MAR 18 1986

Engineering
Code 330

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety
Division of Fuel Cycle & Material Safety
Branch of Material Licensing
Washington, D. C. 20555

Docket No. 030-08557
License No. 25-15091-01
Control No. 419529

Gentlemen:

I am submitting herewith a copy of a Nuclear Densometer Course Proposal, a schedule of topics covered, a curriculum vitae for the principle lecturer and resumes of associates. The course was prepared by the Departments of CE and EM of the Montana State University, Bozeman, Montana, and is used by the Montana State Department of Transportation.

The course is presented on a contract basis for Continuing Education by the University. It comes complete with course materials in a three ring binder and a copy of the two tests required to be passed for successful completion is also included.

Your review and approval of this course for operator training is needed because it is a more comprehensive and extensive training than the Troxler course and is less costly.

Sincerely,

(Sgd) Sherman E. Oland

Sherman E. Oland
Radiation Protection Officer

200:SEOLAND:mdc:03-13-86-X6675
bcc: 200 Reading File
330 Reading File
330 Subject File
(ROADS2:15)

Bureau of Indian Affairs

NUCLEAR DENSOMETER COURSE PROPOSAL

INTRODUCTION: This course answers the need for training of nuclear densometer operators. This two and one half day course will be taught in Billings at a site selected by Bureau of Indian Affairs. The intent here is to outline course elements and to provide a cost estimate.

PURPOSE: To provide participants with sufficient training to operate a nuclear densometer safely and with a high degree of accuracy on embankments, base courses and asphalt surfaces.

GENERAL: Due to the sometimes limited opportunities available to train new and old gauge operators there is a great deal of time spent verifying procedures and correcting results. A training course about how the gauges work, how to keep them operational, and about the materials being tested is needed to help correct this problem.

This course will cover nuclear safety as well as compaction and pavement inspection. The Troxler-3411 actually operated by the participants in the field will be used. The Troxler 3411 manual will be used as a reference. Each participant will be issued a course notebook and a gauge manual which they will be allowed to keep.

The course is divided into three segments: safety and maintenance, a brief review of soil and asphalt characteristics as related to nuclear densometer testing, and practical exercises with each participant using a densometer. Nuclear saftey will be given a practical approach with only the minimum theory required to make it understandable. In order to understand how the gauge works,

461162

the participants must know the medium it is testing; therefore, soil and asphalt compaction methods and standards will be discussed. The compaction box and statistical stability tests will be used to demonstrate the accuracy of the gauges. The final phase will be repetitive testing. Participants will be able to use proper procedures in testing embankments, base courses and asphalt pavements to include control strip techniques. Participants will be able to understand the causes and remedies of false readings. Successful completion of the course will be based on each participant passing two written examinations as well as performing a field test in gauge operations. Participants will be graded on a pass/fail basis and will be required to pass examinations and the practical exercises with a grade of 90% or better. Participants successfully completing the course will be issued a wallet size certificate stating they have passed the course of instruction and are qualified Nuclear Gauge Operators. The certificate is signed by a Radiological Safety Officer, Bureau of Indian Affairs, and the MSU Instructor.

The course will be taught at a level for high school graduates or GED equivalent. The course and course content are those designed to satisfy criteria established by the DIA and the Nuclear Regulatory Commission. The participants will be expected to provide their own basic learning materials, i.e., papers, pencils, scales, etc. It is a course requirement that each participant bring a hand held calculator. Class size will be limited to twenty participants selected by the Bureau of Indian Affairs. This is due to the limited number of nuclear gauges available. One gauge for every two participants is recommended.

A copy of the proposed schedule for each session is attached. Course pace and coverage is dependent on the participants skill and is thus the prerogative of the instructor. The number of sessions offered are to be determined by the Bureau

of Indian Affairs. The calendar schedule of the courses will be established as mutually convenient for both the University and the Bureau of Indian Affairs but as not to interfere with the 1984 construction season.

During the actual teaching of the course, the MSU will provide adequate classroom space. All texts and printed educational materials will be supplied to the students by the University. Any special laboratory supplies or equipment will be supplied by the University as necessary.

PERSONNEL: The proposed course will be taught by faculty of Montana State University in cooperation with the Course Director, Alan Jackson. It is expected that the following faculty members will be involved: Rich Hovey, P.E., and Glenn Lehrer, P.E. of the Civil Engineering and Engineering Mechanics Department. Curriculum vitae are attached.

461162

Department of CE & EM

MSU

Bozeman, Montana 59717

Nuclear Densometer Operators Short Course
developed for

the Bureau of Indian Affairs

PROPOSED SCHEDULE

Day 1

8:00am- 9:00am	Session 1	Orientation, Introductions
9:00am-10:30am	Session 2	Principles of Nuclear Physics for Soil Measurement
10:30am- Noon	Session 3	Health Safety Regulations and Emergency Measures
1:00pm- 2:00pm	Session 4	Operator and Periodic Maintenance
2:00pm- 4:00pm	Session 5	Gauge Operation, Standard Count, Statistical Stability
4:00pm- 5:00pm	Session 6	Test I

Day 2

8:00am- 9:00am	Session 7	Density Moisture Measurements
9:00am- Noon	Session 8	Proctor, Asphalt and Control Strip Techniques
1:00pm- 2:00pm	Session 9	Gauge Operator Review
2:00pm- 4:00pm	Session 10	Individual Gauge Operation
4:00pm- 5:00pm	Session 11	Test II

Day 3

8:00am- Noon	Session 12	Gauge Field Test Exercise, Course Completion, Critique

PROP/4

CURRICULUM VITAE

Alan T. Jackson
Lecturer
Department of Civil Engineering/Engineering Mechanics
Montana State University
Bozeman, Montana 59717

College Education

B.S. in Civil Engineering, Virginia Military Institute, 1956.
M.S. in Civil Engineering, University of Missouri at Rolla, 1968.

Professional Experience

Lecturer, Department of Civil Engineering/Engineering Mechanics, Montana State University, Bozeman, Montana. Responsible for development and teaching of enginering continuing education courses. 1978 - date.

Operations Manager, Duffy Distributors, Inc., Joplin, Missouri. Responsible for hiring, training, motivation, ordering, layout and route sales in starting the first Coors distributorship in Missouri. 1978.

Graduate Teaching Assistant, Department of Civil Engineering/Engineering Mechanics, Montana State University, Bozeman, Montana. 1976-1978.

Professor of Military Science, Oklahoma, Corps of Eningeers. Responsible for administration and recruiting for an ROTC program. ROTC enrollment tripled in three years. 1973 - 1976.

Reserve Components, Personnel and Administration Center, St. Louis, Missouri. Responsible for assignment of qualified officers of the Army reserves to 8,600 mobilization positions. 1971-1973.

Engineer Logistics Officer, J-4, Military Assistance Command, Saigon, Vietnam. Project officer responsible for providing bill of materials for fire support bases in Cambodia, reimbursement of tactical bridging used in Cambodia, Vietnamese 5 year offshore and in country overhaul programs and U. S. procedures for supporting the dependent shelter program. 1970-1971.

Senior Engineer Advisor, Republic of Vietnam Army Engineers, I Corps Area, Danang, Vietnam. Advised in matters pertaining to use, maintenance, and supply of eningeer material and in requisition of real estate by the allied forces. 1966.

Engineer Staff Officer, U. S. Army Engineer Center, Ft. Belvoir, Virginia. Prepared bill of materials for asphalt paving program, located tactical bridge crossing sites, assisted in snow removal plan for presidential inauguration. 1964-1965.

Company Commander, Company A, 317th Engineer Battalion and 814th Float Bridge Company, Hanau, Germany. Combat type engineering including roads, airfield matting, minefields, fixed and floating bridge construction, assault boats and light tactical rafts. 1961-1964.

Platoon Leader, 161st Engineer Company, Chun Chon, Korea. Employed in the construction of quonset and wood frame buildings at Camp Page. 1958.

Chief, Receiving, Shipping and Classification Branch, Engineering Supply Center, Sagami, Japan. Supervised 160 employees in the receipt, issue and identification of engineering equipment parts. 1957.

Professional Activities

Associate Member, American Society of Civil Engineers.
Member of American Society for Engineering Education.
Affiliate Member, Montana Association of Registered Land Surveyors.

461162

RESUME

Richard B. Hovey
P.O. Box 615
Bozeman, MT 59715

EXPERIENCE

November 1977 to present - Coordinator of the Continuing Education and Engineering Extension Program, Department of Civil Engineering, Montana State University, Bozeman, Montana. Developed the continuing education program into a $300,000 plus yearly operation with a 25% to 40% annual growth rate in terms of both income and number of participants. Taught a variety of short courses from one day to three weeks in length covering topics in supervision and management, road design and construction, and special problems solution. Established a course quality criteria to meet the special needs of the adult short course participant. Served as a management and engineering consultant to the U.S. Forest Service as a part of the short course program. Involved in the development of a statewide television system for continuing education and extension.

October 1974 to November 1977 - Administrative Officer and Affiliate Faculty member, Department of Civil Engineering, Colorado State University. Position involved budget preparation and budget management involving $940,000 annual salaries and $100,000 expense monies. Prepared class and faculty schedules. Assisted in management of approximately 50 professional faculty and supoport staff personnel. Managed departmental facilities and capital equipment. Develop computer based management systems for a variety of departmental and college management problems. Conference coordinator for the 1975 American Society for Engineering Education Annual Conference.

October 1973 to October 1974 - T. L. Fritz and Associates, Fort Collins, Colorado (no longer operating), Engineering and Management Consultant. Involved in a variety of consulting activities including educational seminar development in Critical Path Methods (CPM) and construction management techniques, client contact and development, contract negotiations, management system development.

March to October 1973 - Kenneth Medearis and Associates, Savings Building, Fort Collins, Colorado 80521. The original agreement with Dr. Medearis was that this employment would be temporary. Served as field engineer for KMA on Project Rio Blanco, a nuclear stimulation of natural gas. Worked as liaison with the corporate sponsor and the Atomic Energy Commission. Inspected installation of structural bracing for damage prevention. Provided post-shot assistance in damage claim work and repair. Other KMA activities included field operation of instrumentation equipment, data preparation for high level computer analysis and some client contact.

February 1973 to March 1973 - Frand Hummel, Golf Architect, Greeley, Colorado. Mr. Hummel and I had different opinions on professional and ethical conduct.

March 1972 to January 1973 - Engineer with Reid Burton Construction Company, P. O. Box 905, Fort Collins, Colorado 80521. Responsibilities included job take-off and estimation, job layout, supervision and surveying on commercial and industrial structures. Other activities included subcontract preparation, contract administration, purchasing and supplier and subcontractor administration. Some experience was gained in owner-contractor negotiations.

March 1971 to August 1971 - Engineer with Kenneth Medearis and Associates, Savings Building, Fort Collins, Colorado 80521. This was a part-time position during my graduate work. Responsibilities included a field inventory for a seismic-structural report and assisting in the written presentation of this report. This work was related to work completed from March to October 1973.

October 1968 to June 1971 - William H. Dietsch, Jr., golf course architect. Served as project engineer with responsibilities including various forms of civil engineering work, construction planning and supervision and management of construction projects. This work continued on a part-time basis during my graduate work.

January 1971 to June 1972 - Full-time graduate student in Business Administration at Colorado State University. Also worked March to December teaching engineering surveying laboratory courses, soil mechanics laboratory courses and doing field work for the Civil Engineering Department at C.S.U.

September 1969 to January 1971 - Full-time graduate student and teaching assistant in Civil Engineering at Colorado State University.

June 1969 to September 1969 - Project Engineer on the golf course contruction at the Country Club of Miami, Miami, Florida. I was in charge of all aspects of construction valued at over a half million dollars.

June 1968 to June 1969 - Design Engineer, The Ken R. White Company, Consulting Engineers, Denver, Colorado. I was assigned to the Helena, Montana office. I was a staff design engineer involved in all phases of interstate highway design.

June 1970 to September 1970
September 1967 to April 1968 - KZIX-KFMF FM Radio Station, Fort Collins, Colorado.

461162

September 1968 to May 1969 - KBLL Radio and Television, Helena, Montana.

(During the above listed times, I was employed as a part-time radio and TV announcer by these stations.)

June 1967 to September 1967 - Summer School, Colorado State University.

June 1966 to September 1966 - Employed by the American Golf Course Construction Company, Fort Lauderdale, Florida.

June 1965 to September 1965 - American Golf Course Construction Company.

June 1964 to September 1964 - American Golf Course Construction Company.

June 1958 to June 1964 - During this time, I worked part-time for Kimball J. M. Cormack, P.O. Box 88, Colorado Springs, Colorado, on his horse ranch doing a variety of ranch chores from painting to breaking and training horses.

EDUCATION

M.S.B.A. - Colorado State University - June 1973

M.S.C.E. - Colorado State University - March 1971

B.S.C.E. - Colorado State University - June 1968

High School Diploma - Roy J. Wasson High School, Colorado Springs, Colorado - June 1964.

PROFESSIONAL ORGANIZATIONS

June 1968 to present - an active member of American Society of Civil Engineers serving on several committees. Fall of 1972 to Fall of 1977, served as associate contact member to the Colorado State University student chapter of A.S.C.E.

1980 - Western Branch vice president of Montana Section
1982 - President-elect Montana Section
1983 - President Montana Section

Member of the Aircraft Owner's and Pilot's Association

Member of the National Society of Professional Engineers

Member of the American Society for Engineering Management

Member of American Management Association

PROFESSIONAL REGISTRATION AND LICENSE

Registered Professional Engineer in Colorado, Montana, Wyoming

Licensed private pilot with multi-engine time logged.

Hold a valid third class commercial radio telephone license.

461162

CLENN H. LEHRER
Adjunct Associate Professor
Department of Civil Engineering/Engineering Mechanics
Montana State University
Bozeman, Montana 59717

College Education:

B.S., United States Military Academy; Emphasis on Engineering and Science, West Point, New York, June 1960; GPA 3.46/4.0

M.S. in Civil Engineering, Ohio State University, Columbus, Ohio, June 1966; GPA 3.78/4.0

Teacher's Certification (Secondary) with a major in Math and a Minor in Political Science, University of Utah, Salt Lake City, Utah, February 1979, Honor Graduate; GPA 3.91/4.0

Command and General Staff College, Honor Graduate, Ft. Leavenworth, Kansas, June 1977.

Engineer Officer's Advanced Course, Honor Graduate, Ft. Belvoir, Virginia, June 1968.

Facilities Engineer Management Course, Safeguard System Activation Course, Engineer Officers' Basic Course, Ranger School, Airborne School, Jungle Warfare School, Special Demolition School.

Professional Experience:

Adjunct Associate Professor, Department of Civil Engineering /Engineering Mechanics, Montana State University, Bozeman, Montana, 1980 to present.

Professor of Military Science, College of Social and Behavior Science, University of Utah, Salt Lake City, Utah, 1977 to 1980.

Instructor, University of Alaska, Fort Greely, Alaska, 1976.

Instructor, University of North Dakota, Nekoma, North Dakota 1974.

Instructor and Assistant Professor, United States Military Academy, West Point, New York, 1968-1971.

Facilities Engineer, U.S. Army, Ft. Greely, Alaska 1974-76.

Missile Field Division Chief, U.S. Army Safeguard Systems Command, Langdon, North Dakota, 1972-74.

Company Commander, 173rd Airborne Brigade, Long Ben, Vietnam, 1966-67.

Pipeline Engineer, 10th Engineer Brigade, Saigon, Vietnam, 1966.

Company commander, 11th Engineer Battalion, Camp Essayons, Korea, 1964.

Engineer Unit Command Positions, 1961-1963.

Professional Activities:

Registered Professional Engineer, Montana and Ohio.

American Society of Civil Engineers, member.

Society of American Military Engineers, 1963-1980, member.

Association of the United States Army 1977-1980, Board

member, SLC Chapter.
Board of Education Member, Fort Greely, School District, 1975-76.
Utah Council for the Social Studies, conducted seminar in 1979.
Advisor, National AGC Education Committee.
Consultant, Construction Management.

Publications:

"Viet Cong Tunnels," The Military Engineer, July-August 1968, pp. 242-247.

The Effect of Size and Shape on the Load-Penetration Relationship for Model Footings on Sand, Master's Thesis, The Ohio University, 1966.

461162

TEST 1

1. What is radiation?

2. When your gauge is turned off, does it still emit radiation?

3. How old is radiation?

4. List the four types of radiation emitted from nuclear gauges.

5. What types of radiation are blocked by the walls of the source container.

6. What material is the source of Gamma rays made of?

7. What material is the neutron source made of?

8. Where is the Gamma ray source located?

9. Where is the neutron source located in the Troxler 3411 gauge?

461162

10. What does the Gamma ray source look like?

11. What does the neeutron source look like?

12. What is the definition of half life?

13. What is the difference between a rad and a rem?

14. The radiation source size is measured in what units?

15. What is the depth of measurement in the backscatter mode for the 3411B?

16. What is the maximum dose you are allowed to receive in one month by the Montana Department of Highways?

17. What is the major potential source of error in the Direct transmission mode?

18. What is the major potential source of error in the backscatter mode?

19. What is the maximum dose of radiation you are allowed to receive a week _____ in one year _____ by the Nuclear Regulatory Commission?

20. If a person standing one foot away from a nuclear gauge receives 1 millirem per hour, moving two feet away reduces the intensity to _____.

21. If you receive 0.9 millirems per hour, how many hours will it take to exceed the weekly limit?

22. List three safety measures.

23. When not using the gauge, where is the best place for your badge.

24. Excessive heat or dampness does/does not affect film badges.

25. A D-8 Dozer crushes your gauge, list four actions you would take immediately.

26. Regulations require what precautions to be taken to prevent theft at night.

27. If the building where your nuclear gauges are stored burns to the ground, what four precautions do you take?

28. If you are carrying your gauge in an automibile, where should the gauge be placed?

29. It is best to charge the batteries whenever you get a chance, whether they need it or not, that way the densometer will always be ready. T or F

30. The recharge period for a full charge is how long?

31. The AC charger is made to use with both 115 or 230 volts regardless of which place the charge switch is set on. T or F

32. The DC charger cable can be plugged into your vehicle cigarette lighter receptacle and be charged on both 6 and 12 volt systems. T or F

33. In order to insure your gauge will be operational on a fast moving construction project located away from AC current supply sources, what piece of equipment do you need and where can you find it when your battery runs down?

34. The radiation dose rate of the 3411 with the bottom plate assembly removed is dD_____d@ MREM per hour.

35. Where is the neutron source located in the Troxler 2401 and Seaman gauge?

36. Do you oil or grease the source rod?

37. When the source rod is difficult to lower what action should you take?

38. Why would you need to remove the shoe plate?

39. What do you lubricate the slide shield and shoe plate with?

40. What do you lubricate the source rod with?

41. Do you work in front or behind the gauge when cleaning it? Why?

42. What can happen to the air gap stand to cause erroneous readings?

43. If the scalar does not turn on what action do you take?

44. Do you leave the gauge on or off when charging?

45. Surface voids are known to cause errors. List two places where surface voids are a problem.

46. When charging your batteries do you plug into the wall socket or the instrument first?

TEST II

1. Do not use the gauge unless the power has been turned on for at least _____ minutes.

2. In using the 3411 the FAST test time may be used where only _____ is involved, since the expected total error is not much improved by the difference in time. (density/moisture) CIRCLE ONE

3. In using the 3411 where _____ is required, it is advisable to use NORM in order to obtain the necessary accuracy. (density/moisture) CIRCLE ONE

4. In using the 3411 a sudden shift in the density standard count or moisture standard count is checked by taking five tests. If the highest and lowest counts differ by more than _____ counts for density or _____ counts for moisture, you should run a stability test.

5. For a direct transmission test what action do you take to insure the drill rod can be easily removed?

6. For a direct transmission test the drill rod should be driven into the soil at least _____ inches further than the depth of measurement.

7. In direct transmission testing what two precautions are necessary to avoid erroneous readings due to voids?

8. When backscatter testing what is the most common error involving the source rod?

9. When readings in trenches are taken, is it best to use the direct transmission or backscatter mode when making density measurements?

10. How do you correct moisture readings in trenches?

11. What type seating material should you use?

12. It makes no difference if the seating material contains moisture. T or F

13. Are glass beads authorized to use as seating material?

14. Improper seating causes low or high density results?

15. It is good or bad procedure to check direct transmissions readings with the air gap and backscatter modes?

16. What are the two primary reasons for using nuclear gauges rather than the sand cone or other means.

17. Which is the most accurate for density, the sand cone or the nuclear gauge?

18. If the direct transmission mode gives you more density than backscatter should you use it?

19. The Nuclear Regulatory Commission authorizes the maximum exposure of _____ millirem a week. What is the maximum exposure authorized by the Bureau of Land Management? _____ millirem a week/month/year CHOOSE ONE

20. If you have to beat the drill rod back and forth to extract it, will the results of a direct transmission test be valid?

21. If you pull the drill rod out and the hole caves in will the test be valid?

22. In taking the moisture and density standard counts using the 3411, what time do you use? 1/4 min. 1 min. 4 min. CIRCLE ONE

23. For a control strip for 3/4" base material, a total of _____ tests are averaged to determine the control strip density and moisture.

24. Particles of asphalt or dirt on the surfaces of the gauge do not affect the readings as long as they are kept ot a minimum. T or F

25. Under what two conditions do you determine when the control strip surfacing aggregates material reaches its maximum density?

26. Using Troxler gauges, the standard counts are taken with the source rod in the _____ position.

27. In the Troxler gauges, the backscatter and air gap readings are taken with the source rod in the _____ position.

28. It does not matter if you switch standard blocks with different gauges because the counts will be the same. T or F

29. The consistency of the standard block is the same therefore it makes no difference how you place the gauge on the block. T or F

30. What four steps must you take to determine if a nuclear gauge is in error?

31. If the battery is low but not in the red it will give you bad readings. T or F

32. Do you clean the source rod with a brush or a rag?

33. If the gauge has been tested and it checks out okay and you are still meeting only 85% density - 3% on the moisture requirement, what action do you take?

34. You are testing asphalt and decide to use a second nuclear gauge to check your results. The results show a consistent 8 PCF difference, what should you tell the contractor?

35. Is it good or bad practice to step back or away from the machine while it is counting? Why?

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461162