FINAL REPORT OF THE DEPARTMENT OF ENERGY
PILOT INTERNSHIP PROGRAM ON RADIOACTIVE WASTE

At

VANDERBILT UNIVERSITY
(September 1, 1993 to August 31, 1994)

I. Introduction

The tenth and final year of the program began with the selection of new interns. Mailings were sent to prospective graduate students and rising juniors at Vanderbilt University with grade point averages of 3.0 or better (out of 4.0) advertising the availability of internship in radioactive waste disposal. The choice of interns this year was difficult since the number and quality of applicants was so high. The interns selected were:

STUDENT	STATUS	GRADE POINT AVERAGE
Sarah J. Hazen	First-year Graduate Student in Environmental Engineering B.S. Civil Engineering - University of Minnesota with Distinction	3.6/4.0
Joseph P. Houghton	First Year Graduate Student in Environmental Engineering B.S. in Engineering Loyola Marymount University Magnum Cum Laude	3.7/4.0
Julie A. Huckaba	First-year Graduate Student in Environmental Engineering B.S. Civil Engineering - University of Memphis - Magna Cum Laude	3.8/4.0
Don Lamb	First-year Graduate Student in Environmental Engineering B.S. Civil & Environmental Engineering North Western University	3.3/4.0
Dana E. Marcinak	First-year Graduate Student in Environmental Engineering B.S. in Civil Engineering - Vanderbilt University	3.2/4.0

Their vitae are included in Appendix A

DISCLAIMER

Sarah J. Hazen spent her summer internship at Bechtel National in Oak Ridge where she studied Compilation and Screening of Available Chemical Test Kits for Field Monitoring Use at FUSRAP Sites. She graduated and went to work for a consulting firm.

Joe Houghton was at the EG&G Geotech Technical Measurements Laboratory where he made a qualitative Evaluation of Computer Models using Various Geophysical Techniques to Detect Targets Buried in the Rabbit Valley Geophysics Performance Evaluation Range. He graduated and went to work for the Los Angeles County Sanitary District.

Julie A. Huckaba went to work at Oak Ridge National Laboratory where she studied The Use of CAP-88 Atmospheric Pollutant Transport Model to Estimate the Dose to Oak Ridge Residents. She graduated and went to work for a consulting firm.

Don Lamb spent his summer internship at Bechtel National in Oak Ridge where he studied The Implementation of an In-Situ HPGe Spectroscopy system for On-Site Characterization of Radionuclides. He went to work for a consulting firm.

Dana Marcinak spent the summer at the Savannah River Technology Center where she did a Liquidus Study for High Sodium Content low-level Glass Formation. She graduated and went to work for a consulting firm.

Many of the students would have returned to their Intern sites for jobs but because of downsizing none were available.

II. Course of Studies

As outlined in the proposals for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 153, Principles of Modern Physics; Physics 238, Atomic and Nuclear Physics (Laboratory course); and CE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix B. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed hazardous chemical and radioactive waste problems. Graduate interns are also encouraged to take CE 310, Probabilistic Methods and Engineering Design; CE 299, Risk Assessment; Economics 283, Economics of Natural Resources and the Environment; CEE 299, Environmental Policy; and Environmental Law at the Law School.

III. Intern Assignments

Applications were solicited from the firms initially suggested by DOE and from other prime contractors doing environmental restoration and waste management work. Those solicited were: Argonne National Laboratory, Bechtel National, Inc., Martin Marietta Energy Systems, NUS Corporation, IT Corporation, Westinghouse Hanford Operations, EG & G Geotech Technical Measurements Laboratory, Sandia National

Laboratory, and Westinghouse Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix C. A curriculum vita for each student was sent to each company (shown in Appendix D). It was stressed with the company representatives that the internship must be a learning experience in environmental restoration and waste management.

The students were counseled on the various opportunities, but were encouraged to make independent choices consistent with some distribution among companies and projects. Each student was reminded that he/she was required to do a senior paper of master's thesis on a topic within the environmental restoration and waste management field. A letter reminding them of the obligation to do so was sent to each intern. Each student then made his/her choice.

All interns returned to school after their practicum.

Andrew T. Allen was at EG&G Geotech Technical Measurements Laboratory where he made a qualitative Evaluation of Remedial Alternatives for Lease Tracts Administered under the Uranium Lease Management Program. He graduated and went to work for a consulting engineering firm.

Stephen G. Cope was at Oak Ridge National Laboratory where he studied Leak Testing at the Oak Ridge National Laboratory. He graduated and went on to law school.

Phillip D. Gibbs was at Bechtel National where he studied the Removal of Radionuclides from Soil using ESI-600 and ESI-605X Chelating Agents at the Colonnie Site. He graduated and went to work for a consulting engineering firm.

Jeffrey S. Leong was Pacific Northwest Laboratory where he studied The Effect of Political Risk on Environmental Decisions. He graduated and went into the Air Force.

Craig Charles Saur was at the Westinghouse Savannah River Site where he studied The Salt Solubility of low-level Mixed Wastes in Glass. He graduated and went on to graduate school.

IV. Technical Advisory Committee

No Technical Advisory Committee was held because of the termination of the program.

V. Internship Program Not Renewed

The only educational programs in environmental management that were continued were those in South Carolina, New Mexico and Historically Black Colleges.

VI. No Recruitment of New Students

The Internship Program was terminated.

VII. Quality Assurance

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the program director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter, the program director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further works on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, the appropriate faculty member continues to work with the student.

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at

VANDERBILT UNIVERSITY
(September 1, 1992 to August 31, 1993)

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The ninth year of the program began with the selection of new interns. Mailings were sent to prospective graduate students and rising juniors at Vanderbilt University with grade point averages of 3.0 or better (out of 4.0) advertising the availability of internships in radioactive waste disposal. The choice of interns this year was difficult since the number and quality of applicants was so high. The interns selected were:

STUDENT	STATUS	GRADE POINT AVERAGE
Andrew T. Allen	First-year Graduate Student in Environmental Engineering B.S. Civil Engineering - Tennessee Technological University	3.7/4.0
Stephen G. Cope	Junior in Civil & Environ. Eng. - Vanderbilt University	3.5/4.0
Philip D. Gibbs	First-year Graduate Student in Environmental Engineering B.S. Civil Engineering - University of Kansas - Distinction	3.8/4.0
Jeffrey S. Leong	First-year Graduate Student in Environmental Engineering B.S. Civil & Environ. Eng. - Vanderbilt University - Magna cum Laude	3.6/4.0
Timothy E. Musick	First-year Graduate Student in Environmental Engineering B.S. in Civil Engineering - Tennessee Technological University	4.0/4.0
Craig Charles Saur	Junior in Civil & Environ. Eng. - Vanderbilt University	3.9/4.0

Their vitae are include in Appendix A.

II. Course of Studies

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 153, Principles of Modern Physics; Physics 238, Atomic and Nuclear Physics (Laboratory course); and CEE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix B. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed hazardous chemical and radioactive waste problems. Graduate interns are also encouraged to take CE 310, Probabilistic Methods and Engineering Design; CE 299, Risk Assessment; Economics 283, Economics of Natural Resources and the Environment; CEE 299, Environmental Policy; and Environmental Law at the Law School.

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The students were counseled on the various opportunities, but were encouraged to make independent choices consistent with some distribution among companies and projects. Each student was reminded that he/she was required to do a senior paper or master's thesis on a topic within the environmental restoration and waste management field. A letter reminding them of the obligation to do so was sent to each intern. Each student then made his/her choice.

Sherry Anne Fuls terminated her internship after the first semester for personal reasons. She was doing A work at the time.

Richard L. Bell terminated his internship after a few weeks of the first semester for personal reasons.

The remaining interns returned to school after their practicum.

Laura K. McWhorter Artates was at Bechtel National where she helped determine alternative methods of solidification/stabilization for fine powder mixed radioactive and hazardous chemical waste. She plans to complete her course requirements in the fall semester. She has accepted a job with Bechtel National at Oak Ridge, TN where she did her practicum.

Scott F. Siegwald was at Westinghouse Savannah River Company where he experimented with three alternative methods for acidifying the high level waste sludges to make them suitable as feed for the Defense High Level Waste Vitrication Process. He plans to complete his course requirements in the fall semester. He has applied for a job at Westinghouse Savannah River company where he did his practicum. He has sent abstracts of his practicum work to Spectrum '94 and Waste Management '94 for possible presentation.

Thomas M. Smith was at Argonne National Laboratory where he did a field determination of the probable source of an on-site tritium plume. He also tentatively established the dimensions and concentration of the plume. He plans to complete his course requirements in the fall semester. He has applied for a job at Argonne National Laboratory where he did his practicum.

Cynthia Boston was at the Westinghouse Hanford Company where she examined and codified all the regulatory inhibitors, RCRA, CERCLA and Washington State regulations, to using existing and planned liquid effluent treatment and disposal facilities for ground water treatment and disposal facilities. She plans to complete her course work in the spring semester. She has had a job offer from Westinghouse Hanford Company where she did her practicum. She is also considering other jobs and graduate school at this time.

IV. Status of the Second Year Interns

Judy Adler graduated summa cum laude in Civil and Environmental Engineering and has enrolled at the University of North Carolina, Chapel Hill in Environmental Science and Engineering.

Brian Babcock graduated summa cum laude in Chemical Engineering and is employed in the EM Division at Argonne National Laboratory.

Joel Kuehnert will graduate at the end of the fall semester and is looking at graduate schools and job opportunities.

Hoa Tuy La graduated summa cum laude in Chemical Engineering and Mathematics. She applied for a job at Westinghouse Savannah River Company where she had done her practicum, but was not able to be hired because of a job freeze. She has taken a job with a paper manufacturing company, Kimberly Clarke.

Michael Pierce will graduate at the end of the fall semester and has accepted a job at AquAeTer, a local environmental consulting firm.

James Wescott graduated in December and is employed in the EM Division at Argonne National Laboratory.

Douglas Yerkes graduated in December and is pursuing a Ph.D. degree in Environmental Engineering at Vanderbilt University.

V. Technical Advisory Committee

The seventh meeting of the Technical Advisory Committee was held in conjunction with the spring colloquium on February 4, 1993. At the colloquium, the interns presented the results of their

summer work and also described their impressions of the program. In addition, their local sponsors described their experience with the interns over the summer and discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the practicum sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. At the close of the session, the Technical Advisory Committee expressed again its enthusiasm for the program.

None of the expenses of the colloquium or the Technical Advisory Board were paid from DOE funds.

VI. Internship Program Renewal

The Department of Energy has included the Internship Program in its five-year program (ADS Reports). We are grateful for the continued expression of confidence in this program.

VII. Recruitment of New Students

The existence of the Internship Program continues to be publicized by the activities of the students, as detailed previously, and by the activities of the Director. Professor Parker continues to serve as Westinghouse Savannah River Distinguished Scientist Professor at Clemson University. He spent the fall semester there and returned on a regular basis to supervise the work of the interns at Vanderbilt University. This year Professor Parker was invited to make a presentation at the plenary session and present the summary report of SAFEWASTE '93, at Argonne National Laboratory, and to the Advisory Committee to Assistant Secretary for Environmental Restoration and Waste Management.

Professor Parker continues to serve on the Scientific Advisory Board for the Strategic Environmental Research and Development Program of the U.S. Department of Defense, U.S. Department of Energy and the U.S. Environmental Protection Agency, SAIC Environmental Technical Advisory Board for FUSRAP, Steering Committee for the University of Tennessee - Martin Marietta Joint Educational Program in Environmental Restoration and Waste Management, National Academy of Sciences National Research Council Board on Eastern Europe and Eastern Asia, External Review Committee of the Pilot Risk Assessment Studies of DOE Sites, to the International Programme Committee of Safewaste '93, University of Tennessee's Advisory Committee for the Waste Management Research and Education Division, Advisory Committee for Martin Marietta's HAZWRAP Division, Westinghouse Hanford Company's External Advisory Committee on Waste Management, and Westinghouse's West Valley Waste Advisory Committee.

Professor Parker was appointed to the International Institute for Applied Systems Analysis (IIASA) Advisory Committee for the Eastern European Protection of the Biosphere (MAYAK) and the International Atomic Energy Agency's Waste Management Assessment and Technical Review Programs Peer Review Committee of the Czech Republic's Research and Development Programme for a Geological Repository. Further national publicity for the program is obtained because Vanderbilt University has been designated by the Department of Energy as a participating program in the U.S. Department of Energy Environmental Restoration and Waste Management Fellowship Program. This designation permits graduate students, appointed as fellows in the program, to hold their fellowship at Vanderbilt University. The program director of the Internship Program is also the coordinator for the fellowship program. Fellows may hold their appointment in environmental or chemical engineering, physics, geology or chemistry. One Vanderbilt student was a fellow this year.

In addition, Vanderbilt University has also been designated a participating program in the Department of Energy's Environmental Restoration and Waste Management Scholarship Program. The scholarships are available in a wide variety of engineering or science disciplines. This program supports students enrolled in community/technical colleges and undergraduate four-year college and university programs. The program director for the Internship Program is also the scholarship program coordinator.

VII. Quality Assurance

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the program director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter the program director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, the appropriate faculty member continues to work with the student.

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I. Introduction

The eighth year of the program began with the selection of new interns. Mailings were sent to prospective graduate students and rising juniors at Vanderbilt University with grade point averages of 3.0 or better (out of 4.0) advertising the availability of internships in radioactive waste disposal. The choice of interns this year was difficult since the number and quality of applicants was so high. The interns selected were:

STUDENT	STATUS	GRADE POINT AVERAGE
Richard L. Bell	First-year Graduate Student in Environmental Engineering B.S. Environmental Engineering - New Mexico Institute of Mining & Technology - Highest Honors	3.8/4.0
Sherry Anne Fuls	First-year Graduate Student in Environmental Engineering B.S. Civil Engineering - Ohio Northern University - High Distinction	3.9/4.0
Laura K. McWhorter	First-year Graduate Student in Environmental Engineering B.S. Metallurgical Engineering - University of Illinois - Urbana - Champaign	4.2/5.0
Scott F. Siegwald	First-year Graduate Student in Environmental Engineering B.S. Environmental Science - Texas Christian University - Summa Cum Laude	3.9/4.0
Thomas M. Smith	First-year Graduate Student in Environmental Engineering B.S. in Civil Engineering - Marquette University	3.5/4.0
Cynthia Boston	Junior in Civil & Environ. Eng. - Vanderbilt	3.6/4.0

Their vitae are included in Appendix A.

Robert Waters, who was an intern, continues as an Environmental Restoration and Waste Management Fellow. We are quite proud of Bob's achievements. Not only has he presented his internship work at Spectrum '92 and at Notre Dame University, he is also senior author of the review article on *Hazardous Waste Characterization* which is being published in Annual Reviews. His vita is included in Appendix B.

STUDENT	STATUS	GRADE POINT AVERAGE
Robert Waters	Third-year Graduate Student in Environmental Engineering	2.9/3.0
	B.S. Civil Engineering - University of Kentucky	3.7/4.0
	M.S. Civil Engineering - Tulane University	3.8/4.0
	M.S. Environmental Engineering - Vanderbilt University	2.9/3.0

II. Course of Studies

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 153, Principles of Modern Physics; Physics 238, Atomic and Nuclear Physics (Laboratory course); and CEE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix C. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed hazardous chemical and radioactive waste problems. Graduate interns are also encouraged to take CE 310, Probabilistic Methods and Engineering Design; CE 299, Risk Assessment; Economics 283, Economics of Natural Resources and the Environment and Environmental Law at the Law School.

The two IBM AT Personal Computers (PC) purchased for the Internship Program continue to prove invaluable, but are no longer able to handle some of the newer computer models of environmental transport and waste disposal. If money were available, it would be useful to upgrade them to 486 machines.

III. Intern Assignments

Applications were solicited from the firms initially suggested by DOE and from other prime contractors doing environmental restoration and waste management work. Those solicited were: Bechtel National, Inc., Martin Marietta Energy Systems, NUS Corporation, IT Corporation, Westinghouse Hanford Operations, EG & G Geotech Technical Measurements Laboratory, and Westinghouse Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix D.

Early in the spring semester, most of the companies sent representatives to Vanderbilt University to present seminars on the work they are doing and to interview the interns for possible assignments of their work places. Prior to the visits, a curriculum vita for each student was sent to

each company (shown in Appendix E). During the visits, it was stressed with the company representatives that the internship must be a learning experience in environmental restoration and waste management.

The students were counseled on the various opportunities, but were encouraged to make independent choices consistent with some distribution among companies and projects. Each student was reminded that he was required to do a senior paper or master's thesis on a topic within the environmental restoration and waste management field. A letter reminding them of the obligation to do this was sent to each intern. Each student then made his choice.

First year students and their summer assignments were:

Judy Adler at Bechtel National where she designed a program to look at on-site contamination at a FUSRAP site to determine if the contamination came from off-site or not.

Brian Babcock at Bechtel National where he tested a new method using three solvents, water, methylene chloride and hexane, to extract polynuclear aromatic hydrocarbons from soil for insertion into a gas chromatograph for screening contaminated sites.

Joel Kuehnert at Westinghouse Hanford Company where he reviewed the transfer records for one of the high level waste tanks to determine its contents and to compare that analysis with a prediction from a computer program.

Hoa Tuy La at Westinghouse Savannah River Company where she wrote a computer code for tracking the chemical and radioactive constituents of the high level tanks for site-wide use. She also wrote the documentation for the code.

Michael Pierce at Sandia National Laboratory where he wrote a computer code to determine the efficacy of a radiofrequency heating system to enhance the removal of volatile organics.

James Wescott at Chem Nuclear Geotech where he tested the absorption of uranium by lung fluids.

Douglas W. Yerkes at Haliburton-NUS where he worked on the redesign of a radiofrequency heating system for enhanced removal of volatile organics.

IV. Status of the Second Year Interns

All seven interns returned to school after their practicum.

Laura A. Howard - completed her course requirements in the fall semester and submitted the draft of her Masters of Science paper. She was married shortly thereafter and will return to the work force after she relocates to Oak Ridge, Tennessee.

Eric McNair - completed his course work requirements in the fall semester. He presented his paper on *Radon Emanation and Diffusion Coefficients*. He received his Masters of Sciences Degree in May, 1992. He took a position with a local environmental consulting firm, Advent, which specializes in hazardous waste problems.

Dennis Rolander - presented his paper on means of removing radioactive contamination from lead so that it will not be classified as mixed waste. He graduated magna cum laude with a Bachelor of Science degree. He has enrolled in a civil engineering master's degree program at North Carolina State.

Lemuel Stevens - presented his paper on *The Redesign of a Mobile Diffused Aeration Stripper Unit for Remediation of Petroleum Hydrocarbon Plumes*. He graduated with a Master of Science degree and went to work for a local environmental consulting firm, Robert E. Alley & Associates.

Jeffrey Stone - presented his paper on the efficacy of the *Ultrasonic Ranging and Detection Systems* to locate and measure the gamma emissions in contaminated zones. Jeff graduated magna cum laude in Chemical Engineering. He is now attending medical school.

Robert Waters - presented his paper on the *Core Sampling Analysis Data Specification Process*. Bob received his Master's degree and continued at Vanderbilt University for a Ph.D. degree in Environmental Engineering. His thesis topic is a *Probabilistic Risk Assessment of RCRA Treatment Processes*.

Robert Wilson - presented his paper on the *Modification of the Glass Formation Computer Model, STGSOL*, to accept free energy data for 30 compounds found in the high level waste sludge. Rob graduated as of August, 1992, and will attend California Institute of Engineering in Chemical Engineering.

V. Technical Advisory Committee

The sixth meeting of the Technical Advisory Committee was held in conjunction with the spring colloquium on February 18, 1992. At the colloquium, the interns presented the results of their summer work and also described their impressions of the program. In addition, their local sponsors described their experience with the interns over the summer and discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the practicum sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. At the close of the session, the Technical Advisory Committee expressed again its enthusiasm for the program.

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Vanderbilt University. This year Professor Parker was invited to make presentations at the National Technology Initiative Meeting, the Annual Meeting of the Israel Nuclear Scientists, Annual Meeting of the American Geophysical Union and at the International Institute for Applied Systems Analyses' Workshop on Nuclear Contamination and Waste Disposal. In addition, he presented the Annual Distinguished Civil Engineering Lecture at the University of Nevada-Reno.

He also gave seminars at Vanderbilt University's Department of Environmental Engineering, at Clemson University's Executive Training Institute, Chemical Engineering Department, Environmental, Law and Technology Symposium, and Environmental Systems Engineering Department, and at the Pennsylvania Science Teachers' course on Understanding Radiation Effects and Emergency Preparedness.

Professor Parker was appointed to the Scientific Advisory Board for the Strategic Environmental Research and Development Program of the U.S. Department of Defense, U.S. Department of Energy and the U.S. Environmental Protection Agency, to the SAIC Environmental Technical Advisory Board for FUSRAP, Steering Committee for the DOE Joint Educational Program in Environmental Restoration and Waste Management, to the National Academy of Sciences National Research Council Board on Eastern Europe and Easter Asia, to the External Review Committee of the Pilot Risk Assessment Studies of DOE Sites and to the International Programme Committee of Safewaste '93.

Further national publicity for the program is obtained because Vanderbilt University has been designated by the Department of Energy as a participating program in the U.S. Department of Energy Environmental Restoration and Waste Management Fellowship Program. This designation permits graduate students, appointed as fellows in the program, to hold their fellowship at Vanderbilt University. The program director of the Internship Program is also the coordinator for the fellowship program. Fellows may hold their appointment in environmental or chemical engineering, physics, geology or chemistry. One Vanderbilt student was a fellow this year.

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STUDENT	STATUS	GRADE POINT AVERAGE
Judy A. Adler	Junior in Civil & Environmental Engineering	3.9/4.0
Brian D. Babcock	Junior in Chemical Engineering	3.9/4.0
Joel M. Kuehnert	Junior in Civil & Environmental Engineering	3.6/4.0
Hoa Tuy La	Junior in Chemical Engineering, Chemistry & Mathematics	3.8/4.0
Michael Pierce	First-year Graduate Student in Environmental Engineering B.S. Mechanical Engineering - Rice University	3.1/4.0
James B. Wescott	First-year Graduate Student in Environmental Engineering B.S. North Carolina State University in Civil Engineering - Magna Cum Laude	3.6/4.0
Douglas W. Yerkes	First-year Graduate Student in Environmental Engineering B.S. Civil Engineering - University of California, Davis	3.2/4.0

Their vitae are included in Appendix A.

In addition, Robert Waters, who was an intern, won an Environmental Restoration and Waste Management Fellowship. We are quite proud of Bob's achievement since only 10 were awarded in the country last year. His vita is included in Appendix B.

STUDENT	STATUS	GRADE POINT AVERAGE
Robert Waters	Second-year Graduate Student in Environmental Engineering	2.9/3.0
	B.S. Civil Engineering - University of Kentucky	3.7/4.0
	M.S. Civil Engineering - Tulane University	3.8/4.0

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The equipment purchased for use as part of the Internship (liquid scintillation counter, ion chromatograph, UV-vis spectrophotometer) are in use in instruction and research. Senior and graduate interns are encouraged to take CEE 273, Environmental Engineering Laboratory, where they will be introduced to this equipment and instructed on its use in environmental monitoring. The monitoring techniques will be useful for groundwater modelling, waste stream evaluation and laboratory testing of waste treatment technologies. In addition, the interns have been exposed to the unique capabilities of this equipment for research into the partitioning of carbon in environmental processes, i.e., a complete (solid-liquid-gas phase) mass balance on carbon, separation and quantification of hydrophilic organic compounds in waters, such as organic acids, and fingerprinting of wastes (UV-visible scanning). The experience with this equipment through hands-on laboratory work, research seminars, and classroom teaching provides invaluable training for the interns.

The two IBM AT Personal Computers (PC) purchased for the Internship Program continue to prove invaluable. They are used extensively in both coursework and research work. If money were available, it would be useful to upgrade one to a 386 machine.

III. Intern Assignments

Applications were solicited from the firms initially suggested by DOE and from other prime

contractors doing environmental restoration and waste management work. Those solicited were: Bechtel National, Inc. Westinghouse Electric Corporation, NUS Corporation, IT Corporation, Westinghouse Hanford Operations, EG&G Geotech Technical Measurements Laboratory, and Westinghouse Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix D.

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First-year students and their summer assignments are:

Laura A. Howard - Oak Ridge National Laboratory, Oak Ridge, TN -

There are several ponds at Oak Ridge National Laboratory that had been used to equalize the liquid waste flows and to allow settlement of solids. The pond sediments are therefore, contaminated. The ponds need to be remediated and closed. Laura assembled and evaluated existing data on the ponds and was thereby able to evaluate alternatives for removing and treating the water, still in the ponds, and the sediments and closing the ponds.

Eric McNair - EG&G Geotech, Inc., Grand Junction, CO -

For the proper design of uranium mill tailings repository covers, it is necessary to determine both the Rn-222 emanation fraction and its diffusion coefficient through the cover material. The values presently used for these parameters are not necessarily accurate representations of conditions in the field. Radon emanation fractions were determined with a germanium gamma spectrometer. The radon diffusion coefficient measurements were made by allowing the gas to diffuse through soil packed in PVC columns. With the aid of a sodium iodide spectrometer the amount of radon collected by charcoal traps was measured and the diffusion coefficients were determined. This work resulted in two papers, "*Radon Emanation Fractions and Radium Concentrations in Tailings Samples Collected at Various Depths from Four Monticello, Utah, Tailings Piles,*" and "*Measurement of Radon Diffusion Coefficients of Soils Available for Use as a Radon Barrier Cover for the Monticello Repository.*"

Dennis Rolander - Oak Ridge National Laboratory, Oak Ridge, TN -

Radioactively contaminated lead presents a special problem as a mixed waste. Dennis searched the literature for a strippable coating that could be applied to the lead. He also helped prepare a statement of work for a contractor to remove the contamination from already contaminated

lead to the degree that it will pass the toxicity characteristic leaching procedure.

Lemuel Stevens - NUS-Haliburton, Oak Ridge, TN -

NUS has a mobile diffused aeration stripper unit for remediation of petroleum hydrocarbon plumes. However, the unit did not operate efficiently. Lem redesigned the blower piping to enhance the unit's efficiency and tested the new design. The mobile unit will be useful in rapidly responding to and cleaning up spills. The work resulted in a publication "*Applications of a Mobile Groundwater Treatment System for Remediating Groundwater Contaminated with Volatile Organics*" for the DOE Model Conference, October, 1991.

In addition, Lem drafted a remedial action plan for a leaking underground storage tank site in Florida. The remedial action plan was accepted in September 1991.

Jeffrey Stone - Oak Ridge National Laboratory, Oak Ridge, TN -

The plant site has been monitored using the Ultrasonic Ranging and Detection Systems (USRADS). The system is a backpack unit with gamma emissions measuring and transmission and ultrasonic emitting components to rapidly monitor and locate sources of contamination. "Groundtruth" had not been determined for the system. Jeff analyzed the USRADS data, compared it with traditional field measurements and determined the system's applicability.

Robert Waters - Westinghouse Hanford Company, Richland, WA -

Many of the 177 high-level waste tanks are leaking. All of the tanks will have to be eventually taken out of service. Without characterization of the contents the remediation strategies cannot be determined. Sampling of cores from the tanks is difficult (high radiation fields and limited access) and chemical and radiological analyses expensive ($750,000 per core). Consequently the analyses need to match the needs of those using the data. Bob brought together the analytical chemists, the modelers, the risk assessors, etc. in a structured format to harmonize the plans for core sample analyses with the specific needs of the data users. This has resulted in a structured procedure which will be used for all tank sampling. The work has resulted in a publication "*Summary of the Tank 241-SY-101 Core Sampling Analysis Data Specification Process,*" *WHC-MR-0273, August 1991.*

Robert Wilson - Westinghouse Savannah River Company, Aiken, SC -

The liquid high-level waste at the Savannah River, Hanford and West Valley sites are to be vitrified. The sludge in the waste tanks contain practically all of the elements. To determine the actual glass formation process and the final glass composition requires the free energy data for 30 compounds that are found in the sludge. They will be utilized in a glass formation computer model, STGSOL, which must be modified to run with the accuracy desired. Rob did that and then compared the predicted composition with the known composition of glasses made from simulated wastes.

IV. Status of the Second Year Interns

All eight interns returned to school after their practicum.

Jonathan E. Huddleston

Jonathan presented his paper on the flow of air from the surrounding soil into the horizontal extraction well with 2-D and 3-D particle tracking programs. This was part of the Integrated Demonstration Project at the Savannah River site. Jonathan graduated in December, cum Laude, and went to work for Westinghouse Savannah River Plant on the Integrated Demonstration Project. This fall he entered law school to specialize in environmental law.

Angela K. John

Angela presented her paper on the effects of the magnitude and timing of pulsed trichloroethylene (TCE) contaminated well-water on a pure culture of TCE degrading bacterium. This study was part of the Savannah River Integrated Demonstration project on the horizontal well. Angela graduated in May with a Master of Sciences Degree. She had won one of the 10 American Nuclear Society - Argonne National Laboratory Student Fellowships to work abroad at a nuclear facility. She spent the summer at Kernforschung Julich (KFJ). Upon her return she was employed by Bechtel National at Oak Ridge, Tennessee to work on DOE projects.

Philip Johnson

Phil presented his paper on the re-evaluation of the half-lives of the two radon daughters Pb-214 and Bi-214. He was able to show that using the most modern instrumentation and laboratory techniques that the presently accepted values for the half-lives of the two isotopes are the best estimates of their half-lives. Phil also completed a paper, as part of the Mason Prize Award, on the efficacy of pump and treat as part of groundwater remediation as compared to excavation and pump and re-inject. For personal reasons, Phil withdrew from the program and took a job with the Los Angeles County Sanitary District.

Ronda Lawrence

Ronda presented her paper on the radiological effects of burning logs from timber near the West Valley, New York reprocessing site. She showed that the dose from Cs-137, the major nuclide present, was small. Upon graduation, Ronda took a job with Bechtel National at their Philadelphia office. She also presented her paper at the National Meeting of the Society of Women Engineers.

Christopher McKee

Chris presented his paper on waste minimization techniques for the tank farms at the Hanford site. He graduated Magna cum Laude and entered graduate school at Vanderbilt University in Environmental Engineering.

Melanie Overby

Melanie presented her paper on the radiological characterization of Coldwater Creek in St. Louis as part of the DOE's Formerly Utilized Sites Remedial Action Plan carried out by Bechtel National. Upon graduation, Magna cum Laude, Melanie went to work for Champion Paper Company, Montgomery, Alabama.

Scott Thompson

Scott presented his paper on the remediation of groundwater (particularly water well samples in remote locations) contaminated with inorganic contaminants by solar distillation. He graduated cu Laude and went to work for Eli Lilly Company.

S. Brent Thomas

Brent presented his paper on the evaluation of robotic units to locate buried wastes accurately and with cost effectiveness. Brent won one of the 10 American Nuclear Society - Argonne National Laboratory Student Fellowships to work abroad at a nuclear facility. He spent the summer at Kernforschung Julich (KFJ).

V. Technical Advisory Committee

The fifth meeting of the Technical Advisory Committee was held in conjunction with the spring colloquium on January 24, 1991. At the colloquium, the interns presented the results of their summer work and also described their impressions of the program. In addition, their local sponsors described their experience with the interns over the summer and discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the practicum sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. At the close of the session, the Technical Advisory Committee expressed again its enthusiasm for the program.

None of the expenses of the colloquium or the Technical Advisory Board were paid from DOE funds.

VI. Internship Program Renewal

The Department of Energy has included the Internship Program in its five-year program (ADS Reports). We are grateful for the continued expression of confidence in this program.

VII. Recruitment of New Students

The existence of the Internship Program continues to be publicized by the activities of the students, as detailed previously, and by the activities of the Director. This year, Professor Parker was appointed Westinghouse Savannah River Distinguished Scientist Professor at Clemson University. He spent the fall semester there and returned on a regular basis to supervise the work of the interns at Vanderbilt University. This year he was invited to make presentations at the First International Sakharov Congress, and at the Second Annual Scientific Conference of the USSR Nuclear Society. In addition, he made presentations at the annual meetings of the Waste Management -91, Scientific Basis for Nuclear Waste Management XIV (Materials Research Society), National Academy of Sciences - National Research Council's Board of Radioactive Wastes Management's Symposium on the Environmental Protection Agency's Response to the Remand of 40CFR191 and the Electric Power Research Institute's Symposium on the same topic.

Further national publicity has been obtained by Vanderbilt University having been designated

by the Department of Energy as a participating program in the U.S. Department of Energy Environmental Restoration and Waste Management Fellowship Program. This designation permits graduate students, appointed as fellows in the program, to hold their fellowship at Vanderbilt University. The program director of the internship program is also the coordinator for the fellowship program. Fellows may hold their appointment in environmental or chemical engineering, physics, geology or chemistry.

In addition, Vanderbilt University has also been designated a participating program in the Department of Energy's Environmental Restoration and Waste Management Scholarships Program. The scholarships are available in a wide variety of engineering or science disciplines. This program supports students enrolled in community/technical colleges and undergraduate four-year college and university programs. The program director for the internship program is also the scholarship program coordinator. Two Vanderbilt students held scholarships this year.

VIII. Quality Assurance

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the program director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter the program director visits the site to discuss with the intern and this supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, then the appropriate faculty member is encouraged to continue to work with the student.

PROGRESS REPORT ON THE

DEPARTMENT OF ENERGY'S

PILOT INTERNSHIP PROGRAM ON RADIOACTIVE WASTE

AT

VANDERBILT UNIVERSITY

(September 1, 1989 to August 31, 1990)

I. INTRODUCTION

The sixth year of the program began with the selection of the new interns. Mailings were sent to prospective graduate students and rising juniors at Vanderbilt University with grade point averages of 3.0 or better (out of 4.0) advertising the availability of internships in radioactive waste disposal. The choice of interns this year was difficult since the number and quality of applicants was so high. The new interns selected were:

STUDENT	STATUS	GRADE POINT AVG.
Laura A. Howard	First year graduate student in Civil & Environmental Engineering. B. S. Civil Engineering, Clemson	3.5/4.0
Eric McNair	First year graduate student in Civil & Environmental Engineering. B.S. Agricultural Engineering, U. of Arizona M.S. Civil Engineering, U. of Virginia	2.7/4.0 3.9/4.0
Dennis Rolander	Junior in Civil & Environmental Engineering	3.7/4.0
Jeffrey Stone	Junior in Civil & Environmental Engineering	3.6/4.0

STUDENT	STATUS	GRADE POINT AVG.
Robert Waters	1st year graduate student in Civil & Environmental Engineering. B.S. Civil Engineering, University of Kentucky M.S. Civil Engineering, Tulane University	 3.7/4.0 3.8/4.0
Robert Wilson	Junior in Civil & Environmental Engineering	3.7/4.0

Their vitae are included in Appendix A.

In addition, at our invitation, a number of students applied for and two won Environmental Restoration and Waste Management Scholarships. We are quite proud of their achievements since only 25 were awarded in the country. Their vitae are included in Appendix B.

Environmental Restoration and Waste Management Scholars

STUDENT	STATUS	GRADE POINT AVG.
Michael Wm. Enghauser	Senior in Civil & Environmental Engineering	3.5/4.0
Robert K. Collins	Senior in Chemical Engineering	3.6/4.0

II. COURSE OF STUDIES

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 153, Principles of Modern Physics; Physics 238, Atomic and Nuclear Physics (Laboratory Course); and CEE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix C. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed hazardous chemical and radioactive waste problems.

The equipment purchased for use as part of the Internship (liquid scintillation counter, ion chromatograph, UV-vis spectrophotometer) are in use in instruction and research. A new laboratory course, CEE 273 - Environmental Engineering Laboratory, was taught for the first time in the Spring 1989 semester. Senior and graduate interns are encouraged to take this course where they will be introduced to this equipment and instructed on its use in environmental monitoring. The monitoring techniques will be useful for groundwater modelling, waste stream evaluation and laboratory testing of waste treatment technologies. In addition, the interns have been exposed to the unique capabilities of this equipment for research into the partitioning of carbon in environmental processes, i.e., a complete (solid-liquid-gas phase) mass balance on carbon, separation and quantification of hydrophilic organic compounds in waters, such as organic acids, and fingerprinting of wastes (UV-visible scanning). The experience with this equipment through hands-on laboratory work, research seminars, and classroom teaching provides invaluable training for the interns.

The two IBM AT Personal Computers (PC) purchased for the Internship Program continue to prove invaluable. They are used extensively in both course work and research work. If money were available, it would be useful to upgrade one to a 386 machine.

III. INTERN ASSIGNMENTS

Applications were solicited from the firms initially suggested by DOE and from other major firms doing environmental restoration and waste management work. Those solicited were: Bechtel National, Inc., Westinghouse Electric Corporation, General Electric Corporation, NUS Corporation, IT Corporation, Westinghouse Hanford Operations, UNC Geotech Technical Measurements Laboratory, and Westinghouse Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix D.

Early in the spring semester, most of the companies sent representatives to Vanderbilt University to present seminars on the work they are doing and to interview the interns for possible assignments at their work places. Prior to the visits, a curriculum vita for each student was sent to each company (shown in Appendix E). During the visits, it was stressed with the company representatives that the internship must be a learning experience in environmental restoration and waste management.

The students were counseled on the various opportunities, but were encouraged to make independent choices consistent with some distribution among companies and projects. Each student was reminded that he was required to do a senior paper or master's thesis on a topic within the environmental restoration and waste management field. A letter reminding them of the obligation to do this was sent to each intern. Each student then made his choice.

Jonathan Edward Huddleston - Westinghouse Savannah River Co., Aiken, SC.

Jonathan worked on the integrated horizontal well project which was a field demonstration of in situ air stripping of volatile organic solvents. He modelled the flow of air from the surrounding soil into the horizontal extraction well with 2-D and 3-D particle tracking programs. He was responsible for the installation of pressure monitoring tubes and gauge manifolds at the well heads.

Angela John - Westinghouse Savannah River Co., Aiken, SC.

Angela assembled and adapted a 5-L benchtop fermentation system, designed to support chemostatic, aseptic growth of a pure culture of Trichlorethylene (TCE) degrading bacterium. Once a stable continuous culture was established, she initiated pulse experiments, exposing the system to carefully timed pulses of TCE contaminated well water. She monitored the TCE influent and effluent concentrations, cellular population levels (both direct cell counts and absorbance measurements), as well as ambient temperature, pH, and dissolved oxygen in order to determine the impact on TCE concentration from the various pulses by the biological system (and vice-versa).

Philip Randolph Johnson - UNC Geotechnical Measurements Center, Grand Junction, CO.

Phil worked with Dr. Dowell Martz of the Radon Laboratory on a project to redetermine the half-lives of two radon daughters, Lead-214 and Bismuth-214. By using various nuclear instrumentation techniques involving both gamma- and alpha-ray spectrometry, they were able to show that the presently accepted half-life values of Lead-214 and Bismuth-214 are the best estimates of the true half-lives of these radioisotopes.

Ronda Renee Lawrence - West Valley Nuclear Services Company, West Valley, NY.

Ronda measured ^{137}Cs and ^{40}K levels in new growth of 15 types of trees around the West Valley Demonstration Project. Cesium-137 activity ranged from background to 30 pci/kg off-site and as high as 630 pci/kg on site. Potassium 40 levels were similar off-and on-site. If the ash from contaminated trees is used as fertilizer, the effective dose equivalent was calculated to be as high as 14 μrem/yr, but smoke from burning the wood only gave a calculated dose of 1.4 μrem/yr.

Christopher Patrick McKee - Westinghouse Hanford Company, Richland, WA.

Chris worked on waste minimization techniques for the tank farms at the Westinghouse Hanford site with particular emphasis on the 242-A evaporator. He also put together an extensive cost analyses on the final disposal of high-and low-level radioactive waste.

Scott Thompson - UNC Geotechnical Measurements Center, Grand Junction, CO.

Scott did scoping studies on remediation of groundwater containing inorganic contaminants by solar distillation. He studied the effect that inorganic contaminants in the groundwater would have on the evaporation rate, determined the heat input required to produce a specified water output as the processed groundwater became concentrated and did the preliminary work in determining the changes in the chemical composition of the groundwater after distillation.

Melanie Mareese Overby - Bechtel National Inc., Oak Ridge, TN.

Melanie conducted a radiological characterization on Coldwater Creek in St. Louis, Missouri. This study consisted of field sampling, lab analysis, data evaluation, sampling plan design, and authoring and orally presenting a final report and recommendations. This study was part of DOE's Formerly Utilized Sites Remedial Action Plan (FUSRAP).

Steven Brent Thomas - Westinghouse Savannah River Co., Aiken, SC.

Brent evaluated currently available robotic units to locate buried waste accurately and with cost effectiveness. He evaluated three major brands of germanium detectors and ground penetrating radar. He also evaluated the relative effectiveness of position detection by gyroscope and ultrasonic obstacle sensing.

IV. STATUS OF THE SECOND-YEAR PROGRAM INTERNS

All five second-year students returned to complete their internships.

W. Reid Adams - Westinghouse Hanford Company, Richland, WA

Reid presented his paper on grouping contaminated sites into operable units at the Hanford site. He graduated cum laude in May, 1990 and took a job with ERM Southwest in New Orleans, Louisiana to work on hazardous waste problems.

Lawrence Lacy Baldy - Bechtel National, Inc., Oak Ridge, TN

Lacy presented his paper on risk assessment of remedial action sites at the Oak Ridge National Laboratory. After graduation, cum laude, he returned to Bechtel National at Oak Ridge to work on DOE cleanup activities.

Ronald James Falco - UNC Geotechnical Measurements Center, Grand Junction, CO

Ron Falco's paper "Time-Averaged Exposures to Radon and Thoron Progeny at Several Colorado Locations" has been published in the Health Physics Journal. He

graduated December, 1989 with a Master of Science degree and went to work for Engineering Sciences in Denver, Colorado on hazardous waste problems.

Brennan Smith - Westinghouse Hanford Company, Richland, WA

Brennan presented his paper on developing a conceptual model of the geology, hydrology and groundwater regimes at the operable unit 100-HR-3 at the Hanford site. He graduated cum laude and went to graduate school at the University of Iowa.

Mark Valenzuela - Bechtel National Inc., Oak Ridge, TN

Mark presented his paper on the development and verification of an analytical model of the transport of contaminants in the unsaturated zone. He graduated summa cum laude and went on to graduate school at Cornell University.

V. TECHNICAL ADVISORY COMMITTEE

The fourth meeting of the Technical Advisory Committee was held in conjunction with the fall colloquium on November 14, 1989. At the colloquium, the interns presented the results of their summer work and also described their impressions of the program. In addition, their local sponsors described their experience with the interns over the summer and discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the practicum sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. At the close of the session, the Technical Advisory Committee expressed again its enthusiasm for the program.

None of the expenses of the colloquium or the Technical Advisory Board was paid from DOE funds.

VI. INTERNSHIP PROGRAM RENEWAL

The Department of Energy has included the Internship Program in its five-year program. (ADS Reports) We are grateful for the continued expression of confidence in this program.

VII. RECRUITMENT OF NEW STUDENTS

The existence of the Internship Program continues to be publicized by the activities of the students, as detailed previously, and by the activities of the Director. This year, Professor Parker was appointed a member of the Commission on Geosciences, Environment and Resources of the National Research Council. He also led the Delegation from the U.S. National Academy of Sciences to the Soviet Union on Radioactive Waste Disposal. He was

also a member of the Department of Energy's Delegation to the Soviet Union on Radioactive Waste Disposal and was appointed to the Joint (USA-USSR) Coordinating Committee for Environmental Restoration. In addition, he made presentations at the annual meetings of the Health Physics Society, Institute of Nuclear Materials Management, American Nuclear Society, DOE Model Meeting, Babcock and Wilcox, Western State Energy Board and the International Scientific Forum on Energy.

Further national publicity has been obtained by Vanderbilt University having been designated by the Department of Energy as a participating program in the U.S. Department of Energy Environmental Restoration and Waste Management Fellowship program. This designation permits graduate students, appointed as fellows in the program, to hold their fellowship at Vanderbilt University. The Program Director of the Internship Program is also the coordinator for the Fellowship Program. Fellows may hold their appointment in Environmental or Chemical Engineering, Physics, Geology or Chemistry.

In addition, Vanderbilt University has also been designated a participating program in the Department of Energy's Environmental Restoration and Waste Management Scholarships program. The scholarships are available in a wide variety of engineering or science disciplines. This Program supports students enrolled in community/technical colleges and undergraduate four year college and university programs. The Program Director for the Internship Program is also the Scholarship Program Coordinator.

VIII. QUALITY ASSURANCE

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the Program Director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter the Program Director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, then the appropriate faculty member is encouraged to continue to work with the student.

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I. INTRODUCTION

The fifth year of the program began with the selection of the new interns. Mailings were sent to prospective graduate students and rising juniors at Vanderbilt University with grade point averages of 3.0 or better (out of 4.0) advertising the availability of internships in radioactive waste disposal.

The new interns selected were:

STUDENT	STATUS	GRADE POINT AVERAGE
W. Reid Adams	Junior in Civil and Environmental Engineering	3.36/4.00
Lawrence Lacy Baldy	Junior in Civil and Environmental Engineering	3.22/4.00
Ronald James Falco	First year graduate student in Civil and Environmental Engineering, B.S., Chemical Engineering, University of California-Berkeley	3.24/4.00
Brennan Smith	Junior in Civil and Environmental Engineering and Economics	3.31/4.00
Mark Valenzuela	Junior in Civil and Environmental Engineering	3.94/4.00

Two other candidates were admitted but withdrew at the beginning of the semester when it was found that their premedical course requirements precluded their taking the necessary courses for the internship.

All of the interns selected for the fourth year chose to return to Vanderbilt after their field assignment.

II. COURSE OF STUDIES

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 153, Principles of Modern Physics; Physics 238, Atomic and Nuclear Physics (Laboratory Course); and CEE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix A. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed hazardous chemical and radioactive waste problems.

The equipment purchased for use as part of the internship (liquid scintillation counter, ion chromatograph, UV-vis spectrophotometer) are in use in instruction and research. A new laboratory course, CEE 273 - Environmental Engineering Laboratory, was taught for the first time in the Spring 1989 semester. Senior and graduate interns will be encouraged to take this course where they will be introduced to this equipment and instructed on its use in environmental monitoring. The monitoring techniques will be useful for groundwater modelling, waste stream evaluation and laboratory testing of waste treatment technologies. In additions, the interns have been exposed to the unique capabilities of this equipment for research into the partitioning of carbon in environmental processes, i.e., a complete (solid-liquid-gas phase) mass balance on carbon, separation and quantification of hydrophilic organic compounds in water, such as organic acids, and fingerprinting of wastes (UV-visible scanning). The experience with this equipment through hands-on laboratory work, research seminars, and classroom teaching provides invaluable training for the interns.

The two IBM AT Personal Computers (PC) purchased for the internship program continue to prove invaluable. They are used extensively in both course work and research work.

III. INTERN ASSIGNMENTS

Applications were solicited from the firms initially suggested by DOE and from other major firms doing decontamination and decommissioning work. Those solicited were: Bechtel National, Inc., Westinghouse Electric Corporation, General Electric Corporation, NUS Corporation, IT Corporation, Westinghouse Hanford Operations, UNC Geotech Technical Measurements Laboratory, and DuPont Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix B.

Early in the spring semester, most of the companies sent representatives to Vanderbilt University to present seminars on the work they were doing and to interview the interns for possible assignments at their work places. Prior to the visits, a curriculum vita for each student was sent to each company (shown in Appendix C). During the visits, it was stressed with the company representatives that the internship must be a learning experience in D & D.

The students were counseled on the advantages and disadvantages of the various opportunities, but were encouraged to make independent choices, consistent with some distribution among companies and projects. Each student was reminded that he was required to do a senior paper or master's thesis on a topic within the decontamination and decommissioning field. A letter reminding them of the obligation to do this was sent to each intern. Each student then made his choice:

Reid Adams - Westinghouse Hanford Company, Richland, Washington

Reid investigated the amounts and distribution of radioactive and hazardous chemical wastes at the 1100 area to determine which sites could be grouped together into operable units. If this could be accomplished, major savings in characterization and monitoring could be achieved.

Lacy Baldy - Bechtel National, Inc., Oak Ridge, Tennessee

Lacy worked on risk assessment of Oak Ridge National Laboratory remedial action sites to determine potential human health threats in helping derive cleanup criteria and on the validation of a radionuclide transport model.

Ronald Falco - UNC Geotech Technical Measurements Center, Grand Junction, Colorado

Ron, with his supervisor, Dowell Martz, made the first comprehensive, simultaneous, continuous measurements of Radon (^{222}Rn) and Thoron (^{220}Rn) in homes. This work has been submitted to the Journal of the Health Physics Society for possible publication.

Brennan Smith - Westinghouse Hanford Company, Richland, Washington

Brennan worked with the hydrogeologists at Hanford in trying to represent conditions at operable Unit 100-HR-3 in a conceptual model of the geology, hydrology and ground water flow regimes based upon data such as borehole geologic and geophysical logs, ground water level measurements, and river stage measurements.

Mark Valenzuela - Bechtel National, Inc., Oak Ridge, Tennessee

Mark worked on development and mathematical verification of an analytical model of the transport of contaminants in the unsaturated zone.

IV. STATUS OF THE SECOND-YEAR PROGRAM INTERNS

The six second-year students returned for the second year of the internship (grade reports for all interns for the second year are included in Appendix D).

Eric Dawson - Eric finished his master's paper on "A Risk Analysis of the Effectiveness of the RCRA Underground Storage Tank Regulations." He graduated with his M.S. in May 1989. He presented a paper based on his internship work, "Soil Sampling for Shippingport Site Release," at the annual Health Physics Society meeting in Albuquerque, NM, on June 26, 1989. He has gone to work for Engineering Science in Houston, working on assessment of hazardous waste sites.

Tina Hannye - Tina produced a "Solidification and Stabilization Manual" for Bechtel National, Inc. She graduated summa cum laude in Civil and Environmental Engineering in May 1989. Tina has taken a job with Eli Lily in West Lafayette, IN.

Todd Harris - Todd's internship work - "The Half Life of Po218" - was published in the Journal of the Health Physics Society in July 1989. Todd graduated summa cum laude in May 1989 in Chemical Engineering. He accepted a position with Calgon in their Reactor Chemicals Department.

Eric Lookofsky - Eric completed his summer paper "Modeling the Loading of Uranium Hexafluoride in Packed Beds of Sodium Fluoride." He received his degree in Chemical Engineering in May 1989 and has accepted a position with Shell Oil Company at Houston, Texas.

John Rudolph - John completed his paper on his experiences at Westinghouse Hanford where he worked on an operable units designation project and an outline for a RCRA Interim Status Closure Plan and Final Status Permit Application. John graduated magna cum laude in May 1989 in Civil and Environmental Engineering. He accepted a position at the Paducah Gaseous Diffusion Plant as an environmental engineer.

Dean Vlachos - Dean finished his paper "Radionuclide Activity Associated with Soil Particle Size." He graduated with his M.S. in May 1989. He is working for Advent Consultants in Nashville, Tennessee, as a water resources engineer, where, among other duties, he works on RCRA permit applications.

V. TECHNICAL ADVISORY COMMITTEE

The fourth meeting of the Technical Advisory Committee was held in conjunction with the fall colloquium on November 14, 1988. At the colloquium, the interns presented the results of their summer work and also described their impressions of the program. In addition, their local sponsors described their experience with the interns over the summer and discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the local sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. At the close of the session, the Technical Advisory Committee expressed again its enthusiasm for the program.

None of the expenses of the colloquium or the Technical Advisory Board was paid from DOE funds.

VI. INTERNSHIP PROGRAM RENEWAL

The Department of Energy has renewed the internship program for another three years. We are grateful for the continued expression of confidence in this program.

VII. RECRUITMENT OF NEW STUDENTS

The existence of the internship program continues to be publicized by the activities of the students, as detailed previously, and by the activities of the Director. This year, Professor Parker was appointed a Commissioner by the U.S. Congress for the Monitored Retrievable Storage Review Commission. He also served as Chairman of the International Atomic Energy Agency's Advisory Group on Public Understanding of Waste Management Issues and as Chairman of their first Waste Management Assessment and Technical Review Programme Peer Review (Panel on Evaluation of the United Kingdom Nirex Limited Programmes on Deep Repository Post Closure Safety Research and Development and Site Assessment). In addition, he made presentations at the annual meetings of the Health Physics Society, Institute of Nuclear Materials Management, and Babcock and Wilcox's Fuel Improvement Seminar.

The choice of interns this year was difficult, since the number and quality of applicants was so high. Those awarded internships are:

STUDENT	STATUS	GRADE POINT AVERAGE
Jonathan Edward Huddleston	Senior in Civil and Environmental Engineering	3.34/4.00
Angela John	First year graduate student in Civil and Environmental Engineering, B.S., Agriculture and Life Science, Cornell University	3.67/4.00

Philip Randolph Johnson	First year graduate student in Civil and Environmental Engineering, B.S., Earth Sciences, University of Wisconsin, Green Bay; M.S., Geology, Southern Methodist University	3.82/4.00
Ronda Renee Lawrence	Junior in Civil and Environmental Engineering	3.08/4.00
Christopher Patrick McKee	Junior in Civil and Environmental Engineering	3.36/4.00
Melanie Mareese Overby	Junior in Civil and Environmental Engineering	3.39/4.00
Steven Brent Thomas	Senior in Chemical Engineering	3.70/4.00
Scott Thompson	Junior in Chemical Engineering	3.36/4.00

VIII. QUALITY ASSURANCE

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the Program Director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter, the Program Director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, then the appropriate faculty member is encouraged to continue to work with the student.

PROGRESS REPORT ON THE

DEPARTMENT OF ENERGY'S

PILOT INTERNSHIP PROGRAM ON RADIOACTIVE WASTE

AT

VANDERBILT UNIVERSITY

(September 1, 1987 to August 31, 1988)

I. INTRODUCTION

The fourth year of the program began with the selection of the new interns. Mailings were sent to prospective graduate students and rising juniors at Vanderbilt University with grade point averages of 3.0 or better (out of 4.0) advertising the availability of internships in radioactive waste disposal.

The new interns selected were:

NAME	STATUS	GRADE POINT AVERAGE
Eric J. Dawson	First year graduate student in Environmental Engineering B.S., Colorado State University	3.83/4.00
Tina Marie Hannye	Junior in Civil and Environmental Engineering	3.93/4.00
Robert Todd Harris	Junior in Chemical Engineering	3.89/4.00
Eric Samuel Lookofsky	Junior in Chemical Engineering	3.29/4.00
John Mathis Rudolph	Junior in Civil and Environmental Engineering and Mathematics	3.65/4.00
Dean Vlachos	First year graduate student in Environmental Engineering B.S., Colorado State University	3.90/4.00

All of the interns selected in the fourth year chose to return to Vanderbilt after their field assignment.

II. COURSE OF STUDIES

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 133, Introduction to Modern Physics, or Physics 153, Principles of Modern Physics (in the future, students will be encouraged to take Physics 153); Physics 238, Atomic and Nuclear Physics (Laboratory Course); and CEE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix A. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed hazardous chemical and radioactive waste problems.

The equipment purchased for use as part of the internship (liquid scintillation counter, ion chromatograph, UV-vis spectrophotometer) has been set up and tested. A new laboratory course, CEE 273 - Environmental Engineering Laboratory, will be taught for the first time in the Spring 1989 semester. The interns taking this course will be introduced to this equipment and instructed on its use in environmental monitoring. The monitoring techniques will be useful for groundwater modelling, waste stream evaluation and laboratory testing of waste treatment technologies. In addition, the interns have been exposed to the unique capabilities of this equipment for research into the partitioning of carbon in environmental processes, i.e., a complete (solid-liquid-gas phase) mass balance on carbon, separation and quantification of hydrophillic organic compounds in water, such as organic acids, and fingerprinting of wastes (UV-vis scanning). The experience with this equipment through hands-on laboratory work, research seminars, and classroom teaching will provide invaluable training for the interns.

Tim Tope, an earlier intern, has already used the ion chromatograph in a research project. Now that the equipment is operational, it is expected to be more widely used by the interns.

The two IBM AT Personal Computers (PC) purchased for the internship program continue to prove invaluable. They are used extensively in both course work and research work.

III. INTERN ASSIGNMENTS

Applications were solicited from the firms initially suggested by DOE and from other major firms doing decontamination and decommissioning work. Those solicited were: Bechtel National, Inc., Westinghouse Electric Corporation, General Electric Corporation, NUS Corporation, IT Corporation, Westinghouse Hanford Operations, UNC Geotech Technical Measurements Laboratory, and DuPont Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix B.

Early in the spring semester, most of the companies sent representatives to Vanderbilt University to present seminars on the work they were doing and to interview the interns for possible assignments at their work places. Prior to the visits, a curriculum vita for each student was sent to each company (shown in Appendix C). During the visits, it was stressed with the company representatives that the internship must be a learning experience in D & D.

The students were counseled on the advantages and disadvantages of the various opportunities, but were encouraged to make independent choices, consistent with some distribution among companies and projects. Each student was reminded that he was required to do a senior paper or master's thesis on a topic within the decontamination and decommissioning field. A letter reminding them of the obligation to do this was sent to each intern. Each student then made his choice:

Ernest Roberts Alley, Jr. - E.I. DuPont de Nemours, Savannah River Laboratory, Aiken, South Carolina - Though Rob was admitted in the third year of the program, as discussed in last year's progress report, he chose to do his field study this year. Rob continued some of the work begun by Tim Tope on the off-gas cleanup from the plutonium waste incinerator. He was in charge of the design, construction, and startup of the two loop design modifications to the mobile off gas system (SMOG). In the development of an incineration facility for the plant, the SMOG was expanded from a one loop water system to a two loop system for particulate salt removal as part of the design modifications. Tests on salt buildup and water transport between the two loops were begun.

Eric Dawson - General Electric Company, Shippingport Decommissioning Project, Beaver Valley, Pennsylvania - Eric extended the work done by Connor Haugh in designing a plan for site soil sampling to be sure it meets the site release criteria. In addition, he worked with the release team doing many parts of the release procedures, such as performing surveys, taking samples, documenting results, assisting in engineering analyses, and in preparation of data packages.

Tina Hannye - Bechtel National, Inc., Oak Ridge, Tennessee - Tina prepared a reference document concerning solidification and stabilization processes, including physical, chemical and biological, and incineration. The document shows what types of waste are best suited for this treatment, what type of pretreatment is most helpful and what the costs are.

R. Todd Harris - UNC Geotech Technical Measurements Center, Grand Junction, Colorado - Todd utilized existing equipment and expertise to determine the half life of ^{218}Po and the precision of that measurement. Though previous measurements existed, there were discrepancies in the values. With the increased interest in radon exposure, a more accurate value was needed. Todd and his supervisor, Dowell Martz, have submitted this work to the Health Physics Journal for possible publication.

Eric Lookofsky - Martin Marietta Energy Systems, Inc., Paducah Gaseous Diffusion Plant, Paducah, Kentucky - Eric worked at preparing a computer mode to achieve better understanding of trap chemistry and performance to improve operating conditions to maintain UF_6 emissions at low levels. The study tested the increased efficiency of trapping using Al_2O_3 following NaF complexation.

John Rudolph - Westinghouse Hanford Company, Richland, Washington - The purpose of the study was to prepare a collection and treatment plan of the contaminated groundwater at the Hanford site, utilizing newer technology. Technologies which were to be investigated were filtration, precipitation, reverse osmosis, ion exchange and biodestruction.

Dean Vlachos - Bechtel National, Inc., Oak Ridge, Tennessee - Dean carried out laboratory experiments to determine if a relationship exists between radionuclide activity and size distribution of contaminated soils from selected FUSRAP sites. If such a relationship exists, then it may be possible to reduce the costs of FUSRAP site cleanup by separating the fines with their higher concentration of radionuclides from the lower concentrations in the larger sizes and then treating the fines to a greater degree than the larger sizes.

IV. STATUS OF THE SECOND-YEAR PROGRAM INTERNS

The six remaining second-year students returned for the second year of the internship (grade reports for all interns for the second year are included in Appendix D).

Ernest Roberts Alley, Jr. - Rob continued his studies and will graduate in May 1989.

David Cristol - David graduated in mechanical and materials engineering and went to work for Boeing Aerospace in Huntsville, Alabama.

Connor Haugh - Connor finshed his master's paper on "A Risk Analysis of the Effectiveness of Synthetic Liners in Reducing the Risk from Hazardous Waste Landfills." He will receive his degree in environmental engineering in December 1988. He went to work for the U.S. Geological Survey on hazardous waste sites.

Bruce Patrick Herndon - Bruce graduated summa cum laude with a joint degree in computer science and mathematics and went on to graduate work in expert systems at Stanford University.

Elizabeth Ann Shurte - Elizabeth graduated in chemical engineering and went into the Army to fulfill her ROTC obligations. She presented the paper she prepared with her summer internship supervisor, Nevyn Rankin, entitled "Evaluation of the Effectiveness of Commercially-Available Decontamination Chemicals on Stainless Steel and Inconel 625" at Waste Management '88.

Jamie Wright - Jamie chose, at the end of the first semester, to return to Bechtel National, Inc., to continue her work on the cleanup of FUSRAP sites. She has enrolled at the University of Tennessee-Knoxville in Nuclear Engineering 597, Special Topics in Radiation Protection, taught by James Turner, and Public Health 511, Occupational Health. Upon successful completion of these courses, she will graduate with a master's degree.

Tim Tope - Tim, a former intern, has continued his graduate studies in environmental engineering at Vanderbilt University. During this past year, he won the Carl Mason Prize for Research in the Treatment, Destruction or Disposal of Industrial, Hazardous or Nuclear Waste for "A Method for Rating the Integrity of Flexible Membrane Liners for Hazardous Waste Disposal Sites." In addition, he presented "Minimum Technical Criteria and Public Involvement in Siting Hazardous Waste Facilities," in conjunction with Frank L. Parker and John A. Roth, at the DOE Model Meeting in Oak Ridge, Tennessee on October 5, 1988, and will present "Use of U.S. EPA's EXAMS Model to Predict the Fate of Contaminants into the Rhine and Monongahela Rivers," with Daniel S. Travis and Frank L. Parker, at Superfund '88 - Hazardous Materials Control Research Institute on November 30, 1988.

V. TECHNICAL ADVISORY COMMITTEE

The third meeting of the Technical Advisory Committee was held in conjunction with the fall colloquium on October 1, 1987. At the colloquium, the

interns presented the results of their summer work and also described their impression of the program. In addition, their local sponsors described their experience with the interns over the summer and discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the local sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. At the close of session, the Technical Advisory Committee expressed again its enthusiasm for the program.

None of the expenses of the colloquium or the Technical Advisory Board was paid from DOE funds.

VI. INTERNSHIP PROGRAM RENEWAL

The Department of Energy has renewed the internship program for another three years. We are grateful for the continued expression of confidence in this program.

VII. RECRUITMENT OF NEW STUDENTS

To make the existence of the program better known, the Director presented a paper, "A University Program in Hazardous Chemical and Radioactive Waste Management," at the Oak Ridge Model Conference at Oak Ridge, Tennessee, on October 13, 1987. He presented an invited paper, "Risk Assessment Applied to Indoor Radon," in a panel discussion on radon at the American Nuclear Society Meeting in Los Angeles on November 16, 1987. He also presented an invited paper, "What We Can Learn About Low-Level Radioactive Waste Management from Other Countries," at the American Chemical Society meeting on September 3, 1987 in New Orleans. All of these appearances resulted in favorable publicity for the program and increased applications for the fifth year of the internship program.

The choice of interns this year was difficult, since the number and quality of applicants was so high. Those awarded internships are:

NAME	STATUS	GRADE POINT AVERAGE
Reid Adams	Junior in Civil and Environmental Engineering	3.36/4.00
Lawrence Lacy Baldy	Junior in Civil and Environmental Engineering	3.22/4.00
Ronald James Falco	First year graduate student in Civil and Environmental Engineering, B.S., Chemical Engineering, University of California-Berkeley	3.24/4.00
Brennan Smith	Junior in Civil and Environmental Engineering and Economics	3.31/4.00
Mark Valenzuela	Junior in Civil and Environmental Engineering	3.94/4.00

Two other candidates were admitted but withdrew at the beginning of the semester when it was found that their premedical course requirements precluded their taking the necessary courses for the internship.

VIII.QUALITY ASSURANCE

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the Program Director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter, the Program Director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, then the appropriate faculty member is encouraged to continue to work with the student.

PROGRESS REPORT

ON THE

DEPARTMENT OF ENERGY'S

PILOT INTERNSHIP PROGRAM ON RADIOACTIVE WASTE

AT

VANDERBILT UNIVERSITY

(September 1, 1986 to August 31, 1987)

I. INTRODUCTION

The third year of the program began with the selection of the new interns. Mailings were sent to prospective graduate students and rising juniors with grade point averages of 3.0 or better (out of 4.0) at Vanderbilt University advertising the availability of internships in radioactive waste disposal.

The new interns selected were:

NAME	STATUS	GRADE POINT AVERAGE
E. Roberts Alley, Jr.	Junior in Environmental Engineering	3.38/4.00
David Cristol	Junior in Mechanical Engineering	3.4/ 4.00
Connor J. Haugh	First year graduate student in Environmental Engineering	3.3/ 4.00
Bruce Patrick Herndon	Junior in Computer Science and Mathematics	3.8/ 4.00
Elizabeth Anne Shurte	Junior in Chemical Engineering	3.4/ 4.00
James David Williams	Senior in Mechanical Engineering	3.93/4.00
Jamie H. Wright	First year graduate student in Environmental Engineering	2.4/ 3.00

All but one of the interns selected in the third year chose to return to Vanderbilt after their field assignment. David Williams, who was graduated in the spring of 1987 in Mechanical Engineering, was offered a three-year Office of Naval Research Fellowship at Stanford University, and he chose to go there to continue work on robotics that he started while on his internship at the Savannah River Plant.

II. COURSE OF STUDIES

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 161, Elements of Modern Physics (in the future, this will be Physics 133, Introduction to Modern Physics, or Physics 153, Principles of Modern Physics); Physics 238, Atomic and Nuclear Physics (Laboratory Course); and CEE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix A. Students in their second year have been encouraged to take EWRE 355, Hazardous Waste Engineering, to prepare them to deal more effectively with mixed waste problems.

The two IBM AT Personal Computers (PC) purchased for the internship program have proven invaluable. They have been utilized extensively both in course work and research work. This additional experience has prepared the students to commence their assignments at the field sites immediately upon arrival. The students have utilized the PCs extensively during their field assignments, as will be discussed in the section detailing their summer experience.

III. INTERN ASSIGNMENTS

As in the first and second year, applications were solicited from the firms initially suggested by DOE and from other major firms doing decontamina-

tion and decommissioning work. Those solicited were: Bechtel National, Inc., Westinghouse Electric Corporation, General Electric Corporation, NUS Corporation, IT Corporation, Rockwell Hanford Operations, and DuPont Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix B.

Early in the spring semester, most of the companies sent representatives to Vanderbilt University to present seminars on the work they were doing and to interview the interns for possible assignments at their work places. Prior to the visits, a curriculum vita for each student was sent to each company (shown in Appendix C). During the visits, it was stressed with the company representatives that the internship must be a learning experience in D & D.

The students were counseled on the advantages and disadvantages of the various opportunities, but were encouraged to make independent choices, consistent with some distribution among companies and projects. Each student was reminded that he was required to do a senior paper or master's thesis on a topic within the decontamination and decommissioning field. A letter reminding them of the obligation to do this was sent to each intern. Each student then made his choice:

> Ernest Roberts Alley, Jr. - Though Rob is a rising senior, after discussion with the Program Officer, we agreed that he would benefit more from an extra year of course work before doing his field work. This summer he worked with a consulting engineering firm on hazardous waste permit applications and computer applications in environmental engineering.
>
> David Cristol - Bechtel National, Inc., Oak Ridge, TN
> Though David was assigned to Bechtel National, Inc., at Oak Ridge, Tennessee, because of his interests in robotics, he joined the Bechtel robotic decontamination team working at the Savannah River Plant. He was to study the mobilization and use of robotics in D & D and to determine the advantages and disadvangates of using remotely-operated equipment versus using hand-held equipment.
>
> Connor J. Haugh - General Electric Company, Shippingport Decommissioning Project, Beaver Valley, Pennsylvania
> Connor is to participate in the continuing decontamination

and decommissioning of the Shippingport Atomic Power Station of the Duquesne Light Company. He will participate in, among other things, the planning, scheduling, processing of radioactive waste streams (liquid and solid), packaging of radioactive waste and shipment of radioactive waste.

Bruce Patrick Herndon - E.I. DuPont de Nemours, Savannah River Laboratory, Aiken, South Carolina
Bruce worked on expert systems for the operation of the defense high-level waste glass meter.

Elizabeth Anne Shurte - E.I. DuPont de Nemours, Savannah River Laboratory, Aiken, South Carolina
Lisa is to evaluate alternative decontamination methods and solutions for different materials and isotopes and develop a matrix to allow best choices to be made.

James David Williams - E.I. DuPont de Nemours, Savannah River Laboratory, Aiken, South Carolina
David is to extend the force sensing capabilities of the telerobot manipulator to include force feedback to the programmable controller. Then, he is to implement expert systems to control the manipulator using feedback from the force sensors.

Jamie H. Wright - Bechtel National, Inc., Oak Ridge, TN
Jamie is to develop a procedure for performing preliminary assessments and site investigations (PA/SI) for FUSRAP sites. The data to be gathered will be sufficient to meet the PA/SI requirements of SARA, CERCLA, HSWA and RCRA and to calculate a Hazard Ranking System Score.

In addition, Kevin Brown, who completed his two-year internship, was invited (and accepted the invitation) by the Savannah River Laboratory to return this summer to complete his work on an expert system for the alpha incinerator to be used as his M.S. paper.

IV. STATUS OF THE SECOND-YEAR OF THE PROGRAM INTERNS

The students all completed their course work successfully (grade reports for all interns for the second year are included in Appendix D). All six second-year students returned for the second year of the internship.

Lance Cooper completed his Master's paper and graduated. His paper, Comparison of Pollutant Fluxes in Saturated and Unsaturated Flows Beneath Hazardous Waste Sites, has been accepted for presentation at HMCRI's 8th

National Conference and Exhibition, Superfund '87. He is presently working for CH2M Hill on their Oak Ridge Characterization Project.

William Crawford has graduated. His paper, A Conceptual Design of a Plutonium Recovery Incinerator, was instrumental in having the Savannah River Plant fund the development and installation of such an incinerator. He is working for E.I. DuPont de Nemours.

Lloyd Denman has graduated. His paper, The NUS Process Services Corporation Filter Encapsulation Liner, developed a technique for properly sealing the liner. Mr. Denman now works for Los Angeles County on hazardous waste problems.

Richard McMillen has graduated. His paper was on Electrical Redesign of a High Pressure Compactor. He has gone to George Mason University for graduate work.

Adrien Seybert has graduated. Her paper on Thermal Analysis of a High-Level Waste Storage Tank has been completed. Ms. Seybert has a six-month appointment as a Congressional Intern for Senator Albert Gore, Jr. and is working in Washington, D.C. doing technical research in the nuclear area for one of his assistants.

Timothy Tope completed his coursework and graduated. His paper, Particle Sizing Analysis in a Pilot Scale Incinerator Off-Gas Scrubbing System, describes the modification of the scrubbing system to be better able to determine its efficiency. The paper won the fourth place award at the Southeastern Conference of Student Chapters of the American Society of Civil Engineers. Mr. Tope is a graduate student in the Solid and Hazardous Waste Engineering Program in Environmental and Water Resources Engineering at Vanderbilt University. After graduation, he will fulfill his Air Force duty requirements.

V. TECHNICAL ADVISORY COMMITTEE

The second meeting of the Technical Advisory Committee was held in conjunction with fall colloquium on October 7, 1986. At the colloquium, the interns presented the results of their summer work and also described their impression of the program. In addition, their local sponsors described their experience with the interns over the summer and also discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the local sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are listed in Appendix E. Written comments received from the members of the Technical Advisory Committee are shown in Appendix F.

None of the expenses of the colloquium or the Technical Advisory Board was paid from DOE funds.

VI. INTERNSHIP PROGRAM RENEWAL

The Department of Energy has renewed the internship program for another three years. We are grateful for the continued expression of confidence in this program.

VII. RECRUITMENT OF NEW STUDENTS

To make the existence of the program better known, the Director presented a paper on the Program, University's Role in Hazardous Chemical Waste Management and Research, at the International Congress on Hazardous Materials Management in Chattanooga, Tennessee, June 9, 1987, an invited luncheon address, Risk Analysis as Applied to Mill Tailings Piles and Hazardous Wastes, at the U.S. Department of Energy's Remedial Action Program Annual Meeting, April 29, 1987, and chaired a session of the Oak Ridge Modeling Meeting, February 5, 1987. During the Remedial Action Program meeting, discussions were held with DOE's Idaho Operations Office and the Technical Measurement

Center personnel about the possibilities of cooperative efforts and placement of interns. All of these appearances resulted in favorable publicity for the program and increased applications for the fourth year of the internship program.

The choice of interns this year was difficult, since the number and quality of applicants was so high. Those awarded internships are:

NAME	STATUS	GRADE POINT AVERAGE
Eric J. Dawson	First year graduate student in Environmental Engineering B.S., Colorado State University	3.83/4.00
Tina Maria Hannye	Junior in Civil and Environmental Engineering	3.93/4.00
Robert Todd Harris	Junior in Chemical Engineering	3.77/4.00
Eric Samuel Lookofsky	Junior in Chemical Engineering	3.29/4.00
John Mason Rudolph	Junior in Civil and Environmental Engineering and Mathematics	3.65/4.00
Dean Vlachos	First year graduate student in Environmental Engineering B.S., Colorado State University	3.90/4.00

VIII. QUALITY ASSURANCE

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a description of the proposed summer project. After receipt of the proposal, the Program Director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter, the Program Director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is

encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, then the appropriate faculty member is encouraged to continue to work with the student.

PROGRESS REPORT

ON THE

DEPARTMENT OF ENERGY'S

PILOT INTERNSHIP PROGRAM ON RADIOACTIVE WASTE

AT

VANDERBILT UNIVERSITY

(July 1, 1985 to August 31, 1986)

I. INTRODUCTION

The second year of the program began with the selection of the new interns. Following the procedures begun last year, mailings were sent to a wide variety of schools and organizations and within Vanderbilt University advertising the availability of internships in radioactive waste disposal.

II. INTERN SELECTION

All but one of the interns selected the first year chose to return to Vanderbilt after their field assignment. Mark Kaye, who was graduated in the spring of 1986 in Chemical Engineering, chose to remain at Bechtel National, Inc. at Oak Ridge, Tennessee to continue his work on decontamination and decommissioning of nuclear facilities.

The new interns selected were:

NAME	STATUS	GRADE POINT AVERAGE
Lance Cooper	First year graduate student in environmental engineering	3.87/4.00
William Crawford	Junior in Chemical Engineering	3.65/4.00
Lloyd Denman	Junior in Civil Engineering	3.1/ 4.00
Richard McMillen	Senior in Electrical Engineering	3.6/ 4.00
Adrien Seybert	Junior in Chemical Engineering	3.00/4.00
Timothy Tope	Junior in Civil Engineering	3.71/4.00

III. COURSE OF STUDIES

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 161, Elements of Modern Physics; Physics 238, Atomic and Nuclear Physics (Laboratory Course); and EWRE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix A.

It became apparent during the first year of the internship program that the students, while familiar with the use of main frame computers, were not proficient in the use of mini-computers. With the permission of the Project Officer, two IBM AT Personal Computers were purchased. These have been extensively utilized both in course work and research work. This additional experience has prepared the students to commence their assignments at the field sites immediately upon arrival.

IV. INTERN ASSIGNMENTS

As in the first year, applications were solicited from the firms initially suggested by DOE and from other major firms doing decontamination and decommissioning work. Those solicited were: Bechtel National, Inc., Westinghouse Electric Corporation, General Electric Corporation, NUS Corporation, IT Corporation, Rockwell Hanford Operations, and DuPont Savannah River Laboratory. Those interested provided us with proposed work assignments for the interns. These are shown in Appendix B.

Early in the spring semester, most of the companies sent representatives to Vanderbilt University to present seminars on the work they were doing and to interview the interns for possible assignments at their work places. Prior to the visits, a vita for each student was sent to each company (shown in Appendix C). During the visits, it was stressed with the company representatives that the internship must be a learning experience in D & D.

The students were counseled on the advantages and disadvantages of the various opportunities, but were encouraged to make independent choices, consistent with some distribution among companies and projects. Each student was reminded that he was required to do a senior paper or master's thesis on a topic within the decontamination and decommissioning field. A letter reminding them of the obligation to do this was sent to each intern. Each student then made his choice:

> Lance Cooper - Bechtel National, Inc., Oak Ridge, TN. Investigate the optimization of containment cell design parameters. Develop a computer code to estimate the cost of a disposal cell per unit waste volume as a function of the variation of the parameters of the disposal cell [height, length and width of cell, thickness of clay liner and cap components (clay, riprap, gravel, sand), top and side slopes of the cap and configuration of clay dikes].

William Crawford - E.I. DuPont de Nemours, Savannah River Laboratory, Aiken, SC. Design and develop an in-glove-box incinerator for plutonium contaminated solid waste. Incinerator will be designed to be compatible with plutonium recovery. Perform process design and specifications of components followed by experimental pyrolysis and hydro-pyrolysis studies on the waste to insure the viability of the process.

Lloyd Denman - NUS Process Services Corporation, Columbia, SC. Assist in the design, testing and licensing of cast concrete containers for use in disposing of low-level radioactive filters and ion-exchange resins. Particular emphasis will be placed on the integrity of the cover seal.

Richard McMillen - Westinghouse-Hittman, Columbia, MD. Design power controls that will enable the Westinghouse-Hittman high force compactor to be used for non-standard conditions. The compactor allows two drums to be placed inside a single drum.

Adrien Seybert - Rockwell Hanford Operations, Richland, WA. Modify a heat transfer model to determine the maximum temperature in a high-level radioactive waste tank as a function of age and type of waste and height of waste in the tank. The problem is particularly complex because of the effect of the changing gas-air buffer on the heat exchange processes of evaporation, conduction and convection.

Timothy Tope - E.I. DuPont de Nemours, Savannah River Laboratory, Aiken, SC. Characterize flue-gas emissions, particularly particle size, from a pilot incinerator before and after scrubbing with the Hydrosonics steam scrubber and the adjustable venturi scrubber.

In addition, Kevin Brown, who completed his two-year internship, was invited (and accepted the invitation) by the Savannah River Laboratory to return this summer to complete his work on an expert system for the alpha incinerator. [Four of the five first-year students returned for the second year of the internship.]

The students all successfully completed their course work (grade reports for all ten interns for the year are included in Appendix D). Two of the students in their second year, Vick and Rohe, were graduated, and one, McMillen, was graduated at the end of his first year in the program.

V. STATUS OF THE FIRST-YEAR INTERNS

Pauline Nelson completed her course work for the Master of Science in Engineering and worked on her master's paper on "Performance and Efficiency of Commercial PCB Incinerators."

Kevin Brown has completed his course work for the Master of Science in Engineering degree and is working on his master's thesis on "Expert System Use in Operating an Alpha Incinerator."

Mike Vick graduated with highest honors, winning the Andrews Award in Environmental Engineering. He presented the results of his summer's work at a meeting of the Southeastern American Society of Civil Engineering Chapters and won the prize for the best student paper, entitled "The Treatment of Uranium-Contaminated Emulsified Oils." He is currently enrolled in the Master of Science Program in Environmental Engineering at Cornell University.

Mike Rohe graduated with honors.

Mark Kaye is working with Bechtel National, Inc. on decontamination and decommissioning of nuclear facilities. In addition, he presented the results of his summer's work at the 19th Health Physics Society Mid-Year Topical Symposium on Health-Physics Considerations in Decontamination and Decommissioning. The title of his paper was "Comparisons of Passive Environmental Radon Monitors (PERMS) and Track Etch (R) Radon Detectors During Remedial Action at the Niagara Fall Storage Site."

VI. TECHNICAL ADVISORY COMMITTEE

The first meeting of the Technical Advisory Committee was held in conjunction with fall colloquium on September 19, 1985. At the colloquium, the interns presented the results of their summer work and also described their

impression of the program. In addition, their local sponsors described their experience with the interns over the summer and also discussed their programs and likely opportunities for the following summer. The new interns attended the colloquium and the luncheon with the local sponsors and the members of the Technical Advisory Committee (frequently the same person). The members of the Technical Advisory Committee are shown in Appendix E. The written comments of the Technical Advisory Committee are shown in Appendix F. Also included in Appendix F is a letter from John Baublitz, Deputy Director, Office of Remedial Action and Waste Technology, containing a commendation of the program by the Oak Ridge Operations Office.

None of the expenses of the Colloquium or the Technical Advisory Board was paid from DOE funds.

VII. RECRUITMENT OF NEW STUDENTS

To make the existence of the program better known, the Director attended the Nuclear Regulatory Commissions's International Conference on Decontamination and Decommissioning, July 16-18, 1985 in Washington, D.C., and the Health Physics Society Mid-Year Topic Meeting on Health Physics Considerations in Decontamination and Decommissioning in Knoxville, TN, in February, 1986. A poster advertising the program was displayed at the latter meeting. In addition, feedback from the first year interns, newspaper articles on the program, and the appearance of the Program Director on the McNeil-Lehrer Hour in connection with the Chernobyl accident, where he was identified as the Director of the only US DOE-sponsored training program in decontamination and decommissioning all resulted in favorable publicity for the program and increased applications for the third-year internships.

VIII. CHANGE IN PROGRAM YEAR AND APPOINTMENT OF INTERNS FOR THIRD YEAR

To coincide with the start of the school year and the end of the summer internship session, the program year was changed to September 1 to August 31. Consequently, interns for the third year of the program were appointed within the time period covered by this report. Because one of the students appointed in the second year had an ROTC tuition scholarship, the internship program was charged only for his summer program. This made excess funds available in the program budget and, with the concurrence of the Program Officer, seven students were appointed as interns for the third year of the program. They are:

NAME	STATUS	GRADE POINT AVERAGE
Ernest Roberts Alley, Jr.	Junior in Environmental Engineering	3.38/4.00
David Cristol	Junior in Mechanical Engineering	3.4/ 4.00
Connor J. Haugh	First year graduate student in Environmental Engineering	3.3/ 4.00
Bruce Patrick Herndon	Junior in Computer Science and Mathematics	3.8/ 4.00
Elizabeth Anne Shurte	Junior in Chemical Engineering	3.4/ 4.00
James David Williams	Senior in Mechanical Engineering	3.93/4.00
Jamie H. Wright	First year graduate student in Environmental Engineering	2.4/ 3.00

IX. QUALITY ASSURANCE

In addition to the Technical Advisory Committee overview of the entire program, a system of checks has been installed to assure the quality of the program. Within two weeks after the student begins his summer assignment, he and his supervisor prepare a proposed summer project description. After

receipt of the proposal, the Program Director reviews it to be sure that the topic and scope of the work are compatible with the objectives of the program. Shortly thereafter, the Program Director visits the site to discuss with the intern and his supervisor the work program and any difficulties there may be in implementing it. At the end of the summer internship, the intern and his supervisor prepare, if appropriate, a proposal for further work on the summer project. During the course of the summer program, the intern is encouraged to seek advice from the appropriate faculty members at Vanderbilt University. If work is continued at Vanderbilt, then the appropriate faculty member is encouraged to continue to work with the student.

PROGRESS REPORT

ON THE

DEPARTMENT OF ENERGY'S

PILOT INTERNSHIP PROGRAM ON RADIOACTIVE WASTE

AT

VANDERBILT UNIVERSITY

(August 1, 1984 to June 30, 1985)

I. INTRODUCTION

Early in August, 1984, Vanderbilt University was notified that the budget for an internship program in the decontamination and decommissioning of hazardous waste had been approved. Efforts had been underway prior to that time to identify potential undergraduate and graduate students who would be suitable candidates for the internship. However, until final approval was received, no firm commitments could be made.

II. INTERN SELECTION

Immediately after the award, efforts were intensified to find the highest quality students possible. Though a number of applications for graduate study in the program were received, the quality of the undergraduates applying for the program was so much higher that, after consultation with the Department of Energy's Technical Liaison, Dr. L. C. Brazeley, we opted to appoint five undergraduates at the junior level or above. The students named as interns were:

Pauline Nelson	second semester senior in civil engineering	2.10/3.00
Kevin Brown	first semester senior in chemical engineering	2.52/3.00
Mark Kaye	first semester senior in chemical engineering	2.04/3.00
Michael Vick	second semester junior in civil engineering	3.77/4.00
Michael Rohe	first semester junior in mechanical engineering	2.39/3.00

III. COURSE OF STUDIES

As outlined in the proposal for the Pilot Internship Program, each student continued his normal curriculum in his respective engineering discipline, with the additional requirements of Physics 161, Elements of Modern Physics, Physics 238, Atomic and Nuclear Physics (Laboratory Course), and EWRE 269, Radiological Aspects of Environmental Engineering. Copies of the syllabi are attached as Appendix A. Also, each student was required to attend the course "Radiation Safety: Principles and Orientation", given by the Office of Radiation Safety, Vanderbilt University. A copy of the course outline is attached as Appendix B.

Early in the first semester, the DOE Technical Representative, Dr. L.C. Brazeley, met with the interns and explained the purpose and objectives of the program, and coordinated the training program for them with the Project Director, Dr. F.L. Parker.

IV. INTERN ASSIGNMENTS

DOE provided the Project Director with a list of contacts at DOE contractor sites to arrange the work-training assignments for the interns. A copy of this list is attached as Appendix C. All of the named individuals were written to explain the purposes of the program and solicit their help in arranging the summer work assignments for the students.

Responses were received from only a few of the named individuals and resulted in contacts with operating contractors at the West Valley Site, West Valley Nuclear Services Co., Inc. (a Westinghouse subsidiary); at the FUSRAP sites, Bechtel National; and at the Maxey Flats Low-Level Waste Disposal Site (Westinghouse). Harry Burkholder, of the Waste Treatment Program at Pacific Northwest Laboratories, responded favorably, but later informed us that funding had been cut from his program, and it would not be possible to accept any interns. As word of our program spread, however, we were contacted by the decontamination and decommissioning group at the Savannah River Laboratory and were asked if they could participate in the summer internship program.

Early in the spring semester, each of the above companies sent representatives to Vanderbilt University to present seminars on the work they were doing and to interview the students for possible assignments at their work places. The Project Director visited each of the groups, though not each of the sites, to discuss the technical and administrative aspects of the program. During the visits, it was stressed that the internship must be a learning experience in the D & D area.

As a result of the interviews and discussions, each of the students submitted to the companies a copy of their vita (copies attached as Appendix D) and each of the companies submitted a list of projects (copies attached as Appendix E) that they thought would be suitable for a summer intern. The students were counseled on the advantages and disadvantages of the various opportunities, but were encouraged to make their own choices, consistent with some distribution among companies and projects. Each student was reminded that they were required to do a senior paper or master's thesis on a topic within the decontamination and decommissioning field. A letter reminding them of the obligation to do this was also sent to each intern. Each of the students then made their choice:

Pauline Nelson - Westinghouse Hittman, Columbia, Maryland
Develop concepts and plans for the decommissioning of Maxey Flats Low-Level Radioactive Waste Disposal Site. Experience to be gained in the fields of soil chemistry, soil mechanics, ground water flow, pathway analyses, site drainage, and erosion modeling.

Kevin Brown - Savannah River Laboratory, Aiken, South Carolina
Assistance in the start-up and debugging of a full-scale plutonium waste incinerator, including development of real-time data analyses and correlation, using state-of-the-art process computer technology.

Mark Kaye - Bechtel National, Oak Ridge, Tennessee
Assist in the environmental assessment of radioactive materials at the Niagara Falls Storage Site (pitchblende residues), radiological

engineering for remedial action planning, and implementation of radiological engineering plans and controls at the site.

Michael Vick - Bechtel National, Oak Ridge, Tennessee

Help plan the remedial action at the National Lead Industries' Colonie, New York site (depleted uranium and hazardous chemical wastes), including neutralization of the wastes, developing procedures, and performing field work (sampling and monitoring).

Michael Rohe - Savannah River Laboratory, Aiken, South Carolina

Tests to characterize the effect of variables in high-pressure-water decontamination techniques

The students all successfully completed the course work and three, Nelson, Brown, and Kaye, were graduated. Grade reports for all the interns for the year are attached as Appendix F.

V. INTERN RECRUITMENT

An intense recruiting campaign was carried out to solicit applications for the second year of the three-year pilot program. Ads were placed in Science magazine, EOS, the weekly newspaper of the American Geophysical Union, and in the newsletter of the Health Physics Society. In addition, letters were sent to all likely candidates among those who had participated as summer students at the Argonne National Laboratory, and to all undergraduate engineering students at Vanderbilt University with a grade point average better than 3.00 out of 4.00. Notices were sent to most accredited departments of chemistry in the contiguous United States. Though a number of inquiries were received, very few applications resulted. To date only four internships for next year

have been awarded, though it is believed that by the time school begins, the remaining internships will have been awarded to suitable candidates.

VI. INTERN VISITATIONS

After the students had been at their internship sites, they were visited by the Project Director to determine if the work assignments were compatible with the aims of the program, if they were performing their work satisfactorily, what deficiencies they had found in their training, their relationships with the local sponsor, what the local sponsors thought about the program now that it was actually impinging on their work, what additional background they would have liked for the students to have had, and whether they would like to continue in the program next year.

The students and their local sponsors were all enthusiastic about the program, want it continued and even expanded. Polly Nelson, in addition to the topics previously listed, is also looking at tracers to determine the flow of wastes from the new improved burial ground design that is required under their caretaker contract, and the use of concrete in stabilizing existing waste burial grounds. Because of this last task, Polly feels she would have benefited from a course in concrete technology. She also pointed out that, though she had had experience in using main frame computers, she had had no experience in the use of microcomputers. John Funk, Polly's supervisor, was delighted with her work and would like to have more interns next summer.

Kevin Brown, in addition to all of the items previously detailed, has helped in the startup of the incinerator and is now involved in the design of an expert system (artificial intelligence) input to the

controls. His supervisors, Ken Mersman and David Charlesworth, are so delighted with his progress that they have already agreed to hire him next summer to complete that study. This will satisfy their needs and fulfill Brown's thesis requirements for the master's degree.

Mike Rohe, in addition to the items detailed above, has been carrying out an experimental study on how best to seal off contaminated pipes when they are cut loose during a decommissioning. He has experimented with a series of plastic caps and investigated three methods - propane torch, hot air, and infrared - to seal them. He has modified a commercially-available infrared heater so that it can be used in place to seal the pipes as they are cut for safer transport. Mike and his supervisor, Nevyn Rankin, are very happy with the progress that Mike has made and the impetus he has given to the development of decontamination and decommissioning techniques.

Mike Vick, in addition to planning the work for the cleanup of the mixed liquid wastes at the site, is performing pilot bench scale and full-scale demonstration tests to determine the best cleanup procedures. They have found satisfactory means of separating the oil from the uranium-contaminated fluids and for solidifying the remaining fluids, using Envirostone.

Both Mike Vick and his supervisor, Phil Crotwell, are delighted with the work assignment. Mike has gotten a good idea of what it means to take responsibility for finding a solution to decontamination and decommissioning problems and has succeeded in doing so. Crotwell would be very happy to have more interns next summer to tackle different phases of the cleanup plan at the site. Mike, as have some of the other

interns, has taken advantage of the resources available to him in the faculty at Vanderbilt for consultation on specific topics, in his case, removal of oils and breakup of emulsified oils. He also expressed an interest in exposure and use of microcomputers.

Mark Kaye has gotten some field experience at the Niagara Falls site and, in addition, has devised a program to test the capabilities of the PERM and the track etch methods for radon detection at the TNC at Grand Junction, Colorado. He is also writing procedures for siting radon monitors. In addition, he is working on methods for extracting PCBs from mixed wastes and the construction of a mobile evaporator for mixed wastes.

Not only are the immediate supervisors of Brown and Rohe happy with their input, but I also met with the manager of research for the plant, Dr. Ed Albanesius, and associate director of the plant, and they are most eager to continue the working arrangement with Vanderbilt University and the internship program. Mike Rohe noted that, for his special assignment, further training in fluid mechanics would have been helpful. Both Brown and Rohe felt that work on the microcomputers would have been helpful in their work.

Some of the background deficiencies noted by the students are inevitable. As long as they know how to obtain the information, where to get it and how to apply it, there is no cause for concern. It is impossible to teach anyone everything that they will need to know in their career. The information on concrete technology, for example, is easily available and students need to be able to access that kind of information. Advanced training in fluid mechanics is highly desirable,

but similar to concrete technology, is highly specialized and can be obtained through independent study. However, the lack of training in the use of microcomputers is pervasive and will be remedied this next year for the interns (and our other students as well). All of the students, of course, have experience with main frame computers, but this will now be supplemented with training on microcomputers.

VII. COLLOQUIUM

After the students return from their internship in the fall, a colloquium is planned for September 19, at which they will relate their experiences to each other and to the newly-appointed interns. In addition, their local sponsors will be here to relate their experiences with the interns. From both groups not only will knowledge of D & D techniques be learned but, in addition, we shall be able to incorporate their suggestions into the program for the next year, so that technical and administrative aspects of the program will be improved. A tentative schedule for the colloquium is attached as Appendix G.

VIII.TECHNICAL ADVISORY COMMITTEE

Finally, a high-level technical advisory committee to the program is in the process of being formed to meet during the colloquium and to offer suggestions on how to improve the program. Tentative acceptances have been received from DOE and all the local sponsors. In addition, other major companies involved in D & D will be invited to send representatives to the Advisory Board. The total number of members is expected to be ten or less. None of the expenses of the meeting of the colloquium or the Board will be paid for by DOE funds.

IX. CONCLUSIONS

In the discussions at all of the sites, it has become apparent that lessons learned at one location are not usually transferred to similar problems at the same site, not to mention similar problems at other sites. There does not seem to be any system to gather, interpret, critique and evaluate methods developed for similar problems at different sites. State-of-the-art reviews of technologies, here and abroad, would be most useful in determining the most efficient means of decontaminating and decommissioning contaminated and surplus sites.

The internship program, based upon the evaluation of the students, local sponsors and the faculty, has been a resounding success, and will assist in fulfilling a need for trained scientists and engineers in this vital and growing field.