ASET Technical Report Writing Training Guide

Table of Contents

Introduction

This manual consists of four sections. A brief description of each section is provided below.

1.0 Characteristics of Good Technical Writing: In this section, you will learn what makes good technical writing. You will learn key techniques to use in your technical writing. You will have the opportunity to practice these techniques in written activities.

2.0 Formatting Your Writing: In this section, you will learn how to structure and format your technical writing. You will learn techniques to make your technical writing look professional. You will also learn how to make your technical writing more readable through structure and formatting decisions.

3.0 Writing Your Report: In this section, you will learn the components that should go into a report as well as some of the ‘dos’ and ‘don’ts’ for each component.

4.0 Editing Your Report: In this section, you will learn how to edit your report so that your final product is error-free.

1.0 Characteristics of Good Technical Writing

1.1 Precision

Technical writing is a unique form of writing with its own distinct characteristics. The first of these characteristics is precision. **Precision** is defined as being specific, exact and accurate. Precision is important in technical writing because inaccuracy and vagueness can be costly and time-consuming.

The following techniques will help you to be precise:

- Use specific and correct terminology.
- Use exact modifiers rather than general or vague modifiers.
    - *The material is resilient and durable*. versus *The material is strong*.
- Avoid terms of approximation.
    - *about, around, more or less, approximately, pretty, quite*
- Avoid terms of exaggeration.
    - *extremely, very, really*
- Put time and measurements into exact language. Specify times, dates, and amounts using numbers, rather than terms of approximation.
    - *The water was 120 degrees.* versus *The water was pretty hot*.
    - *The foundation was 2'8" thick.* versus *The foundation was quite thick.*

Activity: Make the sentences below more precise. Add any information you feel is necessary.

1. The company is a supplier of electrical products.

2. We should include some additional products in the testing process.

3. You can prevent the problem by adding liquid.

4. The wall was built quite a while ago and is very long.

5. Venting below the requirement will cause extensive damage to the structure.

1.2 Conciseness

Conciseness is defined as writing only what needs to be communicated in as few words as possible. Conciseness is important in technical writing because wordiness weakens the impact of the content and ideas. Readers lose focus and attention when writing is wordy.

The following techniques will help you to be concise:

- Don't use ten words if five will do.
- Delete anything that is not necessary to the ideas you are communicating.
- Use short simple sentences when possible, rather than longer more complex sentences.
- Keep most of your sentences shorter than 20 words.

- Do not put more than two independent clauses (two complete ideas) in a sentence.
  √ *They completed the first quality control test (first complete idea) and then made the required adjustments (second complete idea).*
  X They completed the first quality control test (first complete idea), then made the required adjustments (second complete idea) and then completed the second quality control test (third complete idea).
- Do not put more than one subordinate clause (additional incomplete idea) in a sentence.
  √ After completing the first quality control test (one incomplete idea), they made the required adjustments.
  X After completing the first quality control test (first incomplete idea), even though it was costly (second incomplete idea), they made the required adjustments.
- Have one main item of information per sentence.
- Avoid sentences that you cannot read aloud without stopping for breath.

In addition to the techniques above, there are five very specific techniques that you can use to be concise:

- Use shorter words rather than longer words.
  - *Stress* versus *Emphasize*
  - *Use* versus *utilize*
  - *Buy* versus *Purchase*
- Avoid redundancy.
  - *Advanced planning, actual experience, basic fundamentals, 10am in the morning, close proximity, cold temperature, frozen ice*
- Avoid wordy phrases.
  - *Thus…* versus *It is therefore apparent that*….
  - *Because…*versus *In view of the fact that*….
  - *Conclude….* Versus *Bring to a conclusion*…
  - *Decide* versus *Arrive at a decision*….
  - *If possible* versus *If at all possible*….
  - *Although…*versus *In spite of the fact that*….
  - *Now* versus *At the present time*….
- Avoid repetition of the same idea in a different way. Write an idea only once.
- Avoid sentences using a dummy subject “It is….” and “There are…”
  - *It is important to include all steps in the procedure*. versus *All steps in the procedure should be included.*
  - *There are at least three different materials that can be selected for manufacturing this product.* versus *At least three different materials can be selected for manufacturing this product.*

NOTE: It is possible to be TOO concise. You need to balance conciseness with providing all of the information readers need in order to understand your ideas. If your writing is brief, but does not include everything the readers need to know, you have defeated the purpose of conciseness. You want your reader to be able to read efficiently, but if they have to go back over something because you have left out important details, then they can no longer read efficiently.

Activity: Make changes to the following paragraph to make it more concise, without eliminating important details.[1]

A deaerator is a mechanical device that is extensively utilized for the elimination of oxygen and additional kinds of dissolved gases from the feedwater that is directed into steam-generating boilers found in many industrial contexts. In almost all particular situations, the dissolved oxygen in the boiler feedwater will result in extremely serious corrosion damage and destruction in steam systems by attaching to the walls of all of the metal piping and other metallic equipment and forming oxides (rust). It is water that also combines with any and all dissolved carbon dioxide to produce or generate carbonic acid that causes additional destructive corrosion. Most of the deaerators currently in use are uniquely designed to remove oxygen down to levels of 7 ppb by weight (0.005 cm^3/L) or even less. At the present time there are essentially two basic or standard types or kinds of deaerators, the tray-type and the spray-type:

- The *tray-type* (also called the *cascade-type*) is composed of a vertical domed deaerating section or piece mounted on top of a horizontal cylindrical container which serves the function of the deaerated boiler feedwater storage tank.
- The *spray-type* consists only of a horizontal (or vertical) cylindrical vessel which functions as both the deaerating segment and the boiler feedwater storage container.

1.3 Coherence

Coherence is defined as being smoothly interconnected and comprehensible. Another way to think of coherence is as the glue that holds your writing together. There are two key components to coherence—syntax and logic.

Syntax is the order in which your words are arranged to produce a clear meaning. Each language has its own rules for syntax. Three key rules for syntax in English are:

- In most cases we put the subject first, followed by the verb, followed by the object. We shorten this to **S-V-O**.
- If we have more than one adjective before a noun, we put them in the following order—opinion, size, age, shape, colour, origin and then material. This is called the **order of adjectives**.
- Different types of adverbs go in different locations in a sentence.
    - Adverbs of manner usually go after the verb or the object. *He completed the process carefully.*
    - Adverbs of place also usually go after the verb or the object. *He put the ball there*.

[1] Adapted from http://en.wikipedia.org/wiki/Deaerator

- Adverbs of time usually go at the end of the sentence. *The test will be completed tomorrow*.
- Adverbs of frequency usually go before the main verb. *They usually complete the test accurately.*

Logic simply means that the content you are writing follows a clear order in terms of the meaning you want to convey. Two key techniques for logic are:

- Begin with what is known and then move to information that is new.
- Put the main point or big picture first and then follow up with details.

Activity: Make the following paragraph more coherent by improving the syntax and logic.[2]

> The effects of arc flash can be seen on building adjacent walls and electrical nearby equipment. Often ablated and eroded the walls and equipment are. In addition to the explosive blast of such a fault, destruction also arises from the intense radiant heat produced by the arc flash. The metal plasma arc produces tremendous amounts of light energy from far infrared to ultraviolet. Surfaces of nearby people and objects absorb this energy and instantly are heated to vaporizing temperatures. Arc flash temperatures can reach or exceed 35,000 F at the arc terminals. The massive energy released in the fault vaporizes the metal conductors involved rapidly, blasting molten metal and expanding plasma outward with force extreme. Welding and other industrial applications electrical arcs produce, however, are fed by limited energy and well-controlled. A typical arc flash incident can be inconsequential but easily could produce a more severe explosion conceivably. The result of the violent event can cause destruction of equipment involved, fire, and injury not only to the worker but to nearby people also. An arc flash is an electric arc supplied with sufficient electrical energy to cause substantial damage, fire or injury.

1.4 Appropriate Degree of Confidence and Certainty

Good technical writing conveys an **appropriate degree of confidence and certainty** to readers for that particular situation.

Situations in which you want to sound confident and certain in your technical writing include:

- You are the expert.
- You have all of the information you need.
- You have influence or control over a situation.
- The situation is urgent.

[2]Adapted from http://en.wikipedia.org/wiki/Arc_flash

Situations in which you might want to sound less confident and certain in your technical writing include:

- You don't have expertise.
- You don't have all of the information you need.
- You don't have influence over a situation.
- There is high liability and high risk.
- There are other political considerations.

Your job as a writer is to convey the appropriate degree of confidence, or the opposite, for the situation. If you convey confidence when uncertainty is appropriate you will appear arrogant or misguided. If you convey uncertainty when confidence is appropriate you will appear as if you don't know what you are doing.

The English language has a variety of words and phrases that we can use to sound either confident and certain or unconfident and uncertain. Below are some examples

Confident and Certain	Unconfident and Uncertain
should, must, have to, need to	may, might, could
shall	possibly, probably
know	maybe, perhaps
is, will	hope
	seems to be
	appears to be
	in all probability

Activity: Rewrite the statements below to make them more certain and confident.

1. These steps might possibly improve the distillation process in microbrewery operations if we are lucky.

2. The environmental assessment indicates that the proposed commercial development could probably proceed with minimal adverse results.

3. The redesigned hospital HVAC system may improve energy efficiency if only by a very marginal amount.

4. Generator A seems to be the best option to be the possible replacement for the existing generator.

5. The redesigned building will perhaps meet LEED requirements.

1.5 Appropriate Degree of Involvement

Good technical writing also conveys an appropriate **degree of involvement** to readers for that particular situation. This means that as the writer you are indicating a particular distance between yourself and the content of the writing.

The main difference between the active voice and the passive voice is whether or not the subject is acting on the object, or if the object is being acted on. Typically, this is shown through the order of the subject, verb, and object:

- Active: S→V→O
- Passive: O→V→S

The main way that you can indicate degree of involvement is with your choice of either the active voice or the passive voice. The active voice shows more involvement and the passive voice shows less involvement.

- *We shut the compressor down.(Act.)* versus *The compressor was shut down*. (Pass.)

Sentences with dummy subjects ("It is…." and "There are…") also show less involvement with the content.

- *We shut the compressor down*. versus *It was the compressor that was shut down*.

Activity: Rewrite the following sentences to convey either more or less involvement between the writer and the content.

1. We analyzed the existing building for water, heat and energy efficiency.

2. It was evident that the crack in the body of the truck was due to the pressure created by the incorrectly reattached exterior component.

3. There were clear indications that the storm water and sewage management system was inadequate for the existing residential population.

4. The expected life span of the road, constructed with the two different sets of materials, was calculated.

5. In the Phase I Environmental Assessment we discovered significant indication of contamination.

1.6 Writing for Your Reader

The final characteristic of good technical writing is that it is **written for its readers** or audience. You are not writing for yourself, you are writing for your audience. In order to write something that the readers will want to read and be able to understand you need to ask and answer the following questions:

- Why are they reading the report? What will they do with the information after they have read the report?
- What is the level of expertise of your readers with the subject matter? Are they experts? Semi-experts? Non-experts?

- What information will they already know about the subject matter? What will they not know?
- What information do they need to know? Not need to know?

Another way to ensure that you write for your reader is to complete the following sentences:

- My reader is interested in……
- My reader requires…..
- Therefore, I must do the following as I write….

One of the biggest challenges in writing for your reader is to adapt your technical information for a non-expert. Here are some techniques to use in this adaptation:

- Include explanations of technical terms, jargon, acronyms and initializations.
- Include a glossary of terms at the end of the report.
- Keep your sentences short, with only one piece of information per sentence.
- Use headings that clearly describe the information that follows.
- Include visual materials (graphics) where possible to improve comprehension of the information.

Activity: Rewrite the paragraph below for non-expert readers. If you are not familiar with any of the terminology or acronyms, make up your own definitions.[3]

> The original process for extracting bitumen from the Athabasca Oil Sands is the CHWE process. This process uses open-pit mining technology. Once extracted, the mined ore is reduced through crushing. Hot water (50 — 80 °C) is added to the ore and the slurry that is formed is transported using a hydro transport line to a PSV where the bitumen is recovered by flotation as bitumen froth. The bitumen froth consists of 60% bitumen, 30% water and 10% solids by weight. The bitumen froth is cleaned to reject the contained solids and water to meet the requirement of downstream upgrading processes. Depending on the bitumen content in the ore, between 90% and 100% of the bitumen can be recovered using current hot water extraction techniques. After oil extraction, the waste sand and other materials are returned to the mine, which is eventually reclaimed. Recently, *in situ* methods like SAGD and CCS have been developed. These methods extract bitumen from deep deposits through the injection of steam to heat the sands. This reduces the bitumen viscosity so that it can be pumped out like conventional crude oil.

[3] Adapted from http://en.wikipedia.org/wiki/Athabasca_oil_sands

2.0 Formatting Your Report

2.1 The Importance of Formatting

What difference does it make how you format your report? Isn't the most important thing the information in the report and not how the report looks? Formatting makes a difference and how the report looks is just as important as the information in it. Formatting makes your technical writing:

- Professional
- Standardized
- Predictable
- Readable

2.2 Page Set Up

Start your formatting decisions at the page level.

Margins: These usually range from 1" to 1.5". The top margin may be slightly larger than the bottom margin and the left and right margins may vary depending upon whether a page is even or odd. These are both style choices. However, regardless of the style choices you make, do NOT take your margins below 1" and be consistent throughout your report.

Header: The header is the space at the top of the page. You can leave the header blank or you can put the title of your technical writing there, so that the title appears at the top of every page automatically. If you put your title in the header, use smaller font than in the body of your report, either a 9 or 10 font size. Do not have a header on the cover page or title page of your technical writing.

Footer: The footer is the space at the bottom of the page. You can use the footer for any copyright information for the document and for the page numbers. Once again use smaller font than in the body or your report, either a 9 or 10 font size. Do not have a footer on the cover page or title page of your technical writing.

Line spacing: Most technical writing uses single spacing. The line spacing may be increased if the reader needs space in which to make comments, for example if the writing is being evaluated.

Line justification: Line justification dictates which side or sides of the page the lines in your document will vertically align with. There are three line justification choices—justified left, justified right and justified both left and right. While having lines justified both left and right looks better, it is actually hard to read because the spacing between the words is uneven. The easiest line justification to read in English is justified left.

Look at the Sample Technical Report and note the page set up.

2.3 White Space

Most writers focus on the words they write, which makes sense. However, when you are formatting your technical writing you also have to pay attention to the parts of the page that do NOT have writing on them, called the **white space**. White space is important in your technical writing because it contributes to the readability of your document. A page which is completely filled with writing, while perhaps full of great writing would be virtually impossible to read. Readers need white space on pages because:

- White space gives the readers' eyes a chance to rest before they tackle the next piece of the writing.
- White space divides the writing into manageable 'chunks' so that the reader does not get overwhelmed by the amount of reading to be completed.
- White space organizes the writing on the page so that the different sections and pieces 'jump out' at the reader.

Different formatting decisions that you make will impact the amount of white space your reader has:

- Wider margins give the reader more white space around the edges of the document.
- Indentation at the start of a paragraph or a double space between paragraphs (either choice is fine) gives the reader white space within your writing.
- A double space before and after a graphic surrounds the graphic with white space.
- A double space after titles and headings draws attention to those titles and headings.

NOTE: It is possible to have too much white space. If you have too much white space, your writing actually gets lost in the whiteness. White space is all about judgment and style. If you are not sure about the amount of white space you have provided, get a second or third opinion.

Look at the Sample Technical Report and note the use of white space.

2.4 Font

There are several formatting decisions you need to make about **font,** which is the type of letter you will use.

Font style: Fonts are divided into two main categories; serif and sans serif. **Serif** font styles have a small line to finish the main stroke of a letter. Here is an example of a serif font style, called Times New Roman. You will notice the small lines on the edges of each letter. **Sans serif** styles do not have that small line to finish off the main strokes of a letter. This manual is written in a sans serif style, called Arial.

The use of one or the other is a style choice you have; however, you should not mix and match them in the same piece of writing. Switching back and forth between styles can confuse your reader.

Font size: Follow these guidelines when selecting your font size:

- The body of your report should be in either an 11 or 12 font size.
- Your headings should be in a 12 or 14 font size.
- Your title on the title or cover page can go up over 30 depending upon how long your title is.
- Your headers and footers should have font sizes below those in the body of the report but no smaller than 9.

As a point of reference, in this manual, the body of the report is in 11, the main headings are in 14, the sub-headings are in 12 and the header and footer are in 10.

Why does font size matter? You want to make your writing easy to read, and fonts in the 11 and 12 range are the easiest to read. The slightly larger fonts make your headings and titles stand out and the slightly smaller fonts de-emphasize the information in the headers and footers.

Font format: Today's word processing programs provide us with a range of formatting options, the most frequently used of which are bold, underline and italics. Use them in your headings and titles, otherwise use them very sparingly for emphasis.

Font colour: Your technical writing should be entirely in black and white except for any colour that appears in your visual materials or graphics.

Look at the Sample Technical Report and note the fonts used.

2.5 Sections and Headings

Every document you write has an internal structure that makes your document coherent, logical and easy to read. One of your jobs as a technical writer is to make that internal structure clear to the reader. Most types of writing are usually read in linear fashion, from start to finish. With most technical writing; however, readers read only the parts that are of interest to them. It is therefore very important for the writer to provide clues to help readers locate those parts of interest quickly. One of the ways you do this is through the use of **sections** and **headings**. The first step is to decide how you will **organize** your document or what the internal structure will be. The second step is to **label** the parts of the internal structure with different leveled headings.

A document can be organized in a number of different ways:

- Chronological—with the information arranged in the order in which events occurred.
- Classification—with the information arranged in different categories.
- Priority—with the information arranged by importance.
- Level of difficulty—with the information arranged from easiest to most difficult.
- Process— with the information arranged according to the steps in a process or procedure.
- Problem and solution— with the information arranged as a problem-solving process.

Your choice of organization/structure depends upon your purpose and your audience. You can also organize different sections of your document in different ways. For example, your methodology can be organized by process, and your findings and conclusions can be organized by priority.

Once you have your internal organization decided upon you need to label the parts of the structure. We will use this section as an example of the different levels of organization of a document.

First level	Second Level	Third Level
2.0 Formatting Your Report	2.1 The Importance of Formatting	None
	2.2 Page Set Up	Margins, Header, Footer…
	2.3 White Space	None
	2.4 Font	Font style, Font size…

When you are formatting the headings for the different section levels of your document, use more impactful formatting for the higher levels and less impactful formatting for the lower levels. Continuing with our example of this section, the following are the formatting choices to reflect each section level.

First level	Second Level	Third Level
Font size 14 Bold	Font size 12 Bold	Font size 11 Underline

We have then used italics, font size 11 to highlight examples and bold, font size 11 to highlight key words.

Finally, you need to decide whether you will use a numbering system along with your headings. This is a style choice.

First level	Second Level	Third Level
2.0	2.1	No number

One final pointer for your sections and headings: The amount of information in each section of your writing should be reasonably balanced. In other words, try to keep each section about the same length.

Look at the Sample Technical Report to identify the sections and headings the author chose to use as well as to note the formatting.

2.6 Using Graphics

Almost all technical writing that you complete, including reports, will have visual materials, also known as **graphics**, in addition to written information. We use graphics in technical writing for two main reasons:

- To clarify information presented in writing.
- To speed up the reader's comprehension of a concept or idea.

Graphics are particularly important when the reader is a non-expert and when the concepts are particularly complex.

NOTE: It is possible to have TOO much visual material, so that your technical writing looks more like a story book than a serious piece of writing. Make judgment calls about whether a specific graphic complements and enhances your technical writing. Do NOT use graphics as fillers or decorations.

Types of graphics: Anything other than text is considered to be visual material or graphics. This includes all of the following: charts, graphs, tables, equations, formulas, photographs, logos, drawings, schematics and diagrams. There are three sets of decisions you need to make about your graphics.

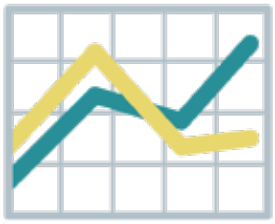
Appearance:

- You should set your graphics off from the rest of the text in your report by framing them with white space. Have a blank line before the graphic and a blank line after the graphic.
- Size the graphics so that they are not greater than ½ a page. If this is not possible, you should put all larger graphics in the appendices. You do not want to have one single graphic that interrupts the flow of your writing.
- Use colour only if the colour makes the graphics more visually appealing and enhances the quality of the information they convey.

Placement:

- Graphics should immediately follow the texts that describe them. They should NOT be placed before their descriptions.
- Graphics can either be centered or justified left.
- Don't split up a paragraph with a graphic. Finish the paragraph and then put in the graphic.
- As previously mentioned, graphics that are larger than ½ a page should be placed in the appendices at the back of the report.
- Don't put a series of graphics one after the other. Break them up with some text.
- Don't wrap text around the side of the graphic as this is difficult to read.

Exhibit 1, Quality Control Testing



Identification:

- Label each graphic with an exhibit or figure number followed by a title ('Exhibit 1: Quality Control Testing' or 'Figure 1, Quality Control Testing').
- Label each graphic sequentially as it appears in the report.
- The title should capture the main idea of the graphic or your purpose for including it in your writing.
- For a short report, label everything either as 'Exhibit/Figure 1', 'Exhibit/Figure 2'
- For a longer report (greater than 50 pages) divide your graphics into more categories (tables, equations and figures) and label each one as 'Table 1', 'Table 2'…., 'Equation 1', 'Equation 2'…, and 'Figure 1', 'Figure 2'…

- Document the source of the graphics if they are not yours.
- Refer to the graphic in the text by its label ('Figure 1', 'Figure 2' and so on).
- Make a list of your graphics labels and titles and place this immediately following your Table of Contents. Call this your 'List of Illustrations', 'List of Figures' or 'List of Exhibits'.

Look at the Sample Technical Report to see how the author inserted graphics into the text as well as the list of these graphics found at the front of the report.

2.7 Using the Work of Others

When completing any type of technical writing there is no expectation that everything you write be original. In fact, you are expected to build upon the work of others. Using the work of others demonstrates that you are knowledgeable about what is going on in your field. It also demonstrates that you can take existing knowledge and either apply it or expand upon it. Using the work of others in your writing is called **citing**. There are three key elements to keep in mind in terms of formatting when using the work of others in your technical writing: **quoting**, **paraphrasing** and **referencing**.

Quoting: **Quoting** is using someone else's exact words. There are two formatting rules for quoting.

1. Short direct quotations of not more than two of three lines should be made part of the text and enclosed in double quotation marks ("…").
2. Quotations longer than three typewritten lines begin on a new line, are introduced by a colon, are single-spaced, and are not enclosed in quotation marks. It is best to indent such quotations from both sides of the page to set them off clearly from the text. Follow the paragraphing and punctuation of the original.

Paraphrasing: **Paraphrasing** is using someone else's idea, but putting it into your own words. Even though the words are your own, you still need to indicate whose idea it is and where you found it.

Referencing: When you use information, ideas and graphics that are not your own, you must indicate the source for this material. You do this by **referencing** it. Referencing provides readers with information that they can use to find your sources. This allows them to read further on the topic should they want to. It also allows them to validate the information you have included in your report.

You MUST reference anything that is not yours. If you don't, you can be accused of **plagiarism**, which is falsely claiming that you are the originator of the information.

In your technical writing you can reference a wide variety of sources including:

- Textbooks
- Journal articles
- Multimedia materials (video, audio)
- Websites
- Standards, codes and regulations
- Product specifications and other product information
- Company documents (reports, letters, memos, manuals)
- Personal communications (e-mails, interviews)

There are two pieces to the system for indicating that work is not yours: the in-text citation and the reference list. As the name implies, the **in-text citation** puts information about the source right into the text, as in the example below. The sources are numbered sequentially as they appear in the body of the report and then the page number is given. Below, the in-text citation is for the seventh source used in the report, on page 185 of the source.

> Test 6 and 7 of the investigation were performed outside in February when the temperature reached -400 C. The results obtained were consistent with results obtained above this temperature, but it should be noted that the instrument manufacturer indicates the "lowest reliable operating temperature is -300 C" **[7, p185]**

The second part of the system for indicating that work is not yours is the **reference list**, a numerical list of all of the sources you have used. Your reference list entries should include all of the information the readers need in order to verify your sources and find them if they want to read more information on the idea or topic. This includes the author, the title of the work, the date of publication, the publisher and the page number. Your reference list is limited to materials that are definitely cited and the entries are arranged in the order in which they first appear in the body of your report.

List of References

[1] E.A. Wilson, B. Preson, Finite element analysis of element problems using different displacement, Int. J. Numer. Meth. Eng. 2 (1) (1970) 387-395.

[2] S.K. Chan, I.S. Tuba, A finite element method for contact problems of solid bodies part-I, theory and validation, Int. J. Mech. Sci. 18 (13) (1971) 615-625.

Most organizations have their own preferred style for both in-text citations and reference lists. Follow the style required by that organization or pick a style and use it consistently throughout your writing. The **APA (American Psychological Association)** system is commonly used in scientific and technical writing. The **MLA (Modern Language Association)** system is another popular format. The following web pages contain helpful resources for both of these citation styles:

- APA: http://owl.english.purdue.edu/owl/resource/560/01/
- MLA: http://owl.english.purdue.edu/owl/resource/747/01/

Look at the Sample Technical Report to see how the author has used the work of others as well as the list of sources at the end of the report.

2.8 Footnotes

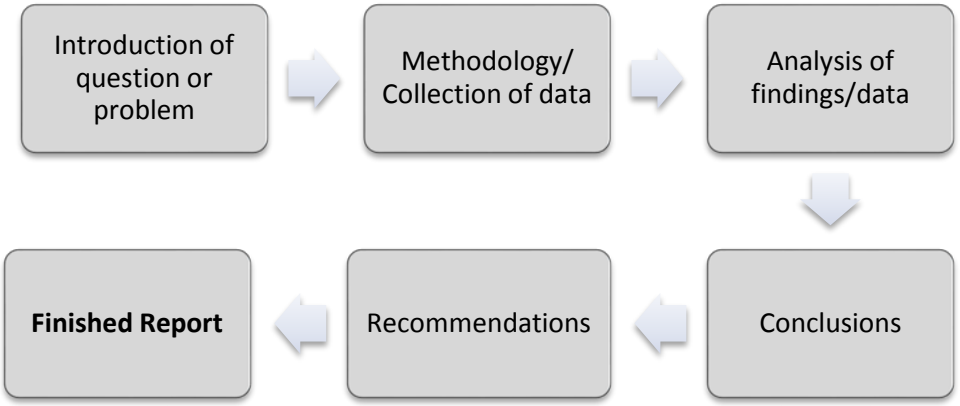
Explanations and other notes not easily incorporated into the text may be inserted at the bottom of the page as footnotes. Footnotes appear above the footer on the page. The reader is directed to look at the bottom of the page by an asterisk or superscript number. Footnotes are optional in technical writing. Avoid overuse of footnotes; you don't want your reader to have to move from the top to the bottom of the page too often when reading.

Look at the Sample Technical Report to see if the author has used footnotes, and if yes, what information has been put in the footnotes.

3.0 Writing Your Report

3.1 Structure

The **structure** is always your starting point in any technical writing. A technical report focuses on a central question or problem. As the report progresses, the following steps take place:



Your written document should follow your procedure for gathering the information for your report. You may choose to have different headings or titles for the different steps of the process, and you may choose to combine some of the steps into the same section, but each of the steps should be represented in your report.

Look at the Sample Technical Report to note the overall structure of the report.

3.2 Introduction

The purpose of the **introduction** is to provide readers with background information about the question, problem or issue that you are going to be writing about. You can't just jump right into talking about the question, problem or issue because the readers will not have the knowledge they require in order to make sense of what you are writing about. You should start with general information and gradually become more specific. We will provide two different possible structures for your introduction. Both are effective; select the structure that suits your writing style and the content of your document.

In the first introduction structure, you answer each of the following questions in turn:

- What is the background to the question, problem or issue?
- What is the question, problem or issue that you will be writing about?
- What is the significance of the question, problem or issue that you will be writing about? OR What is the purpose of your report?
- What is the scope of your report?
- How will your report be structured or arranged?

In the second introduction structure, you describe each of the following:

- **C**urrent situation
- **A**lteration (what needs to be changed about the current situation)
- **P**remise (why the current situation needs to be changed)
- **S**tructure (how the document is arranged)

Look at the Introduction in the Sample Technical Report.

Activity: Briefly answer the above questions for the question, problem or issue for a report you are currently writing or have just written. Use point form.

3.3 Methodology

The purpose of the **methodology** or data collection step of the process is to tell readers how you went about addressing the question or issue, or solving the problem. This section answers the basic question 'What did you do?' This section has a very simple structure. It is organized chronologically in terms of what you did first, second, third, fourth and so on.

This section can also be combined with the next section, Analysis of Findings and Data, into one large section called the **Discussion** section.

Look at the Methodology or Discussion section in the Sample Technical Report.

Activity: Briefly indicate the steps that you took in addressing the question, problem or issue you wrote about in section 3.2. Use point form. Keep your points in chronological order.

3.4 Analysis of Findings and Data

The purpose of this section is to use your knowledge and expertise of the subject matter to analyze the results, findings or data that you generated through your methodology. In completing this section, you may use any or all of the following analysis processes:

- Comparing and contrasting.
- Indicating significance (what is important and what is not important).
- Indicating what is positive and negative.
- Indicating what was expected and what was surprising.
- Indicating what is related to the problem, question and issue and what is not.

This section can also be combined with the methodology into one large section called the **Discussion** section.

Look at the Analysis of Results and Findings or the Discussion section of the Sample Technical Report.

Activity: Choose one of the analysis processes from above. Make a chart completing that analysis process for the question, problem or issue that you wrote about in section 3.2. Use point form.

3.5 Conclusions and Recommendations

To understand what to do for the final sections of your report, you must first understand what these sections are and what they are NOT.

A **summary** is a *collation of the key points* made in the preceding sections of the document. In contrast, a **conclusion** is a *fact that has been verified* or brought to light by the information in the preceding sections of the document. **A recommendation** is an i*nformed and expert suggestion* on what the next steps should be.

A couple of other things to keep in mind when writing these sections:

- Both conclusions and recommendations can be short—no more than one page each.
- Conclusions should be written as statements of fact.
- Recommendations should be written with an appropriate degree of confidence and certainty.
- Recommendations are not always required, depending upon the reason the report is being written. Check with the person who has requested the report whether they want recommendations or not.

Look at the Conclusions and/or Recommendations sections in the Sample Technical Report.

Activity: Write one conclusion and one recommendation for a report you are currently writing or have just written.

3.6 Other Components

There are several other components to a technical report, some of which are optional. The components are listed and numbered in the order in which they are placed in your report. Follow this order exactly.

1. Cover: A standard binder or report cover is appropriate if the report is submitted in hard copy. This is not required if the report is submitted electronically.

2. Title and Title Page: The title of any technical writing that you complete should identify the contents of the document. There are three things to think about when you are writing your title:

- It should not be longer than 10 words.
- It should be detailed enough so that the reader knows what to expect in the report.
- It should not contain any jargon, acronyms or other abbreviations.

The title appears on the title page along with your name as the writer, the name of your intended audience, the date of completion, relevant identification (such as a project code if applicable), and the name and logo of your organization (if applicable). We do not usually put page numbers, headers or footers on title pages.

Standard formatting for a title page places the title in the top third of the page, where the eye goes first. Additional information goes in the middle third of the page. The bottom third of the page is usually left blank. See the sample Technical Report for an example.

3. Acknowledgements: It is appropriate to acknowledge and thank individuals who aided, contributed, or acted as a technical advisor to you. This component is optional.

4. Abstract or Executive Summary: You should have either an Abstract or an Executive Summary. If your report is for **informational** purposes you should have an Abstract. If your report is for **decision-making** purposes you should have an Executive Summary.

a) Abstract: The Abstract summarizes the information in your report. This is the component of all reports that is read by the most number of people. In fact, most readers will only read the Abstract and nothing else. The Abstract presents the key points from your report in the same order in which they are found in your report. There is usually one sentence to summarize each major section of the report.

- The Abstract must **accurately** represent what is in your actual document. It should not include any information NOT in your document.
- The Abstract can vary in length from 150 to 500 words. This is a very small word count to work with so you must be **economical** with your words. You cannot include any irrelevant information. Nor should you include examples, references or any visual material.
- The information in the Abstract must be **useful** to the reader. There is no point in including information that the reader will not be interested in or able to use.

b) Executive Summary: The Executive Summary is similar to an Abstract in that it presents the key points of the report. However, the purpose of the Executive Summary is to provide a decision-maker with enough information with which to make the required decisions. The Executive Summary should therefore start with your recommendations, with the rest of the key points positioned to support your recommendations.

5. Table of Contents: The Table of Contents lists major topics and the related page numbers. Minor topics (lower level headings) are included as sub-topics under the appropriate major topic (highest level heading).

6. List of Illustrations: We have already discussed the purpose and format of the List of Illustrations or List of Exhibits.

7. List of Acronyms: This is optional, in the event that you have many acronyms in your writing and/or you have non-expert readers.

8. Body of Your Report: The body of your report, from the Introduction through to the Recommendations, is placed right after your Executive Summary.

9. Glossary of Terms: This is an optional list of terms and words used in the report that is arranged alphabetically.

10. List of References: We have already discussed the List of References.

11. Bibliography: This is an optional list of sources reviewed in the preparation of your report that is listed alphabetically by author's last name. It should not include sources you have already put in your List of References.

12. Appendices: If you recall, when you have any graphics that are more than ½ a page in size, you put them at the back of your report in the Appendices. You should also put your calculations and supporting data in the appendices.

13. Annexes: This is supplementary data that was not created by you that might be nice for your audience to read, but that is not crucial to your report. This is known as 'nice to know' information.

14. Index: This is an optional list of specific topics in the report that is arranged alphabetically. The purpose of the index is to help the reader quickly find the information that they are most interested in, without having to read the entire report.

Look at the Sample Technical Report and identify the additional components listed above (if applicable).

4.0 Editing Your Report

4.1 Spelling

Spelling has become considerably easier with the spell checkers that every word processing application has. However, you should still edit your work for spelling. Spell checkers do not identify all spelling errors. For example they do not identify a correctly spelled word that is actually the wrong word (*their* instead of *there*).

With respect to spelling you also need to decide which spelling system you will use: British, American, or Canadian (although not all word processing software has a Canadian option). It does not matter which system you select, as long as you are consistent throughout your whole report.

4.2 Punctuation

Punctuation gives readers important information that they need in order to understand your ideas. If you leave out the punctuation, your writing actually has no meaning. And if you use the wrong punctuation, you confuse your reader.

Activity: Match each punctuation mark below with the correct information that it gives to the reader (continue onto next page).

1. Period or full stop .	a. This tells the reader that you want to emphasize this thought, usually with emotional emphasis. This is not used in technical writing.
2. Comma ,	b. This tells the reader that a list of items is coming up.
3. Semi-colon ;	c. This tells the reader that the information is extra information that might be helpful or of interest.
4. Colon :	d. This tells the reader that this is an interrogative thought.
5. Exclamation mark !	e. This tells the reader that the first complete thought or item is very closely linked to the second complete thought or item.
6. Question mark ?	f. This tells the reader that your thought is complete and you are going to move on to another complete thought.
7. Brackets (…)	g. This tells the reader to pause and take a breath but that you are not finished your complete thought yet.

4.3 Word Choice

Your word choice in technical writing is very important, particularly when you are writing for non-experts. In order to make correct word choices you first need to understand the different categories of words that you have to choose from.

Activity: Match the word category on the left with its correct description on the right. Then decide if you will use this type of word in your technical writing.

Category	Description
1. Terminology	a. This is an informal word that is unique to a particular group of people.
2. Jargon	b. This is a type of abbreviation in which the first letter of a series of words are said together, but do not form a new word.
3. Abbreviations	c. These are any way in which a word has been shortened.
4. Acronyms	d. This is a group of words that together create a meaning that is quite different from the meanings of the individual words.
5. Initialization	e. This is a set of words specific and unique to a field or industry.
6. Slang	f. This is a type of abbreviation in which the first letter of a series of words are joined together to make a new word.
7. Idioms	g. This is a set of everyday words that have been given a different, unique meaning in a field or industry.

4.4 Numbers

It is important that your numbers be clearly understood when they are a part of your technical writing. There are some basic rules for putting numbers into text that ensure that the information is understood:

- Spell out the numbers zero through nine. Use digits for the numbers 10 and above.
- When you have more than one number in the same sentence, be consistent.
- Spell out a number that is at the beginning of a sentence, or else relocate the number to somewhere else in the sentence.
- Spell out ordinal numbers (first, second, third…)
- Use digits for amounts of money, times, percentages and units of measure.
- Spell out fractions that appear alone in the text. Use digits if the fractions occur with a whole number.
- Use digits for decimal amounts.
- When putting a date into a sentence, use the name for the month, the digits for the day (followed by the superscript letters) and the digits for the year.
    - On January 18th, 2012….
- When putting a date in the header or footer of your document, use the name for the month, the digits for the day (but no superscript letters) and the digits for the year.
    - January 18, 2012
- Avoid using the following formats for dates because these formats are confusing.
    - 2012/02/01
    - 01/02/2012
    - 01/02/12

- When putting just the year into a sentence, use the digits.
    - In 2012…..
- When using a number in a heading of a written document (a chapter title, a section, a stage, a unit, a part) use the digits.
    - Chapter 7, Stage 3, Section 9

If you are ever in doubt as to whether to use the word or digits to represent a number, simply choose the format that is easiest to read and understand.

Activity: Edit the following sentences for the numbers rules introduced above.[4]

1. Chlorination began in the early years of the twentieth century in Great Britain, where its application reduced typhoid deaths by almost seventy percent.

2. More than 200,000,000 Americans and Canadians receive chlorine-disinfected drinking water every day.

3. In each decade since nineteen twenty, 43 to 56 percent of the outbreaks of waterborne diseases reported in all types of water systems were caused by contaminated, inadequately treated groundwater.

4. The EPA has proposed new regulations to reduce disinfection byproducts (DBP) levels. The stage I DBP rule would set new maximum contaminant levels (MCLs) of eighty ppb for total trihalomethanes, 60 ppb for haloacetic acids and ten parts per billion for bromate.

5. 3,000,000 children under the age of 5 died of diarrheal diseases in developing countries in nineteen ninety.

4.5 Grammar

Grammar is the set of rules or patterns that we follow when we put words together into sentences. Each language has its own grammar. We will look at a few key rules that are most often broken by writers.

Run-on sentences: These are sentences that never stop. A simple sentence is one complete thought. A compound sentence is two complete thoughts joined together. Once you start moving into a third or fourth thought, however, your sentence becomes a run-on sentence. To correct run-on sentences, simply break them down into smaller, simpler sentences.

Sentence fragments: Sentence fragments are incomplete thoughts. They leave the reader wanting the rest of your thought or just completely confused. To correct sentence fragments, make them into complete sentences.

[4] Sentences adapted from http://www.waterandhealth.org/drinkingwater/groundwater.html

Parallelism or parallel structure: When you are listing ideas or items, either in a sentence, in a bulleted list, or in a numbered list, all of the ideas and items should be in the same structure or form. They should all be verbs, nouns, adjectives and so on. If they are verbs, they should be the same form of the verb—simple past, simple present, gerund (-ing form) and so on.

X Unparallel	√ Parallel
The new technology is interesting and a challenge. The process consisted of: • GPS measurements. • Map these onto the original designs. • Identifying any discrepancies.	The new technology is *interesting* and *challenging.* The process consisted of: • *Taking* GPS measurements. • *Mapping* these onto the original designs. • *Identifying* any discrepancies.

Pronoun referents: If you use a pronoun to replace a noun, make sure it is clear WHAT or WHO the pronoun is referring to.

Subject-verb agreement: In English, if you have a singular subject you must use the singular form of the verb. If you have a plural subject, you must use the plural form of the verb. Getting this right is not as easy as it seems. The following guidelines will help.

- When two singular subjects are joined by 'or' or 'nor' the verb is singular.
  - *Neither Product A nor Product B meets our requirements.*
- When two plural subjects are joined by 'or' or 'nor' the verb is plural.
  - *Recycled products or original products are both appropriate.*
- When a singular subject and a plural subject are joined by 'or' or 'nor', the verb agrees with the subject immediately following 'or' or 'nor'.
  - *Neither Product A nor the recycled products are appropriate.*
- Two or more subjects joined by 'and' require a plural verb.
- Singular indefinite pronouns ('each', 'nobody', 'someone', 'somebody', 'everyone', 'anyone') require a singular verb.
- Words such as 'either', 'neither', 'each' , and 'each one', when acting as subjects, take a singular verb.

Activity: Edit the following paragraph for the grammar rules introduced above.[5]

In preparation for any significant environmental remediation there should be extensive community consultation in which the proponent should both present information to and seek information from the community and learn about any sensitive future uses of the land including childcare, schools, hospitals, and playgrounds as well as community concerns and interests information. Consultation should be open, on a group basis. So that each member of the community is informed about issues they may not have individually thought about. An independent chairperson acceptable to both the proponent and the community should be

[5] Adapted from http://en.wikipedia.org/wiki/Environmental_remediation.

engaged. This is a proponent expense if fees are required. They should preferably be an expert on the remediation or on the community. Minutes of meetings including questions asked and the answers to them and copies of presentations by the proponent is required. These should be available on the internet, local library or community centre depending upon access.

Answer Key

Note: For the editing activities, there are many possible answers and the answers here are provided as suggestions and guidance.

1.1 Precision

1. *Madison-Grey Electrical is a supplier of electrical products for large industrial and manufacturing facilities.*

2. *The Quality Control Department should include four additional versions of the circuit board in the Electromagnetic Compatibility testing process.*

3. *You can prevent the problem of dehydration by increasing the amount of water by 15%.*

4. *The 1 metre stone retaining wall along the lakefront was built in 1920 and is 650 metres long.*

5. *Venting of the deaerator below the provincial code requirement will cause corrosion to the feedwater storage tank.*

1.2 Conciseness

A deaerator is ~~a mechanical device that is extensively utilized~~ used for the elimination of oxygen and ~~additional kinds of~~ dissolved gases from the feedwater ~~that is directed into~~ for industrial steam-generating boilers ~~found in many industrial contexts~~. In ~~almost all particular~~ most situations, the dissolved oxygen in the boiler feedwater will result in ~~extremely~~ serious corrosion ~~damage and destruction in steam systems~~ by attaching to the metal framework ~~walls of all of the metal piping and other metallic equipment~~ and forming oxides (rust). ~~It is water that~~ Water also combines with any ~~and all~~ dissolved carbon dioxide to produce ~~or generate~~ carbonic acid that causes additional ~~destructive~~ corrosion. Most ~~of the~~ deaerators ~~currently in use~~ are ~~uniquely~~ designed to remove oxygen down to levels of 7 ppb by weight (0.005 cm^3/L) or even less. ~~At the present time~~ There are essentially two ~~basic or~~ standard types ~~or kinds~~ of deaerators, the *tray-type* and the *spray-type*:

- The *tray-type* (also called the *cascade-type*) is composed of a vertical domed deaerating section ~~or piece~~ mounted on ~~top of~~ a horizontal cylindrical container which serves as ~~the function of~~ the deaerated boiler feedwater storage tank.
- The *spray-type* consists ~~only~~ of a horizontal (or vertical) cylindrical vessel which functions as both the deaerating segment and the boiler feedwater storage container.

1.3 Coherence

This activity is virtually impossible to complete because the paragraph has been made so incoherent!

1.4 Appropriate Degree of Confidence and Certainty

1. *These steps will improve the distillation process in the microbrewery operations.*

2. *The environmental assessment indicates that the proposed commercial development can safely proceed.*

3. *The redesigned hospital HVAC system will improve energy efficiency.*

4. *Generator A is the best option to replace the existing generator.*

5. *The redesigned building will meet LEED requirements.*

1.5 Appropriate Degree of Involvement

1. *The existing building was analyzed for water, heat and energy efficiency. (adding distance)*

2. *The crack in the body of the truck was caused by the pressure created by the incorrectly reattached exterior component. (decreasing distance)*

   The pressure created by the incorrectly reattached exterior component caused the crack in the body of the truck. (even less distance)

3. *The storm water and sewage management system was inadequate for the existing residential population. (decreasing distance)*

4. *We calculated the expected life span of the road, constructed with the two different sets of materials. (decreasing distance)*

5. *Significant indication of contamination was discovered in the Phase I Environmental Assessment. (increasing distance)*

1.6 Writing for Your Reader

The original process for extracting bitumen from the Athabasca Oil Sands is the Clark Hot Water Extraction (CHWE) process. This process uses open-pit mining technology, which leaves a large environmental footprint. Once extracted the mined ore is reduced through crushing. Hot water (50 — 80 °C) is added to the ore and the slurry (a mixture of an insoluble substance and liquid) that is formed is transported using a hydrotransport line. It goes to a primary separation vessel (PSV) where the bitumen is recovered by flotation (a process of separating components that uses their different flotation properties) as bitumen

froth. The bitumen froth consists of 60% bitumen, 30% water and 10% solids by weight. The bitumen froth is cleaned to reject the contained solids and water to meet the requirement of downstream upgrading processes. Depending on the bitumen content in the ore, between 90% and 100% of the bitumen can be recovered using current hot water extraction techniques. After oil extraction, the waste sand and other materials are returned to the mine, which is eventually reclaimed. Recently, *in situ* methods like steam-assisted gravity-drainage (SAGD) and cyclic steam stimulation (CCS) have been developed. *In situ* methods leave a much smaller environmental footprint than open-pit methods. These methods extract bitumen from deep deposits through the injection of steam to heat the sands. This reduces the bitumen viscosity (thickness) so that it can be pumped out of the ground as is done with conventional crude oil.

3.2 Introduction

Answers will vary. See the sample technical report to review the introduction.

3.3 Methodology

Answers will vary. Ensure you have written your methodology as a process, in chronological order of steps completed.

3.4 Analysis of Findings and Data

Answers will vary. Ensure you have completed a detailed and logical analysis.

3.5 Conclusions and Recommendations

Answers will vary. See the sample technical report for examples.

4.2 Punctuation

1. Period or full stop .	f. This tells the reader that your thought is complete and you are going to move on to another complete thought.
2. Comma ,	g. This tells the reader to pause and take a breath but that you are not finished your complete thought yet.
3. Semi-colon ;	e. This tells the reader that the first complete thought or item is very closely linked to the second complete thought or item.
4. Colon :	b. This tells the reader that a list of items is coming up.
5. Exclamation mark !	a. This tells the reader that you want to emphasize this thought, usually with emotional emphasis. **This is not used in technical writing.**

6. Question mark ? d. This tells the reader that this is an interrogative thought.
7. Brackets (…) c. This tells the reader that the information is extra information that might be helpful or of interest.

4.3 Word Choice

Category	Description	Used in Technical Writing?
1. Terminology	e. This is a set of words specific and unique to a field or industry.	Y, but explained for non-expert
2. Jargon	g. This is a set of everyday words that have been given a different, unique meaning in a field or industry.	Y, but sparingly
3. Abbreviations	c. These are any way in which a word has been shortened.	Y, but explained first time
4. Acronyms	f. This is a type of abbreviation in which the first letter of a series of words are joined together to make a new word.	Y, but explained first time
5. Initialization	b. This is a type of abbreviation in which the first letter of a series of words are said together, but do not form a new word.	Y, but explained first time
6. Slang	a. This is an informal word that is unique to a particular group of people.	N
7. Idioms	d. This is a group of words that together create a meaning that is quite different from the meanings of the individual words.	N

4.4 Numbers

1. Chlorination began in the early years of the twentieth century in Great Britain, where its application reduced typhoid deaths by almost 70 percent.

2. More than 200 million Americans and Canadians receive chlorine-disinfected drinking water every day.

3. In each decade since 1920, 43 to 56 percent of the outbreaks of waterborne diseases reported in all types of water systems were caused by contaminated, inadequately treated groundwater.

4. The EPA has proposed new regulations to reduce disinfection byproducts (DBP) levels. The Stage 1 DBP rule would set new maximum contaminant levels (MCLs) of 80 parts per billion (ppb) for total trihalomethanes, 60 ppb for haloacetic acids and 10 ppb for bromate.

5. Three million children under the age of five died of diarrheal diseases in developing countries in 1990.

4.5 Grammar

In preparation for any significant environmental remediation there should be extensive community consultation. The proponent should both present information to and seek information from the community. The proponent should learn about any sensitive future uses of the land including childcare, schools, hospitals, and playgrounds. The proponent should also learn about community concerns and interest group information **(run-on sentence error).** Consultation should be open and on a group basis so that each member of the community is informed about issues they may not have individually thought about **(sentence fragment error).** An independent chairperson acceptable to both the proponent and the community should be engaged. This is a proponent expense if fees are required. The independent chairperson **(pronoun referent error)** should preferably be an expert on the remediation or on the community. Minutes of meetings including questions asked and the answers to them, and copies of presentations by the proponent are required **(subject-verb agreement error).** These should be available on the internet, at the local library or at the community centre depending upon access **(parallelism error).**