Understanding Your Audience

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ABSTRACT

It is generally accepted that environmental restoration and waste management issues are complex, involving numerous scientific and engineering elements. It is also (or should be) the goal of the entities responsible for performing or regulating environmental restoration and waste management to provide the stakeholders with presentations that are tailored to their level of understanding of the overall issues and the scientific, engineering, and technical elements encompassed by that issue. For example, a regulatory document such as a permit should be understandable at one level by the general public but also clearly describe the details relating to the permitted activity to the technical disciplines responsible for implementation and overview. This paper will present some guidelines for developing and presenting the technical aspects of environmental restoration and waste management issues to a variety of audiences and provide examples of effective and ineffective presentations.

INTRODUCTION

This paper stems from a 30 year career of writing and reviewing technical reports, proposals, and presentations and listening to and observing the affect of those presentations, particularly the 'live' presentations, on a wide range of audiences. The preponderance of these reports and presentations have been on a variety of environmental issues relating to contamination and cleanup of the full variety of media and the risk and impact of the supporting activities. The audiences have varied from the general public to generally knowledgeable managers to subject matter experts. The success of these presentations is defined by several factors. First, the comprehension of the audience of the main points of the presentation; second, the acceptance by the audience of the validity of the data and any associated conclusions made in the presentation; and, third, the quality of the written portions of the presentation.

DISCUSSION

The problems with many presentations are a result of the following:

[1] Use of too many, undefined, acronyms
[2] Failure to define units or to use units familiar to the audience
[3] Incomprehensible Figures
[4] Consistency of Presentation

Acronyms

Public communications are laden with jargon and acronyms for items and activities that have become common usage. Examples range from words such as radar, HOV, and CDs to agency acronyms such as FBI, IRS, and, of course, DOE and EPA. The problem is that in technical communications, particularly in the radioactive and hazardous waste management business, all too often the speakers or writers do not understand that for a presentation to the public the audience will not necessarily be familiar with even the most common abbreviations or acronyms so the items, actions, or terms they represent all must be presented in full and defined as necessary before acronyms are used. The following acronyms are commonly used in the radioactive and hazardous waste business – how many of them do you know?

- WAC
- PCBs (an acronym with multiple definitions)
- MCL
- COC (at least two possible definitions)
- SWMU
- DP
- HA (highways, hospitals or hazards?)
- RA (risk or readiness?)
- NOV
- EMS
- TRU
- AK
- LLW
- MW
- ORR
- SME (one has to meet one of the definitions to perform another of the definitions)
- ISH
- LOTO
- REM (no – not associated with sleeping)

The above list is a long way from being complete and new acronyms are coined daily. The point is that many of the acronyms have multiple meanings and thus need stated in full first. A case in point – I was in a discussion about environmental concerns with a neighbor who worked for Motorola some years ago. When I mentioned PCBs he looked bewildered. After I explained that PCBs were Polychlorinated Biphenyls, he laughed and said he thought I was talking about printed circuit boards! Also, when someone refers to the NRC do they mean the Nuclear

Regulatory Commission, the National Research Council, the National Response Center or something totally different? Imagine how confusing it would be to give a presentation that included the three 'NRC' entities identified above!

In another instance of the overuse of acronyms, at a public meeting regarding the transportation and disposal of transuranic waste, the following slide was presented.

I'm not even sure that the presenter knew what all the acronyms stood for!

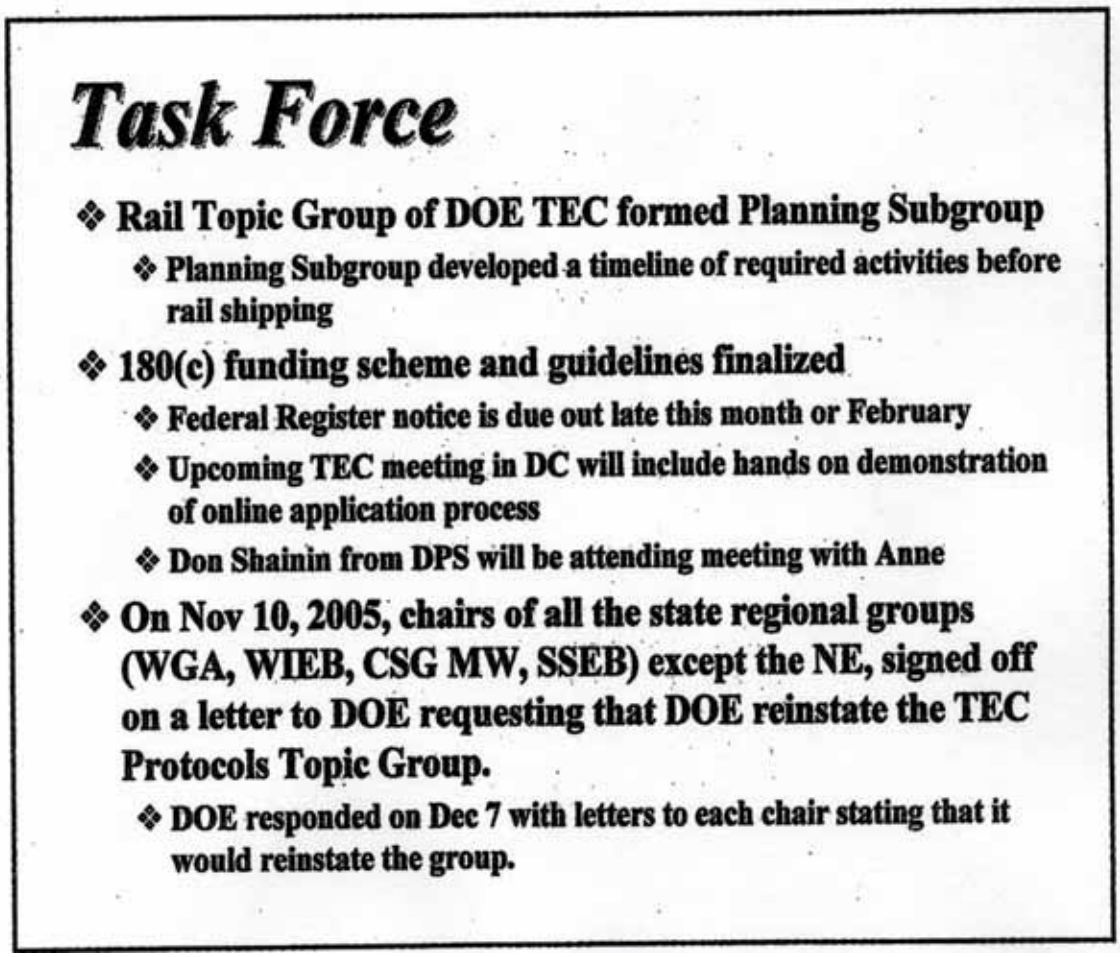

Figure 1

Failure to Define Terms

The second worst sin observed in papers and presentations is the failure to define terms or to use terms that the audience does not understand. One very interesting incident of a failure to define a term was in the Public Health Assessment (PHA) for Los Alamos National Laboratory released by the Agency for Toxic Substances and Disease Registry (ATSDR) in 2006 (1). In the summary, the ATSDR indicated they used *"ATSDR health-based comparison values"* to determine that there was no expected adverse human health effects from the contaminant levels measured in the groundwater, soil and sediment, and surface water. Unfortunately, the ATSDR did not define what they meant nor indicated how they derived '*comparison values*' in the

summary. Thus, the reader did not know whether the 'comparison values' were equal to the concentrations established by EPA in the Safe Drinking Water standards or via other regulatory means, or were more or less stringent. Consequently, the summary becomes a 'trust us' document since the ATSDR did not use common measures or define their measure of evaluation of health affects.

Similar instances of failure to define terms was noted in the ENVIRONMENTAL SURVEILLANCE AT LOS ALAMOS DURING 2005 – EXECUTIVE SUMMARY DRAFT (2)**.** Since this document is designed to provided environmental monitoring and compliance information to the public, it is particularly important that scientific terms be defined. As shown by the following list, the document was particularly remiss in defining the terms associated with exposure to radiation, which is generally the primary concern related to DOE facilities:

a. Person-rem
b. Mrem
c. Rad and mrad
d. Ci. pCi, and aCi
e. µg/L

It is particularly important that executive summaries provide complete clear definitions of terms since the general public are more likely to read the summaries than the detailed text.

Unfortunately, it appears that the radiation exposure and public health specialists all make the same basic assumption that the public knows the definition of radiation exposure terms such as rad, person-rem or millirem since they are not even defined in Environmental Impact Statements issued by DOE (3)(4) or by the ATSDR report referenced above or the EPA Radiation Program website (5) provide a definition of millirem (or mrem) or any other of the above terms. I have been in public meetings where the speakers was asked: "What's a millirem?." The speakers response was "It's one-thousandths of a rem" and the public was still dumbfounded.

Related to failure to define a term is the failure to use terms that would be familiar to the audience. The author/speaker should always attempt to put the scientific or technical terms into language that is more understandable to the audience. An example is the term µg/L, which for the understanding of a non-technical or scientific audience means the same as parts per billion, which, while still unimaginable to most people, is easier to understand. However, it can and should be further explained in comparative terms such as being equal to one grain of sand in a gallon bucket of sand or a comparable comparison understood by everyone. Another example is micron – a unit of measure – which has been best explained to the public as about equal to one-third of the thickness of a human hair or about 4 times smaller than the period at the end of a sentence. Examples of the use of unfamiliar terms that are often not defined include:

Any measure of concentration that is stated in scientific terms such as mg/m^3

D.E. – essentially means drums (usually envisioned by public as 55 gallon drums)

Maximally Exposed Individual

Any definition of radioactive waste. Greater than Class C – a definition of a category of radioactive waste, which is usually used without the definition

Special Nuclear Material

Dermal - skin

In even worse cases, several undefined terms are combined in one sentence, leaving the reader truly puzzled. For example, in the 2005 environmental surveillance report for LANL cited above, the discussion about sampling air emissions indicated there were four types: particulate matter, vaporous activation products, tritium, and air activation products. The two types underlined were never defined. What's worse is that the following text then referred to 'gaseous activated air product' emissions and 'vapor activation products'. Not only were the terms not defined, the authors could not even use them consistently.

As an example of what can be done to present information in easily understandable terms, a hazardous waste disposal site was conducting air monitoring to determine the concentrations of contaminants at their property line. Levels of various volatile organic compounds were measured and reported in parts per billion and a question was asked about the probable health impact on the surrounding community. A senior scientist looked at the data and made the comparison that a person would get more exposure to volatile organic compounds as a result of placing dry-cleaned clothes in a closet and then going back and breathing that closet air a day or so later. The audience understood that risk and the comparison to the risk from the hazardous waste disposal site.

This story points out a major failing in presenting an understanding of dose to the public. For example, the ATSDR report referenced above contains a substantial discussion on the possible doses of PCBs and DDE in the terms of mg/kg/day. However, the average reader would not necessarily realize that this equated to the amount (weight) of contaminant the person is exposed to based on their weight rather than the concentration of contaminant they are exposed to each day. They need simple (hopefully believable) explanations such as – an adult weighing 160 pounds would need to eat at least 8 oz. of catfish from the Rio Grande River twice a week to get a dose of PCBs of 0.003mg/kg.day.

Incomprehensible Figures

We have all heard that one picture is worth ten thousand words. The same should be true for figures. Unfortunately, the reverse usually occurs – one bad figure requires ten thousand words to explain what it is supposed to mean (and also diminishes the credibility of the author in the eyes of the audience). All too often, the author will take a figure that was developed as a large chart or drawing (22" x 34" paper size or larger) and reduce it to fit on an 8½" x 11'' piece of paper or even smaller. The result, as shown by the following figure, is a figure that is incomprehensible to the audience.

In this figure, the main point to be made was the elevation of the topic of the groundwater aquifer. Unfortunately, the elevation of the contours could not be read. In addition, it was not clear what the difference in elevation between each contour was – it turned out to be 100 feet. The author knew that the figure was not readable and apologized for it to the audience. It would have been better for the audience and his personal reputation if he had taken the time to have the figure redrawn in a simplified version that clearly made the point he wanted. Also, you will note that this is an extremely fact dense figure in the first place which would be difficult for to follow without extensive explanation by the author.

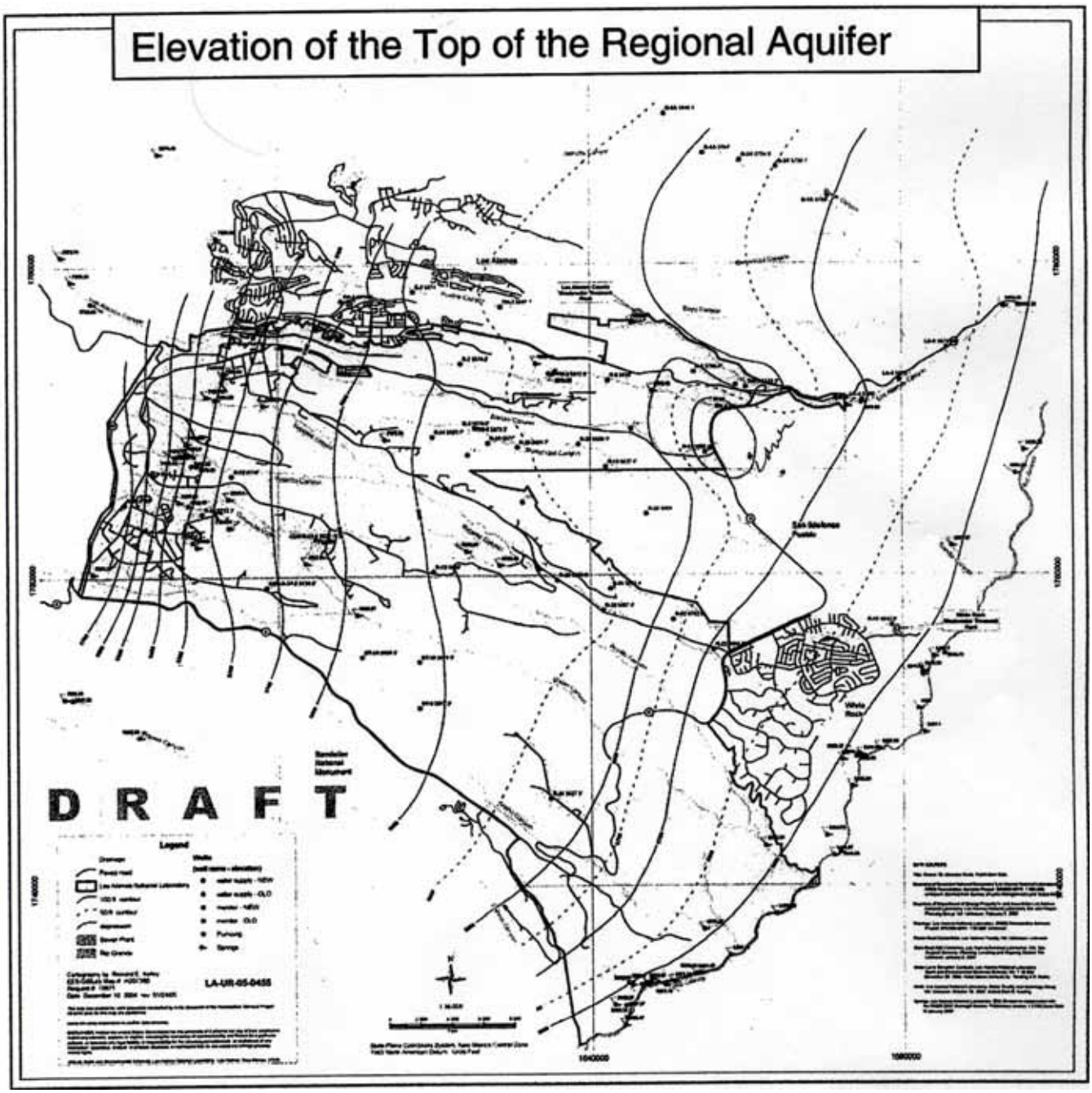
Elevation of the Top of the Regional Aquifer
DRAFT
Legend
LA-UR-05-0455

Figure 2

Another example is shown below in the same size it was presented in a permit modification request to a state regulatory agency. Not exactly clear.

Waste Isolation Pilot Plant
Hazardous Waste Facility Permit
October 16, 2006

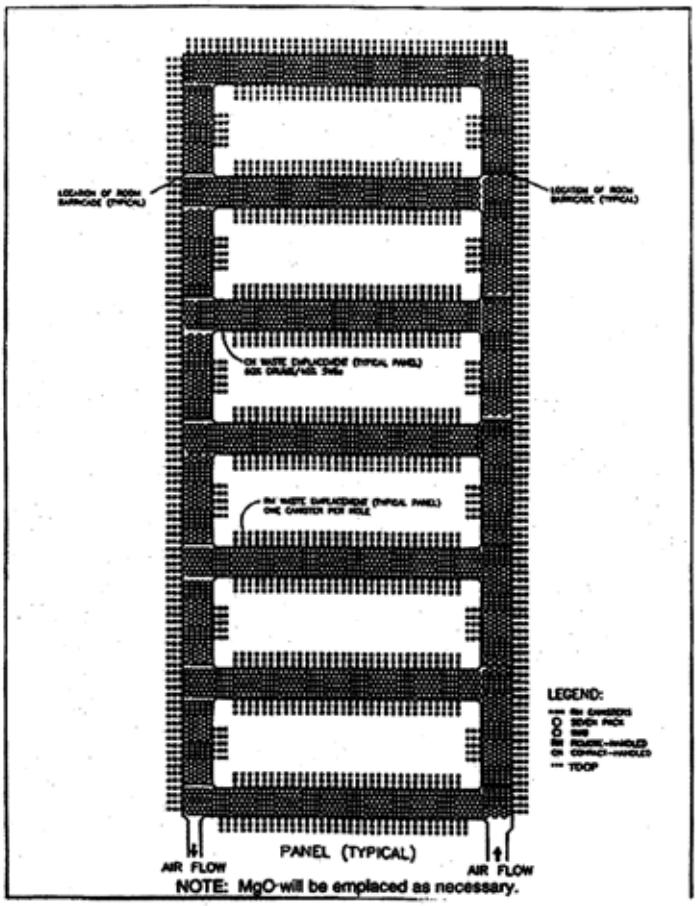

Figure M2-8
Typical RH and CH Transuranic Mixed Waste Container Disposal Configuration

PERMIT ATTACHMENT M2
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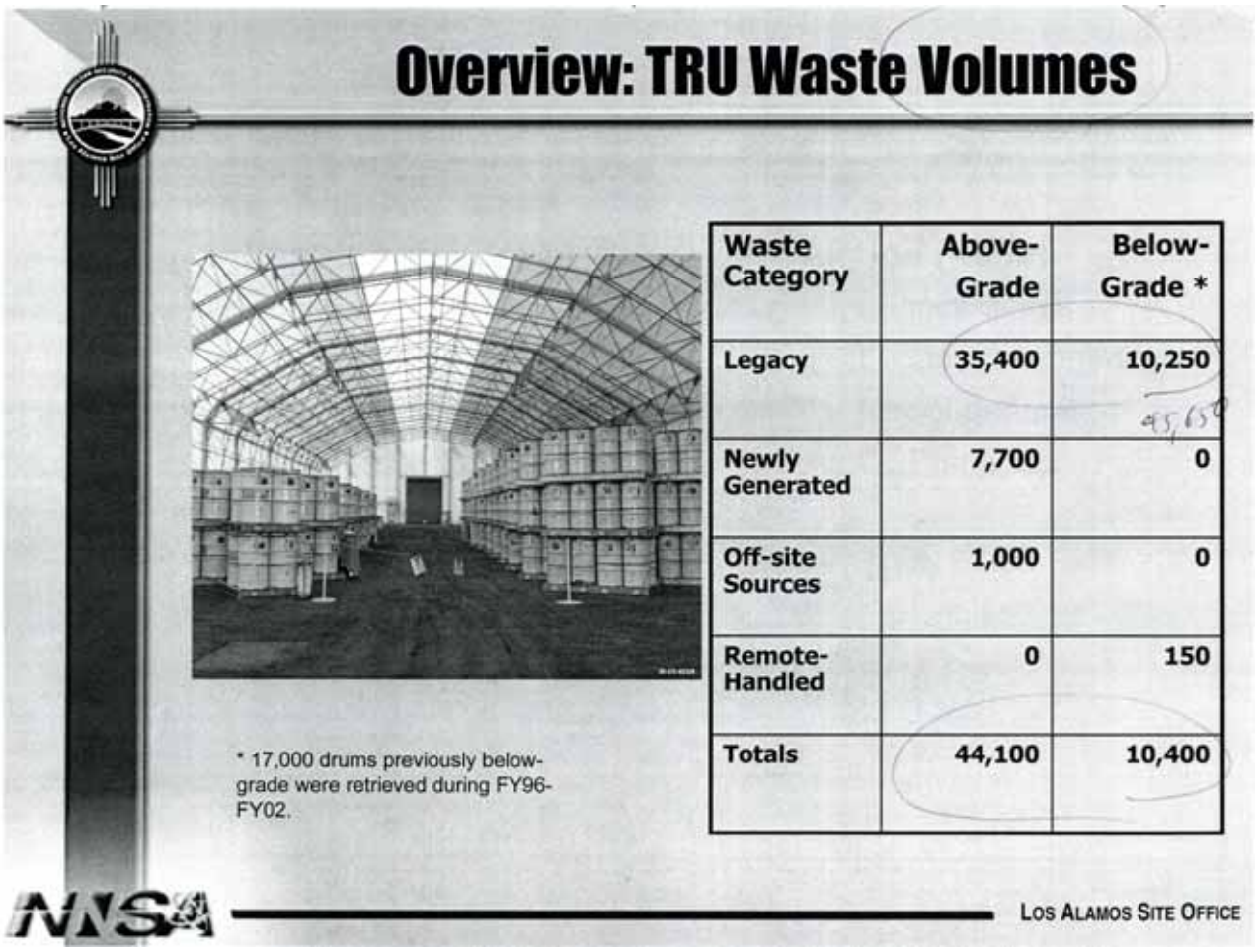
Figure 3

This figure has been copied so many times that the text is unreadable. Unfortunately, in the age of the computer and the ability to cut and paste practically anything from any document or source, it is all too easy to use that shortcut and not worry about the quality of the copy. However, it can result in delays in the approval process if regulators determine it is unreadable as well as negative feedback from the public.

Another common problem with figures and tables is the failure to include units. The following example is from a presentation made to the public regarding the volumes of TRU waste at Los Alamos National Laboratory. A good slide but it has no meaning without units!



Waste Category	Above-Grade	Below-Grade *
Legacy	35,400	10,250
Newly Generated	7,700	0
Off-site Sources	1,000	0
Remote-Handled	0	150
Totals	44,100	10,400

Figure 4

Examples such as these send the message to the audience that the speaker/author has little regard for the quality of his/her presentation and can lead them to wonder what else might be wrong or mis-represented in the presentation. It underscores the need to have papers and presentations checked by an editor to ensure that the presentation quality is met.

Obvious Presentation Errors

The final issues that results in the audience (public or specialists) to not get the message are errors, inconsistencies or discrepancies in the presentations. The more serious inconsistencies

are of two types. First, obvious errors such as spelling or mathematical mistakes that result in the reader focusing more on finding the next one than on the content of the paper or presentation. The second are inconsistent or unclear statements that leave the audience puzzled as to your intent and distract them from the balance of your presentation. Both of these types of inconsistencies also result in a loss of credibility with the audience. Other inconsistencies, such as the failure to apply the rules of grammar and punctuation consistently are bothersome and detract from the reputation of the speaker with respect to concern about quality but do not necessarily result in severe audience distraction and loss of concentration.

One of the most glaring example of a simple spelling error that affected the credibility of the document was a quality assurance plan that had misspelled 'form' as 'from' in every instance. Very consistent, very wrong, very poor quality control. If the quality assurance program lets that type of mistakes slip through, one has to wonder about their ability to ensure good quality of other work!

An example of an inconsistent statement was noticed in the draft 2004 environmental summary report for LANL. In discussing radioactive contamination and exposure, the report indicates in one paragraph that 'radionuclides in domestic crop plants…were indistinguishable from natural and fallout levels'. However when discussing the radionuclide levels in wild edible plants, which were higher than natural or fallout levels, the report just indicated that they were lower than the DOE does limits. This leads the readers to think that the authors may be hiding something. When this inconsistency was pointed out to LANL, they did correct it.

CONCLUSION

In order to effectively get the message to the audience, no matter who comprises the audience, the author of a paper or presentation should make sure that the following is accomplished;

- All acronyms are first stated in full.
- All not commonly used terms are defined
- All figures are readable, and
- All units of measure are included in text, figures, and tables as needed.

In addition, papers should be submitted for both a technical edit and a 'reading' edit, which covers spelling, punctuation, and grammar.

REFERENCES

1. Public Health Assessment for Los Alamos National Laboratory. September 2006
2. Environmental Surveillance at Los Alamos during 2005, Executive Summary, (draft), 2006
3. Environmental Assessment for U-233 Stablization, and Building 3019 Complex Shutdown at the Oak Ridge National Laboratory, Oak Ridge, TN, December 2006
4. Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory, Los Alamos, NM June 2006