DOE OFFICE of SCIENCE

SULI OBLIGATIONS GUIDELINES

Pacific Northwest
NATIONAL LABORATORY

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INDEX

Research Report Paper Guidelines

The main text of the paper is to be between 1500 and 3000 words. The word count does not include footnotes, appendices, the bibliography and similar items. All appendices together must be three pages or less. The form of the paper should follow the guidelines of the appropriate portions of the *Style* *Manual* from the American Institute of Physics. The final paper that you submit should be in "publication" form. Submission must be made using the online EducationLink online system, as an Adobe Acrobat (.pdf) file, prior to the end of their appointment and as directed by the host laboratory. Host institutions will provide submission system relevant instructions and may also provide additional related resources and guidance.

Writing this paper is not a trivial task and will require significant time and effort to complete. Be sure to allow plenty of time to complete and polish your paper. If writing does not come easily to you, do not hesitate to seek help early in the process. Nearly every person who has read scholarly scientific reports emphasize that clear, uncomplicated exposition of the research and its findings is the single most important factor which separates good reports from bad. The following suggestions are widely recommended by knowledgeable and successful writers, but they assume that you can write clear expository English. If you use the passive tense, write long sentences, and use jargon, you should also seek to improve your overall writing skills. General advice:

1) *Allow sufficient time* - Allow enough time to do a good job. All successful writers say that it takes time to generate high quality reports.
2) *Be organized* - Write logically and clearly. Make an outline of the points you want to make before you start, and then join them together in a coherent fashion.
3) *Give the broad picture* - Explain what you are doing and why it is important to your topical area of research. Provide a background which places your project in context.
4) *Write for your audience* - Guide the reviewer to the key points. Don't assume the reader will know your particular field of science or engineering. Some readers will be from outside your topical field. Try to put yourself into the mind of the reader. Answer any questions you would have if you were reading the report.
5) *Highlight your research* - Explain why your approach to the problem is appropriate and what resources you used. Demonstrate what you completed as in intern working on the project.
6) *Include your qualifications* - Establish what you have learned or now know from what you were doing. Include relevant references, but make the gist of the reference clear. A person reading the report will not necessarily want to have to obtain the reference and read it in order to really understand your report.
7) *Get an outside opinion* - Finally, show your paper to one or more colleagues, or your advisor, for comments. Ask them for an honest assessment of strengths and weaknesses. Listen to their comments and revise the paper accordingly.

The instructions for preparing the research report paper contain, or follow, revised and/or excerpted elements from the American Institute of Physics (AIP) Style Manual (4th edition, 1990). This manual provides a basis for material submitted to the journals published by the AIP, which comprise much of the physics literature published in the U.S. Many American physicists refer to the manual frequently and follow its dictates when writing and you are required to do so, selectively, when writing your SULI research project report paper.

Because your SULI paper will not, in general, be written for AIP publication, some parts of the full AIP Style Manual are not relevant to or important for your assignment. In the revised and/or excerpted version here, this unneeded material has been removed. The elements below under the heading **Preparing the Research Report Paper** should be followed, and/or included, in the completed and submitted version of your research report paper.

Preparing the Research Report Paper

I. General instructions

(1) Submit manuscripts in English only (American spelling). If you are not fluent in English, ask a colleague who is to read and correct your manuscript.

(2) Indent paragraphs, so that the start of a new paragraph is clearly distinguished from the continuation of an existing one after a displayed equation.

(3) Number all pages in sequence, beginning with the title and abstract page.

(4) Use a minimum 12 point font.

II. Title

(1) Place the title about a third of the way down from the top of the first page.

(2) Begin the first word with a capital letter; thereafter capitalize only proper names and acronyms.

III. Abstract

(1) Begin the abstract on a new line.

(2) Use wider side margins for the abstract than for the rest of the manuscript, so that it will be clear where the abstract ends and the main text begins.

(3) Type or print the abstract double spaced, preferably as one paragraph of continuous text. Avoid displayed mathematical expressions, figures, and tables.

(4) If a reference to the literature is needed, write it out within square brackets in the text of the abstract rather than referring to the list at the end of the paper. For example: The measurement of

hydrogen permeation into iron reported by W. R. Wampler [J. Appl. Phys. 65, 4040 (1989)], who used a new method based on ion beam analysis,...

(5) Define all nonstandard symbols, abbreviations, and acronyms.

IV. Section headings

(1) Write principal headings in all capital letters and lower-level headings with an initial capital letter to the first word only, as shown in Table I.

(2) If headings are numbered or lettered, use the scheme indicated in Table 1: roman numbers, capital letters, Arabic numerals, and lower-case letters in that sequence for the four levels of heading. Number or letter consecutively through the text.

TABLE I. The four levels of section headings in the body of a manuscript.

As printed in most journals
I. PRINCIPAL HEADING
A. First subheading
1. Second subheading
a. Third subheading. Followed immediately, on the same line, by text.

V. Acknowledgments

(1) The acknowledgments section follows the main text of the paper and precedes any appendixes and the list of references.

(2) It is recommended that this section be given a principal heading ("ACKNOWLEDGMENTS”), but if there is only one acknowledgment the singular form may be used.

VI. Appendixes

(1) Appendixes follow the acknowledgments and precede the list of references.

(2) Headings to appendixes have the form of principal headings. If there are two or more appendixes, they can be labeled A, B, C, etc. Examples:

APPENDIX

APPENDIX: CALCULATION OF F(t)

APPENDIX A

APPENDIX C: PROOF OF THE EQUIVALENCE THEOREM

VII. Footnotes and references

(1) Type or print each footnote as a separate indented paragraph beginning with the appropriate superscript indicator.

(2) For references cited in the text use superscript numerals running consecutively through the text: 1, 2,3, etc. Place citation indicators after commas, periods, quotation marks, colons, and semicolons:

As pointed out by Bray,[6] these calculations are in agreement with other experimental values.[7,8]

We obtained the following values for the two parameters:[13-15] $I = 0.775$ and $r_0 = 0.590$.

Do not put citation indicators where they might be mistaken for numbers with a different meaning.

Write:

A recent measurement[2] of $\square$ v...

instead of

A recent measurement of $\square\, v^2$...

(3) In text, refer to authors by last name (surname, family name) only. In the references themselves, give authors' names in the form in which they appear on the title page of the cited work. For names in the west European tradition, retain the order that puts the family name last (for example, John J. Doe, not Doe, John J.).

(4) For the recommended form and content of bibliographic references see Table II.

In journal references, give the volume number, the article title, the inclusive page numbers (first and last), and the year of publication.

Include the issue when the journal is not paginated consecutively through the volume (for example, *Physics Today, Scientific American).* Give the year in place of the volume number only when the journal does not use volume numbers. References to errata should be labeled as such, as should references to "abstract only" or "title only" publications.

In book references always include the title, the authors' or editors' names, the publisher's name and location, and the year of publication. References to laboratory reports should not contain abbreviations or acronyms for the names of laboratories or agencies; spell them out.

The use of the expression *"et al."* (as in "Jones et *al.*[8] studied this reaction in 1982") is encouraged in the body of the paper, but discouraged in the references unless there are more than three authors' names.

"In press" or "to be published" means that the paper has been accepted for publication in a journal, and the title of the journal must be given. Such a reference may be updated at the proof stage if the referenced paper has been published by then.

(5) Refer to the original sources whenever possible as you gather details for bibliographic references. Do not rely on intermediate citations, which may contain misspelled names or erroneous volume and page numbers and publication dates.

(6) Avoid references to unpublished material that is difficult or impossible to obtain.

(7) For footnotes to tables, see point (8) of the next section.

VIII. Tables

(1) Tabular material more than four or five lines long should be presented as a numbered table with a caption and not included as part of the running text.

(2) Type or print each table double spaced on a separate page after the references and before the figure captions. Place the table caption directly above the table to which it belongs, not on a separate sheet. See Table III for an example.

(3) Number the tables in the order of appearance in the text, and make sure each table is cited in text. Tables displayed and cited in proper sequence in the main body of the paper may be mentioned out of sequence in the introduction.

(4) Give every table a caption that is complete and intelligible in itself without reference to the text.

(5) Give every column a heading. Make it clear and concise. Capitalize the first word of a heading unless it is a standard abbreviation that is always used lower-case.

Units of measurement should be placed in parentheses on the line below the appropriate heading. Choose units so that entries are near unity in magnitude, so that, as far as possible, powers of ten are not needed for most entries.

(6) Align columns of related numbers by decimal. Do not use "ditto" or any symbol such as quotation marks to indicate repeated entries; write each entry out in full. Use raised dots (⋯) instead of dashes to indicate missing values.

(7) Type or print a double horizontal line below the table caption, a single line below column headings, and another double line at the end of the table. Avoid vertical lines between columns: use appropriate spacing instead.

(8) Footnotes to a table are indicated by a sequence of lower-case letters [a], [b], [c], etc., with a new sequence starting with [a] for each table. The ordering of footnote indicators should be left to right across one row, and then left to right across the next row, and so on. Place the footnotes themselves below the double line at the end of the table.

TABLE II. Examples of footnotes

Kind of footnote	As typed in paper
Journal article citations	[1]Gale Young and R. E. Funderlic, "Positron decay in Na," J. Appl. Phys. 44, 5151-5153 (1973).
Issue number included	[2]M. D. Levinson, "Rate of decay of auditory sensation," Phys. Today 30 (5), 44-49 (1977).
Book reference	[3]L. S. Berks, *Electron Probe Microanalysis,* 2nd ed. (Wiley, New York, 1971), p. 40. [4]D. K. Edwards, in *Proceedings of Ihe 1972 Heat Transfer Institute*, edited by R. B. Landis (Stanford University, Stanford, CA, 1972), pp. 71-72.
Reference to unpublished work	[5]R. C. Mikkelson (private communication).

(9) In designing a large table, take into account the size of the journal page on which it is to be printed. Tables may be continued onto a second page or beyond, in which case the column headings will be repeated. Tables may also be turned 90° from the usual orientation.

IX. Figures and figure captions

Figures play a significant role in the expression of scientific ideas. A single well-prepared figure can contribute immeasurably to the clarity of the text, and high standards of presentation are therefore particularly important.

(1) Number figures in order of their appearance in the text and make sure that every figure is cited. Figures displayed and cited in proper sequence in the main body of the paper may be mentioned out of sequence in the introduction.

(2) Every figure must have a caption that is complete and intelligible in itself without reference to the text. Type each caption as one paragraph, beginning with the figure number in the form:

FIG. 1. Variation of distance R with...

In captions, use symbols to represent data points, but use words to identify curves (for example, "solid," "dashed," "dotted," "dot-dashed," etc.). A better alternative is to label curves with letters (A, B, etc.) and to refer to them by letter in the caption ("Curve A represents...").

(3) Figures can be in color when necessary, and where the color adds scientific information not clearly available in an equivalent monochrome version.

(4) Graphs should be self-explanatory, their purpose evident without reference to the text. Indicate clearly what is being plotted, in both the horizontal and the vertical directions. Include appropriate units. Orient letters and numbers so that they may be easily read from the bottom or the right-hand side of the graph. Relevant nongraphic material, such as the key to the symbolism in the graph, may be included within the confines of the graph frame if it will fit without crowding; otherwise put the explanatory material in the caption.

The notation used in graphs should be standard and consistent with the notation used in the text. Write 0.1, not .1, 0 1, or 0,1. Do not capitalize letters indiscriminately: write

in units of *q/a,* not IN UNITS OF *q/a*

and

kinetic energy *Ef*(meV) not KINETIC ENERGY *Ef* (MEV)

Take care to preserve standard forms for symbols and abbreviations, as you would in text. Standard units should be well spaced off and enclosed in parentheses.

If possible, do not use powers of ten in axis labels: use instead the appropriate prefixes of the *Systeme International* (see Table IV). If powers of ten must be used, write for example

R(10^{-4}[Omega]) or $10^{4}R$ ([Omega]).

Never write

R x 10^{-4}[Omega] or R /10^{-4}[Omega],

because in these forms it is not clear whether the scale numbers have been or are to be multiplied by 10^{-4}. Better still; attach the power of ten to the largest number on the axis: 8 x 10^{-4}.

Whenever possible, use integer numbers on the axis scales of figures (1, 2, 3, or O, 5, 10, not 1.58, 3.16, 4.75 or 1.5, 3.0, 4.5). If this is not feasible, then there must be a number both before and after the decimal point: Use 0.5, not .5, and 5, not 5., etc. Do not use unnecessary decimal places: 1.0, 1.5, 2.0 is acceptable, but not 1.00, 2.00, 3.00.

Coordinate ruling should be limited in number to those necessary to guide the eye in making a reading to the desired degree of approximation. Ticks to indicate coordinate values, placed within all four sides of the graph, increase readability, and are recommended. Closely spaced coordinate rulings are appropriate only for computation charts. It is often impossible in a journal to make a graph large enough to preserve accuracy of the data beyond two significant figures. If that accuracy is not sufficient for your purposes, present the data as a table.

Graphs with large blank areas, or large areas containing only nongraphic material, are unacceptable; use only the ranges of coordinates for which there are data. If similar quantities are plotted several times, uses shifted ordinate scales for each plot and enclose the plots in one large rectangle, not in separate boxes, thereby saving space. Isometric drawings giving the illusion of three dimensions to the family of curves are often better.

(5) In diagrams of electrical circuits, the values of resistances, inductances, etc. and component designations should be lettered directly on the diagram. A separate parts list in the caption is then unnecessary, except for special or unusual components.

X. Mathematical expressions and equations

Display all numbered and complicated unnumbered equations on separate lines set off from the text above and below. "Complicated" equations are equations hard to accommodate within running text. These include equations longer than about 25 characters.

(1) Equation numbers:

(a) Only displayed equations may be numbered.

(b) The preferred style is to number equations consecutively throughout the text with Arabic numerals in parentheses: (1), (2), (3), etc. Numbering by section is also acceptable, if the section number is made part of the equation number: (2.1), (2.2), (2.3), etc. In appendixes use the numbering sequence (Al), (A2), (A3), etc.

(c) Place equation numbers flush with the right margin. Leave a space at least two characters wide between an equation and its number.

(d) An equation number should be centered beside a group of equations identified by one number, as in Eqs. (2), (6), and (7) on this page. It should be aligned with the last line of a multilinear equation, as in Eqs. (3)- (5).

(2) Roman versus italic type:

(a) According to conventional practice, Latin letters used as mathematical symbols are set in italic type to distinguish them from ordinary roman text...

(b) Boldface is used for three-vectors, dyadics, some matrices, tensors without indices, etc. It is inappropriate for four-vectors (*k*), vectors represented by a typical component, such as x_i for x = (x_1, x_2, x_3), and the magnitude of a vector, *H* for **H**. Subscripts attached to a three-vector should not be boldface unless they would be so as main characters.

(c) When it is essential to distinguish between vectors and tensors, sans serif may be used for tensors.

Additional writing guidance and suggestions

No two scientific papers are sufficiently alike that any tidy group of fixed rules for writing a scientific paper could apply to all papers with inevitable success. It is possible, however, to state principles and offer suggestions that will encourage any author to present a body of scientific information in a reasonably smooth and coherent form. Please carefully read and study the following guidance, which describe best practices for developing and writing content for the 10 items listed above.

- **Before beginning to write**

Despite the natural tendency to feel that no work is being done on a paper if no actual writing is under way, adequate preparation can help ensure a logical, readable product and shorten the writing time. Preparation can follow these steps.

(1) Analyze the problem. Ask yourself at least these four questions:

(a) Exactly what information do I wish to present in this paper?

(b) For what specific group of readers am I writing?

(c) What background information can I assume these readers have?

(d) What is the most logical sequence in which I should present the information to the readers?

(2) Make a detailed outline. The outline will serve as your writing guide; therefore, make as many subdivisions as possible. It is easier to eliminate or combine existing subheadings than to insert new ones. As you write, you will, almost certainly, revise the outline. Even if the

outline suffers drastic revision before the paper is finished, the very act of preparing and modifying it serves as a mental stimulus that goes far toward ensuring logical development of the subject matter. Be sure your outline reflects the true structure and emphasis you wish your paper to have. Remember that many hurried readers will scan the headings and subheadings to determine if they need to read the entire text; try to help them by making the headings informative and logical.

(3) Plan tables and figures. You may already have thought about the tables and figures while preparing the outline, but if not, do it at this stage. Some data lend themselves to presentation in tabular form; others do not. Appropriate figures can be very valuable, but there are times when a few good sentences convey more information than a drawing or photograph. Avoid unnecessarily duplicating data in tables and figures. Select the form of presentation--tables, figures, or text--with the efficient presentation of your data as the only criterion.

(4) Sit and think. This step should precede, follow, and be interspersed with the others. In other words, do not try to rush through the entire process in one continuous effort, but continually stop and review what you have done and think again about what is to come.

- **General rules for writing**

The following rules can be applied with profit to all technical writing and to all parts of a scientific paper.

(1) Be clear. Consider the beauty and efficiency of the simple declarative sentence as a medium for communicating scientific information. Use it freely, but not exclusively. Avoid long, meandering sentences in which the meaning may be obscured by complicated or unclear construction.

(2) Be concise. Avoid vague and inexact usage. Be as quantitative as the subject matter permits. Avoid idle words; make every word count.

(3) Be complete. Do not assume that your reader has all the background information that you have on your subject matter. Make sure your argument is complete, logical, and continuous. Use commonly understood terms instead of local or highly specialized jargon. Define all nonstandard symbols and abbreviations when you introduce them. On the other hand, omit information unnecessary for a complete understanding of your message.

(4) Put yourself constantly in the place of your reader. Be rigorously self-critical as you review your first drafts, and ask yourself "Is there any way in which this passage could be misunderstood by someone reading it for the first time?"

- **Selecting a title**

The time to decide on a title is after the manuscript has been completed. It must achieve a compromise between succinct brevity and overly complete description. Omit decorative locutions such as "Thoughts on ...," "Regarding ...." Avoid nonstandard abbreviations and acronyms. If properly written a title is short enough to be intelligible at a glance but long enough to tell a physicist if the paper is of interest to him or her.

- **Abstract**

An abstract must accompany your research report, and this is distinct from the General Audience Abstract. It should be a concise summary of the significant items in the paper, including the results and conclusions. In combination with the title it must be an adequate indicator of the content of the article. The abstract should not contain literature citations that refer to the main list of references attached to the complete article, nor allusions to the illustrations. Define all nonstandard symbols and abbreviations. Do not include tabular material or illustrations of any kind. Avoid "built-up" equations that cannot be rendered in linear fashion within the running text. Prepare it as a single paragraph. It should be no longer than about 500 words.

The primary purpose of the abstract is to help prospective readers decide whether to read the rest of your paper. Bear in mind that it will appear, detached from the paper, in abstract journals and on-line information services. Therefore it must be complete and intelligible in itself; it should not be necessary to read the paper in order to understand the abstract.

The abstract should be a clear, concise summary of the principal facts and conclusions of the paper, organized to reflect its pattern of emphasis. Remember that some readers may use the abstract in lieu of the parent document. The title and abstract together will often be used as a basis for indexing; hence they must mention all the subjects, major and minor, treated in the paper. Understanding these considerations, you will want to give as much care to writing the abstract as you did to writing the paper. Some guidelines to assist in this task follow.

(1) State the subject of the paper immediately, indicating its scope and objectives. Do this in terms understandable to a nonspecialist. Describe the treatment given the subject by one or more such terms such as "brief," "comprehensive," "preliminary," "experimental," or "theoretical."
(2) Summarize the experimental or theoretical results, the conclusions, and other significant items in the paper. Do not hesitate to give numerical results or state your conclusions in the abstract.
(3) If the paper is one of a series, indicate that there are related papers.
(4) Indicate the methods used to obtain experimental results. If they are novel, state the basic principles involved, the operational ranges covered, and the degree of accuracy attained.
(5) Do not cite the literature references by the numbers in the list at the end of the paper, and do not refer by number to a selection, equation, table, or figure within the paper. Nonstandard symbols and abbreviations used in the abstract must be defined there as well as in the main text.
(6) Use running text only. Never use displayed mathematical expressions or numbered equations. Omit tables, figures, and footnotes.

(7) Keep the length of the abstract to a small percentage of that of the paper. Write concise, straightforward English; make every word count. Try to substitute words for phrases and phrases for clauses. Be terse, but not telegraphic; do not omit a's, an's, or the's. Regardless of the length of the final draft of your abstract, study it again with a view to shortening it further to a minimum length.
(8) As with the paper itself, have the abstract read critically by some of your colleagues for clarity, completeness, proper emphasis, and objectivity.

- **The introduction**

Every scientific paper should have at least one or two introductory paragraphs; whether this introduction should be a separately labeled section depends upon the length of the paper. Paradoxically, although it appears first it should be written last. You will probably find it easier to start writing the introductory text after you have written part or all of the main body of the paper; in this way, the overall structure and content are more easily seen.

The first sentence of the paper is often the most difficult to write. It is important enough, however, to deserve considerable time and attention. The first sentence and the first paragraph play a critical role in determining the reader's attitude toward the paper as a whole. For best results, be sure to:

(1) Make the precise subject of the paper clear early in the introduction. As soon as possible, inform the reader what the paper is about. Depending on what you expect your typical reader already knows on the subject, you may or may not find it necessary to include historical background, for example. Include such information only to the extent necessary for the reader to understand your statement of the subject of the paper.
(2) Indicate the scope of coverage of the subject. Somewhere in the introduction state the limits within which you treat the subject. This definition of scope may include such things as the ranges of parameters dealt with, any restrictions made upon the general subject covered by the paper, and whether the work is theoretical or experimental.
(3) State the purpose of the paper. Every legitimate scientific paper has a purpose that distinguishes it from other papers on the same general subject. Make clear in the introduction just what this purpose is. The reader should know what the point of view and emphasis of the paper will be, and what you intend to accomplish with it.
(4) Indicate the organization of the paper when its length and complexity are great enough. Short papers should have an obvious organization, readily apparent to the casual reader; long papers, however, can benefit from a summary of the major section headings in the introduction.

- **Main body of the paper**

Presumably, you tentatively decided on the form and content of the main body of your paper, which contains all the important elements of the message you want to convey, when you first decided to write the paper. Now review those decisions in light of the advice given above and write the sections that make up this part of your article. Then read through your first draft, asking yourself such questions as:

(1) Have I included all the information necessary to convey my message?

(2) Have I eliminated all superfluous material?

(3) Have I given proper emphasis to important ideas and subordinated those of lesser importance?

(4) Is the development of the subject matter logical and complete, free of gaps and

discontinuities?

(5) Have I been as quantitative as I could in presenting the material?

(6) Have I made the best use of tables and figures, and are they well designed?

(7) Are the facts I have presented adequate to support the conclusions I intend to draw?

Now revise the first draft of the main body of your paper in the light of your answers to these questions and others that occurred to you as you read the draft.

- **The conclusion**

Typical functions of the conclusion of a scientific paper include (1) summing up, (2) a statement of conclusions, (3) a statement of recommendations, and (4) a graceful termination. Any one of these, or any combination, may be appropriate for a particular paper. Some papers do not need a separate concluding section, particularly if the conclusions have already been stated in the introduction.

(1) Summing up is likely to be the major function of the final section of a purely informational paper. If you include a summary, make sure you include only references to material that appeared earlier in complete form.
(2) Conclusions are convictions based on evidence. If you state conclusions, make certain that they follow logically from data you presented in the paper, and that they agree with what you promised in the introduction.
(3) Recommendations are more likely to be found in, say, technical reports than in scientific papers. But if you do include recommendations make sure they flow logically from data and conclusions presented earlier, with all necessary supporting evidence. As with the conclusions, recommendations should not disagree with what you led the reader to expect in your introduction.
(4) Graceful termination is achieved when the final sentence introduces no new thought but satisfactorily rounds off all that has gone before. Be warned against duplicating large portions of

the introduction in the conclusion. Verbatim repetition is boring, creates a false unity, and is no compliment to the reader's attentiveness.

- **Acknowledgments**

In general, limit acknowledgments to those who helped directly in the research itself or during discussions on the subject of the research. Acknowledgments to typists or illustrators are discouraged, as are acknowledgments to anonymous referees. Financial support of all kinds (for the specific piece of work reported, to an author, or to the institution where the work was carried out) is best acknowledged here rather than as footnotes to the title or to an author's name.

- **Appendixes**

Appendixes conclude the text of a paper. Few papers need them. Their best use is for supplementary material that is necessary for completeness but which would detract from the orderly and logical presentation of the work if inserted into the body of the paper. A proof of a theorem is a good example of material of this type.

Appendixes may also be used for supplementary material that is valuable to the specialist but of limited interest to the general reader.

- **Final draft**

When you have completed the first draft of your manuscript, lay it aside for several days. Then re-read it critically for final revisions. Ask two or three colleagues, at least one of whom is less familiar with the subject than you are, to read your manuscript critically for clarity, conciseness, completeness, logic, and readability. If one of these readers tells you that a passage is unclear, do not argue that it is, in fact, perfectly clear (to you!). Take the comment seriously and change the passage until it suits both of you.

- **Proofreading the paper**

As a final step before submitting the manuscript, proofread it. There are always errors, however excellent the typist. Ask someone else to proofread it too: a fresh pair of eyes can find errors you have overlooked. As you proofread, check the following points:

(a) If the section headings are numbered or lettered, are they numbered or lettered consecutively according to the scheme in Table I? Are the cross-references to sections correct?
(b) Are all ambiguous mathematical symbols identified?
(c) Are all numbered equations in proper sequence and cited correctly in text?
(d) Are all footnotes and references cited in the paper? Do all the citation indicators in text refer to the correct footnote or reference?
(e) Are all tables and figures cited in order in the text?

➢ Units of Measure

The following is a listing of circa 1990 typical units of measure used in the physical sciences. Current usage may vary, and some units may not be listed. This list is for reference only, and additional resources should be used for updated and more extensive information, or for application to other research disciplines. Units marked with asterisks are base, derived, or supplementary units of the *Systeme International.*

Unit Abbreviation

abampere - spell out
abohm - spell out
abvolt - spell out
amagat - spell out
*ampere - A
ampere hour - A h
ampere turns per meter - At/m
angstrom - Å
arc minute - arc min
astronomical unit - AU
atmosphere - atm
atmosphere, standard - A_S
atomic mass unit - u
atomic parts per million - at. ppm
atomic percent - at. %
atomic time unit - atu
atomic unit - a.u.
attofarad - aF
bar - spell out
bark - spell out
barn - b
barye - spell out
biot - Bi
bit or bits - spell out
blobs per hundred microns - blobs/(100 um)
bohr - spell out
British thermal unit - Btu
bytes - spell out
calorie - cal
*candela - cd
candelas per square meter - cd/m^2
candlepower - cp
centimeter - cm
centipoise - cP
*coulomb - C
counts per minute - counts/min
cpm counts per second - counts/s
cubic centimeter - cm^3 (cc not rec.)
curie - Ci
cycle - spell out, c
cycles per second - cps, c/s
day d, - or spell out
debye - D
decibel - dB, dBm
degree - [ring], deg
degrees - Baumé [ring]B
degrees - Celsius (centigrade) [ring]C
degrees - Fahrenheit [ring]F
degrees - Kelvin K
disintegrations per minute - dis/min
disintegrations per minute per microgram - dis/min µg
disintegrations per second - dis/s
dyne - dyn
electromagnetic unit - emu
electron barn - eb
electrons per atom - e/at.
electrons per cubic centimeter - e/cm^3, e/cc, e cm^{-3}
electron unit - e.u.
electron volt - eV
electrostatic unit - esu entropy unit - eu
erg - spell out
*farad - F
femtofarad - fF
femtometer - fm

fermi - F
fissions per minute - fpm
foot - ft
foot-candle -fc
foot-lambert - fL
foot-pound - ft lb
formula units - f.u.
franklin - Fr
gal - Gal (unit of gravitational force centistoke - cS)
gallon - gal
gauss - G
gibbs - spell out
gigacycles per second - Gc/s
giga-electron-volt - GeV
gigahertz - GHz
gigavolt - GV
gilbert - Gi gram - g
hartree - spell out hectogram - hg
*henry - H
*hertz - Hz
horsepower - hp
hour - h
inch - in.
*joule - J
kayser - K
*kelvin - K
kilobar - kbar
kilobyte - kbyte kilocalorie - kcal
kilocycles per second - kc/s
kilodegrees Kelvin - kK kilodyne - kdyn
kilo-electron-volt - keV
kilogauss - kG
*kilogram - kg
kilogram force - kgf
kilogram meter - kg m
kilohertz - kHz
kilohm - k[Omega]
kilojoule - kJ
kilomegacycles per second - kMc/s
kilometer - km
kilo-oersted - kOe
kiloparsec - kpc
kilosecond - ks,ksec
kiloton - kt
kilovolt - kV
kilovolt ampere - kV A
kilowatt - kW
kilowatt hour - kW h
knot - kn
lambert - L
langmuir - L
liter - l, L
Lorentz unit - LU
*lumen - lm
lumens per watt - lm/W
*lux - lx
Mach - M
maxwell - Mx
megahertz - MHz
megacycles per second - Mc/s
mega-electron-volt - MeV
megarad - Mrad
megavolt - MV
megawatt - MW
megohm - M[Omega]
meter - m
meter-kilogram-second ampere - mksa
meter-kilogram-second coulomb - mksc
meter of water equivalent - mwe, m (w.e.)
mho - ohm^{-1}
microampere - µA
microampere hour - µA h
microcoulomb - µC microfarad - µF
microhm - µ[Omega]
micrometer - µm
micromole - µmol
microm - µm
microns of mercury - µm Hg
microsecond - µs, µsec
microunit - µu
mil - spell out
mile - spell out
milliampere - mA
millibarn - mb
millicurie - mCi
millidegrees - Kelvin mK
milligram - mg
millihenry - mH
milliliter - ml
millimeter - mm
millimeters of mercury - mm Hg
millimicron - mµm
million electron volt - MeV

million volt - MV
milliunit - mu
millivolt - mV minute - (i) min, (ii)'
molal (concentration) - m
molar (concentration) - M
*mole - mol or spell out
mole percent - mol %, mole %
mole percent metal - MPM
month - spell out
nanobarn - nb
nanometer - nm
nanosecond - ns, nsec
nanoseconds per meter - ns/m
neper - Np
neutrons per fission - n/[florin]
neutrons per second - n/s
neutrons per seond per square cm - n/s cm^2
*newton - N
normal (concentration) - N
oersted - Oe
*ohm - [Omega]
ohm centimeter - [Omega] cm
ohm centimeter per centimeter per cubic
centimeter - [Omega] cm/(cm/cm^3)
ounce - oz
parsec - pc
parts per billion - ppb
parts per million - ppm
*pascal - Pa
picofarad - pF
poise - P
pound - lb
pound-force per square inch - lb/$in.^2$
pounds per square inch - psi
pounds per square inch absolute - psi (absolute)
pounds per square inch gauge - psi (gauge)
rad - spell out
*radian - rad
radiation length - r.I.
reciprocal ohm - mho
revolutions per minute - rpm
revolutions per second - rev/s, rps
roentgen - R
rydberg - Ry
*second - (i) s, sec (ii)"
shake - spell out
*siemens - S
standard cubic centimeter per second - sccm
statampere - spell out
statohm - spell out statvolt - spell out
*steradian - sr
stoke - S
tera-electron-volt - TeV
tetrahertz - Thz
*tesla - T
ton - spell out
torr - Torr, torr
townsend - Td
unified atomic mass unit - u
*volt - V
volume percent - vol %
*watt - W
*weber - Wb
webers per square meter - Wb/m^2
week - spell out
weight percent - wt%
Weisskopf unit - W.u.
year - yr

- **Standard Abbreviations**

The following abbreviations (and acronyms) may be used without explanation, but this list dates to circa 1990, hence current usage may vary. This list is for reference only, and additional resources should be used for updated and more extensive information. In general, all abbreviations and acronyms should be defined when first introduced in manuscript, unless they appear on this list or are now commonly known and accepted as such.

alternating-current - ac
altitude - alt

anno Domini - A.D.
ante meridiem - a.m.
antilogarithm - antilog aperture ratio 16 - f/16
approximate (in subscript) - approx.
arccosecant - arccsc
arccosine - arccos
arccotangent - arccot
arcsecant - arcsec
arcsine - arcsin
arctangent - arctan
argument - arg
audio-frequency - af
average (in subscript) - av
Bardeen-Cooper-Schrieffer - BCS
body-centered-cubic - bcc
boiling point - bp
Boltzmann constant - k, k_B
calculated (in subscript) - calc
center of mass - c.m.
centimeter-gram-second (system) - cgs
chapter - Chap.
chemically pure - cp
coefficient (in subscript) - coeff
cologarithm - colog
Company - Co.
complex conjugate - c.c.
Confer (compare) - cf.
confidence limits - C.L.
constant - const
contact potential difference - cpd
continuous-wave - cw
Corporation - Corp.
cosecant - csc
cosine - cos
cotangent - cot
cubic - cu
curl - Vx
deoxyribose nucleic acid - DNA
determinant - det
deviation - dev
diameter - diam
direct-current - dc
District of Columbia - D.C.
divergence - div
east - E
edition - ed.
elastic (in subscript) - el
electromotive force - emf
electron paramagnetic resonance - EPR
electron spin resonance - ESR
equation - Eq.
equations - Eqs.
error function - erf
error function (complement of) - erfc
estimated standard deviation - e.s.d.
et alii (and others) - et al.
exempli gratia (for example) - e.g.,
experiment(al) (in subscript) - expt
exponential - e,exp
face-centered-cubic - fcc
figure - Fig.
figures - Figs.
frequency-modulation - FM
gradient - grad
gram-atom - g-at.
gram-atomic-weight - g.at. wt
Hermitian conjugate - H.c.
hexagonal-close-packed - hcp
high-frequency - hf
hyperbolic cosecant - csch
hyperbolic cosine - cosh
hyperbolic cotangent - coth
hyperbolic secant - sech
hyperbolic sine - sinh
hyperbolic tangent - tanh
hyperSne structure - hfs
ibidem (in the same place) - *ibid.*
id est (that is) - i.e.,
imaginary part - Im
Incorporated - Inc.
inelastic (in subscript) - inel
infrared - ir
inside diameter - i.d.
intermediate frequency - if
International Critical Tables - ICT
laboratory (in subscript) - lab
latitude - lat
limit - lim
linear combination of atomic orbitals - LCAO
logarithm - log
logarithm (natural, base *e*) - ln
longitudinal-acoustic - LA
longitudinal-optic - LO

magnetomotive force - mmf
maximum - max
melting point - mp
meter-kilogram-second (system) - mks
minimum - min
molecular orbital - MO
north - N
nota bene (mark well) - N.B.
not determined - N.D.
nuclear magnetic resonance - NMR
number - No.
observed (in subscript) - obs
of order less than - o ( )
of the order of - O( )
outside diameter - o.d. page - p.
pages - pp. Part - Pt.
post meridiem - p.m.
potential difference - PD probable error - pe
quantum chromodynamics - QCD
quantum electrodynamies - QED
quad erat demonstrandum (which was to be demonstrated) - Q.E.D.
radio-frequency - rf
random-phase approximation - RPA
real part - Re
reference - Ref.
references - Refs.
ribonueleic acid - RNA
room temperature - RT
root-mean-square - rms
secant - sec
section - Sec.
sections - Secs.
Series - Ser.
signum function - sgn
sine - sin
south - S
square - sq
standard temperature and pressure - STP
Supplement - Suppl.
Systeme International - SI
tangent - tan
theory, theoretical (in subscript) - theor
total (in subscript) - tot
trace - tr,Tr
transverse-acoustic - TA
transverse-electric - TE
transverse-electromagnetic - TEM
transverse-magnetic - TM
transverse-optic - TO
ultrahigh-frequency - uhf
ultraviolet - uv
valence band - VB
versus - vs
videlicet (that is to say, namely) - viz.
Volume - Vol.
Wentzel-Kramers-Brillouin - WKB
west – W

General Audience Abstract Guidelines:

This 300-word length abstract should generally summarize your SULI experience. This summary should highlight research accomplishment(s), be written at a level approachable by a broad and largely non- subject matter expert audience (*Scientific American* level of sophistication), describe Department of Energy programmatic or mission relevance of your activities, define the institutional setting, and generally discuss activities, outcomes, impacts, lessons learned, and professional growth and development resulting from your appointment. Submission of required materials must be made prior to the end of their appointment and as directed by the host laboratory. Host institutions will provide instructions regarding use of the online submission system.

EXAMPLES

Example 1

Extraction of Uranium from Seawater Using Sorbent Fibers

Oak Ridge National Laboratory and the Marine Sciences Laboratory at Pacific Northwest National Laboratory are conducting joint research on sorbent fibers designed to extract uranium from seawater. The purpose of these tests is to investigate the rate at which uranium accumulates on the fibers and to approximate the maximum capacity expressed as mg-uranium per g-fiber. Results will provide focus for further joint research. Mainly, uranium adsorption onto fibers exposed to filtered seawater was measured at 2.7 mg/g-fiber after 55 days, and the maximum adsorption capacity was determined via curve fit approximation at 3.3 mg/g-fiber. The sorbent fibers also experienced substantial accumulation of vanadium and copper, suggesting that performance gains can be realized by increasing uranium selectivity. This work contributes to the interfacial molecular sciences aspect of the Chemical and Molecular Sciences core capability.

During my time as intern, I learned basic programming in LabView software in connection with my work on water quality instrumentation. The measuring device I used most was the TROLL® 9500 equipped with pH, temperature, and electrical conductivity/salinity sensors. I spent time troubleshooting instrument drift associated with the conductivity sensor. Issues with the TROLL have been as numerous and surprising, but the experience has sharpened my problem-solving skills. Through my analysis of adsorption data in Excel, I have questioned results and narrowed findings to a conclusion fully supported by data.

An expectation that I had for my internship with PNNL was that my work would benefit my project and I would emerge better prepared for graduate school. The meaningful assignments provided by my mentor ensured that these goals were met. Further, I feel my data analysis for the uranium extraction project, along with my report and presentation, have conditioned me for my upcoming work as a University of Idaho research assistant.

Example 2

Optimization of Lipid Analysis in Rat Brain Tissue Using Nano-DESI

Lipids are vital components in biochemical studies due to their capability as markers for disease in tissues. Advances in the field of lipidomics have been assisted by mass spectrometry, an analytical technique that detects charged molecules and represents them as mass-to-charge ratios. However, because tissues contain complex mixtures of molecules, it is difficult to selectively analyze lipids present in the tissue. The goal of this project is to optimize lipid detection in brain tissue. We utilized a technique called nano-DESI MS, which allowed direct and immediate access to the tissue sample being analyzed. Liquid was applied to the sample surface and transferred lipid molecules into the instrument as charged particles. The project was two-fold: first, extraction efficiency was enhanced by testing four neutral organic liquids on the samples; second, ionization efficiency was improved with the introduction of positively-charged reagents. Additionally, a lipid database is being enhanced as a tool to facilitate quicker analysis of complex samples. Further research will include structural determination of unidentified lipids by reactive chemistry and analysis of brain samples affected by drugs or neurological disorders.

Throughout my summer term, the DOE SULI program offered great support and instruction. The EMSL user facility at PNNL, with the mission to create a collaborative, multi-disciplinary research environment and fuel scientific innovation, granted access to technology and instrumentation that contributes to the biological systems core capability. I am most grateful to my mentor Julia Laskin and post-doctoral co-worker Ingela Lanekoff for guiding my progress and assigning such a fulfilling project this summer. Working as a summer intern provided good insight, concerning my interests and professional goals. Due to my dual investments in research and education, I wish to pursue a career that balances these interests.

Example 3

Effects of Remediation Amendments on Vadose Zone Microorganisms

The Hanford 200 area soil is contaminated due to the the production of uranium and plutonium, historical releases to the land, and leaking underground waste storate tanks. Pacific Northwest National Laboratory (PNNL) specializes in environmental subsurface science and has studied delivering chemical reducing agents to the subsurface via foam delivery technology

(FDT), which utilizes surfactant-based foams to overcome preferential flow paths in the subsurface and fill pore spaces with remediation amendments. However, these other surfactants and reducing agents have an unknown effect on indigenous subsurface microorganisms, and there is no standarized testing to assess these interactions. This is important because microbes have potential to drive either the inhibition or enhancement of amendment effectivness toward a target, thereby directly and indirectly playing a significant role in subsurface remediation.

This project focuses on measuring microbial metabolic responses to remediation amendments using Biolog™ Ecoplates, which are a rapid, inexpensive tool capable of studying remediation effects of amendments and surfactants on micoorganisms. Initial microbe extraction from Hanford 200 Area deep vadose zone sediment showed that surfactants and remediation amendments had little to no affect on microbial growth. Moving toward a more realistic field analog, soil columns were packed with Hanford 200 Area sediment; then, soil was exposed to remediation amendments. The resulting metabolic response and diversity was measured, and the surfactants promoted microbial growth. Additionally, the soil columns were visualized using the X-ray microtomography machine at EMSL to probe for the existence of biofilms. This state-of-the-art imaging technique is rapidly developing as a useful tool for visualizing soil-microbe environments. Overall, metabolic signatures provide a tool to predict effects of remediation amendments on subsurface microorganisms. This project exhibited the resilience of deep vadose zone microorganisms and gave the unique opportunity to study Hanford microorganisms.

PowerPoint Presentations Guidelines:

SULI participants have the option to deliver a 12-minute long oral presentation before an appropriate peer group, determined by the host institution. This peer group setting can, for example, involve other SULI participants, other students or visitors, the student's research team, group, division, etc., or combinations thereof. Talks will be scheduled for a 10-minute long discussion, with an additional 2 minutes allotted for questions and discussion. The subject matter for the presentation is to be based upon the participant's internship research project activities. Prior to the presentation, submission, via Educationlink, of a short (150 word) abstract summarizing the presentation content, as well as all final content used in the presentation, is required. The abstract and presentation content should be submitted in a combined single Adobe Acrobat (.pdf) file, and host institutions will provide detailed instructions regarding the file submission on the EducationLink online system. Oral presentations provide participants an opportunity to present their abstract verbally to a wider audience. Planning and practice will make your oral presentation clear, effective, and rewarding.

For all PowerPoint presentations where you are representing PNNL or Battelle, use the approved formats. The PNNL templates (macros) can be downloaded from the PNNL installer. Battelle templates can be downloaded from Battelle Brand Management.

Preparing the Presentation

- When preparing for the presentation, the following steps will help you as you outline your presentation:

- *Select your subject*. Identify your primary subject, the limitations to the subject, and your attitude toward the subject. If you are enthusiastic as well as knowledgeable about your subject, you will generally be a more dynamic presenter.
- *Define your purpose*. Clearly define the purpose of your presentation in audience terms. What do you want the audience to remember and take away from the presentation?
- *Analyze your audience*. Some things to consider include the size of the audience, their sex and ages, their education, their knowledge of your technical area and topic, and their possible biases toward your topic.

- *Select the main points*. Audiences will retain only a limited amount of information, so do not overload your audience with too much information. Choose three to five main points (depending on the length of your presentation). Add supporting points for each main point; illustrate these points with statistics, analogies, examples, or descriptions.
- *Spend extra time on the introduction and conclusion*. Although the introduction is short, it is crucial. You need to capture the audience's attention, establish your credibility, and orient them to your topic. Many presenters begin with an interesting story, anecdote, or statistic that will get the listener engaged. The conclusion is equally important. Because it is last, it is often remembered the most clearly. Summarize the main points of your topic, suggest how the audience can use the information, or present a challenge to the audience.
- *Develop effective visuals*. Visuals (images, slides, posters, etc.) can help you clarify, emphasize, or develop your presentation. Develop your presentation first and then develop visuals to reinforce your message.
- *Make sure your material has been cleared* for public release through the appropriate processes.

Consider the Following When Preparing Slides and Other Visuals

- *Use the PNNL branded template*. When necessary, use a template that is client-directed. When using a non-PNNL branded template, be sure to communicate clearly with the client about iconography and style of the presentation. If possible, incorporate the PNNL logo and brand to increase brand recognition within collateral outside the PNNL brand.
- *Include a title slide* with the title of the presentation, your name, and your affiliation.
- If your presentation is longer than 1 hour, *consider including an outline or "road map" visual* so the audience sees where you are heading. If your presentation is lengthy or complex, repeat this outline visual when changing topics or when summarizing your presentation.
- *Keep your slides simple*; present only one main idea per screen.
- Make sure the *imagery is well-balanced and centered*: leave the same amount of white space at the top and the bottom.
- For word visuals, *strive for the "seven-by-seven" rule*: a title and no more than seven bullets with no more than seven words per bullet. Speak in sentences but use phrases on the visual.

- *Develop slides that can be reused* and repurposed for other presentation. Don't use a topic heading and date at the top or bottom of each visual; it limits the use of the visual to one presentation.
- *Use color for impact*. Color can differentiate or emphasize: a small amount enhances your presentation, but too much or too many different colors detract from it. Try and keep to the PNNL branded color palette laid out in the PowerPoint template.
- *Strive for consistent visuals*. Typeface, type size, line length, and margins should be consistent throughout the presentation (e.g., titles should be all the same size).

Preparing for the Presentation

- When you have developed your presentation
- *Practice your delivery*. Rehearse using a tape recorder, and listen to both content and delivery. Practice your presentation in front of a mirror or have your presentation videotaped.
- *Hold a "dry run*." Your peers or even family members and friends can provide feedback to help you see the strengths and weaknesses. After the dry run, revise your presentation or your delivery based on reviewer comments.
- *Visit the room* where you will be speaking. Verify that it has the equipment you need (e.g., DVD and monitor, projector and screen, extra light bulb, extension cord, microphone, or lectern). Review your visuals using the equipment provided to be sure that they can be seen from everywhere in the room. Locate the light switches, power sources, etc., so that you are not searching during the presentation.

Giving the Presentation

The success of your presentation will be determined by the content of your message, your delivery, and your overall stage appearance. Let the audience know the rules of your presentation; for example, tell them whether you will answer questions at the end or whether they can interrupt you to ask a question. Consider the following tips when giving a presentation:

- *Talk directly* to individuals in the audience; direct eye contact with the audience is essential.

- *Vary the pitch* and volume of your voice and your rate of speaking.
- *Be enthusiastic*! Enthusiasm may overcome a certain lack of presentation skill because audiences usually respond well to it.
- *Be aware of your nonverbal message*. Appear relaxed yet controlled; this will communicate competence. Be dynamic; use your hands and body to illustrate or emphasize your points.
- If possible, *allow time for questions* at the end of the presentation. Audiences begin to tune out when you have gone over your allotted time.

Handling Questions

- To prepare for the question-and-answer session, anticipate questions in advance (what's the toughest question someone could ask?) and practice answering these questions. Consider the following tips for "remaining cool under fire:"

- *Repeat the question*. You are responsible for communicating with the entire audience, not just the questioner. Repeat the question so that everyone understands it; this technique also gives you more time to phrase your reply.
- *Clarify confusing or complicated questions*. Be sure you understand the question. If you are in doubt, rephrase it and ask the questioner if that is the question
- *Watch out for multiple questions*. Questioners often ask more than one question, and presenters often blunder when they try to answer two or three questions in one response. Let the audience know which question you are answering, and tackle the questions one at a time.
- *Don't be forced into "yes or no" answers*. Watch out for loaded questions. Take time to phrase your answer carefully.
- *Don't be tricked by multiple choices*. Questioners often pose choices between alternatives (e.g., "a" or "b"). It is perfectly appropriate to answer "c" and explain why "a" or "b" is not the best choice
- *Answer the question completely*. If you are unsure that you have completely or exactly answered the question, ask the questioner if the answer was satisfactory. If a complete answer would require more time than is available, offer to discuss the subject after the session.

- *Treat every question seriously*. Never dismiss any question, even if you have covered the subject in your presentation. Don't put the questioner on the defensive; you will lose credibility with the audience.
- *Keep your answers brief*.
- *Don't be drawn into debates*.
- *Keep your message intact*. Be sure that the question-and-answer session reinforces your message. Find an opportunity to reiterate your message before you close the session.
- *Don't be afraid to say, "I don't know."* If the question falls outside the context of the presentation or outside your area of expertise, say "I don't know."

Resources

Logos and other graphics are available from Digisource.

Laboratory-level presentations are available from PresentationSource. Check this often for updated and/or new presentations.

SAMPLE FORMS

SULI Symposium Abstract Form

Please fill out the form and up-load it to the appropriate folder on the Sharepoint site:
https://collaborate.pnl.gov/projects/SS2012

Please submit your forms by XXX and your final presentation by on XXX

Background Information:

Your Name:

The directorate you are in: FCSD ☐ EED ☐ NSD ☐ EMSL ☐

Your Mentor's Name:

Additional Co-Authors:

College or University you attend(ed), including city and state:

Presentation Information:

Title:

My research fits best into the following "Core Capability Area" at PNNL (please select only one):

☐ Chemical & Molecular Sciences	☐ Applied Materials Science Engin.
☐ Biological Systems Science	☐ Applied Nuclear Science & Tech.
☐ Climate Change Science	☐ Advanced Computer Science, Visual., & Data
☐ Subsurface Science	☐ Systems Engineering & Integration
☐ Chemical Engineering	☐ Large-Scale User Facilities & Advanced Instru.

Please see https://deputydirector.pnl.gov/agenda/2012/Lab_Agenda_2012.pdf **for a description of each of these categories, or refer to pages 12 and 13 of the "*Laboratory Agenda*" brochure you received at the beginning of the summer.**

Please include a brief (150 words maximum) abstract of the research you have been doing this summer (*address what the project is, how you did it, and why you did it*). Type in box directly or cut and paste existing text.

Note: This abstract counts as your "short abstract" DOE deliverable that you will submit along with a pdf version of your presentation.