SEMINAR IN CRITICAL INQUIRY
TWENTY-FIRST CENTURY NUCLEAR SYSTEMS

David V. LeMone
Department of Geological Sciences
University of Texas at El Paso
El Paso, Texas 79968

ABSTRACT

The experimental University College Entering Student Program core course, Seminar in Critical Inquiry, has not only been successful in increasing university student retention rate but also in improving student academic performance beyond the initial year of transition into the University. The seminar course herein reviewed is a balanced combination of student personal and academic skill development combined with a solid background in modern nuclear systems. It is a valid premise to assume that entering students as well as stakeholders of the general public demonstrate equal levels of capability. Nuclear systems is designed to give a broad and basic knowledge of nuclear power, medical, industrial, research, and military systems (nuclear systems) in 20 – 25 hours.

One major problem is in communication with the younger stakeholders and students, who have a pervasive, basic lack of knowledge concerning the historical background and development of the nuclear systems. They have virtually no background with reference to the Hiroshima or Nagasaki atomic bombs; bikinis are feminine swimwear; the cold war and its global legacies are poorly known; and most don't have a clue of that event of 15 years ago we call Chernobyl.

One caveat for the presenter, it is absolutely essential to be impartial. Conflicting views on debatable subjects in nuclear systems should always be presented with a balance of positive and negative positions. Conversely, subjects discussed in nuclear systems must always include not only the problems associated with it but also the economic and human benefits derived from continuing development of it. This is seldom done.

Two critical inquiry-related aspects enriched the nuclear systems portion of the course and yielded some basic lessons to be taken away and placed into practice. The first considers exercises in critical thinking and writing. This involved the analytical investigation of controversial nuclear system articles on such subjects as the Kyoto Treaty. The second and perhaps more significant application has been in utilizing the business marketing discipline of geodemographics and cluster analysis. The data used are based on the US census, electronic sales data, private studies, etc. In order to understand modern cluster analysis and its resultant economic and political impact, you have to be aware of the fact that America, based on geographic zip codes, is divisible into 15 basic lifestyles and 62 relatively homogeneous clusters of people. The city of El Paso, for example, consists mostly of 15 of the 62 clusters. Geodemographics, once it clusters you by your zip code, knows what cars you drive, who you vote for, your income, the cost of your home, what magazines you read, etc. You are where you live. The application is straightforward. Know and understand your stakeholders. What are their issues and concerns? This knowledge is often the margin in a presentation between success and failure.

INTRODUCTION

Undergraduate students entering the University of Texas at El Paso are required to take either UNIV 1301 (Seminar in Critical Inquiry) or UNIV 2350 (Interdisciplinary Technology and Society). These two University College courses were developed to satisfy the university core requirements. Interdisciplinary Technology and Society is offered as an alternate for the Seminar in Critical Inquiry and deals with an assessment of the impact of technology on the environment and our social and cultural institutions. It emphasizes the use of electronic technology as a resource and a tool. The theme, as in the Seminar in Critical Inquiry discussed herein, is to have the student process problems by research, analysis, and discussion in order to arrive at possible solutions.

The centerpiece of the Entering Student Program is the Seminar in Critical Inquiry. The program was initiated in 1999. Its main function is to ease the transition of a student into the university. This transition has to be accomplished for the entering high school students, community college transfer students, transfer students from another university, or students coming back to the university after a long or short hiatus. Each of these student groups has its own special needs and problems.

The development of the university courses is an indirect response to the large number of students dropping out of the University in the Freshmen and Sophomore years. This theme-driven course is designed to provide the student with the academic and social support to survive and thrive in the university community and its environment [1].

The Seminar is a content-based, point-of-entry, basic course which not only has specific content but also emphasizes a series of specific goals for development [1]. These objectives include 1) self assessment and goal clarification; 2) coping with personal and social problems; 3) strengthening performance and academic skills, 4) becoming a participating part of the university, 5) knowing resources and services provided by the university, and 6) increasing awareness of diversity, culture, beliefs, and value systems. We think that this approach will help the student blend into the University community as well as guiding him into academic success.

The Seminar in Critical Inquiry goals and potential outcomes require some major shifts from the traditional handling of such a course. There is, for example, considerable emphasis on cooperative learning and group interaction. In splitting the normally small (25-30 students) seminar classes into groups, a range from three to five individuals is desirable. Four seems to be the most easily workable and utilizable size.

The origin of this course goes back to 1995 and the establishment of a National Science Foundation sponsored program, Model Institution of Excellence (MIE), at the university. The concept initiated with a series of one-hour special courses. These evolved into the pilot program that is called CircLES (Circles of Learning for Entering Students). The CircLES program continues successfully into the present. It is a program that was specifically designed for students in the Colleges of Science and Engineering [1].

Circles is a cluster program consisting of 20-30 students that take Mathematics, English, and Critical Inquiry together as a unit. It seems to work quite well and has greatly enhanced the retention of these students at the University. The course consists of faculty members from Mathematics, Science, or Engineering assisted by student peer leaders. The peer leader has proven to be a critical interface between the students and the professor.

The course subject in all seminar courses is variable and selected at the discretion of the professor. Professors submit applications to be reviewed. Selection for the seminar courses is approved on the basis of the validity of the subject matter and how well the applicant proposes to integrate it with the goals of the seminar [1]. Professors within the clustered programs try to coordinate with each other on subject matter.

Students enrolled in the rest of the University, as well as those Science and Engineering students unable to fit into the cluster classes of the CircLES program, are integrated into non-clustered Seminar in Critical Inquiry classes. Some experimental clustering, along the lines of the CircLES program, has been introduced in the Liberal Arts areas of Political Science and Sociology.

The University College for both seminars, as well as those involved in teaching the Interdisciplinary Technology and Society, gives orientation and developmental workshops for both professors and peer leaders. The upper division student peer leaders meet periodically throughout the semester. Additionally, a series of excellent optional, periodic all-faculty seminars offered by CETaL (Center for Effective Teaching and Learning) are available for the professors.

It should be noted that professors operating within any of the University College courses must be aware of the makeup of the students in his/her seminar. The nuclear seminars, for example, have been given at three quite different times, which resulted in distinctly different groups of students. The first time that it was taught (fall 1999), the class was composed of recent high-school graduates. The second seminar was a late afternoon-early evening class that had older students, a few of high school age, and five maquiladora supervisors who were getting the course paid for by the management of their various companies.

The latest nuclear systems seminar class offered met on Saturday morning during the fall semester of 2001. This experimental Saturday class addressed an institutional mandate. The University has a responsibility to utilize its facilities to the maximum as well as giving the broadest segment of the public the opportunity for higher education. This not only includes students on the standard degree route but also returning university graduates taking courses to upgrade and update their background. The Saturday class was mostly composed of men and women in their twenties to thirties mixed with a few normal aged Freshmen. The majority of students within this seminar class were employed, working anywhere from 20-50 hours/week and carrying one to three courses. The lesson to be learned here is that in order to be effective you must know your student stakeholders. The Saturday class students cannot be taught effectively in the same manner as standard high school graduate Freshmen.

TWENTY - FIRST CENTURY NUCLEAR SYSTEMS

The basic premise of this paper and the earlier one on Nuclear Enviroethics [1] is that the average high school graduate and the general public stakeholder are comparable. They should be able to equally assimilate the broad areas of nuclear-related systems and how they impact not only the society of today but also that of tomorrow. In essence, it is equating the entering student to the general public. If you can teach an appreciation of the dimensions of nuclear-related systems and technologies, you should be able to apply the lessons learned here to the general public. The content is taught in half of the three-hour semester course. Therefore student exposure to the content of the course must be given in roughly 22-23 hours of lecture and group studies. The other half of the course deals with the mandated application of developing the

student while utilizing the content of the first part as the theme. This is discussed herein under the section called Critical Inquiry.

These nuclear seminars, as the majority of the rest of the other University College seminars offered, have two texts; one is selected for the course content and the second for a self-help collegiate - level text. The texts selected for all three seminars courses were Murray's [2] "Understanding Radioactive Waste" and Gardner and Jewler's "Your College Experience: Strategies for Success" (YCE) [3]. Murray is the ideal text for students in this course as well as for the average stakeholder. It is inexpensive; well written, illustrated, and organized; fundamental; and direct. Despite being out of date, it provides an excellent foundation for the reader. Enhanced with overheads, selective handouts, and internet resources, the text raises the level of the student's comprehension significantly.

The content portion of this course is not given without some difficulty. World War II and the bombing of Hiroshima and Nagasaki are historical events with little understanding to the vast majority of the public. The Cold War and the U.S. and Soviet Nuclear weapons arms race are poorly understood. The resulting abandoned and operational nuclear complexes and their legacies are only vaguely comprehended. When Chernobyl [4] is discussed, it is only brought home to students by showing them the classic film, "Chernobyl, a taste of Wormwood." Many had heard of Tokaimura, but they were not sure as to what it concerns. Part of the responsibility to either students or stakeholders is to be certain that the audience has some sort of a historical perspective. A historical perspective of varying length and content is most useful for comprehension for almost all. Such a historical foundation should include critical events such as: the Manhattan Project; the atomic bombing of Hiroshima and Nagasaki; the Cold War nuclear race and the resulting legacy of weaponry development, production, and testing; and a selection of some of the more spectacular and newsworthy recent and past nuclear accidents (e.g., Three Mile Island, Juarez Cobalt–60 source, Chernobyl, etc.).

There is one particularly nice thing about teaching a course involving nuclear systems. It is that there is always something happening. A selection of those events that coincided with the courses were: the Tokaimura accident in Japan, the successful Pakistan and Indian nuclear tests and the subsequent regional and global military and political impacts, the continuing Kyoto debacle, and the ongoing question of nuclear terrorism since last September 11. The ongoing problems of increasing future energy needs, dependency on foreign petroleum, and the problem on the greenhouse gases and the Kyoto protocol need also to be discussed and assessed. As can be seen by this selection above, the bulk of these press-worthy events are negative.

It also would seem to be reasonable to conclude that it might be worthwhile to share some examples of the benefits arising out of this same much-maligned nuclear system. That is with the proviso that is always required: the presenter must always give a clear and balanced presentation of both the positive and negative aspects. Any lack of balance in the presentation typically results in a loss in the integrity of the individual and a reversed response to the biased view given. From the late eighties, when my first involvement with nuclear waste occurred, to the medial nineties, the problems surrounding radioactive wastes and their disposal were the predominant factors to be examined. The consideration of the positive uses of radionuclides were largely confined to geological (e.g., radiometric dating, gamma ray-neutron well logging, tracers, etc.) and medical applications (e.g., therapeutic sources, etc.).

The further evolution of the positive balance of presentation came as a result of a keynote speech given by Alan E. Waltar of Advanced Nuclear and Medical Systems at the American Nuclear Society meeting in Albuquerque on November 17, 1997 [5]. The title of the speech was

"Non-Reactor Nuclear Technology Applications in the 21st Century." It covered many applications in industry, agriculture, nuclear medicine (diagnostic and therapeutic), environmental protection, scientific research, and agriculture (food irradiation or cold pasteurization). The current seminar course title is "Twenty-First Century Nuclear Systems," echoing Waltar's title, as does its predecessor "Nuclear Enviroethics in the Twenty-First Century." Both titles are particularly appropriate for this time.

Murray [2] gives a brief, broad spectrum of 11 isotope and radiation applications in his chapter 8. It is enough for an introduction, but it desperately needs to be updated and greatly expanded. Those involved in nuclear systems have a responsibility to educate the stakeholders on the geometrically increasing beneficial applications developing in the non-power plant area. As an example, the utilization of nuclear power plants for the desalinization of seawater is moving from site-specific conceptual status [6] to economic analysis [7] to consideration of the safety aspects of nuclear plants coupled with desalination units [8]. This is something of critical concern for students and stakeholders living in arid regions adjacent to oceanic waters. It is also of some interest to those in high population areas where potable subsurface and surface waters are limited. In the local case, it would be applicable to the conditions observed in the international metroplex of El Paso and Juarez. The target in this case would be the subsurface brackish and higher saline aquifers underlying the region.

It should also be noted that Waltar [5] was able to substantiate the overall economic impact of the sales and jobs directly involved in radioisotopes and nuclear energy. He utilized government documents and statistical abstracts from 1991 and 1995 to show growth in sales (330 to 421 billion dollars) and the growth in millions of jobs (4.1 to 4.4). In 1995 radioisotope revenues were 331 billion, whereas nuclear energy totaled only 90 billion dollars. In that year there were 4 million jobs held in the radionuclide area versus a static 400,000 in the field of power plant nuclear energy. In the 1994 statistical abstract, only 11 nations in the world had gross national products in excess of $300 billion [5]. Students and stakeholders should know that upon entering the hospital the chances of you interfacing with radionuclides are about 1 in 3. Obviously, all of these data need to be introduced in a balanced form to both students and stakeholders. All of this being noted, it should always be remembered that the universal problem of radioactive systems is the interface existing between radioactive waste and the biosphere.

The general sequence for course content should initiate with some fundamentals on nuclear architecture, units utilized (both classic American and the standard SI), basic terminology, the nuclear power cycle, biological effects of radiation, and the concepts of fission and fusion. The next area of consideration should be the standard United States radioactive waste classification scheme. The problem of other international waste classifications should also be discussed such as the International Atomic Energy Agency (IAEA) classification scheme. An examination of the types and the quantities of waste generated by natural (e.g., radon), defense (legacy and current wastes), medical, industrial, and research sources is then examined.

After that, the basic nuclear power plant fuel cycle is then revisited. It is reintroduced with each step of the cycle, from the front end to the back end, being evaluated for the class and quantity of wastes produced. The distribution of the reactors of the world [9] and their contribution to the 16% total global energy scenario are examined. All types of the reactors are introduced and discussed with reference to their global and national numbers, their positive and negative features, and their operational characteristics. The questions of reprocessing (e.g., MOX), recycling (e.g., decommissioning recyclable copper metal), volume reduction (e.g.,

incineration, filtration, etc.), and storage problems (e.g., spent nuclear fuel rod pools) are likewise addressed.

Repository aspects represent the next area of concern: site selection, waste classification types (e.g., TRU waste), concepts (e.g., deep geological), historical problems (commercial low-level waste repositories), and future utilization (high level and Yucca Mountain). The problems of radioactive waste transportation, radioactive waste storage, risk analysis, decommissioning, decontamination, recycling, and the ever present political manipulation must be covered also.

The final discussions need to revolve around the political and legal aspects of the system. This involves presentation of the functions and responsibilities of the major international (IAEA), federal (e.g., Nuclear Regulatory Commission), and state (e.g., Texas Natural Resources Conservation Commission) regulatory agencies. Presentation of the major national regulatory acts (Table 1) [10] that are used and the international areas of nonproliferation [11] and safeguards [16] are also introduced.

What did the students consider to be important? They were asked to sit down with the Murray text [5] and pick out the four chapters they considered to be most interesting and informative. The results were that over half of them selected Chapter 18 (Health, Safety, and Environmental Protection). The next most selected chapter was Murray's initial chapter, which he entitled "Questions and Concerns about Wastes." The next level selected included: Biological Effects of Radiation (5), Radiation Standards and Protection (6), and Disposal of Spent Fuel (21) [5]. As a personal observation, current, near current, active, continuing, and future impact radioactive-related issues, intertwined with the course outline, seems to represent the necessary key for capturing and holding the interest of both students and stakeholders.

CRITICAL INQUIRY

The other aspect of the course covers student development. Your College Experience [3] is the text selected for the Critical Inquiry half of the course. It is divided into three major sections: Introduction (3 chapters), Classroom and Academic Skills (10 chapters), and Personal Growth (7 chapters). Several chapters of this text not only blend very nicely into subject matter of the course but also provide very useful applications.

Introductory Section

The introductory section contains a particularly useful chapter on critical thinking and writing. Utilization of critical thinking and writing is what the course on Critical Inquiry is all about. The knowledge that students and stakeholders require is the realization that everything written or seen on television is not always correct and is commonly slanted to an agenda. It seems that writing by its very nature is not accomplished without an ulterior motive, either positive or negative. An example of this would be the numerous articles on the danger of low-level radiation exposure [12] versus those stating the benefits of low-level radiation (e.g., hormesis). The forthcoming WM 02 conference will have a panel section devoted to this subject [13]. The same experiment can readily be made with an examination of the volatile and conflicting attitudes on the Kyoto protocol and the greenhouse gases. It is necessary to sit down and carefully dissect what is being written and observe if there are exposed logic flaws in the arguments (e.g., circular reasoning, red herrings, ad populum, etc.). The spoken word and images, as on television, are powerful subliminal influences. Their messages often consist of a

string of sound bites, combined with a selection of the desired "proper" images for public consumption. The messages are often designed to lead directly to desired conclusions. The stakeholders of this country are constantly being sliced and diced by these hucksters without conscience. This, of course, is well documented in the areas of politics. Piccitto [14] has an excellent text worth review on this subject. I fear that cynicism is a necessary skill in relation to modern society's written and telecommunication blitzes.

Classroom and Academic Skills Section

The bulk of the YCE text [3] is concerned with the section on academic skills. The critical chapter in that segment concerns the problem of time management. It remains as the most important foundation for academic and personal success. Half of this second section's chapters deal directly with useful academic survival skills and tools (learning styles, lecture analysis, text analysis, review techniques, etc.). Chapters on the techniques of oral communication and choosing courses and a career add to these basic skills. This last basic academic and life skill is a central problem for most students: the selection of which university disciplines to take for study and what will be the ultimate career decision.

Two useful chapters are included on electronic (computer) communication and the campus library. The electronic resources of the library at this institution, as well as others, is undergoing truly radical changes from semester to semester. Simply knowing how to use the available tools requires a quarterly updating for both students and faculty. This facility for example is also interconnected with the other 15 institutions of the University of Texas System. One-half of the first week is always devoted to reviewing the available library resources. During the student's visit to the library they learn to search specific items on the available electronic databases as well as the on-line journals (e.g., Cobalt-60 radiation sources used for food sterilization). They are introduced to the library hard copies of the Congressional Record as well as gaining familiarity with the electronic access. They likewise have the opportunity to be introduced to the hard copy sources of the basic 15 major environmental acts and the Code of Federal Regulations (Table 1) [10].

Personal Growth Section

Fully one-third of the YCE text is concerned with the non-academic personal growth activities. This is the area that the university student is in constant daily contact with. The subjects in this section cover such areas as managing stress, relationships, values and standards, and money management. Diversity is handled in this segment also. In working with the presentation of diversity, I stumbled on an interesting and useful application by going forward with the presumption that one of the basic characteristics of a democratic society is the inherent freedom of its citizens to move. That ability extends to not only physical mobility but also economic and social mobility. We can live or move to anywhere we wish, but we do not necessarily do so. Why is that? The simple fact is that as a nation we are no longer cosmopolitan, if we ever were, nor are we that so-called fabled "melting pot" that we are so often linked with. We live together in a provincial mosaic of little villages or clusters within regional towns, cities, and metropolitan city states with people with whom we share the same values and attitudes. These villages or clusters do not remain static, they are mobile, constantly dissolving

in old neighborhoods, and reassembling in new areas. The thing that makes it fascinating is the consistency of these clusters.

If you want to examine diversity in a modern sense, it is appropriate to think of it in the concepts of cluster analysis. This subject is a subset of geodemographics, a marketing science discipline of business. Cluster analysis seeks to analyze and predict what you are like, what messages turn you on and off, and how you think. Weiss [15] has written the fundamental, non-specialist volume for this discipline. He states we are truly diverse. That observation was based on the fact that the 1990 census reports the existence of some 300 races, 600 Indian groups, 70 Hispanic groups, and 75 ethnic combinations. There is much more to this than the simple census validation of perceived and real diversity in the American population. It is simply one factor in many to be considered.

The Claritas organization was the pioneer in cluster analysis. Based on the 1980 census they subdivided America into 40 clusters of life styles. Claritas and its PRIZM system today subdivide the 281.4 million people in America into some 15 social groupings (e.g., Elite Suburbs, Urban Midscale, Working Towns, etc.) of the basic 62 life style clusters [15]. The major key to the 1990 cluster analysis, as the 1980 analysis, has been the U.S. Census Bureau data. These basic data are enhanced with private market research surveys, public opinion polls, point- of- purchase receipts, on-line data, etc. What these 62 clusters reveal is how you live, what you buy, and your basic life style (e.g., Kids and Cul-de-Sacs [upscale suburban families], Latino-America [Hispanic middle-class families], Rural Industria [Low-income blue-collar workers] etc.)[15].

Each cluster classification indicates what you will buy, what media you follow, services, what automobiles you drive, the cost of your homes, etc. It reveals whether you prefer Knudsen's low-fat cottage cheese or Kraft Macaroni and Cheese. You will have clusters of similar political attitudes and entertainment tastes. This certainly was not lost on the Clinton-Gore campaign that targeted the swing voters in the 1996 election. Along with the Perot factor, this won the presidency for the Democrats. Interesting cluster analysis post-mortems of the 2000 election have been and will continue to be coming out (the political divisions between Heartlands and the East and West coasts) [15].

The methodology of separation of the clusters is relatively simple. In America we use individual zip codes to define our modern geography. As Weiss [15] points out, when you say oil to someone in the Winner's Circle cluster, it means extra virgin olive; when you say oil to someone in Rural Industria cluster, it means Quaker State [15]. The concept of' saturation, shotgun mass marketing is no longer competitive. Modern marketing, whether it be for a political campaign, a clothing store, or a plumbing business, is much more targeted in order to receive the maximum benefit for the dollar spent. Another casualty of the modern world seems to be personal privacy.

In addition to Claritas and its PRIZM system, there are other international cluster analysis firms including Canada's Compuserve with its PSYTEUSA system and Europe's Experian and its MOSAIC system [15]. These organizations approach the basic cluster analysis data with different interpretive styles; consequently, they end with different names and numbers for the clusters. Some of these clusters may be easily related while others will be difficult, if not impossible, to equate. The English-based Global MOSAIC is considered to be the top cluster group organization on a worldwide basis. They track 19 countries that have an aggregate of 631 clusters, which may be distilled into 14 basic global life styles. This clustering analysis is of only

800 million people, but this group produces nearly 80% of the world's gross domestic product [15].

This clustered world erected by Weiss to describe the discipline of geodemographics fits well not only into the university classroom in nuclear systems but also in the broader area of communication with the stakeholder. In the class, it is a simple, easily developed exercise utilizing the El Paso metropolitan area zip code map taken out of the telephone directory. The zip code numbers are combined with the clusters, which have been downloaded from the Claritas internet site. You are where you live.

El Paso has some 15 primary clusters, which are distributed, unevenly across the city. Unlike many typical university campuses we are somewhat of a "subway" college with the majority of our students living off-campus. Therefore it is possible for you to give a class exercise with cluster data for each city zip codes and ask for an accuracy critique by the students who live in that zip code. Then ask them based on the El Paso cluster-code data, in what zip code they would locate an upscale jewelry store and a new Taco Bell. The additional take-home questions posed are, how has your zip code cluster changed in your lifetime and in your parents' or an older resident's lifetime living in that zip code? The result of this exercise consists of a clear understanding of the mobility of the population and the stability and relative uniformity of the clusters.

LESSONS LEARNED

1. The University College Entering Student Program course Seminar in Critical Inquiry has been not only successful in increasing the university retention rate but also in improving student academic performance beyond the initial year of transition into the University.

2. A course combining the development of student personal and academic skills combined with a solid background in a discipline has proven to be successful at this University.

3. The premise that entering students and the stakeholders of the general public appear to demonstrate equal levels of capability appears to be a valid one.

4. A broad and basic knowledge of nuclear power, medical, industrial, research, and military systems (nuclear systems) can be taught in a 20 – 25 hour course.

5. There is a pervasive, basic lack of knowledge concerning the historical background of the development of the nuclear systems. This is a major problem in communication with younger stakeholders and students today.

6. In order to be considered valid, conflicting views on debatable subjects in nuclear systems should always be presented with a balance of positive and negative positions.

7. Subjects discussed in nuclear systems need to include not only the problems associated with it but also the economic and human benefits derived from continuing development of it.

8. The critical inquiry-related aspects enriching the nuclear systems portion of the course include:

- Exercises in critical thinking and writing involving the analytical investigation of controversial nuclear system articles on such subjects as the Kyoto Treaty.
- Introduction and research into the electronic and hard copy resources of the library in the areas of nuclear systems and its regulatory background.
- Application of the discipline of geodemographics and cluster analysis in order to understand the modern concept of a cluster analysis and its resultant economic and political impact. You are where you live.

CONCLUSIONS

A number of conclusions can be derived from the experiences gained in working with these entry-level courses. The core-required University College seminar programs have now been proven to be successful for entering students. The premise that the comprehension and capability of entering students and the average stakeholder gives greater importance to the methods and approaches used in the nuclear systems courses. It is possible to present a broad, basic, interesting background in nuclear systems in 20 – 25 hours of presentation. The basic text for this course by Murray needs to be expanded and updated into its fifth edition.

Historical background data, dependent on subject, may often turn out to be significantly useful. In working with an inclusive course or a discussion series, the utilization of current, on-going, and recent system-related events is particularly useful in maintaining interest. It is essential to balance positive and negative features or viewpoints when discussing nuclear systems and their controversial issues.

This study has developed two major points. The first is that the stakeholder, given the proper guidance, can very quickly become knowledgeable in the broad area of nuclear systems. The second point deals with the inability and continuing failure of those promoting nuclear systems to reach their audience. Don't send an Ivy League engineer to run a stakeholder meeting of hardscrabble ranchers in Nevada, unless the engineer really knows his audience. These ranchers reflect where and how they live. If you are planning to influence the stakeholders of this world, you had better listen to what they have to say. Even more critical, you better know who they are. These are the data you extract from geodemographic cluster analyses. Based on the rancher's zip code, you can determine which of the 62 life styles and 15 groups these ranchers belong to. You will gain insight into their level of education, political views, what cars they drive, and whether they like salsa or not. Furthermore, in normal cases where disparate groups live together in the same zip code, they are listed sequentially by decreasing numbers. There are two ways to be effective in arguing on controversial issues: listening to your audience and knowing who they are.

REFERENCES

1. D. V. LEMONE, "Seminar in Critical Inquiry: Nuclear Enviroethics in the Twenty-first Century," Waste Management 2001, Session 67, paper 7, 15 p. (2001)

2. R. L.MURRAY, "Understanding Radioactive Waste," Battelle Press, 4th edition, Columbus, Ohio, 212 p. (1994)

3. J. N. GARDNER and A. J. JEWLER, "Your College Experience (YCE), Strategies for Success," Wadsworth Publishing Company, 4th edition, Belmont, California, 324 p. (2000)

4. G. J. VARGO, "The Chernobyl Accident: A comprehensive Risk Assessment," Battelle Press, Columbus, Ohio, 271 p. (2000)

5. A. E. WALTAR, "Non-Reactor Nuclear Technology Applications for the 21st Century," Keynote speech, Winter Meeting 1997, Albuquerque, New Mexico (1997)

6. IAEA, "Status of non-electric nuclear heat applications: Technology Safety," IAEA-TECDOC-1184, 156 p. (2000)

7. IAEA, "Examining the economics of seawater desalination using the DEEP code," IAEA-TECDOC-1186, 81 p. (2000)

8. IAEA, "Safety aspects of nuclear plants coupled with seawater desalination units," IAEA-TECDOC-1235, 81 p. (2001)

9. NUCLEAR NEWS, "World List of Nuclear Power Plants," vol. 44, No. 3, p. 35-61 (2001)

10. IT, International Technology Corporation, "Where to find the Regulations: Environmental Acts and Code of Federal Regulations" (1992)

11. M. R. BUCKNER and T. L. SANDERS, "Enhancing global nuclear proliferation with a strong U.S. nuclear enterprise," Nuclear News, vol. 44, No. 2, 29-32 p. (2001)

12. J. J. MANGANO, "Low-Level Radiation and Immune System Damage: An atomic Legacy," Lewis Publishers, New York, 227 . (1999)

13. J. B. MUCKERHEIDE and J. A. MEYER, JR., "Panel Session: Low-Level Radioactive Health Effects: Challenging Radiation Protection Policy and Constraints on Applying Low-Dose Radioactive (LDR) Radiation to Stimulate Health and Medical Benefits," Session 10, WMOZ (2002)

14. M. PICCITTO, "Critical Thinking," Prentice Hall, Upper Saddle Creek, New Jersey, 200 p. (2000)

15. M. J. WEISS, "The Clustered World," Little, Brown and Company, Boston, 232 p. (2000)

16. D. SCHRIEFER, "The Strengthened Safeguards System-Implementation Status," Session 1-A, Paper Proceedings of the 42nd Annual Meeting of the Institute of Nuclear Materials Management, 8 p. (2001)

Table I ENVIRONMENTAL ACTS [10]

	CONGRESSIONAL ACTS	CODE OF FEDERAL REGULATIONS
1	Atomic Energy Act (AEA)	10 CFR (0- 199, 703 -1060)
2.	Clean Air Act (CEA)	40 CFR (50-87)
3.	Comprehensive Environmental, Response compensation and Liability Act (CERCLA) & Superfund. Amendments and ReAuthorization (SARA)	40 CFR (300-372)
4.	Clean Water Act (CWA)	40 CFR (104-140,401-471)
5.	Federal Insecticide, Fungicide & Rodentcide Act (FIFRA)	40 CFR (152-180)
6.	Hazardous Materials Transportation Act (HMTA)	49 CFR (106-179)
7.	National Environmental Policy Act (NEPA)	40 CFR (1500-1508)
8.	Occupational Safety and Health Act (OSHA)	29 CFR (1900-1999)
9.	Radiation Protection Programs	40 CFR (190-192)
10.	Resource Conservation and Recovery Act (RCRA)	40 CFR (260-272)
11.	RCRA/Solid Waste	40 CFR (240-257)
12.	Safe Drinking Water Act (SDWA)	40 CFR (141-149)
13.	Surface Mining Control and Reclamation Act (SMCRA)	30 CFR (301-955)
14.	Toxic Substances Control Act (TSCA)	40 CFR (702-799)
15.	Underground Storage Tanks (USTs)	40 CFR (280)