

# **NIOSH TRAINING GRANT FINAL PROGRAM PERFORMANCE REPORT**

**Grant Number:**

T01/CCT610904-08

**Project Title:**

Occupational Safety and Health Training Grant

**Project Period:**

7/1/1998 – 6/30/2003

**Program Director:**

Jerome J. Congleton

**Name of Institution:**

Texas A&M University HSC-SRPH

**Address:**

3000 Briarcrest Dr. Suite 300  
Bryan, TX 77802

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<b>FINAL PROGRESS REPORT</b>	<b>GRANT NUMBER:</b> T01/CCT610904-08
<b>PROGRAM DIRECTOR</b> (Last, first, middle) Congleton, Jerome J.	<b>PERIOD COVERED BY THIS REPORT</b> 7/1/98 – 6/30/03
<b>NAME OF ORGANIZATION</b> Texas A&M University	<b>TITLE</b> Occupational Safety and Health Training Grant

**NIOSH Training Grant – Final Progress Report**

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## FINAL PROGRESS REPORT

### I. ABSTRACT

In the reporting period from July 1, 1998 through June 30, 2003, our program graduated students with 4 PhDs in Interdisciplinary Engineering and 12 MS degrees in Safety Engineering. 7 of the graduates with MS degrees had been supported by the Occupational Safety and Health Training Grant for 2 semesters each. All 7 of the MS graduates were either placed in industry as safety engineers, ergonomists, managers of environmental health and safety programs, or as PhD students. 3 of the PhD graduates are currently faculty in university settings, and 1 is currently working as an ergonomist in industry. This grant has enabled the safety engineering program at Texas A&M University to continue to train and graduate professional ergonomists for industry, government, and academia with capabilities to identify, evaluate, and control workplace hazards that can lead to occupational injuries and illnesses. Students completing the program demonstrate knowledge and skills in ergonomics, workplace and equipment evaluation and design, biomechanics, anthropometry, work physiology, occupational health and occupational disease, anatomy, user-computer interaction, displays and controls, information processing, industrial safety engineering, industrial hygiene, and statistics. This training grant at Texas A&M University is also contributing to the National Occupational Research Agenda of NIOSH, and has historically assisted with the disease prevention objectives of Health People 2000. The training grant has succeeded in strengthening an already successful ergonomics and safety engineering program. With the NIOSH training grant funding, this historically successful program (one of five programs which has in the past qualified for a six year accreditation from the Human Factors and Ergonomics Society) will improve further because it will be able to recruit and retain, on a competitive basis, high quality trainee candidates. Our program has been able to recruit and maintain a highly qualified and successful faculty, including professional engineers, medical doctors, certified professional ergonomists, and certified industrial hygienists. An important note, however, is that our program transferred from the TAMU College of Engineering to the TAMU Health Science Center's School of Rural Public Health (TAMUS-HSC-SRPH) in early 2001, though we continued to support the approved program degrees as included in the original proposal until summer of 2003. For this reason, the following program descriptions provide information on our approved program rather than for our new program at the Health Science Center.

### Relevant Background History

Texas A&M University is the land, sea, and space grant university for the State of Texas. Texas A&M University (TAMU) dates from 1876, when it was established as a technological and agricultural college for men under the name of the Agricultural and Mechanical College of Texas. Until 1963, it remained primarily an undergraduate institution with mandatory military training for all students. In that year, under the far-seeing leadership of the late General Earl Rudder, the college became Texas A&M University. Shortly thereafter, women were officially admitted for the first time, and compulsory military training was abolished. TAMU grew from a few thousand students to over 44,618 in 1994. It is a major university in every respect, with roughly a 5:1 ratio of undergraduate to graduate students and a faculty of over 2400. The Texas A&M System encompasses six other campuses, two extension services (Engineering and Agriculture), a number of research agencies, principally the Texas Engineering Experiment Station, the Texas Transportation Institute, the Texas Agricultural Experiment Station, and the Texas Forest Service. TAMU proper has Colleges of Agriculture and Life Sciences, Architecture, Business Administration, Education, Engineering, Geosciences, Liberal Arts, Medicine, Science, and Veterinary Medicine. Historically located within the College of Engineering is the Safety Engineering Program of the Nuclear Engineering Department. The department is comprised of four degree programs, nuclear engineering, safety engineering, health physics and industrial hygiene (until 2003, whereupon industrial hygiene has now been transferred to our new location at the health science center).

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Each area has had a contingent of faculty, although many have interests in more than one area. There were eighteen faculty within the Nuclear Engineering Department, including three in the Ergonomics Area.

Students from any of these areas of specialization must meet minimum standards of the Department and are awarded Master's degrees in Safety Engineering and Ph.D.'s in Interdisciplinary Engineering:

- (1) Master of Engineering (available only to those with an undergraduate degree in Engineering)
- (2) Master of Science - non-thesis
- (3) Master of Science - thesis
- (4) Doctor of Philosophy in Interdisciplinary Engineering
- (5) Doctor of Engineering

At the Masters level, the program concentrates on developing students as professional engineers in applied research in industry or government. The program also provides the requisite background for those students wishing to pursue doctoral studies. At the Doctoral level, the program focuses on preparation of students for careers either in corporate safety and health or applied research in industry or government or in an academic setting that emphasizes research as well as teaching.

The TAMU catalog describes the general requirements for the graduate degrees. Specific requirements for the degrees in Safety Engineering specializing in ergonomics with a minor in industrial safety engineering and industrial hygiene engineering are described later.

In addition to the resources provided within the TAMU System, College Station is strategically located within a 200 mile radius of all the major cities in Texas with the exception of El Paso. A valuable resource for the program is our existing association with a number of major industries. These industries provide employment for ergonomics graduates, speakers for Human Factors and Ergonomics Society Student Chapter meetings, guest lecturers for classes, and hospitable locations for masters and doctoral research. A partial list of these resources include Alcoa, American Airlines, Artco-Bell Furniture, Brooks Air Force Base, Browning-Ferris Industries, Bryan Iron and Metal, City of Bryan, City of College Station, Exxon, Frito-Lay, IBM, Kent Moore Cabinets, Liberty Mutual Insurance, NASA Johnson Space Center, Neutral Posture Ergonomics, Brazos Sportswear, North American Packaging Corporation, Plantation Foods, Ralph Wilson Plastics, Refrigeration Valves and Systems, Inc., Southwestern Bell, Tenneco Gas, Texaco, Texas Instruments, Texas Municipal Power Authority, Texas Rehabilitation Commission, Texas Workers Compensation Commission, United Parcel Service, 3M, Texas A&M University System, Grant Prideco, Inc., and Schult Homes Inc... All those identified have participated in the Ergonomics Program in some way in the past.

### Goals and Objectives

Provide the industry with trained professionals that can help improve working conditions in the US Industry and help meet the NIOSH National Occupational Research Agenda. From 1985 to present, faculty in our program, including Drs. Congleton, Moore, Vos, Amendola, Kerk, Rock, and Koppa have successfully placed over a hundred graduates (MS and PhD) in US industry, colleges and universities, and federal organizations. The total number of trained safety professionals to graduate our program between 1985 and 2003 include 91 MS and 26 PhD students (this number excludes students in our industrial hygiene program prior to 1985, which has been in place since 1970). These occupational health and safety trained professionals have had good success in reducing injury and illness in the work place and in improving safety education and training. Thus the NIOSH training grant program has helped to achieve our program's mission by providing professionals who continue to improve worker performance, safety, and health through applied ergonomics and safety to existing and emerging technologies.

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## II. SIGNIFICANT FINDINGS

Outlined are the significant findings of 12 MS theses and 4 PhD dissertations. These are subdivided into various categories based upon the nature of the research:

### Risk Assessment

#### **Predictive Validity of the Strain Index in Poultry Processing (Knox and Moore, 2001)**

The Strain Index is a job analysis method for determining if workers are exposed to increased risk of developing distal upper extremity disorders. Its predictive and external validity was initially demonstrated in a pork processing plant. The purpose of this study was to evaluate its predictive validity in one turkey processing plant. While blinded to health outcomes, investigators analyzed the right and left sides of 28 jobs using the Strain Index and classified them as "hazardous" or "safe" based on the Strain Index score. Subsequently, OSHA 200 logs were used to ascertain the occurrence of distal upper extremity disorders retrospectively. If at least one such disorder occurred on the right or left side during the prior three years, that side was classified as "positive." If no such disorder was reported during the prior three years, that side was classified as "negative." When comparing sides, symmetry between morbidity and hazard classification was required. When comparing jobs, such symmetry was not required. Evidence of association between the hazard classifications and the morbidity classifications for the 56 sides and the 28 jobs was evaluated using 2x2 contingency tables. For the sides, the association between hazard classification and morbidity classification was statistically significant with an odds ratio of 22.0. The sensitivity, specificity, positive predictive value, and negative predictive value were 0.86, 0.79, 0.92, and 0.65. Similar results were noted for the jobs – the odds ratio was 50.0, and the sensitivity, specificity, positive predictive value, and negative predictive value were 0.91, 0.83, 0.95, and 0.71. These results provide additional evidence of the Strain Index's external validity and predictive validity.

#### **Predictive Validity of the Strain Index in Manufacturing Facilities (Rucker and Moore, 2002)**

The Strain Index is a job analysis method for determining if workers are exposed to increased risk of developing distal upper extremity disorders. Its predictive and external validity was initially demonstrated in a pork processing plant. The purpose of this study was to evaluate its predictive validity in two manufacturing plants. While blinded to health outcomes, investigators analyzed the right and left sides of 28 single-task jobs using the Strain Index and classified them as "hazardous" or "safe" based on the Strain Index score. Subsequently, OSHA 200 logs were used to ascertain the occurrence of distal upper extremity disorders retrospectively. If at least one such disorder occurred on the right or left side during the prior three years, that side was classified as "positive." If no such disorder was reported during the prior three years, that side was classified as "negative." When comparing sides, symmetry between morbidity and hazard classification was required. When comparing jobs, such symmetry was not required. Evidence of association between the hazard classifications and the morbidity classifications for the 56 sides and the 28 jobs was evaluated using 2x2 contingency tables. For the sides, the association between hazard classification and morbidity classification was statistically significant with an empirical odds ratio of 73.2. The sensitivity, specificity, positive predictive value, and negative predictive value were 1.00, 0.84, 0.47, and 1.00. Similar results were noted for the jobs – the empirical odds ratio was 106.6, and the sensitivity, specificity, positive predictive value, and negative predictive value were 1.00, 0.91, 0.75, and 1.00. While these results provide additional evidence of the Strain Index's external validity and predictive validity, it should be noted that these jobs involved the performance of single tasks.

#### **Inter-Rater Reliability of the Strain Index (Stevens and Moore, 2003)**

The Strain Index is one of several tools available to evaluate exposure to musculoskeletal stressors in the workplace in order to predict whether or not workers are at an increased risk of developing distal upper extremity disorders. The purpose of this study was to determine the inter-rater reliability of the Strain Index. Using a computer to view digitized segments of job tasks that represented a balanced spectrum of task variable ratings, fifteen raters initially estimated or

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measured data for five of the Strain Index task variables and then assigned rating values to the variables according to published procedures. For other video segments, raters performed complete analyses, including calculation of a Strain Index Score that directs the assignment of a Hazard Classification. The raters performed these tasks both as individuals and then as members of five three-person teams. Inter-rater reliability of the procedures leading to and including the Strain Index Score were measured using an Intraclass Correlation Coefficient, ICC(2,1). Inter-rater reliability for the dichotomous Hazard Classification was measured using KR-20. For the task variables and estimated data, ICC(2,1) varied between 0.66-0.84 for the individuals and 0.48-0.93 for the teams. The SI Score had an ICC(2,1) of 0.43 and 0.64 for the individuals and teams, respectively. For the most important variable, Hazard Classification, KR-20 was 0.91 for the individuals and 0.89 for the teams.

#### **Test Re-Test Repeatability of the Strain Index (Stephens and Moore, 2003)**

The Strain Index (SI) has repeatedly shown high levels of validity for differentiating between safe and hazardous tasks for the distal upper extremity (DUE). One limitation of the SI is the lack of reliability data. This study was designed to evaluate the test-retest repeatability of the SI. Fifteen raters, divided into five teams of three, were asked to use the SI to analyze 73 video AVI files of different job tasks; initially as individuals and then as teams. Several months later, raters were asked to repeat individual and team job task assessments. Raters were instructed to analyze tasks using five of six SI task variables, while the sixth was held constant. For three of these task variables, additional data was collected such as peak force and duration of job cycle. Test-retest repeatability was measured using Pearson's R, Spearman's rho, and tetrachoric correlation according to the nature of the variable. Spearman's rho values for individual and team task variable ratings ranged from 0.68 to 0.96 (0.88 average). Pearson's R for task variable data ranged from 0.76 to 0.99 for both teams and individuals with an average of 0.91. The Strain Index's rho values for individuals and teams were 0.70 and 0.84, respectively. For hazard classification, the tetrachoric correlation for individuals was 0.81 and 0.88 for teams. Results of this study supports the conclusion that the Strain Index is repeatable when used by teams as well as individuals.

#### **Validating the Use of Qualitative Ratings of Static Wrist Postures Relative to Quantitative Measurements (Bohac and Moore, 2001)**

This study was conducted to determine the accuracy and reliability of an observer estimating static wrist flexion and extension. The observers' classification of various angles of static wrist flexion and extension into five categories was also evaluated. With the use of PowerPoint presentations, subjects viewed varied angles of static wrist flexion and extension. They then estimated and rated each one using two scales. The results showed significant differences among the raters, but not within the raters. The results also indicate that the majority of variability was due to the True Angle effect. There is an average 6.44% difference in the estimated angle the raters make on the visual analog scale from the true angle displayed in the PowerPoint presentation. It was concluded from this study that what the raters think in their mind is the numerical degree given to a wrist deviation is essentially the same as the numerical degree measured from a mark they make on the visual analog scale for that wrist deviation. In addition, it appears that the raters classify the various true angles into very distinctive categories except when the true angle is 50° wrist extension.

#### **Seating**

#### **Evaluation and analysis of buttock-thigh pressures amongst contemporary ergonomic chairs, with regards to the effects of three-dimensional fabric and memory foam (Vos, Congleton, and Moore, 2001)**

This research project investigated various chair design and postural factors on seat pan pressure distributions in an effort to identify methods of reducing peak and mean pressures in the seat pan. The investigation focused on twelve different ergonomic chairs, variations in chair angle, and the use of armrests. Since most historical research had focused only on males, this study employed females in an attempt to gather data on any potential differences between males and females. A synthetic model was developed to emulate a human's pressure distribution in sitting. The model was constructed to include factors such as load bearing geometry of the skeleton, density and displacement of tissues, and frictional forces. The model performed well, providing results that differed from the human's, but were similar enough they could be used to

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estimate human values with the use of a correction factor. Additionally, male and female pressure distributions were evaluated, focusing on differences in peak pressure, mean pressure, and the number of activated cells. For all of the response variables (peak pressure, mean pressure, and active cells) there were statistically significant differences between genders. In addition, this gender difference indicated that males had higher peak pressures, higher mean pressures, and higher active cells. The chairs that appear to have yielded the greatest reduction in peak pressure (the variable of prime interest) for both genders were chairs 5 and 12. Both have contoured seat pans, and employee a 3-D woven fabric. However, the degree of reduction based on curvature variables such as slope and height of the contours was not investigated. Further research along these lines may assist designers in improving even further on chairs that result in significant reductions in peak and mean pressures, both for males and females.

### **Manual Material Handling**

#### **A prospective study of the relationship of potential personal, non-occupational, occupational, and psychosocial risk factors with occupational injury (Craig and Congleton, 2000)**

The purpose of this study was to identify risk factors associated with occupational injury in workers engaged in manual materials handling jobs. Personal and non-occupational, occupational, and psychosocial risk factor data were gathered for 442 participants employed in fifteen different manual materials jobs. Physiological tests, questionnaires, and rigorous job analyses were used to obtain the 126 variables analyzed in the current research. Company OSHA 200 forms were tracked for each participant for a period of one year following the testing protocol. Univariate logistic regression was performed on all variables and multivariate logistic regression was performed for each risk factor group (personal and non-occupational, occupational, and psychosocial). In addition, an overall blocked multivariate logistic model was executed to determine the most occupational injury related subset of covariates. The present study showed significant evidence of the predictability of occupational injury occurrence through the significant related risk factors presented in the three independently grouped (personal and non-occupational, occupational, and psychosocial) univariate and multivariate models. The overall multivariate injury model demonstrated a statistically significant association of six risk factors with occupational injury. Increased injury susceptibility was related with low estimated aerobic power (odds ratio (OR) = 4.20), low body mass index (OR = 5.32&dash;8.09), high lifting frequency (OR = 4.57), increased average weight of lift (OR = 1.82), participants responding their job was not a service to the public (OR = 2.97), and job dissatisfaction (OR = 10.78). Results of this investigation might be used to assist ergonomic programs to focus on the personal, non-occupational, occupational, and psychosocial changes that result in occupational injury reductions in manual materials handling industries.

#### **Biomechanical, psychophysical, and physiological evaluations of using two-wheel carts in experienced workers based on a soft drink beverage delivery company (Al-Eisawi and Congleton, 1999)**

This study analyzed the use of seven two-wheel carts through static biomechanical, psychophysical, and physiological measures with nine male beverage delivery workers. These experienced workers have used two-wheel carts an average of five years. For the capable loads and acceptable forces, the task of pulling the cart over a curb differed from the other tasks: push, pull and tilt-back. With the maximum applied hand forces, the force produced by the powered stair climber was the lowest while the taller no runner 10-inch wheel cart created the largest force even though it weighed the least. The factors of activity and distance had significant effects on the work load of simulated working conditions measured by the differential heart rates. The pull tasks were always produced higher differential heart rates than the push tasks except for one combination-short distance with light load. There was no significant difference between pull and push tasks for the light load. Comparing the two working postures, the asymmetric posture created more compression and sagittal and frontal shear forces on the L5/S1 disc than the symmetric posture. The five carts created compressive forces above the NIOSH recommended weight limit in the asymmetric posture. The powered stair climber created the lowest force on the L5/S1 while the belt track cart the greatest. The belt track cart also created the forces exceeding the NIOSH limit for both symmetric and asymmetric posture. The cart type had significant effects on forces at the initial stage of the task at the curb and stairs and on differential heart rates at the floor but not at the stairs. At the floor, no significant differences of

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forces were detected among the carts. For the curb and stair, the powered stair climber (the heaviest cart) required very low forces while the guide runner 8-inch wheel cart high forces. The powered stair climber, sliding mechanism cart, and guide runner 8-inch wheel cart had low differential heart rate values while the six-6-inch wheel cart showed the largest value followed by the guide runner 10-inch wheel cart.

### Computing

#### **An investigation of potential risk factors and musculoskeletal symptoms among the mobile computing workforce utilizing laptop computers including airport and airplane environments (Parker and Congleton, 1999)**

A cross-sectional study, via survey, of laptop computer users was performed to investigate user demographics, self-reported pain or discomfort, software, peripheral, location utilization, and laptop usage patterns. The survey gathered information concerning potential personal, non-occupational, occupational, psychosocial risk factors, and laptop utilization in non-traditional working environments (airport and airplane) and the possible development of symptoms related to upper extremity musculoskeletal disorders. 440 laptop users responded to the survey, of which 80% were male. Males were significantly older, taller, and reported a higher weight, with a corresponding significantly higher BMI. Female laptop users (54%) tended to report symptoms of recent pain or discomfort more than males (43%,  $p = 0.0641$ ). The most frequently reported areas for pain or discomfort were the neck (24.2%), back (23.1%), and the hand/wrist (18.8%). Approximately 39% of the survey respondents reported to be current smokers. Male laptop users were more likely to be current smokers than female laptop users. Approximately 56% of males and 61% of females reported themselves as being exercisers. Females reported increased document and decreased keyboard viewing as well as a higher typing speed and using more fingers during typing operations. Approximately 63% of the laptop respondents reported using the computer in the airport and 45% in the airplane environments. Males preferred to hand carry their laptops while females preferred to utilize a shoulder bag or a roll cart. The two most common types of software used were word processing (27%), and communications software (20%). The most common peripherals were AC converters, fax/modems and printers. Overall, this survey population of laptop computer users reported a drastically lower prevalence of musculoskeletal symptoms than those reported in NIOSH HHEs desktop video display terminal operators within various industries.

### Heat Stress and Energy Expenditure

#### **The Effectiveness Of Heat-Reducing Interventions Used In Work Recovery Areas (Rose, Congleton, and Moore, 1999)**

In an aluminum smelter plant, the relationship between WBGTs at eight locations across the potrooms and the National Weather Service's heat index were evaluated using bivariate correlation. The mean WBGT (LC) and correlation coefficient ( $r$ ) for the eight locations were: courtyard (32.0, 0.72), curtain wall at wide aisle (32.1, 0.63), center of wide aisle (32.9, 0.70), back riser of pot (40.8, 0.24), center of pot (50.3, 0.33), front riser of pot (42.9, 0.46), center of narrow aisle (34.4, 0.70), and curtain wall at narrow aisle (33.4, 0.72). These results suggested that WBGTs on or immediately adjacent to the pots were not particularly related to ambient conditions; however, areas where workers recover from heat strain (curtain wall at wide aisle and center of wide aisle) were significantly related to ambient conditions. The smelter implemented four engineering controls (dry fans, cool zone fans, garden hoses without fans, and garden hoses with fans) to reduce heat stress levels in these recovery areas. The effectiveness of these interventions, compared to no intervention, in terms of their effects on WBGTs in the recovery areas is reported. In this study, cool zone fans, garden hoses without fans, and garden hoses with fans resulted in significant reductions in mean WBGTs in areas used for physiological recovery from heat strain.

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**The effect of training in the maximum oxygen consumption (VO<sub>2</sub> max) and the physical conditioning of college female soccer players (division I of the NCAA, USA)**

**(Bartels, Congleton, and Moore, 1999)**

Physiological data for 26 Division 1A female players in a collegiate soccer team were collected before and after a competitive season of playing in order to develop physiological profiles of the team members and to measure the effect of training in the VO<sub>2</sub> max performance. Paired T tests were used for comparison, and illustrated significant differences. Comparative anthropometric measurements with other American universities and national teams showed similar values. Results in body fat percentage were high with skinfolds but low using the hydrostatic technique. VO<sub>2</sub> max absolute was the highest among comparable data. The VO<sub>2</sub> max relative was in the middle of the spectrum. Comparison with other studies confirm the findings of Bangsbo (1994) regarding a 47 to 58 ml\*kg<sup>-1</sup> \*min<sup>-1</sup> range for female soccer athletes. The anthropometrics results were: age = 19.11 ± 0.95 years old, body weight = 61.60 ± 6.07kg, height = 1.65 ± 0.04 ms, body fat percentage % (density) = 16.54 ± 3.07, body fat percentage % (skinfolds) = 20.46 ± 3.91. Results in physiology were VO<sub>2</sub> max relative = 49.64 ± 5.26 ml\*kg<sup>-1</sup>\*min<sup>-1</sup>, VO<sub>2</sub> max absolute = 2.99 ± 0.199 l\*min<sup>-1</sup>, max heart rate 187.34 ± 8.93 bpm. Results for power were for vertical jump (VJ) = 49.38 ± 7.39 cm and for power clean (PC) = 25.98 ± 3.91 kg. Results for strength were bench press (BP) = 51.6 ± 8.72 kg and squat (SQ) = 98.08 ± 11.24 kg. Results for speed were 36.4 ms dash (40yd) = 5.13 ± 0.20 sec and 273 ms shuttle (300yd) = 53.79 ± 1.98 sec. There were no significant changes for VO<sub>2</sub> max relative and absolute in the Spring to Summer period. There were statistically significant physiological decrements in VO<sub>2</sub> max relative and absolute in female players after the competitive season and from Summer to Fall. The body fat calculated through hydrostatic means increased significantly and the heart rate max increased, showing a decreased conditioning from Summer to the end of Fall. A relationship between VO<sub>2</sub> max and a higher level of performance during the season was reviewed by correlating VO<sub>2</sub> max relative with the frequency of playing. VO<sub>2</sub> max relative average was higher for the players with more playing frequency according to the proposed index. After the competitive season, a statistically significant decrease in the VO<sub>2</sub> max relative and absolute was observed.

**III. Detailed Description of Training Program**

**Academic Training**

**Program Leadership and Faculty**

Professors Dr. J.S. Moore, MD, CIH, MPH, CPE, Dr. Jerome J. Congleton, Ph.D., CPE, PE, Dr. Alfred A. Amendola, Ph.D., PE, and Dr. Gordon A. Vos, PhD have been the program co-directors and have been responsible for the overall direction of this program. Dr. J. Steven Moore has joint appointments in the College of Engineering, College of Medicine, and School of Rural Public Health. Dr. Congleton has joint appointments in the College of Engineering and School of Rural Public Health. Dr. Amendola was a professor at Texas A&M until 2001, whereupon he began employment at NIOSH in the DSR. Dr. Vos has an appointment in the School of Rural Public Health. All of these individuals at one point reported to the College of Engineering at TAMU, but the remaining three now report to Dr. Ciro Sumaya, Dean of the School of Rural Public Health, Texas A&M University System Health Science Center School of Rural Public Health, and have since 2001. The Dean of the Health Science Center is Dr. Nancy W. Dickey, MD. The principal faculty, their titles, departments, and areas of research interest have been as follows:

- Jerome J. Congleton, Ph.D., PE, CPE, Professor, Nuclear Engineering Department, Safety Engineering Program
  - Industrial ergonomics, human factors, material handling, safety & health (now at TAMUS-HSC-SRPH)
- J. Steven Moore, MD, CPE, CIH, MPH, Professor, Nuclear Engineering Department, Safety Engineering Program
  - Occupational medicine, industrial hygiene, toxicology, epidemiology, work-related musculoskeletal disease (now at TAMUS-HSC-SRPH)
- Alfred A. Amendola, PhD, Associate Professor, Nuclear Engineering Department, Safety Engineering Program
  - Systems and process safety, ergonomics, industrial hygiene
- Craig H. Blakely, Ph.D., MPH, Interim Department Head, Public Policy Research Institute
  - Program evaluation, industry / university cooperative research evaluation (now at TAMUS-HSC-SRPH)

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- Gordon A. Vos, Ph.D., Assistant Professor, Department of Environmental and Occupational Health
  - Industrial ergonomics, industrial hygiene, human factors engineering, safety & health

Table 1 provides the numbers of graduates from our historic Safety Engineering and Ergonomics Program for the calendar years 1985 through 2002 YTD, inclusive, keyed to faculty (both past and present). Because of the recent transfer of our program and faculty to the TAMU-HSC-School of Rural Public Health (which was effective September 1, 2002) not enough time has yet passed for us to list graduates from our MSPH or MPH, programs.

**Table 1**  
**Number of Graduates**  
**Safety Engineering and Ergonomics Program**  
**1985 through 2002 YTD**

Faculty	Masters	Doctoral
J.J. Congleton	45	18
A. A. Amendola	1	0
C. J. Kerk	9	1
J. C. Rock	10	0
R.J. Koppa	20	7
J. S. Moore	6	0

In addition to our primary faculty, lecturers and consultants are utilized to give advice and recommendations to specific questions about course content, MS thesis topics, Ph.D. dissertation topics, laboratory experiments, etc. In addition to the advice they give to the program director and faculty, they also provide seminars to our students.

#### **Admissions and Prerequisites**

Student applicants must meet university admission standards as described in the Graduate Catalog. Nuclear Engineering Departmental admission standards require applicants to have a minimal Verbal GRE score of 400 and the Quantitative plus Verbal GRE score of 1050 for MS and 1150 for Ph.D.. The Department also requires the Grade Point Average (GPA) over the last 60 hours of undergraduate work to be 3.0 / 4.0 for those entering the MS program. For students entering the Ph.D. program, a GPA of 3.5 / 4.0 is required from their MS program. In reality, these requirements serve as guidelines and consideration is given to specific courses taken, previous majors, letters of recommendation, and work experience.

In addition to the university and departmental requirements, students applying for acceptance into the Safety Engineering / Ergonomics Area must have a Verbal GRE score of 450 and gain consensus acceptance from the Safety Engineering / Ergonomics faculty members.

Departmental prerequisites listed are intended to ensure an adequate background in mathematics, computing and engineering prior to pursuing graduate studies in industrial engineering:

1. Two courses in engineering calculus. (Suggested: Math 151 and 161.)
2. Two additional courses in mathematics that require first semester calculus as a prerequisite. (Suggested: Math 251, 304, and 308.)
3. A course in engineering mechanics or calculus based physics. (Suggested: PHYS 218.)
4. A course in calculus based probability and statistics. (Suggested: STAT 601.)
5. Proficiency in scientific computing programming. (Suggested: CPSC 203, 206, or 207)

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### Program Plan

It should be noted that our historic plan was accurate through 2003, whereupon we transferred academically from the College of Engineering to the TAMUS HSC School of Rural Public Health. The following discussion focuses on the program state in its original form (no longer applicable now in 2003).

Texas A&M University has offered specialized training in the area of human factors and safety engineering at the graduate level since 1970. Specialized training in ergonomics has been developed since 1985 by Dr. Congleton. Dr. Moore is specializing the trainees in the area of occupational medicine and epidemiology and work-related musculo-skeletal disorders. Dr. Vos provides specialized training in industrial hygiene, human factors engineering, and ergonomics. Based on current and past strengths and successes, the proposed program offered at the Masters and Ph.D. level is a balanced program in ergonomics with a minor in industrial safety engineering and industrial hygiene engineering.

For students accepting funding through the NIOSH Training Program, the proposed MS in Safety Engineering in ergonomics with a minor in industrial safety engineering and industrial hygiene engineering is shown in Table 2. The proposed Ph.D. in Interdisciplinary Engineering in ergonomics with an outside minor in industrial safety engineering and industrial hygiene engineering is shown in Table 3. This degree plan assumes the student begins with little or no course work in ergonomics. For a student who completes the MS program as indicated in Table 2 and elects to continue for a Ph.D. with *additional* funding from the NIOSH Training Program, a proposed degree plan is shown in Table 4. Customized programs will be devised for Ph.D. students whose prerequisite MS course work falls between that required for the degree plans in Tables 3 and 4.

A major purpose of the NIOSH training grant is to provide adequate funds to attract additional qualified faculty members, provide a base for student support and obtain the necessary equipment and research supplies. An excellent program of courses for the training program is already established. A potential result of the success of the program will be to attract several full-time and part-time students who otherwise would not have enrolled at Texas A&M University.

As demonstrated in the typical course schedules for the MS and Ph.D. (Tables 2 and 3), the training program in ergonomics with a minor in industrial safety engineering and industrial hygiene engineering is built around eleven courses:

INEN 635	Human Operator in Complex Systems
SENG 636	Biological Control System Analysis (Ergonomics)
INEN 632	Human Factors Engineering in System Design
SENG 644	Worker Physiology
SENG 645	Occupational Biomechanics
SENG XXX	Elective in Safety Engineering / Ergonomics
SENG 670	Industrial Safety Engineering
SENG 674	System Safety Engineering
SENG 680	Industrial Hygiene Engineering
NUEN 409	Radiological Safety
STAT 619	Design and Analyses of Experiments

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**TABLE 2**  
**MS in Safety Engineering in Ergonomics**  
**(Minor in Industrial Safety Engineering & Industrial Hygiene Engineering)**

<b>Course Title</b>	<b>Course ID</b>	<b>Hours</b>	<b>Notes</b>
Human Operator in Complex Systems	INEN 630	3	A
Human Information Processing	INEN 635	3	C
Biological Control Systems Analysis (Ergonomics)	SENG 636	3	B
Human Factors Engineering in System Design	INEN 632	3	C
Worker Physiology	SENG 644	3	C
Occupational Biomechanics	SENG 645	3	B
Occupational Medicine	MSCI 689	3	C
Radiological Safety	NUEN 409	3	B
Statistics	STAT 619	3	B
Industrial Safety Engineering	SENG 670	3	B
Industrial Hygiene Engineering	SENG 680	3	B
Graduate Seminar in Safety Engineering/Ergonomics	SENG 681	1	B
Thesis	SENG 691	4	
<b>Total</b>		<b>32</b>	<b>D</b>

Notes:

- A Prerequisite, if the student has not previously taken a Safety Engineering/ergonomics course. Does not count toward total credit hours.
- B Required courses for an MS in Safety Engineering.
- C Safety Engineering/Ergonomics elective.
- D The Thesis Option requires a minimum of 32 hours, which includes at least 28 hours of course work and a thesis.

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**TABLE 3**  
**Ph.D. in Interdisciplinary Engineering in Ergonomics**  
**(Minor in Industrial Safety Engineering & Industrial Hygiene Engineering)**

<b>Course Title</b>	<b>Course ID</b>	<b>Hours</b>	<b>Notes</b>
Human Operator in Complex Systems	INEN 630	3	A
Human Information Processing	INEN 635	3	B
Biological Control Systems Analysis (Ergonomics)	SENG 636	3	B
Human Factors Engineering in System Design	INEN 632	3	B
Worker Physiology	SENG 644	3	B
Occupational Biomechanics	SENG 645	3	B
Occupational Medicine	MSCI 689	3	B
Radiological Safety	NUEN 409	3	B
Statistics	3 courses	9	C
Departmental Minor I - Health Protection Engineering	2 courses	6	E, D
Departmental Minor II - Other Dept. Electives	2 courses	6	E, F
Industrial Safety Engineering	SENG 670	3	B, G
Industrial Hygiene Engineering	SENG 680	3	B, G
Graduate Seminar in Safety Engineering/Ergonomics	SENG 681	2	B
Dissertation Research	SENG 691	24	H
<b>Total</b>		<b>68</b>	

Notes:

- A Prerequisite, if the student has not previously taken a Safety Engineering/ergonomics course.
- B Required courses for a Ph.D. in Interdisciplinary.
- C Mathematics / Statistics requirements. Choose three with one from each group:
  - 1. STAT 414 Mathematical Statistics I
  - STAT 610 Theory of Statistics
  - 2. INEN 616 Design and Analysis of Industrial Experiments
  - STAT 619 Analysis of Variance
- D These courses may be from MS degree plan.
- E These courses may not be from MS degree plan and must differ from Minor I.
- F Choose two courses from any line in the following categories:
  - Engineering Management (INEN courses)
  - Bioengineering (BIEN courses)
  - Kinesiology (KINE courses)
  - Computer Science (CPSC courses)
  - Psychology (PSYC Courses)
- G Electives mandatory to receive NIOSH funding. If these courses have been taken previously, it would be recommended Product Safety Engineering (SENG 671) and System Safety Engineering (SENG 674) be placed on the degree plan, however, other SENG courses could also be selected
- H Ph.D. beyond MS requires a minimum of 64 hours, which includes 18-24 hours of SENG 691 Research.

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**TABLE 4**  
**Ph.D. in Interdisciplinary Engineering in Ergonomics**  
**(Minor in Industrial Safety Engineering & Industrial Hygiene Engineering)**  
**For a Student Who Completed an MS in the NIOSH Program from Table 3**

<b>Course Title</b>	<b>Course ID</b>	<b>Hours</b>	<b>Notes</b>
Health Protection Engineering Electives	2 courses	6	A
Graduate Seminar in Health Protection Engineering	SENG 681	2	A
Statistics	2 courses	6	B
Departmental Minor (Health Protection Engineering)	2 courses	6	C
Outside Departmental Minor	6 courses	18	
Product Safety Engineering	SENG 671	3	A
System Safety Engineering	SENG 674	3	A
Electives	2 courses	6	E
Dissertation	SENG 691	18 (max. 24)	
<b>Total</b>		<b>68</b>	<b>F</b>

Notes:

- A Required courses for a Ph.D. in Interdisciplinary Engineering.
- B Mathematics / Statistics requirements. Assumes STAT 619 or taken for MS. Choose two courses. One must be chosen from below:
  - STAT 414 Mathematical Statistics I
  - STAT 610 Theory of Statistics
- C These courses may not be from MS degree plan and must differ from the Departmental Minor chosen for the MS. Choose six courses from below. There should be a minimum of two courses from any area in the following categories:
  - Human Factors (INEN courses)
  - College of Medicine (MSCI courses)
  - Bioengineering (BIEN courses)
  - Kinesiology (KINE courses)
  - Computer Science (CPSC courses)
  - Psychology (PSYC Courses)
  - Veterinary Anatomy & Public Health (VAPH courses)
  - Veterinary Physiology & Pharmacology (VTPP courses)
- D Electives required to receive NIOSH funding.
- E Other electives not previously taken from this list:
  - SENG 685, special topics not within the scope of thesis research and not covered by other formal courses; and
  - Other courses approved by the student's committee.
- F Ph.D. beyond MS requires a minimum of 64 hours, which includes 18-24 hours of 691 Research.

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We consider that an important feature of our training program is the inclusion of the practicum (problem) for students who have had no industrial experience or are doing a non-thesis masters. During those semester projects, the students are assigned to one of the cooperating industries. The projects require the students to conduct an appropriate survey to ascertain the existence of an occupational safety or health problem or to evaluate the severity of a known problem. They must then propose a solution, justify it, and provide an estimate of the cost of implementation. The student must then present the project to local management (or to the student committee) by both oral and written reports. Those students assigned to industrial situations work with the engineering /occupational safety and health professional for that facility and thus see realistic problems from the applied point of view. Only students who have had no job experience or who are doing a non-thesis Masters are required to take the practice.

Elective courses which relate indirectly to ergonomics because of their utility or close association with that field include safety engineering, industrial hygiene, statistics, computer programming, physiology, kinesiology, manufacturing, bioengineering, psychology, human factors and medicine. A partial list of these courses is listed in Table 5.

**Table 5**  
**Elective Courses Supporting the Program (Partial List)**

<b>Course Title</b>	<b>Course ID</b>	<b>Department/College</b>
Analysis of Movement	KINE 627	Health & Kinesiology
Exercise Physiology I	KINE 637	Health & Kinesiology
Exercise Physiology II	KINE 638	Health & Kinesiology
Process Safety Engineering	SENG 455	College of Engineering
Air Pollution Engineering	SENG 477	College of Engineering
Product Safety Engineering	SENG 671	Nuclear Engineering
Safety Engineering in Facilities Design	SENG 672	Nuclear Engineering
System Safety Engineering	SENG 674	Nuclear Engineering
Fire Protection Engineering	SENG 677	Nuclear Engineering
Instrumentation for Industrial Hygiene	SENG 682	Nuclear Engineering
Evaluation & Control of Occupational Environment	SENG 683	Nuclear Engineering
Problems in Safety Engineering	SENG 685	Nuclear Engineering
Acoustics and Noise Control	SENG 686	Nuclear Engineering
Industrial Ventilation	SENG 687	Nuclear Engineering
Special Topics in Safety Engineering	SENG 689	Nuclear Engineering
Human Factors Engineering in System Design	INEN 632	Industrial Engineering
Human Information Processing	INEN 635	Industrial Engineering
Human Factors in Expert Systems Development	INEN 639	Industrial Engineering
Desc. Representation & Qualitative Reasoning	INEN 641	Industrial Engineering
Modeling of Human-Computer Interaction	INEN 643	Industrial Engineering
Computing for Visualization I	VIZA 652	Architecture
Computing for Visualization II	VIZA 653	Architecture
Applied Epidemiology	VAPH 607	Veterinary Anatomy & Public Health
Epidemiology Methods I	VAPH 608	Veterinary Anatomy & Public Health

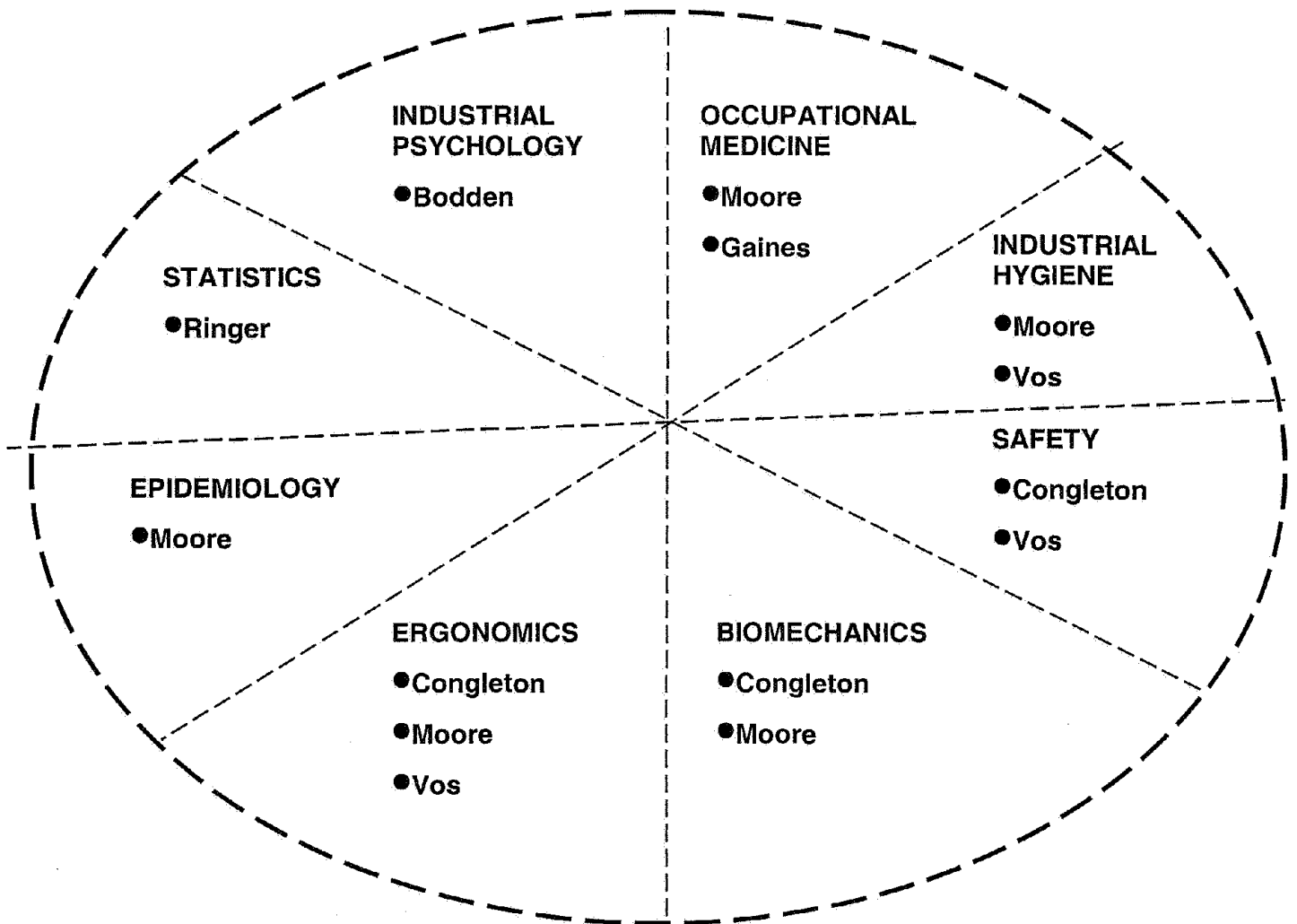
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We have offered this graduate program leading to the MS in Safety Engineering with emphasis in ergonomics and a minor in industrial safety engineering and industrial hygiene engineering. The curriculum emphasizes the effects of the work environment on humans: its hazards and necessary controls. Applicants who have had courses similar to those in this program at the senior or graduate level will take substitute courses depending on that trainee's background. For example, an applicant who holds a degree in biology may not need additional training in anatomy and physiology but instead would enroll in additional engineering or environment-related courses, such as shown on the list of electives.

The doctoral program in the Interdisciplinary Engineering Department has shown a successful history at Texas A&M University and is significantly distinguished from the MS program. As illustrated in the degree plans presented previously, Ph.D. students in safety engineering and ergonomics are required to take three additional statistics courses and have two non-Safety Engineering / Ergonomics minors, one within the department and the other outside the department. The multiple aspects of the Occupational Ergonomics Group formed by J.J. Congleton (Ph.D., PE, CPE), J. S. Moore (MD, MPH, CIH, CPE), G.A. Vos (PhD), and A. A. Amendola (Ph.D., PE, CPE) is shown in Figure 1. The contributions of faculty from the College of Engineering, College of Medicine, College of Statistics and Consultants have contributed to an excellent knowledge base in the area of Occupational Ergonomics and Safety. Over the years, Texas A&M University has produced a fine list of graduates in ergonomics and safety engineering at the MS and Ph.D. levels.

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Figure 1: Multi Aspects Of The Occupational Ergonomics Program



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### **Training Candidates**

Admissions requirements for the training grant candidates were detailed previously. The interdisciplinary nature of ergonomics makes it open to graduate study by those that have undergraduate degrees in fields other than industrial engineering or even engineering. Admission to graduate study is the same as outlined above, but a number of "leveling" undergraduate courses are prescribed. The student is not permitted to form a graduate advisory committee or begin thesis or dissertation research until the leveling courses have been taken and successfully passed. This policy is consistent with the granting of an engineering degree through the Department. At the present time, a majority of Safety Engineering and Ergonomics students have undergraduate engineering degrees, but others have backgrounds as diverse as psychology, physiology, computer science, business administration, biology, and urban planning.

Trainees will be initially advised by Dr. Congleton or Dr. Moore who will provide the initial program and schedule for the training period for each student prior to the formation of the thesis Advisory Committee. These programs will be individualized to meet the students' career objectives.

Each student's performance will be monitored during the semester by checking with the faculty teaching the courses in which the student is enrolled. The feedback from the faculty provides the information needed to evaluate the student's progress. At the end of each semester, the student grades will also be used as an indication of his or her performance in the program.

The curriculum is designed for students trained in engineering as well as other fields to learn to recognize hazardous work conditions in manufacturing and processing operations, evaluate those hazards, and design control systems for them. Trainee applicants will be screened by the program directors and faculty to ensure that highest qualified candidates with career objectives in occupational safety and health are admitted to the program. Preference will be given to those applicants who:

1. Are entering the program for a doctoral degree,
2. Hold BS degrees in Engineering, Environmental Health or related disciplines,
3. Hold positions in occupational safety and health, or
4. Have had training in engineering, biology, chemistry, psychology or management.

All other factors being equal, preference will be given to those who can best serve the regional needs in occupational safety and health and who have the highest grade average and score on the GRE aptitude test. Several means will be utilized to recruit qualified individuals to enroll in this training program:

1. Direct contact with individuals interested in pursuing a graduate program in this area.
2. Advertisement of the program in professional journals and by professional societies in their periodical bulletins.
3. Flyers describing the training program will be distributed to other universities.
4. Personal contact at conferences and by consultation with peers in academia, industry, and government.

### **Training Facilities and Resources**

Ergonomics is a broad-based discipline and TAMU has many training and research laboratories to support the program. The main laboratory complex is at the NSF IUCRC in Ergonomics, Texas A&M University Systems Building. In addition to the Human Factors and Ergonomics Laboratory (which includes the biomechanics lab), there is secondary support from labs such as Methods/Facilities Design Lab, Texas Transportation Institute, Manufacturing Systems Teaching Lab, Robotics Lab, Automation Lab, Automated Visual Inspection Lab, Statistical Control of Quality Lab, Knowledge Based Systems Lab, and several computer labs.

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**Current and past Training Record**

The program stresses problem recognition, evaluation, and especially control of occupational safety and health hazards and prepares the trainees for positions of immediate responsibility. Tables 6 and 7 list names of graduates in the *ergonomics* specialty within our Safety Engineering, Ergonomics, and Interdisciplinary Engineering degree plans with notation for years of graduation, job titles, and employers for the doctoral and masters programs, respectively. During the past ten years our trainees have accepted jobs from private organizations, educational institutions, and government agencies. Note that MSIH graduates are not included on these lists.

**TABLE 6**  
**List of Ergonomics Graduates**  
**Ph.D. in Industrial Engineering/ Interdisciplinary Engineering**

Name	Date Entered	Degree Date	Degree	Job Title	Employer
Joshua Chard	9/93	12/97	INEN	Safety Engineer	AI Tec, Alabama
Brian Craig	9/93	5/00	ITDE	Assistant Professor	Lamar Univ., TX
Kevin P. McSweeney	9/93	8/98	ITDE	Human Systems Engineer	AVONDALE Maritime, LA
Khaled W. Al-Eisawi	9/94	8/97	INEN	Consultant	SABRE Decision Technologies, South Lake, TX
Stephen Hudock	8/95	5/98	ITDE	Senior Safety Engineer	NIOSH, Cincinnati, OH
Jongsun Kim	8/95	8/98	ITDE	Associate Professor	Korean Air Force Academy
Gordon Vos	1/99	5/01	ITDE	Assistant Professor	Texas A&M University HSC, TX

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**TABLE 7**

**MS Industrial/Safety Engineering Graduates (unless otherwise noted)**

<b>Name</b>	<b>Date Entered</b>	<b>Degree Date</b>	<b>Job Title</b>	<b>Employer</b>
Rebecca King	1/96	12/96	Safety Engineer	MEMC Southwest, TX
Martha Parker	1/96	5/97	Ergonomics Engineer	Neutral Posture, TX
Kyle Wingate	9/96	12/97	Ergonomics Engineer	Intel, Chandler, AZ
David Abell	9/95	8/97	Ergonomist	General Motors, Indiana
Angela Narvaez	5/96	5/98	Safety Associate	HP, Houston, TX
Scott Whalen	5/96	12/97	Safety Engineer	Boeing, Seattle, WA
Rex Bryan	8/96	8/99	Safety Engineer	General Motors, MI
Kendra Bartels	6/97	8/99	Consultant	Ergonomics Consulting, TX
Stacey Rose	6/97	8/99	Loss Prevention Consultant and PHD Student	Texas Mutual Insurance Co.
Erin Walline	1/98	8/99	PHD Student	TAMU
Jason English	1/98	8/99	Safety Engineer	Nelson & Associates
Nathan Rucker	1/98	8/99	Safety Engineer	Novellus
Rachel Ventra	1/99	12/2000	EH&S Consultant	ERM Environmental, TX
Melanie Bohac	1/99	12/2000	Design Specialist	Dell Computers, TX
Jeffery Doerr	1/99	12/2000	Engineer	Applied Materials, TX
Micheal McDermott	1/99	12/2000	Engineer	Dept. of Defense Contractor, PA
Edward Stevens	8/2001	5/2003	Doctoral Student	TAMU
John-Paul Stephens	8/2001	5/2003	Doctoral Student	TAMU

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#### IV. LIST OF PUBLICATIONS

McSweeney, K. P., Congleton, J. J., Kerk, C. J., Jenkins, O. C., and Craig, B. N., "Correlation of Recorded Injury and Illness Data with Smoking, Exercise, and Absolute Aerobic Capacity," *International Journal of Industrial Ergonomics*, Vol. 24/2, pp. 193-200, May 1999.

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Craig, Brian, Congleton, J.J., Kerk, C.J., Amendola, A.A., Gaines, W.G., Jenkins, O.M., " A Prospective Field Study of the Relationship of Potential Occupational Risk Factors with Occupational Injury/Illness", *AIHA Journal*: Vol. 64, No. 3, pp. 376-387, 2003.

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Knox, K., Moore, J.S., 2001. Predictive validity of the strain index in turkey processing. Journal of Occupational and Environmental Medicine 43, 451-462.

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<b>PROGRAM DIRECTOR</b> (Last, first, middle) Congleton, Jerome J.	<b>PERIOD COVERED BY THIS REPORT</b> 7/1/98 – 6/30/03
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## APPENDIX A

### BIOGRAPHICAL SKETCHES

Jerome J. Congleton, PhD, PE, CPE

J. Steven Moore, MD, CPE, CIH, MPH

Gordon A. Vos, PhD

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### BIOGRAPHICAL SKETCH

Give the following information for all professional personnel contributing to the training program, beginning with the Program Director. Photocopy this page for each person. Do not exceed two pages on any individual.

<b>NAME</b> Jerome J. Congleton	<b>TITLE</b> Professor	<b>BIRTHDATE (Mo/Day/Yr)</b> 3/7/44	
<b>EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training)</b>			
<b>INSTITUTION AND LOCATION</b>	<b>DEGREE</b>	<b>YEAR CONFERR ED</b>	<b>FIELD OF STUDY</b>
University of Evansville, Indiana	BS	1967	Industrial Engineering
University of Arkansas	MS	1973	Management
Texas Tech University	Ph.D.	1983	Industrial Engineering

#### RESEARCH AND TRAINING SUPPORT (See instructions)

**Active Support:** (1) TEES/Grant 08-32525-4727E – NIOSH TG in Ergonomics, Congleton and Moore, 7.0% FTE, \$73.6K. (2) Methods and Standards contract with Corpus Christi Army Depot, Congleton, 25% FTE, \$600K. (3) Inter-Departmental Salary Support – Athletic Department, 18.0% FTE. **Pending Review:** None. **Planned:** None.

**RESEARCH AND/OR PROFESSIONAL EXPERIENCE:** Concluding with present position, list in chronological order previous employment, experience, and honors. List present membership on any Federal Government public advisory committee. List, in chronological order, the titles and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

#### Research and Professional Experience

United States Air Force, Fighter Pilot, 1967-73; ALCOA, Industrial Engineer for Maintenance, 1973-74; ALCOA, Safety Supervisor, 1974-77; ALCOA, Safety Manager, 1977-80; Rea Magnet Wire Co. (subsidiary of ALCOA) - Safety and Hygiene, Corporate Manager, 1980-81; Texas Tech University, Research & Teaching Assistant, 1981-83; Texas A&M University - Industrial Engineering Dept., Assistant Professor, 1983-88; Texas A&M University - Industrial Engineering Dept., Associate Professor, 1988-1995. Texas A&M University, - Nuclear Engineering Department, Professor, 1995-2002. Director of the Ergonomics Center at Texas A&M University, 1996. Grants Program Co-Director of the National Institute for Occupational Safety and Health Training Grant in Ergonomics, 1995-present. Co-Director of the National Science Foundation Industry/University Cooperative Research Center in Ergonomics, 1994-present. Texas A&M University System Health Science Center School of Rural Public Health – Environmental and Occupational Health Department, Professor, 2002-Present.

#### Honors

Board of Directors - International Industrial Ergonomics and Safety Foundation  
Member - Human Factors Society  
Member - American Industrial Hygiene Association  
Director of Ergonomics Division of Institute of Industrial Engineers, 1994.  
Distinguished Flying Cross and 16 Oakleaf Clusters to the Air Medal (213 Combat Missions)  
State of Texas, Registered Professional Engineer, P.E. #55267  
Certified Professional Ergonomist, CPE #481  
Associate Safety Professional, BCSP #A776  
Patent - Congleton, J.J., "Neutral Body Posture Chair," U.S. Department of Commerce, Patent Trademark Office, U.S. Patent #4552404, Issued November 12, 1985.  
Peer Review (Advisory Committee) for the 1991 Revised NIOSH Work Practices Guide for Manual Lifting (WPG).

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<b>NAME OF ORGANIZATION</b> Texas A&M University	<b>TITLE</b> Occupational Safety and Health Training Grant

### Publications

1. Congleton, J.J., Ayoub, M.M., and Smith J.L., "The Design and Evaluation of the Neutral Posture Chair for Surgeons," Human Factors Journal, Vol. 27, No. 5, pp. 589-600, 1985.
2. Patterson, P.E., Koppa, R.J., Congleton, J.J., and Huchingson, R.D., "Low Back Stress, Muscle Usage, and the Appearance of Transient Load Movement During Manual Lifting," The International Journal of Industrial Ergonomics, Vol. 1, pp. 137-143, 1986.
3. Patterson, P.E., Congleton, J.J., Koppa, R.J., and Huchingson, R.D., "The Effects of Load Knowledge of Stresses at the Low Back During Lifting," Ergonomics, Vol. 30, No. 3, pp. 539-549, 1987.
4. Congleton, J.J., Ayoub, M.M., and Smith, J.L., "The Determination of Pressures and Patterns for the Male Human Buttocks and Thigh in Sitting Utilizing Conductive Foam," The International Journal of Industrial Ergonomics, Vol. 2, pp. 193-202, 1988.
5. Bordett, H.M., Koppa, R.J., and Congleton, J.J., "Torque Required by Elderly Females to Operate Faucet Handles of Various Shapes," Human Factors Journal, Vol. 30, No. 3, pp. 339-346, 1988.
6. McCoy, M.A., Congleton, J.J., Johnston, W.L., and Jiang, B.C., "The Role of Lifting Belts in Manual Lifting," The International Journal of Industrial Ergonomics, Vol. 2, pp. 259-266, 1988.
7. Koppa, R.J., Jurmain, M.M., and Congleton, J.J., "An Ergonomic Approach to Refrigerator Design for the Elderly Person," Applied Ergonomics, Vol. 20, No. 2, pp. 123-130, 1989.
8. Rodrigues, C.C., Congleton, J.J., Koppa, R.J., and Huchingson, R.D., "Maximum Acceptable Weight of Lift Asymmetrical Combination Manual Handling Task," The International Journal of Industrial Ergonomics, Vol. 4, No. 3, pp. 245-253, 1989.
9. Schulze, L.J.H., Koppa, R.J., Congleton, J.J., Johnston, W.L., and Whiteley, J.D., "Effect of Pneumatic Screwdrivers and Workstation on Operator Body Posture," The International Journal of Industrial Ergonomics, Vol. 8, No. 1, pp. 17-31, 1991.
10. Whiteley, J.D., Congleton, J.J., Thomas, R.E., and Schulze, L.J.H., "An Exploratory Study of Spinal Creep Measurement in a Simulated Aircraft Environment," International Journal of Industrial Ergonomics, Vol. 8, No. 1, pp. 49-58, 1991.
11. Thomas, R.E., Congleton, J.J., Huchingson, R.D., Whiteley, J.D., and Rodrigues, C.C., "An Investigation of the Relationships Between Driver Comfort, Performance and Automobile Seat Type During Short Term Driving Tasks," International Journal of Industrial Ergonomics, Vol. 8, No. 1, pp. 103-114, 1991.
12. Thomas, R.E. and Congleton, J.J., Preface "Special Issue: Posture and Seating," International Journal of Industrial Ergonomics, Vol. 8, No. 1, pp. 1-2, 1991.
13. Grant, K.A., Congleton, J.J., Koppa, R.J., Lessard, C.S., and Huchingson, R.D., "Use of Motor Nerve Conduction Testing and Vibration Sensitivity Testing as Screening Tools for Carpal Tunnel Syndrome in Industry," The Journal of Hand Surgery, Vol. 17, No. 1, pp. 71-76, 1992.
14. Reddell, C.R. Congleton, J.J., Huchingson, R.D., and Montgomery, J.F., "An Evaluation of a Weight Lifting Belt and Back Injury Prevention Training Class for Airline Baggage Handlers," Applied Ergonomics, Vol. 23, No. 5, pp. 319-329, 1992.
15. Grant, K.A., Congleton, J.J., Koppa, R.J., "Age and Weight Effects on Motor Nerve Conduction Time Measurements in an Asymptomatic Industrial Population," Journal of Occupational Rehabilitation, Vol. 2, No. 4, pp. 175-182, 1992.
16. Thomas, R.E., Vaidya, S.C., Herrick, R.T., and Congleton, J.J., "The Effects of Biofeedback in Carpal Tunnel Syndrome," Ergonomics, Vol. 36, No. 4, pp. 353-361, 1993.
17. White, K.M., Congleton, J.J., Koppa, R.J., Huchingson, R.D., and Pendleton, O.J., "Vibrometry Testing for Carpal Tunnel Syndrome: A Longitudinal Study of Daily Variations," Archives of Physical Medicine and Rehabilitation, Vol. 75, pp. 25-28, 1994.
18. Schulze, L.J.H., Congleton, J.J., Huchingson, R.D., and Koppa, J., "Effects of Pneumatic Screwdrivers and Workstations on Inexperienced and Experienced Operator Performance," International Journal of Industrial Ergonomics, Vol. 16, No. 2, pp. 175-189, 1994.

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<b>NAME OF ORGANIZATION</b> Texas A&M University	<b>TITLE</b> Occupational Safety and Health Training Grant

21. White, K.M., J.J. Congleton, O.J. Pendleton, R.D. Huchingson, and R.J. Koppa, "Defending the Wrist Deviation Test for Carpal Tunnel Syndrome Screening: A Comparison of Vibration Thresholds and Distal Motor Latency." International Journal of Occupational Safety & Ergonomics, Vol. 2, No. 4, pp. 315-335, 1996.
22. Espritt, A.J., C.J. Kerk, J.J. Congleton, L.L. Crumpton, and K.M. White, "Effects of Menstruation on Vibrotactile Threshold in the Peripheral Median Nerve," International Journal of Industrial Ergonomics, Vol. 19, pp. 201-204, 1997.
23. Craig, B.N., J.J. Congleton, C.J. Kerk, J.M. Lawler, and K.P. McSweeney, "Correlation of Injury Occurrence Data With Estimated Maximal Aerobic Capacity And Body Composition In A High Frequency Manual Materials Handling Task, accepted, AIHA Journal, May 1997.
24. Congleton, J.J., B.J. Jones, S.G. Schiflett, R.D. Huchingson, K.P. McSweeney, "An Evaluation of Voice Stress Techniques in a Simulated AWACS Environment." International Journal of Speech Technology, Vol. 2, pp. 61-69, 1997.
25. McSweeney, K. P., Congleton, J. J., Kerk, C. J. Jenkins, O. C., and Craig, B. N., "Correlation of Recorded Injury and Illness Data with Smoking Exercise, and Absolute Aerobic Capacity," International Journal of Industrial Ergonomics, Vol. 24/2, pp. 193-200, May 1999.
26. Al-Eisawi, K. W., Kerk, C. J., Congleton, J. J., Amendola, A. A., Jerkins, O. C., and Gaines, W. G., "The Effect of Handle Height and Cart Load on the Initial Hand Forces in Cart Pushing and Pulling," Applied Ergonomics, 30 (3), 235-245, 1999.
27. Cunningham, J. J., Latg, B. A., McSweeney, K.P., and Congleton, J. J., "Development of a System for Improved Transportation and handling a full-sized Pregnant Sows at a Metropolitan Research Facility," Contemporary Topics, Volume 37, No. 5, September 1998, pp. 82-85.
28. Craig, B. N., Congleton, J. J., Kerk, C. J., Lawer. J. M. and McSweeney, K. P., "Correlation of Injury Occurrence Data with Estimated Maximal aerobic Capacity and Body Composition in a High- Frequency manual materials handling Task," American Industrial Hygiene Association Journal. Vol. 59, pp. 25-33, January 1998.
29. McSweeney, K.P., Congleton, J.J., Kerk, C.J., Jenkins, O.C, and Craig, B.N., "Correlation of Recorded Injury and Illness Data with Smoking Exercise, and Absolute Aerobic Capacity, " International Journal of Industrial Ergonomics, Vol. 24/2, pp. 193-200, May 1999.
30. Al-Eisawi, K.W., Kerk, C.J., Congleton, J.J., Amendola, A.A., Jenkins, O.C., and Gaines, W.G., "The Effect of Handle Height and Cart Load on the Initial Hand Forces in Cart Pushing and Pulling," Applied Ergonomics, 30 (3), pp 235-245, 1999.
31. J.M. Fink, J.P. Wagner, J.J. Congleton, "Microwave Emissions from Police Radar", American Industrial Hygiene Association Journal, Vol. 60, No. 6, pp 770-776, 1999.
32. Miller, T., White, T., Kinley, A., Congleton, J. J., and Clark, M., "The Effects of Training History, Player Position, and Body Composition on Exercise Performance in Collegiate Football Players," The Journal of Strength and Conditioning Research, In Press, December 1999.
33. Bales, D., Craig, B., Congleton, J. J., Kerk C. J., and Jenkins, O., "The Influence of Supporting the Oxylog Instrument on Estimated Maximal Aerobic Capacity During a Step Test and Heart Rate in a Lifting Test," Applied Ergonomics, In Press, December 1999.
34. Bales, D. W., Craig, B. N., Congleton, J. J., Kerk, C. J., Amendola, A. A., Gaines, W. G., and Jenkins, O. C., The Influence of Supporting the Oxylog Instrument on Estimated Maximal Aerobic Capacity During a Step Test and Heart Rate in a Lifting Test, Applied Ergonomics, 32/4, August 2001, pp 367-377.
35. McSweeney, K., Craig, B., Congleton, J., and Miller, D., Ergonomic Program Effectiveness: Ergonomic and
36. Medical Intervention, International Journal of Occupational Safety and Ergonomics, 8(4), 2002.
37. Craig, B. N., Congleton, J. J., Kerk, C. J., Amendola, A. A., Gaines, W. G., and Jenkins, O. C., A Prospective
38. Field Study of the Relationship of Potential Occupational Risk Factors with Occupational Injury/Illness.
39. American Industrial Hygiene Association Journal, May/June 2003.

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### BIOGRAPHICAL SKETCH

NAME	TITLE	BIRTHDATE (Mo/Day/Yr)
Steven Moore, MD, MPH, CIH, CPE	Professor	7/14 /52

**EDUCATION** (Begin with baccalaureate or other initial professional education and include postdoctoral training)

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERR ED	FIELD OF STUDY
University of Texas, Austin, TX	BS	1974	Biology
University of Texas Health Science Center, Dallas, TX	MD	1978	Occupational Medicine
Medical College of Wisconsin	MPH	1989	Public Health

**RESEARCH AND TRAINING SUPPORT** (See instructions)

**Active Support:** (1) TEES/Grant 08-32525-4727E – NIOSH TG in Ergonomics, Congleton and Moore, 9.09% FTE, \$73.6K. (2) TEES/Grant 08-32525-5582B - Alternative keyboards - NIOSH, Dr. Swanson, 2.0% FTE, \$79K. (3) TEES/Grant 08-32555-6180A – USX feed for NSF/IUCRC – Congleton and Moore, 3.43% FTE, \$25K. **Pending Review:** Low Back Pain: Quantifying Risk Factors, Moore and Vos (TAMU PIs), 6.75% FTE, \$75K (TAMU site). **Planned:** None.

#### Research and Professional Experience

##### Faculty Appointments:

1985 - 1988 Assistant Clinical Professor, Department of Preventive Medicine, Medical College of Wisconsin.  
1988 - 1994 Assistant Professor, Department of Preventive Medicine, Medical College of Wisconsin.  
1994 - 1995 Associate Professor and Interim Chairman, Department of Preventive Medicine, Medical College of Wisconsin  
1993 - present Adjunct Associate Professor, Department of Industrial and Systems Engineering, University of Wisconsin - Milwaukee  
1995 - present Associate Professor, Department of Occupational Health Sciences, University of Texas Health Center at Tyler  
1995 - 1997 Associate Professor, Department of Occupational and Environmental Medicine, University of Texas Health Center at Tyler  
1998 - present Professor, College of Engineering, College of Medicine and School of Rural Public Health, Texas A&M University, College Station, Texas

##### Hospital and Administrative Appointments:

1988 - 1995 Milwaukee County Medical Complex  
1993 - 1995 Froedtert Memorial Lutheran Hospital  
1989 - 1993 Director, Occupational and Environmental Health Research Center, Medical College of Wisconsin  
1990 - 1994 Director, Occupational Medicine Residency Programs, Medical College of Wisconsin  
1995 - present Director of Industrial Hygiene and Ergonomics; Texas Institute for Occupational Safety and Health  
1995 - present University of Texas Health Center at Tyler

##### Honors

1973 Junior Fellow; University of Texas  
1980 Citation; Commander, Submarine Squadron 10  
1981 Navy Commendation Medal; Commander, U.S. Atlantic Fleet  
1996 1995 Paper of the Year - American Industrial Hygiene Association Journal

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### **Select Peer-Reviewed Papers**

1. Moore, J.S., and A. Garg: "The Strain Index: A proposed method to analyze jobs for risk of distal upper extremity disorders." *Am. Ind. Hyg. Assoc. J.* 56(5):443-458, 1995.
2. Moore, J.S., and A. Garg: "Use of participatory ergonomics teams to address musculoskeletal hazards in the red meat packing industry." *Am. J. Ind. Med.* 29(4):402-408, 1996.
3. Moore, J.S., and A. Garg: "A case study of an epidemic of upper extremity disorders in a corporate office." In: *Advances in Occupational Ergonomics and Safety I*. A. Mital, H. Krueger, S. Kumar, M. Menozzi, and J.E. Fernandez, eds. Taylor & Francis, London, 1996. pp. 858-863.
4. Moore, J.S.: "Proposed pathogenetic models for specific distal upper extremity disorders." *Proceedings of the International Conference on Occupational Disorders of the Upper Extremities*, Ann Arbor, MI; 1996.
5. Moore, J.S., and A. Garg: "Participatory ergonomics in a red meat packing plant. Part 1: Evidence of long-term effectiveness." *Am. Ind. Hyg. Assoc. J.* 58(2):127-131, 1997.
6. Moore, J.S., and A. Garg: "Participatory ergonomics in red meat packing plant. Part 2: Case Studies." *Am. Ind. Hyg. Assoc. J.* 58:498-508, 1997.
7. Moore, J.S.: DeQuervain's tenosynovitis. *J. Occup. Environ. Med.* 39(10):990-1002, 1997.
8. Moore, J.S.: "Office Ergonomics Programs: A case study of North American corporations." *J. Occup. Environ. Med.* 39(12):1203-1211, 1997.
9. Moore, J.S., and A. Garg: "The effectiveness of participatory ergonomics in the red meat packing industry: Evaluation of a corporation." *Int. J. Ind. Ergon.* 21:47-58, 1998.
10. Jeng, O-J, R.G. Radwin, J.S. Moore, M. Roberts, J. Garrity, and T. Oswald: "Evaluation of a sensory and psychomotor functional test battery for carpal tunnel syndrome using an industrial population." *Am. Ind. Hyg. Assoc. J.* 58(12):885-892, 1997.
11. Moore, J.S.: Flexor tendon entrapment of the digits. *J. Occup. Environ. Med.* 42(5):526-545, 2000).
12. Katz, J.N., S. R. Stock, B.A. Evanoff, D. Rempel, J.S. Moore, A. Franzblau, and R.G. Gray: "Classification Criteria and Severity Assessment in Work-Associated Upper Extremity Disorders: Methods Matter." (editorial) *Am. J. Ind. Med.* 38(4):369-372, 2000.
13. Moore, J.S., N.P. Rucker, and K. Knox: Validity of Generic Risk Factors and the Strain Index for Predicting Non-Traumatic Distal Upper Limb Disorders. *AIHAJ* 62:229-235, 2001 .
14. Knox, K. and J.S. Moore: Predictive Validity of the Strain Index in Turkey Processing. *J. Occ. Env. Med.* 43(5):451-462, 2001.
15. Rucker, N.P. and J.S. Moore: Predictive Validity of the Strain Index in Manufacturing. *Appl. Occ. Env. Hyg.* 17(1):63-73, 2002.
16. Moore, J.S.: Proposed Biomechanical Models for the Pathogenesis of Specific Distal Upper Extremity Disorders. *Am J Ind Med* 41:353-369, 2002

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NAME	TITLE	BIRTHDATE (Mo/Day/Yr)
Gordon A. Vos	Assistant Professor	2/24/72

### EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training)

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
Texas A&M University, College Station, TX	BS	1995	Bio-Environmental Science
Texas A&M University, College Station, TX	MS	1997	Industrial Hygiene
Texas A&M University, College Station, TX	PHD	2001	Interdisciplinary Engineering

### RESEARCH AND TRAINING SUPPORT (See instructions)

**Active Support:** (1) TEES/Grant 08-32525-4727E – NIOSH TG in Ergonomics, Congleton and Moore, 9.0% FTE, \$73.6K. (2) Inter-Departmental Salary Support – TAMU System Office of Risk Management, 20.0% FTE. **Pending Review:** (1) NIH/NIOSH SERCA Proposal – Revision of Strain Index for Computer Users., Vos, 60% FTE, \$75K. (2) Low Back Pain: Quantifying Risk Factors, Moore and Vos (TAMU PIs), 6.3% FTE, \$75K (TAMU site). **Planned:** None.

### Research and Professional Experience

#### Positions and Employment

1990 Internship, Oil Field Operations Dept., Occidental Petroleum, Los Angeles, CA  
1994 Internship, Research on Bio-Remediation, Texas A&M University, College Station, TX  
1995 Internship, Health, Environment and Safety Dept., ELF Atochem, Philadelphia, PA  
1996 Internship, Environment Health and Safety Dept., Amoco Oil Co., Texas City, TX  
1997 – 1998 Industrial Hygienist, Amoco Oil Corporation, Tulsa, OK  
1999 – 2000 Graduate Assistant, Nuclear Engineering Dept., Texas A&M Univ., College Station, TX  
2001 – 2002 Research Scientist, Nuclear Engineering Dept., Texas A&M Univ., College Station, TX  
2002 – Present Assistant Professor, School of Rural Public Health, TAMUS-HSC, College Station, TX

#### Other Experience and Professional Memberships

1996 – 2003 President, InTech Software Corp (Exposure Assessment Software), College Station, TX  
1996 – 2003 Member, American Industrial Hygiene Association, Fairfax, VA  
1998 – 2003 Member, Exposure Assessment Strategies Committee, AIHA, Fairfax, VA  
2002 – 2003 Associate Director, NSF I/UCRC in Ergonomics, College Station, TX

#### Honors

1998 Awarded the "James Hammond Industrial Hygiene Award," for outstanding accomplishment and achievement as a new professional in industrial hygiene