

FINAL PROGRESS REPORT

**OCCUPATIONAL HEALTH AND SAFETY SECTION
DEPARTMENT OF ENVIRONMENTAL HEALTH
COLORADO STATE UNIVERSITY
FORT COLLINS, COLORADO 80523**

**INDUSTRIAL HYGIENE TRAINING PROGRAM
COLORADO STATE UNIVERSITY**

Project Period July 1, 1994 to June 30, 1997

FEB 1998

Program Director: Dr. Roy M. Buchan, CIH

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TABLE OF CONTENTS

	<u>Page</u>
Abstract	1
Significant Findings	2
Report 1994 thru 1997	3
Baccalaureate Program	3
Master of Science Degree Program	4
Ph.D. Program	5
 Tables	
I. Applicants to Program	3
II. B.S. Graduates and Their Employment	4
III. M.S. Graduates and Their Employment	5
IV. Student and Thesis Dissertation Title	6
 Publications	7
Conclusion	9

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ABSTRACT

The original inception of this program was in 1973 with the first NIOSH funding in 1975. This Final Progress Report covers the period of July 1, 1994 through June 30, 1997. During that period there were 29 graduates of the programs. The program is made up of a B.S. level program, an M.S. program and the Ph.D. program. There were 15 graduates at the baccalaureate level that found employment in industrial hygiene, 12 masters students were graduated and placed in industrial hygiene positions, and 2 Ph.D. candidates completed their programs of study and were successfully employed in industrial hygiene. Over this period of time there were 102 qualified applicants to the graduate program and 44 were admitted for a ratio of 2.3 qualified applicants per open position in the program. There were 13 theses or dissertations completed which resulted in 12 papers being published in refereed scientific journals, one paper published in a proceedings of a conference, and two chapters were written and published in textbooks by the faculty. In total it was a very successful grant period with high quality students being graduated, and high quality products being produced.

SIGNIFICANT FINDINGS

As regards significant findings, these would fall into two categories, significant findings from research, and findings from programmatic operations and management. As regards research only the most significant findings will be elucidated here and the reader is referred to the research titles listed in the report for detailed explanations. It was found contrary to our hypothesis that there was no difference between air purifying respirator fit due to anthropomorphic facial differences among Caucasians, African Americans, Hispanics, and women of all three races. Research also revealed that orthopedic surgery in veterinary practice provides for potentially significant exposures to blood aerosol. The mining operations of the Battlement Mesa of Nevada poses real hazards to workers for exposure to aerosols of zeolite, and mordenite on the order of the most benign hazards associated with asbestos. Modern composting for municipal operations which includes wood shavings, and chips mixed with anaerobically treated sewage sludge poses potential hazards working in close proximity to the composting operations particularly in the winter when operations are confined to the indoor environment. Of the many potentially pulmonary reactive components to grain dust at harvest and in country elevators, the most hazardous components of the aerosol seem to be the grain dust itself, and the endotoxins associated with the dust, and possibly the mycotoxins in the dust. It was also found that clients to the free on-site consultation services of the 7(c)1 OSHA State programs tend to correct serious hazards found in their operations, and that those hazards remain corrected for at least a one year period, indicating that the OSHA 7(c)1 Consultation Program of the U.S. Department of Labor and the Occupational Safety and Health Administration really works, and that if injury and lives saved can be equated to hazards identified and corrected, the consultation programs are important contributors to the national occupational health and safety effort of the United States government. These are but the most important findings associated with the research over the three years being reported on for this report, other less significant findings can be found in the other theses and publications listed in this report.

Aside from research, the most significant finding about this training program is that its fundamental philosophy of turning out a journeyman level industrial hygienist, a person with sound practical professional skills is a successful approach. This is evidenced by the high demand for students to get into the program, more applicants than slots available; the fact that student research is being published in respected scientific journals; and most importantly virtually every graduate of the program, B.S. through the Ph.D. has found gainful employment in industrial hygiene. This is obviously enhanced by the fact that this program has enjoyed the support of NIOSH for many years and that the financial support to students is critical to these outcomes, coupled with the fact that students also tend to excel when there is an active and funded research program built around the education and training program.

REPORT 1994 THROUGH 1997 NIOSH TRAINING GRANT

This report covers a three year period and is divided into the three areas of education supported by NIOSH at Colorado State University in industrial hygiene; B.S. Environmental Health, M.S. Environmental Health, and Ph.D. Environmental Health. It is important to note that with the exception of the B.S. program, the degrees at the graduate level show "industrial hygiene" as the discipline that the student graduated in.

If program success can be measured by demand, the Colorado State program is an outstanding success. Over the three year period of this report there were 102 applicants qualified for admission to the program and of that number 44 were admitted. This accounts for a ratio of 2.3 applicants per available slot in the program (Table I.).

TABLE I
APPLICANTS TO PROGRAM

QUALIFIED APPLICANTS	ADMITTED	YEAR
15	9	FA 1994
10	3	SP 1995
23	9	FA 1995
14	5	SP 1996
29	10	FA 1996
11	8	SP 1997

This did not take into account the total number of applicants that were not considered qualified for admission to the graduate program. Overall, such demand and the ability to be selective of our students has led to an exceptional quality of students in our program which ultimately leads to success across the entire program.

A. Baccalaureate Program

The baccalaureate program in environmental health was initiated in 1970, and Roy Buchan was hired in 1973 to add an industrial hygiene element to the program. It must be noted that students do in fact major in environmental health, but for those that have special interest, take the introductory industrial hygiene courses and laboratory of the

Program Director: Roy M. Buchan

graduate program. It is our philosophy that these students are not truly industrial hygienists, but they are perfectly capable in functioning as industrial hygiene technologists serving under the direction of an experienced industrial hygienist. Over the three year period of this project cycle, 15 students sought out industrial hygiene as an option of study and all found gainful employment (Table II.)

TABLE II
B.S. GRADUATES AND THEIR INDUSTRIAL HYGIENE EMPLOYMENT

STUDENT	DEGREE	EMPLOYMENT
Ries, Jamie	B.S.	Storage Tek - Colorado
Campbell, Chad	B.S.	Public Service - Colorado
Jensen, Colleen	B.S.	Citgo - Texas
Brines, Vanessa	B.S.	Burns & McDonnell - Kansas
Kulmar, Jered	B.S.	Mactec - Colorado
Ulmer, Jacque	B.S.	Sandia National Lab - New Mexico
Ramirez, Jason	B.S.	Public Service - Colorado
Jannais, Chris	B.S.	Construx - Illinois
Martinez, Tony	B.S.	Graduate School - Colorado
Risan, Dana	B.S.	Hewlett Packard - Colorado
Allen, Irene	B.S.	Booz and Allen - Colorado
Woods, Steve	B.S.	Graduate School - Colorado
Hails, Steve	B.S.	Safeway Inc. - Oregon
Mottram, Peter	B.S.	Walsh Consultants - Colorado
DeQuaise, Chris	B.S.	Western Area Power Authority - Colorado

It should be noted that while students in the 1980's found employment primarily in government, but now the B.S. level graduate is finding employment in the private sector and at national laboratories. It should also be noted that a majority of these students return to graduate school to study industrial hygiene after a few years experience. This has proven to be a successful program and it is definitely filling a need based upon the fact that all students are working in the field of industrial hygiene.

B. Master of Science Degree Program

The masters degree program in environmental health has a specialty in industrial hygiene, and the transcripts show that the student majored in industrial hygiene. There are two options, one with a thesis and one without. During the period of this report all but one student completed the degree option with the thesis. There we 12 M.S. graduates and all are employed in industrial hygiene (Table III.) in a variety of organizations, ranging from

TABLE III
M.S. GRADUATES AND THEIR INDUSTRIAL HYGIENE EMPLOYMENT

STUDENT	DEGREE	EMPLOYMENT
Haas, Jim	M.S.	Los Alamos National Laboratory - New Mexico
Colgan, Cliff	M.S.	XNS Subscription Services - Colorado
Darragh, Alex	M.S.	7(c)1 Consultation
Duckworth, Chris	M.S.	USDOL - Colorado
Wold, Chad	M.S.	Lutheran Health Systems - North Dakota
Grogin, Phil	M.S.	Los Alamos National Laboratory - New Mexico
Johnson, Craig	M.S.	Colorado State University - Colorado
Buchanan, Katy	M.S.	USDOL - Colorado
Coy, Jim	M.S.	Los Alamos National Laboratory - New Mexico
Sokolowski, Mike	M.S.	U.S. Navy - California
Crimi, Michelle	M.S.	Bensten Consultants - Massachusetts
Miller, Sally	M.S.	Woodward Clyde - Colorado

the U.S. Navy to the private sector. This continues to be a very successful program based upon placement, and based upon the success of publishing their research in refereed industrial hygiene journals. This program is the underpinning of the entire program and most NIOSH support for students goes to these masters level students.

C. Ph.D. PROGRAM

The Ph.D. program was initiated just prior to this project period through the assistance of NIOSH and its grant approval process. It was in fact, the first Ph.D. program in industrial hygiene Rocky Mountain Region. The two Ph.D. candidates to complete their work were Dr. Don Beard and Dr. Bill Brazile. Dr. Beard's dissertation research on the potentially pulmonary reactive components of grain dust was a classic and a valuable contribution to the literature relating to the health effects of grain dust exposures at harvest and in country elevators. Dr. Beard is now a faculty member in industrial hygiene at East Tennessee University. Dr. Brazile's work has finally put to rest that facial differences among different racial groups could lead to poor respirator fit for minorities. Dr. Brazile is now employed by the Los Alamos National Laboratory, one of the leading research institutions in the world in respirator research. In summary, the Ph.D. program is of modest size but it is obviously of very high quality. Table IV which follows is a complete listing of all M.S. and Ph.D. thesis and dissertation topics for the three year period reported.

TABLE IV
STUDENT AND THESIS DISSERTATION TITLE

AUTHOR	YEAR	TITLE
Beard, Mala LaDon	1994	Pulmonary Reactive Components of Winter Wheat Grain Dust at Colorado Farms and Elevators
Haas, James	1994	Occupational Health and Safety Hazards in Colorado Small Industries Using the OSHA 7(c)1 Consultation Program
Colgan, Clifford	1995	Assessment of Wood Stain Inhalation Exposure Using the video Exposure Monitoring Technique
Darragh, Alexander	1995	Quantification of Air Contaminants at a Municipal Sewage Sludge Composting Facility
Duckworth, Chris	1995	Tape Sampling Versus Microvacating: An Evaluation and Comparison of Both Methods for the Removal of Surface Contamination
Vance, Amanda Maria	1995	Evaluation of a RCRA Ground Water Monitoring Protocol at a Hazardous Waste Landfill
Wold, Chad	1995	A Performance Evaluation of Two Personal Heat Stress Monitors
Brazile, William J.	1996	Respiratory Fit and Facial Dimensions of Two Minority Groups
Buchanan, Katy J.	1996	Noise-Induced Hearing Loss in a Farming Population in Northeastern Colorado
Coy, James D.	1996	Field Evaluation of a Portable Photoionization Detector for Assessing Exposure to Solvent Mixtures
Johnson, Monty C.	1996	Characterization of Blood Containing Aerosol Generated During Canine Total Hip Arthroplasty Surgery
Crimi, Michelle	1997	Bioremediation of HD Contaminated Soil
Miller, Sally	1997	The Potential for Respirable Crystalline Silica Exposure in Geotechnical Laboratories

D. PUBLICATIONS

The following is a list of the publications that have been published during the three year period of this funding period of our NIOSH training grant in industrial hygiene.

- Corrigan, C., Blehm, K., "A comparison of the tape sampling and microvacating procedure for the evaluation of surface glass fiber contamination" accepted for publication, AEOH.
- Champney, M., Stallones, L., lehm, K., Tucker, A., Merchant, D., "A Survey of Respiratory Systems in a Farming Population in Northeastern Colorado," Journal of Agromedicine, 3(3):47-57, 1996.
- Bigelow, P., and Gilkey, D. (1997) Safety Saves Money for Local Framing Contractor - HomeSafe Pilot Program Brings New Approach to How the Job is Done. National Association of Home Builders. 4(14):1-2.
- Haas, J.K., R.M. Buchan, "Occupational Health and Safety Hazards in Colorado Small Industry," Appl. Occ. Env. Hyg. 10(3):151-155, March, 1995.
- Beard, M.D., R.M. Buchan, F.B. Reeves, and M. Salasek. "Pulmonary Reactive Components of Winter Wheat Grain Dust at Colorado Farms and Elevators," Appl. Occ. Env. Hyg., Vol. 11, No. 12, December, 1996.
- Ryan, G., R.M. Buchan, T.J. Keefe, and C.S. McCammon. "A Longitudinal Study of an American Public Building Following Asbestos Removal," Appl. Occ. Env. Hyg., Vol. 11, No. 12, December, 1996.
- Darragh, A., and R.M. Buchan, "Aerosol of Wood/Sewage Sludge Compost," Appl. Occ. Env. Hyg., 12(3):190-194, March, 1997.
- Stephenson, D.L., C.J. Fairchild, and R.M. Buchan, "A Fiber Characterization of the Natural Zeolite, Mordenite: A Potential Inhalation Health Hazard," Appl. Sci. & Tech., under editorial review.
- Johnson, M.C., R.M. Buchan, D.R. Sandfort, P.D. Schwartz, "Characterization of Blood-Containing Aerosol Generated During Canine Total Hip Replacement Surgeries." Appl. Occ. Env. Hyg., Vol. 12, No. 11, November, 1997.
- Brazile, W., R.M. Buchan, "Respirator Facial Fit Among Hispanics, African Americans, and Women." Appl. Occ. Env. Hyg. Vol. 13, No. 4, April, 1998.
- Bradley, C., Alderman, B., Williams, M., Checkoway, H., Fernbach, S., Green, C., Bigelow, P., and Reif, J. (1995) Parental Occupations as Risk Factors for Craniosynostosis in Offspring. Epidemiology. 6:306-310.
- Thomas, R., Bigelow, P., Keefe, T., and Yang, R. (1996) Variability in BEIs Using Physiologically Based Pharmacokinetic Modeling and Monte Carlo Simulation. American Industrial Hygiene Association Journal. 57:23-32.

Program Director: Roy M. Buchan

Chapters in Books:

Bigelow, P., and E.J. Love. (1995) Hazards to Male Reproductive Function in Agriculture. In: Agricultural Health and Safety: Workplace, Environment, Sustainability. Pp. 195-202. McDuffie, H., Dosman, J. Semchuk, K., Olenchock, S. Sentilselvan, A., Ed. CRC Press: Boca Raton, Florida.

Bigelow, P., Beebe, J., and Piatt, J. (1995) Use of a Simulation Technique to Evaluate Air Quality During the Operation of CNG Fueled Tugs in the Denver International Airport Baggage Tunnels. In: Indoor Air Quality 95: Practical Engineering for IAQ. Pp. 121-129. Atlanta, GA: American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc.

Proceedings, Abstracts

Bradley, C., Alderman, B., Williams, M., Fernbach, S., Green, C. Bigelow, P., and Reif, J. (1994) Parental Occupationas and Risk Factors for Craniosynostosis. In: Proc. Annual Meeting Teratology Soc.

Program Director: Roy M. Buchan

E. CONCLUSION

In conclusion it is felt that the linkage of having a B.S. , M.S. , and Ph.D. program definitely has its advantages in term of matriculating knowledge throughout the program. The graduate students also serve as role models for the undergraduates increasing their aspirations for higher education and a greater level of professionalism. The fact the all students have the opportunity to interact with, and go on industrial hygiene and safety surveys is a definite plus for turning out students with a very practical orientation. There is considerable demand to get into the program (2.3:1) during this grant period and it is now around 4:1 for admission to the program. The program is widely recognized of being of high quality. The research that has been conducted as part of the graduate students educational experience has been of high quality and continues to be so. Fortunately, the program is enjoying greater and greater external funding for research, however, without doubt the underpinning of the program is continued NIOSH training grant support. Without that support we would see a program diminished in size and quality. We at Colorado State University sincerely appreciates the years of continued support for our programs and we recognize much of our success is due to NIOSH.



DEPARTMENT OF HEALTH & HUMAN SERVICES

Memorandum

Date May 29, 1998
From Principal Engineer, OECSP
Subject Final Performance Report for entry into NIOSHTIC/NTIS for
NIOSH Training Grant No. T01 CCT 810435
To William Bennett, IRB, EID (C-28)

The enclosed report has been received from the Program Director to document work performed during the specified grant project period. The following information applies to the designated Training Project Grant (TPG):

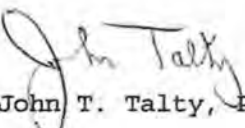
1. Title: Industrial Hygiene Training Program
Center Director: Roy M. Buchan, Ph.D.
Department of Environmental Health
Colorado State University
Fort Collins, CO 80523

Grant No.: T01 CCT 810435

Project Period: 7/1/94 - 6/30/97

Please place the report in DIDS and I also recommend it for entry into NIOSHTIC and submission to NTIS.

Thanks for your assistance.


John T. Talty, P.E., DEE

cc: T. Meinhardt/B. Kuchinski

Enclosure

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