records Management Program.*
ORDER 1324.8	*Rights & Interests Records Protection Program.*
ORDER 1430.2A	*Scientific and Technical Information Program.*
ORDER 1700.1	*Freedom of Information Program.*
ORDER 5500.7B	*Emergency Operating Records Protection Program.*

13.2 AMERICAN NATIONAL STANDARDS INSTITUTE/NATIONAL MICROGRAPHICS ASSOCIATION STANDARDS

ANSI/AIIM MS19-1987	*Recommended Practice for Identification of Microforms.*
ANSI/AIIM MS23-1983	*Practice for Operational Procedures/Inspection and Quality Control of First Generation, Silver-Gelatin Microfilm of Documents.*
ANSI PH1.43-1985	*Photography (film)--Processed Safety Film--Storage.*
ANSI/PH1.25-1984	*Safety Photographic Film, Specification for.*
ANSI IT9.1-1989	*Imaging Media - Silver Gelatin Type - Specifications for Stability.*
ANSI IT9.2-1988	*Imaging Media - Filing Enclosures and Storage.*
ANSI/PH4.8-1985	*Methylene Blue Method for Measuring Thiosulfate and Silver Densitometric Method for Measuring Residual Chemicals in Films, Plates, and Papers.*
ANSI/MS14-1988	*Specifications for 16- and 35-mm Microfilms in Roll Form.*
ANSI/PH1.53-1986	*Processed Films, Plates, and Papers--Filing Enclosures and Containers for Storage.*
ANSI IT9.5-1988	*Imaging Media - Diazo Films.*

13.3 UMTRA PROJECT GUIDANCE DOCUMENTS

Guidance for UMTRA Project Surveillance and Maintenance, UMTRA-DOE/AL-350124.0000, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Technical Assistance Contractor Document Numbering System, DOE/AL/62350-1D, March 1993, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Style and Format Guidelines for Technical Assistance Contractor UMTRA Project Documents, DOE/AL/62350-12D, draft, January 1994, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Project Licensing Plan for UMTRA Sites, UMTRA-DOE/AL-150524.0000, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Vicinity Properties Management and Implementation Manual, UMTRA-DOE/AL-050601.0000, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

Albuquerque Operations Manual, no date. Standard operating procedures, U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

13.4 FEDERAL GOVERNMENT GUIDANCE DOCUMENTS

36 CFR Parts 1220-1238, *Records Management.*

National Fire Protection Association Publication NFPA 232, *Protection of Records.*

Federal Standard No. 125D, *Film, Photographic and Film, Photographic Processed (for permanent records use).*

APPENDIX A

DOCUMENT TRANSMITTAL AND RECEIPT

DOCUMENT TRANSMITTAL AND RECEIPT FORM

The Document Transmittal and Receipt Form (Figure A.1) contains the following categories to be completed in accordance with the following specifications:

TRANSMITTAL NUMBER:	Correspondence Control Number (defined in Appendix B, Correspondence Control).
DATE:	Original date of completing the form for approval.
SITE:	Name of the official UMTRA Project site.
REASON FOR TRANSMITTAL:	Brief explanation of why documents are being transferred; i.e., contract completion, properties involved have been certified, documents no longer required in contractor's office, and the like.
TO:	Full name and address of recipient corporation.
FROM:	Full name and address of sending corporation.
RECEIVED BY:	Signature and title of the responsible recipient.
DATE RECEIVED:	Date of signature and title of the responsible sender.
TRANSMITTED BY:	Signature and title of the responsible sender.
DATE TRANSMITTED:	Date of signature and receipt of documents.
BOX NUMBER:	Sequential numbering of the boxes sent in each transmittal.
FILE NUMBER:	Original file number(s) from the sender's file index.
FILE TITLE:	UMTRA Project Document Control System title from the filing index.
RECEIPT ACKNOWLEDGED:	Signature of the responsible recipient acknowledging that the documents were inventoried and verified to exist as listed.
UPDCC DISPOSITION:	Location where UMTRA Project Document Control Center places documents after their inventory and official receipt is acknowledged (not to be used by transmitting corporation).

JACOBS ENGINEERING GROUP INC.
ALBUQUERQUE OPERATIONS

DOCUMENT TRANSMITTAL AND RECEIPT

Page 1 of _____

Transmittal No.: _____ Date: _____ Site: _____

Reason for Transmittal: _____

To:	From:
Received By: _____	Transmitted By: _____
Date Received: _____	Date Transmitted: _____

Box Number	File Number	File Title	Receipt Acknowledged	UPDCC Disposition

FIGURE A.1 DOCUMENT TRANSMITTAL AND RECEIPT FORM

MAC: NONSITE/UF[illegible]MANUAL/DOCTRANS

APPENDIX B

CORRESPONDENCE CONTROL

1.0 CORRESPONDENCE CONTROL NUMBER

The correspondence control number is composed of four elements according to the format, definition, and example as follows:

ORIGINATOR/RECIPIENT/MONTH AND CALENDAR YEAR-SEQUENTIAL NUMBER

Format: CCC/CCC/MMYY-NNNN

where C = CHARACTER
M = MONTH
Y = YEAR
N = NUMBER

ORIGINATOR:	Three-character codes designating the originating corporation. Section 3.0 of this appendix contains a list of codes to be used.
RECIPIENT:	Three-character codes designating the recipient corporation. Section 3.0 of this appendix contains a list of codes to be used.
MONTH OF YEAR:	Two-digit number designating the month; i.e., 09 = September.
SEQUENTIAL NUMBER:	Four-digit numbers beginning with 0001 and uniquely designating each correspondence per combination of originator, recipient, and calendar year.
Example:	UMT/BEN/0186-0001, which indicates the first correspondence sent in January of calendar year 1986, to Bendix Field Engineering Corporation from the DOE UMTRA Project Office.

2.0 CORRESPONDENCE CONTROL LOG

The correspondence control log shall contain the following information:

ORIGINATOR/ CORPORATION:	Corporation sending a document.
ORIGINATOR/ INDIVIDUAL:	Last name and initials of the person within the corporation transmitting the document.
RECIPIENT/ CORPORATION:	Corporation receiving a document.
RECIPIENT/ INDIVIDUAL:	Last name and initials of the person to whom a document is addressed.
DATE/RECEIVED:	Date shown on the date stamp.
DATE/ORIGINATED:	Actual date assigned to a document for transmission.
SUBJECT/TITLE:	Accurate description of the primary subject matter of the document. Avoid broad characterizations.
KEY WORDS:	Five key words can be associated with a document at a maximum. Only primary subjects of each document should be used.
LOCATION:	An index number selected from the Project Document Index, and assigned to a document noting the location of that document in the files. Five location numbers can be given to a document at a maximum.
CORRESPONDENCE CONTROL NUMBER:	A unique number assigned to each correspondence in accordance with Section 1.0 of this appendix.

NOTE: The correspondence control log may be generated and maintained manually or electronically (computerized).

3.0 PROJECT PARTICIPANTS AND CORPORATIONS

The following codes are used as part of the correspondence control number as described in Section 1.0 of this appendix. The list will be expanded by the UMTRA Project Document Control Center as additional Project participants or corporations are identified.

	ARZ	Arizona, State of
	BEN	Bendix Field Engineering Corporation
	COL	Colorado, State of
	ALO	Department of Energy, Albuquerque Operation Office (Kirtland AFB)
	ARX	ARIX - Contractor to UNC
*	GJO	Department of Energy, Grand Junction Office
	IOO	Department of Energy, Idaho Operations Office
*	UMT	Department of Energy, UMTRA Project Office
	DOE	Department of Energy, all offices other than those above
	EPA	Environmental Protection Agency
	HOP	Hopi Tribe
	IDA	Idaho, State of
*	JEG	Jacobs Engineering Group Inc., Albuquerque Operations Office
	MIS	Miscellaneous (use for all other addressees)
	MKC	M-K Ferguson/Cleveland (VP Design)
	MKE	Morrison-Knudsen Engineers, Inc. (San Francisco Office)
*	MKO	M-K Ferguson Company (Albuquerque Office)
	MOU	Monsanto Research Corporation/Mound
	NAV	Navajo Nation
	NDK	North Dakota, State of
	NEW	New Mexico, State of
	NRC	Nuclear Regulatory Commission
	ORE	Oregon, State of
*	ORN	Oak Ridge National Laboratory
	PEN	Pennsylvania, State of
	PNL	Pacific Northwest Laboratory
	RAE	Rogers & Associates Engineering Corporation
*	RST	RUST Geotech
	SDK	South Dakota, State of
	TEX	Texas, State of
	UTA	Utah, State of
	WYO	Wyoming, State of

*Principal UMTRA Project participants.

APPENDIX C

REFERENCE DOCUMENT CONTROL

1.0 REFERENCE LOCATION NUMBER

The reference location number is composed of two elements according to the format, definition, and example as follows:

DISCIPLINE-SEQUENTIAL NUMBER

Format: CC-NNNN

Where C = CHARACTER
N = NUMBER

DISCIPLINE: Two-character codes designating the reference document category. Section 4.0 of this appendix contains a list of codes to be used.

SEQUENTIAL NUMBER: Four-digit numbers beginning with 0001 and uniquely designating each reference document within each discipline.

Example: EN-0218, which indicates the 218th reference document in the Engineering Category.

2.0 REFERENCE INDEX CARD FORMAT

Reference index cards shall contain the following information:

TITLE:	Complete title of the reference, omitting initial "A's" and "The's."
PERSONAL AUTHOR:	Last name and initials of the author. If more than one author is listed, use the first author named, followed by "et al."
CORPORATE AUTHOR:	Corporation responsible for preparing the reference.
REPORT NUMBER:	Official number assigned to the document by the corporate author. When no number exists, an arbitrary sequential number shall be assigned, preceded by the characters "NFN" (No Formal Number).
DOCUMENT DATE:	Actual date assigned to a reference by the publisher.
REFERENCE LOCATION NUMBER:	Defined in Section 1.0 of this appendix.

3.0 REFERENCE DOCUMENT CONTROL LOG

The reference document control log shall contain the following information:

TITLE:	Complete title of the reference, omitting initial "A's" and "The's."
LOG DATE:	Date entered into the log.
PERSONAL AUTHOR:	Last name and initials of the author. If more than one author is listed, use the first author named, followed by "et al."
CORPORATE AUTHOR:	Corporation responsible for preparing the reference.
REPORT NUMBER:	Official number assigned to the document by the corporate author. When no number exists, an arbitrary sequential number will be assigned, preceded by the characters "NFN" (No Formal Number).
DOCUMENT DATE:	Actual date assigned to a reference document by the publisher.
REFERENCE LOCATION NUMBER:	Defined in Section 1.0 of this appendix.
KEY WORDS:	Five key words associated with a document at a maximum. Only primary subjects of each reference should be used.

4.0 CODES FOR UMTRA PROJECT REFERENCE DOCUMENT CATEGORIES

The following codes are used as part of the reference location number as described in Section 1.0 of this appendix. The list will be expanded by the UMTRA Project Document Control Center as additional reference document categories are identified.

BG	Bibliographies
BZ	Biology/Zoology
CO	Cover Systems and Designs
DP	Data Processing
DD	Decontamination/Decommissioning
EN	Engineering
EV	Environment
GR	General Reference
HG	Hydrology/Geology/Geotechnical Engineering
HP	Health Physics
LG	Legislation
LN	Liners
ME	Measurements
PM	Project Management
RG	Regulations
SE	Socioeconomics
ST	Stabilization
TR	Transportation
UR	Uranium
WM	Waste Management

APPENDIX D

MICROFILMING SPECIFICATIONS

1.0 INTRODUCTION

This appendix describes the standards and techniques for producing microfilm copies of UMTRA Project documents.

1.1 GENERAL

Documents shall be prepared for microfilming by removing all staples, paper clips, and bindings; inserting informative targets that assist in retrieving records on microfilm; repairing (or creating improved) originals when necessary; and organizing paper documents into packages that are comparable to microform packages.

The majority of the documents (measuring 8 1/2 x 11 inches) shall be microfilmed on 16-millimeter (mm) silver halide film at a reduction ratio of 26:1 and shall be jacketed in chronological order in standard, five-chamber Bell & Howell color-striped jackets (see Figure D.1). Larger documents will be filmed at 32:1. Documents that are too large to fit in the image area of 16-mm film at a reduction of 32:1 will be filmed on 35-mm film and inserted in jackets that accommodate 35-mm film.

Documents shall be filmed on rotary or planetary cameras at variable reduction ratios as specified for each task or job order. All documents shall be filmed in comic mode when possible and shall be right-reading (see Figure D.2).

All microfilm shall be developed using conventional processing methods that ensure that film is adequately fixed and washed so as to meet archival standards set forth by the Association for Information and Image Management (also known as National Micrographics Association (NMI)) and the American National Standards Institute (ANSI).

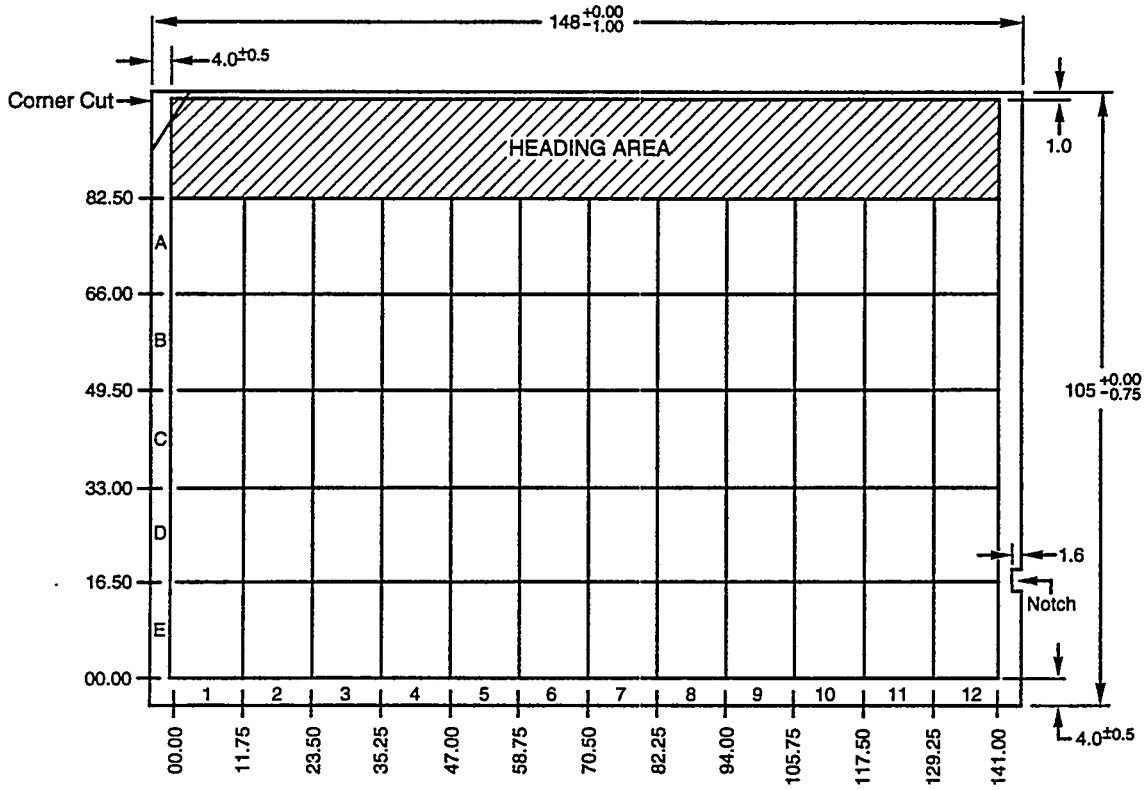
Microfilm shall be mounted in jackets, aperture cards, cartridges, and reels as required by document size constraints and retrieval requirements.

1.2 TECHNICAL REQUIREMENTS FOR JACKETING WORK

Documents to be jacketed shall be filmed on planetary cameras (Bell & Howell Filemasters or equivalent) using dual camera heads so that two duplicate rolls of camera original film are produced. One of the rolls of film shall be used for archival storage and the other for jacketing. Only camera original film (silver halide) shall be loaded in jackets.

Jacket formatting shall be as follows:

- All film shall be left-justified in the jacket; i.e., the first image of a subject jacket shall be placed in Row A, Column 1 (see Figure D.1). All images appearing after the first image shall be placed to the immediate right of each image in a film channel until no space is available to the right of existing images in the channel. When no space is available to the right of an image appearing in Row A, additional frames shall be placed in Row B, Column 1, again extending to the right until the channel is completely full, and then in Row C, Column 1, and so on until the jacket is full.



1. FORMAT - 12 Columns x 5 Rows = 60 Frames.
2. Effective Reduction 20X.
3. Dimensions in millimeters.

FIGURE D.1 JACKET FORMAT

Examples of Right Reading

Examples of Reverse Reading

FIGURE D.2 EXAMPLES OF READING FORMATS

Jacket loading techniques shall be as follows:

- Separate (cut) lengths of film in the same channel shall always abut. The margin between the trailing edge of the left-hand frame and the leading edge of the right-hand frame shall approximate the margin between the adjacent frames on an uncut length of film. There shall be no overlap of lengths of film in the same channel.

- Film images shall not extend beyond either the left or right openings of each channel and shall be at least 5.0 mm from the edge of the left and right sides of the jacket.

- Jackets shall be "packed," but documents shall not be split at the end of a jacket. If a document of less than 60 images cannot appear in its entirety in one jacket, it shall be placed at the beginning of a new jacket. Documents consisting of more than 60 images shall also be placed at the beginning of a new jacket, and a target placed in the E12 frame informing the reader that the document is continued on the next consecutive jacket.

Jacket titling shall be as follows:

- Titling, by any method or machine, shall be legible, typographically correct, and reproducible. All characters in the heading shall be upright and right-reading. All entries shall be readable without magnification.

- The document identification number shall be in the left-most portion of the heading area.

- The minimum area to be used for heading information is shown in Figure D.1. The heading area shall be used for heading and identification purposes on all jackets and shall not be used for any other purpose.

- Jacket titles shall be at least 5.0 mm from the edge of both the left and right sides of the jacket, 1.0 mm from the top edge of the jacket, and above the registration holes that appear in the titling area.

1.3 TECHNICAL REQUIREMENTS FOR PRODUCTION OF CAMERA ORIGINAL ROLL FILM

A certificate of authenticity shall appear on each roll of camera original film, as specified in ANSI/NMA Standard MS 19-1978, Part A of *Recommended Practice for Identification of Microforms*.

If the quality of one or more pages of an original document is deemed insufficient to yield microimages that could conform to the specified requirements, a statement to this effect shall be placed in the frame where the document image should appear.

Each roll of camera original microfilm shall contain a test target, placed at the beginning of the roll. The camera test card shall be an assembly of five ISO test charts No. 2 or NBS as detailed in ANSI/NMA MS 23-1983. The camera test chart shall be photographed at the reduction of the first recorded document image. An accurate, graduated metric scale at least 100 mm long, and a numerical indication of the reduction, shall be included in the

frame containing the NBS chart. The test on the NBS chart shall be upright and right-reading.

1.4 QUALITY CONTROL REQUIREMENTS

A background density of the camera negative film shall fall within the range of 0.9 to 1.2, and resolution of camera negative film shall not fall below 90 line pairs for rotary cameras, nor below 150 line pairs for planetary cameras.

Resolution testing of distribution microfilm using a microscope at an approximate magnification of 50X shall permit a resolution of not less than 90 lines/mm. A pattern shall be considered resolved when the direction of both sets of lines in the pattern, and in all coarser (lower-numbered) patterns, is discernible by visual examination under the microscope.

Image-by-image inspection of the developed film shall be performed to certify that all documents that are filmed are readable and are positioned correctly on the film surface, and that the film contains no defects such as covered in ANSI/NMA MS-23-1983. Skewed images shall not be acceptable and shall render rolls or microform carriers (and duplicates thereof) defective. Such defects will necessitate refilming of the original material.

Contrast and density of all microimages shall be adequate and of sufficient uniformity so that all information on a roll of film or in a microform carrier may be reproduced with such fidelity that its use will not be impaired.

NOTES FROM THE PUBLICATIONS SERVICES DEPARTMENT

WELL-KNOWN SCIENTIFIC PRINCIPLES

GREEN'S THEORUM - If the experiment works, you must be using the wrong equipment.

ISSUE NO. 1 July 30, 1993

COMMA CONFUSION (Act I)

Do you believe in the shotgun approach to comma usage; that is, you scatter commas about whenever you breathe or stop to think? Or, do you prefer the ostrich approach: if you just ignore commas and leave them all out, maybe the problem will go away? That, my friends, will lead us to reader confusion, at best, and to misinterpreted information, at worst.

Commas may be little, but they are powerful. One missing or out of place comma can change the entire meaning of a sentence.

(Now the closet teacher comes out in me.)

The comma is used as the smallest interruption in continuity of thought or sentence structure. There are a few rules governing its use. Aside from these, the comma's use is mainly a matter of the author's good judgment, with ease of reading as the end in view.

For this issue and the next few issues, we'll look at the obligatory rules of comma usage and, hopefully, ease the confusion.

Commas in Series

To separate the three or more elements of a series, use a comma between each element and before the conjunction "and," "or," or "nor" separating the last two elements of the series.

Wrong: (Tsk! Tsk!) In April 1989, sampling began at locations 141, 241 and 341.

Right: In April 1989, sampling began at locations 141, 241, and 341.

Exception: (There are always exceptions!)

If the three or more elements of the series are all separated by conjunctions, no commas are used between the elements.

Wrong: The report wil' be filed by the project manager, or the site manager, or the health and safety engineer.

Right: The report will be filed by the project manager or the site manager or the health and safety engineer.

See, I knew it, you want to argue with me. Oh well!

NOTES FROM THE PUBLICATIONS SERVICES DEPARTMENT

WELL-KNOWN SCIENTIFIC PRINCIPLES

SAUPCOFF'S FINAGLING FACTOR - That quantity which, when multiplied by, divided into, added to, or subtracted from the answer you got, gives the answer you should have gotten.

ISSUE NO. 2 August 18, 1993

COMMA CONFUSION (Act II)

BEWARE THE COMPOUND PREDICATE (SHIVER): THE JAWS THAT BITE, THE CLAWS THAT CATCH.

(It's really only a trap to get you to put a comma where it doesn't belong.)

The second obligatory rule of commas covers their use in *compound sentences*. A brief definition of a compound sentence should help you understand this rule.

A compound sentence contains two or more simple sentences joined at the same level. Each simple sentence so joined is called an *independent clause* (it can stand alone).

COMMAS IN COMPOUND SENTENCES

Independent clauses in a compound sentence may be joined in several ways.

- They may be joined by a semicolon when no coordinating conjunction is used or when the independent clause contains commas (we'll talk about semicolons in a later issue).
- They may be joined by a little bitty word (and, but, for, or, nor, so, and yet) called a *coordinating conjunction* (are you impressed?). When independent clauses are joined by coordinating conjunctions, a comma is used preceding the coordinating conjunction between the independent clauses. (WHEW! Puff! Puff!)

  Wrong: We effectively used concentrated ammonium hydroxide to prepare diammonium salt from THTB but we could not force the reaction to go to the triammonium derivative.

  Right: We effectively used concentrated ammonium hydroxide to prepare diammonium salt from THTB, but we could not force the reaction to go to the triammonium derivative.

  Exception: (Of course!)

  If the independent clauses are short and closely related, you may omit the comma preceding the coordinating conjunction.

  Right: I tried and I failed.

- Or, they may be joined by commas in a series of three or more independent clauses when the last two clauses are joined by a coordinating conjunction. (WHEW!)

  Right: He ran into the woods, he caught the bear, and he was very sorry he caught it.

(over)

WARNING!!

Now, back to *compound predicates*. A sentence with compound predicates looks very much like a compound sentence, but you shouldn't be fooled. If the two or more clauses of the sentence cannot stand along (*dependent clauses*), the sentence is <u>not</u> a compound sentence. In general, **no comma should be used to separate compound predicates.**

Wrong:	Additional water samples were collected in August, and were found to contain low levels of volatile organics.
Right:	Additional water samples were collected in August and were found to contain low levels of volatile organics.

NOTES FROM THE PUBLICATIONS SERVICES DEPARTMENT

WELL-KNOWN SCIENTIFIC PRINCIPLES

FREDION'S LAW OF THE PERVERSITY OF INANIMATE OBJECTS - Any inanimate object, regardless of composition or configuration, may be expected at any time to perform in a totally unexpected manner for reasons that are either entirely obscure or completely mysterious.

ISSUE NO. 3 August 31, 1993

COMMA CONFUSION (Act III)

A COMMA-DEE IN THREE ACTS

(Groan!)

Hurray! The finale of this loathsome play is finally here. Folks, dry as this has been, it could be much worse. There are at least 40 more rules or exceptions to rules of comma usage that we have not covered in these three *FYIs*. I have only touched on those that seem to be the most troublesome in our documents.

O.K., sharpen your pencils. Here is your first Pop Quiz.

Q. What are the only two purposes that commas serve?

A. (Don't you dare read this until you've tried to answer the question yourself.) They *set off* nonessential expressions that interrupt the flow of thought, and they separate elements of a sentence to clarify their relationship to one another. Two commas are used to *set off* an expression, but only a single comma is needed to *separate* elements.

Q. How can you tell a *nonessential expression* from an *essential expression*? (No, it isn't by the color of their booties.)

A. There are two tests:

1) Remove the expression. If its absence changes the meaning of the sentence, it is an essential expression. Essential expressions are generally <u>not</u> set off by commas. If its absence does not change the meaning of the sentence, it is a nonessential expression and should be set off by commas.

2) If the first test doesn't help, try saying the sentence aloud. If your voice tends to drop when you say the expression, it is nonessential. If your voice tends to rise, the expression is essential. If anyone sees you talking to yourself, blame it on me.

If you answered both of these questions correctly, congratulations! Come and see me for a gold star for your forehead.

Following are examples of several small, but equally troublesome, comma usage rules.

MISCELLANEOUS COMMA MYSTERIES AND MARVELS

Commas and Names

Use commas to *set off* names of states or countries following city names and to *set off* abbreviations that follow a person's name. For example:

The UMTRA Project staff will be on temporary assignment in Concrete, North Dakota, during the months of December, January, and February.

James Franklin, M.D., announces the opening of his clinic for depressed UMTRA employees.

Commas and Dates

There are three acceptable methods for writing dates in text. Only one of them uses commas to *set off* the year. For example:

The nearly final report will be issued on August 27, 1993, and will include signature pages.

The absolutely final report will be issued on 27 August 1993 and will include signature pages.

The revised final report will be issued in August 1993 and will include signature pages.

Interrupting Elements

Use commas to set off words, phrases, and clauses that *interrupt* the flow of a sentence from its subject to its verb or from its verb to its object. For example:

They are, at least in theory, capable of handling most crises.

Transitional Expressions and Independent Comments

Use commas to set off transitional expressions (like *however, therefore, on the other hand*) and independent comments (like *obviously, in my opinion, of course*) when they interrupt the flow of the sentence. Do not set these elements off, however, when they are used to emphasize the meaning of the sentence (essential expressions). For example:

We are determined, nevertheless, to finish on schedule.

But: We are nevertheless determined to finish on schedule.

Hint: Does your voice go up or down when you say nevertheless?

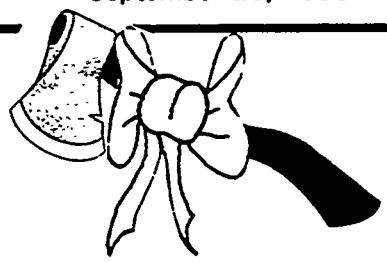
If you are sincerely interested in more information on the fascinating subject of commas, see me. I will be happy to run you copies of pages of rules and then make an appointment for you with a good shrink.

NOTES FROM THE PUBLICATIONS SERVICES DEPARTMENT

WELL-KNOWN SCIENTIFIC PRINCIPLES

THE FUTILITY FACTOR - No experiment is ever a complete failure -- it can always serve as a bad example.

ISSUE NO. 4 September 28, 1993



Lizzy Borden took an ax
and gave your chapter forty whacks.
When she saw what she had done,
she gave your chapter forty-one.
(Lizzy Borden, aka The Editor)

WRITING CONCISELY

Someone recently asked me if the technical editors were now editing more aggressively. Well, I certainly hope so! Yes, folks, the technical editors have been asked to become more aggressive.

No, we're really not out to get you! We really don't want to inhibit your style and creative genius. There are two very good reasons for this aggressiveness.

- Our documents are usually written by several contributing authors. When they are finally pieced together, they sound like they are written by several authors. The reader is confused and distracted when styles abruptly change. It is one of the technical editor's jobs to pull these various styles together and make them sound like one voice.

- It is good economics to make our documents as concise as possible. Concise documents take less time to prepare and less time to review and they cost less to produce. Another of the technical editor's jobs is to eliminate wordiness (deadwood, smoke-screen, gobbledygook, and Pentagonese).

There is also one not-so-good, but very real, reason for doing this. Technical editors are inherently incapable of leaving a sentence alone. (*Please forgive us our little sins.*)

The trick to this type of editing is to be able to be aggressive without altering the meaning of your documents. Your review of editorial changes is critical to keep this from happening. It is even more critical, however, that your writing be as concise and clear as possible.

I CHALLENGE YOU!

Here is an exercise that I dare you to complete. I promise it will improve your writing skills, and the editors will reduce the ax whacks (WOW!) to only twenty or so...

1) Find a long paragraph you have written and edit it by eliminating 50% of the words, WITHOUT CHANGING THE MEANING OF THE PARAGRAPH.

2) Edit the resulting paragraph by eliminating another 50% of the words, WITHOUT CHANGING THE MEANING OF THE PARAGRAPH.

3) Bring all three versions to me. If you are successful, YOU WILL WIN A WONDERFUL PRIZE along with my undying admiration!

The reverse side of this FYI has a few pointers to help you with this challenge.

Remember - Moses wrote the story of creation
(a somewhat complex story) in fewer than 300 words!

SURE CURES FOR DEADWOOD, SMOKE-SCREENS, GOBBLEDYGOOK, AND PENTAGONESE

Passive Voice

The passive sentence is wordy. The active sentence is short, precise, easy to read, and perfectly clear. (Hint: Wordy sentences frequently begin with "it." This flag should alert you to possible wordiness ahead.) For example:

Passive: This could be thought to be consistent with the view that chemical bonding is affected by these substitutions.
Active: These substitutions may affect chemical bonding.

Passive: It was found that an NMR spectrometer worked better than any other type.
Active: An NMR spectrometer worked best.

Another wordiness flag is "There is" or "There are" at the beginning of the sentence. For example:

Passive: There are three active ingredients in these tablets. They are. . . .
Active: The three active ingredients in these tablets are. . . .

Passive: There are occasions when overtime is necessary.
Active: Overtime is occasionally necessary.

The verb in a wordy sentence is often buried under complex grammatical structures. Let the smothered verb breathe (GASP! PANT! PANT!). For example:

Problem: Shipment of the equipment was made in May, and installation took place in June.
Revision: The equipment was shipped in May and installed in June.

Problem: The processing of information is accomplished by the use of machines.
Revision: Machines process the information.

Circumlocutions (Evasion)

Sometimes a writer seems reluctant to state a sentence clearly. Perhaps he or she believes that "beating around the bush" for awhile will soften or obfuscate (obscure) the message. When it is possible, make simple, direct statements. For example:

Problem: We plan to devote considerable effort to the study of developing requirements and will seek to develop proposed solutions to the various possible needs we can foresee in advance of the time that a decision will be required.
Revision: We'll try to solve the problem when we find out what it is.

Problem: Your contention that the information submitted to you by us contained certain inaccuracies has prompted us to undertake a careful re-evaluation of the data submitted, with the result that the original information has been determined to be accurate in all instances.
Revision: We rechecked our data and found it to be accurate.

NOTES FROM THE PUBLICATIONS SERVICES DEPARTMENT

WELL-KNOWN SCIENTIFIC PRINCIPLES

VINCENT'S LAW - The probability of a given event occurring is inversely proportional to its desirability.

ISSUE NO. 5 December 1, 1994

WELL FOLKS...I'M BACK! JUST LIKE A BAD PENNY.

Now that we can actually take a deep breath in the Publications Department, I thought it was time to resurrect these little FYI missives. I hope you are glad to see them again. If not, please don't tell me; it would severely hurt my feelings.

I want to ease you back into these, so I won't tackle any of that ugly stuff like capitalization or punctuation this time. Instead, following are some rules to live by. Put these in a lovely frame and hang them over your computer. If you follow them forever, you will certainly get your reward!

TEN COMMANDMENTS FOR TECHNICAL WRITERS

- ***Thou shalt remember thy readers all the days of thy life; for without readers, thy words are as naught.***
- ***Thou shalt not forsake the time-honored virtue of simplicity.***
- ***Thou shalt not abuse the third person passive.***
- ***Thou shalt not dangle thy participles; neither shalt thou misplace thy modifiers.***
- ***Thou shalt not commit monotony.***
- ***Thou shalt not cloud thy message with a mass of technical jargon.***
- ***Thou shalt not hide the fruits of thy research beneath excess verbiage; neither shalt thou obscure thy conclusions with vague generalities.***
- ***Thou shalt not resent helpful advice from thy editors and reviewers.***
- ***Thou shalt consider also the views of the layman, for his is an insight often unknown to technocrats.***
- ***Thou shalt write and rewrite without tiring; for such is the key to improvement.***