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ABSTRACT

To improve vocational educational programs in agriculture, occupational information on a common core of basic skills within the occupational area of the bulk fertilizer plant worker is presented in the revised task inventory survey. The purpose of the occupational survey was to identify a common core of basic skills which are performed and are essential for success in the occupation. Objectives were accomplished by constructing an initial task inventory to identify duty areas and task statements for the occupation. The initial task inventory was reviewed by consultants in the field, and 146 tasks were identified. A random sample of 75 bulk fertilizer plants based on the 1975 directory of the Ohio Grain, Feed, and Fertilizer Association was obtained. Data were collected utilizing employer and employee questionnaires. Thirty-three questionnaires were returned of which 24 were usable. A compilation of basic sample background information is presented on size of fertilizer plant, total work experience, employment at current job, and preparation as a bulk fertilizer plant worker. A compilation of duty areas of work performed and work essential for the occupation is given. Percentage performance by incumbent workers and the average level of importance of specific task statements are presented in tabular form. (Author/EC)

DETERMINATION OF A COMMON CORE OF BASIC SKILLS IN AGRIBUSINESS AND NATURAL RESOURCES

An Emperical Determination Of Tasks Essential To Successful Performance As A Bulk Fertilizer Plant Worker

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AN EMPERICAL DETERMINATION OF TASKS ESSENTIAL TO SUCCESSFUL PERFORMANCE AS A BULK FERTILIZER PLANT WORKER

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FOREWORD

The Department of Agricultural Education at The Ohio State University is involved in a major programmatic effort to improve the curricula in educational programs in agriculture. One product in this effort is this report of the bulk fertilizer plant worker task inventory survey. The data reported were collected as part of a more comprehensive thrust designed to develop a common core of basic skills in agribusiness and natural resources.

It is hoped that the revised task inventory contained in this report will be useful to curriculum developers working for improved occupational relevance in schools. Twenty-seven additional inventories in other occupational areas are also reported from this project.

The profession owes its thanks to Daniel R. Miller, graduate research associate, for his work in preparing this report. Special appreciation is also expressed to George G. Greenleaf, Executive Vice President, Ohio Grain, Feed, and Fertilizer Association, Inc., for his input and help in securing the cooperation of those employed in this occupational area.

J. David McCracken
Project Director

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INTRODUCTION

Occupational information is needed to develop and revise vocational and technical education curricula. Teachers and curriculum developers generally determine which skills might be taught in a program based upon teacher expertise, advisory committee input, informal and formal community surveys, and/or task inventories.

The Agricultural Education Department at The Ohio State University has utilized and revised a system for obtaining and using occupational information as an effective aid in planning, improving, and updating occupational education curricula. This report presents the results of a task analysis survey of the occupation, bulk fertilizer plant worker. The information contained herein may be used by curriculum development specialists, teachers, local and state administrators, and others involved in planning and conducting vocational and technical programs in agriculture.

Purpose and Objectives

The major purpose of the occupational survey was to identify the skills which are performed and essential for success as a bulk fertilizer plant worker. The specific objectives of this survey were as follows:

1. Develop and validate an initial task inventory for the bulk fertilizer plant worker.
2. Identify the specific tasks performed by the bulk fertilizer plant worker.
3. Determine the relative importance of the specific tasks to successful employment as a bulk fertilizer plant worker.

Definition of the Occupational Area

The bulk fertilizer plant worker works in retail fertilizer plants that deal directly with the public. The specific duties performed by the bulk fertilizer plant worker will vary with the size and type of business. The bulk fertilizer plant worker is primarily involved with the work performed in the fertilizer plant which relates to the preparation of fertilizer. In some cases, the bulk fertilizer plant worker may also have responsibility for applying fertilizers. In general, the bulk fertilizer plant worker operates and maintains mill equipment involved in preparing fertilizers; stores and warehouses fertilizers and ingredients; operates, services, and maintains application equipment; delivers fertilizers; applies fertilizers; prepares fertilizers; and cleans and maintains the plant buildings and structures.

METHODOLOGY

Objectives were accomplished by constructing an initial task inventory, validating the initial inventory, selecting a sample of workers, collecting data, and analyzing data.

Initial Task Inventory

Duty areas and task statements for the bulk fertilizer plant worker were identified by searching existing task lists, job descriptions, curriculum guides, and reference publications. Additionally, contacts with several industry personnel aided in clarifying the specific responsibilities of the bulk fertilizer

plant worker. All the tasks that the project staff thought to be performed were assembled into one composite list.

The initial tasks were grouped into functional areas called "Duties".

After the task statements were grouped under the proper duty areas, each task statement was reviewed for brevity, clarity, and consistency. In all, 136 task statements were included in the initial task inventory.

Initial Inventory Validation

After the initial task inventory was constructed, it was reviewed by ten consultants employed in fertilizer plants. The consultants were managers of the fertilizer plants.

The consultants were asked to respond to the initial task list inventory by performing the following activities:

1. Indicate whether any of the tasks listed were not appropriate.
2. Add any additional tasks they believed were performed by the bulk fertilizer plant worker.
3. Make changes in the wording of tasks to help add clarity to the statements.

The comments from the ten consultants were pooled and revisions were made as needed. Two duty areas were added as a result of the review.

As a result of the initial task inventory review process, 146 tasks were identified.

Worker Sample Selection

Since the specific duties and tasks performed by the bulk fertilizer plant worker are related to the size and type of business where employed, an attempt was made to survey bulk fertilizer plant workers employed in various sizes and types of bulk fertilizer businesses. It was not possible to secure a list of the specific names and addresses of all incumbent workers in the state. Therefore, a sample of 75 bulk fertilizer plants was obtained from the 1975 directory of the Ohio Grain, Feed, and Fertilizer Association, Inc. using a stratified random sampling approach. The strata used were type of business and geographical location.

Data Collection

A packet of materials was sent to the owner or manager of the randomly-selected bulk fertilizer plants. The packet of materials included:

1. A cover letter from the Ohio Grain, Feed, and Fertilizer Association, Inc.
2. An employer questionnaire printed on blue.
3. An employee questionnaire printed on yellow.
4. A stamped and self-addressed return envelope.

The manager or owner was instructed to complete the employer questionnaire and to have a responsible bulk fertilizer plant worker complete the employee questionnaire. The manager or owner was instructed to collect the employee questionnaire and return both the employer and employee questionnaire in the stamped and self-addressed return envelope by the date specified in the cover letter.

A follow-up of non-respondents consisted of mailing a packet of materials two weeks after the initial mailing. The first follow-up consisted of a packet of materials identical to the initial packet except that a cover letter on Ohio State University stationery replaced the cover letter on Ohio Feed, Grain, and Fertilizer Association, Inc. stationery.

A final follow-up of non-respondents was initiated four weeks after the initial mailing. A telephone contact by a project staff member was made with 50% of the non-respondents. The non-respondents were asked to complete the questionnaire and emphasis was placed on the importance of their response to the success of the project during the telephone conversation.

Data Analysis

The 33 questionnaires which were returned were checked for completeness and accuracy by the project staff. Information from the 24 usable responses was coded on Fortran coding sheets for key punching. In addition to coding appropriate respondent background information, each specific task statement was coded as to whether it was performed (1 = Task performed by respondent; blank = Task not performed by respondent) and the level of importance of the task (3 = Essential; 2 = Useful; 1 = Not Important). The information was keypunched on IBM cards and verified by personnel at the Instruction and Research Computer Center at The Ohio State University.

The data was analyzed using the SOUPAC computer program and the facilities of the Instruction and Research Computer Center. Consultant assistance for analyzing the data was provided by personnel at The Center for Vocational Education. The SOUPAC computer analysis resulted in the computation of relative frequencies, means, and rankings for each task statement. The results of the computer analyses were printed in tabular form for ease of interpretation.

FINDINGS

Objectives of the study resulted in the compilation of basic sample background information, the determination of tasks performed by the bulk fertilizer plant worker, and the identification of tasks essential to successful performance as a bulk fertilizer plant worker.

Description of the Sample

Information regarding the performance of tasks and the importance of the tasks to successful employment as a bulk fertilizer plant worker was obtained from bulk fertilizer plant workers in various bulk fertilizer plants across Ohio.

Response to the Survey

A total of 75 questionnaires were mailed and 33 replies were received. This represented a 44% rate of return. The response to the questionnaire is summarized in TABLE I.

TABLE I

EMPLOYEE RESPONSE TO THE QUESTIONNAIRE

	N	Percent of All Employees In The Survey
Employees in Survey	75	100.0
Total Returns	33	44.0
Usable Returns	24	32.0
Unusable Returns	9	12.0
Nonrespondents	42	56.0

Size of Business

Bulk fertilizer plant workers from various size bulk fertilizer plants were included in the study. The number of full-time equivalent (two one-half time bulk fertilizer plant workers equal one full-time equivalent) bulk fertilizer plant workers employed in the business was used as an index to assess the size of business where the bulk fertilizer plant worker was employed. Of the 24 usable questionnaires received, 24 included information regarding the size of the business. TABLE II summarizes the responses to the question, "How many full-time equivalent bulk fertilizer plant workers are employed in your business?" Seven bulk fertilizer plant workers or 29.1% were employed in firms employing two full-time equivalent bulk fertilizer plant workers. Five bulk fertilizer plant workers or 21.1% were employed in firms employing one full-time equivalent bulk fertilizer plant worker. Thus, 50.2% of the bulk fertilizer plant workers were working in firms employing one to two full-time equivalent bulk fertilizer plant workers. The number of full-time equivalent bulk fertilizer plant workers employed in the firms ranged from 1-30. The average number of full-time equivalent bulk fertilizer plant workers employed in the firms was 3.5.

TABLE II

SIZE OF BULK FERTILIZER PLANT WHERE CURRENTLY EMPLOYED

Number of Bulk Fertilizer Plant Workers Employed in Firm	N	Percent of Respondents
1	5	21.1
2	7	29.1
3	4	16.6
4	4	16.6
5 or more	4	16.6
Total	24	100.0

$\bar{X}$ number of bulk fertilizer plant workers in the firm = 3.5

Total Work Experience

Bulk fertilizer plant workers with varying amounts of work experience in the bulk fertilizer industry were included in the

study. TABLE III summarizes the responses to the question, "How many total years have you worked in the bulk fertilizer industry?" Nine bulk fertilizer plant workers or 37.4% had from 11-15 total years of work experience in the bulk fertilizer industry. Seven bulk fertilizer plant workers or 29.1% had from one to two total years of work experience in the bulk fertilizer industry. Five bulk fertilizer plant workers or 21.1% had from six to ten total years of work experience in the bulk fertilizer industry. The total years of work experience in the bulk fertilizer industry ranged from 1-18 years. Bulk fertilizer plant workers had an average of 6.8 years of total work experience in the bulk fertilizer industry.

TABLE III

TOTAL AMOUNT OF WORK EXPERIENCE IN THE BULK FERTILIZER INDUSTRY

Years	N	Percent of Respondents
1-2	7	29.1
3-5	2	8.3
6-10	5	21.1
11-15	9	37.4
16 or more	1	4.1
Total	24	100.0

$\bar{X}$ years in the industry = 6.8

Employment at Current Job

Bulk fertilizer plant workers in the survey had spent varying amounts of time in their present job. TABLE IV summarizes the responses to the question, "How many years have you worked at your present job?" Ten bulk fertilizer plant workers or 41.8% had worked at their present job from one to two years. Seven bulk fertilizer plant workers or 29.1% had worked at their present job from three to five years. The years of work at their present job ranged from 1-18 years. Bulk fertilizer plant workers had been employed at their present job an average of 5.5 years.

TABLE IV

LENGTH OF TIME AT PRESENT JOB

Years	N	Percent of Respondents
1-2	10	41.8
3-5	7	29.1
6-10	4	16.6
11 or more	3	12.5
Total	24	100.0

$\bar{X}$ years at present job = 5.5

Preparation as a Bulk Fertilizer Plant Worker

Bulk fertilizer plant workers obtained training for their job from various sources. TABLE V summarizes their responses to the question, "Where did you receive your training as a bulk fertilizer plant worker?" Twenty-four bulk fertilizer plant workers or 100% indicated they received training on-the-job. Five bulk fertilizer plant workers or 21.1% indicated they attended a company school or course to receive training as a bulk fertilizer plant worker. Four bulk fertilizer plant workers or 16.6% indicated they had received training as a bulk fertilizer plant worker by attending a high school program. Four bulk fertilizer plant workers or 16.6% indicated they had received training as a bulk fertilizer plant worker through adult education classes.

Duty Areas of Work Performed by the Bulk Fertilizer Plant Worker

The 146 tasks were grouped under 12 duty areas. Each respondent indicated whether he performed the specific task in his current position as a bulk fertilizer plant worker. The percentages of respondents performing each task were averaged for all tasks under each duty area. The mean percentage of incumbents who performed specific tasks in specified duty areas is presented in TABLE VI.

Duty areas of work in which 50% or more of the incumbent workers performed the tasks were:

TABLE V

SOURCE OF TRAINING RECEIVED AS A BULK FERTILIZER PLANT WORKER

Source	N	Percent of All Employees In The Survey
On-The-Job	24	100.0
High School Program	4	16.6
Technical School Program	1	4.1
College/University Program	2	8.3
Adult Education Program	4	16.6
Company School/Course	5	21.1
Farm Experience	1	4.1

1. Performing General Office Work
2. Inventorying Supplies
3. Following General Safety Precautions
4. Storing and Warehousing Fertilizers
5. Maintaining Equipment and Vehicles
6. Using and Maintaining Hand and Power Tools
7. Applying Fertilizers
8. Operating Plant Equipment and Vehicles
9. Delivering Fertilizers
10. Maintaining Buildings and Structures
11. Preparing Fertilizers

Duty Areas of Work Essential for Successful Performance as a Bulk Fertilizer Plant Worker

A level of importance rating was obtained for each task. The respondent could rate the task as essential, useful, or not important for successful performance as a bulk fertilizer plant worker. A ranking of essential was assigned a numerical rating of "3", useful a numerical rating of "2", and not important a numerical rating of "1". The level of importance ratings for each task were averaged for all tasks under each duty area. The average level of importance ratings for the specific tasks in the specified duty areas are presented in TABLE VI.

Duty areas of work which received a 2.0 or higher level of importance rating by incumbent workers were:

1. Performing General Office Work

2. Inventorying Supplies
3. Following General Safety Precautions
4. Storing and Warehousing Fertilizers
5. Maintaining Equipment and Vehicles
6. Using and Maintaining Hand and Power Tools
7. Applying Fertilizers
8. Operating Plant Equipment and Vehicles
9. Delivering Fertilizers
10. Maintaining Buildings and Structures
11. Preparing Fertilizers

Percentage Performance and Level of Importance Ratings of Specific Tasks

The percentage performance by incumbent workers and the level of importance for each specific task is also presented in TABLE VI.

It is recommended that the results for each specific task be examined by educators and others who are developing educational programs to determine curriculum content for preparing bulk fertilizer plant workers. Specific tasks with a high level of performance and a high level of importance rating should be given more emphasis in the educational program than specific tasks with a low level of performance and a low level of importance rating.

TABLE VI

PERCENTAGE PERFORMANCE AND AVERAGE RATING OF IMPORTANCE* OF SPECIFIC TASKS

TASK STATEMENTS	Percent Performing	Average Level of Importance
Performing General Office Work		
File business forms and records	50	2.2
Meet various people	95	2.8
Use telephone	87	2.8
Write memos, notes, and letters	66	2.2
Mean Rating	74.5	2.5
Recording Information		
Record maintenance information on mill equipment	50	2.6
Record materials used in formulating mixtures	58	2.6
Record daily output of processed fertilizer	25	2.3
Record daily input of raw materials	33	2.4
Record blend ingredient information	45	2.4
Mean Rating	42.2	2.5
Inventorying Supplies		
Assist in taking physical inventory	83	2.8
Determine inventory on hand from inventory records	50	2.4
Mean Rating	66.5	2.6
Following General Safety Precautions		
Apply first aid to minor cuts, bruises, and burns	79	2.7
Follow safe work habits	75	2.9
Identify potential safety hazards	75	2.8
Store chemicals	87	2.8
Use fire extinguishers	75	2.8
Wear appropriate protective clothing	75	2.9
Ventilate work areas	75	2.8
Interpret safety information on labels and signs	79	2.9
Use proper lifting and carrying methods	66	2.5
Store inflammable materials	70	2.7
Wear appropriate work clothes	83	2.8
Adjust safety devices	66	2.8

*Average rating of importance may range from 1-3 with 3 being the highest

TABLE VI (Cont.)

PERCENTAGE PERFORMANCE AND AVERAGE RATING OF IMPORTANCE OF SPECIFIC TASKS

TASK STATEMENTS	Percent Performing	Average Level of Importance
Install safety devices	66	2.8
Correct potential safety hazards	83	2.8
Remove debris from work areas	83	2.8
Use electrical connectors and safety devices	79	2.8
Identify safety zones around plant equipment	54	2.5
Mean Rating	74.7	2.8
Storing and Warehousing Fertilizers		
Identify problems that might occur during storage	79	2.6
Determine where materials should be stored	79	2.7
Clean storage areas	79	2.7
Use rodent control measures	54	2.4
Label storage areas, bins, and tanks	83	2.7
Store materials in order of use, season, and convenience	70	2.3
Stack sacked materials	83	2.4
Determine volume of bulk fertilizers in storage	83	2.2
Determine amount of storage space needed for materials	79	2.5
Determine storability of materials	66	2.4
Unload trucks and rail cars	87	2.8
Unload liquid fertilizers into storage tank	75	2.7
Transfer NH_3 from trucks and tank cars to storage tank	50	2.5
Advise farmers on storage of fertilizers	75	2.4
Advise farmers on transferring NH_3	58	2.7
Move rail cars	77	2.7
Mean Rating	73.6	2.5
Maintaining Equipment and Vehicles		
Add coolant to radiators	79	2.8
Add oil to equipment	83	2.9
Adjust carburetors on small gas engines	75	2.8
Change oil and oil filters	79	2.8
Clean debris from equipment	83	2.7
Grease equipment	83	2.8
Inflate tires	87	2.7
Inspect cooling systems for leaks	75	2.7
Install and adjust belts	83	2.7

TABLE VI (Cont.)

PERCENTAGE PERFORMANCE AND AVERAGE RATING OF IMPORTANCE OF SPECIFIC TASKS

TASK STATEMENTS	Percent Performing	Average Level of Importance
Install and adjust chains	87	2.7
Install and service battery	87	2.7
Interpret maintenance instructions in operator's manuals	87	2.7
Remove equipment from storage	83	2.7
Repack bearings	87	2.6
Replace and adjust spark plugs	83	2.6
Replace bearings and seals	87	2.6
Replace radiator hoses	87	2.8
Service air cleaners	87	2.7
Prepare equipment for storage	87	2.8
Repair damaged electrical cords and wires	75	2.6
Lubricate and clean electric motors	70	2.6
Oil equipment	87	2.9
Replace pulleys and sprockets	83	2.8
Reset electrical motors	75	2.7
Apply paint to equipment	87	2.6
Service air compressors and pressure vessels	66	2.5
Tear down and repair pumps	75	2.6
Mean Rating	81.7	2.7
Using and Maintaining Hand and Power Tools		
Adjust tools	70	2.6
Clean tools	79	2.7
Identify tools	79	2.6
Interpret tool operation instructions	70	2.5
Recondition tools	54	2.1
Select tools for specific jobs	79	2.7
Store tools	79	2.7
Use hand tools safely	79	2.7
Mean Rating	73.6	2.6
Applying Fertilizers		
Calculate cost for various application methods and recommendations	50	2.4
Determine when to apply fertilizers	75	2.6
Mix fertilizer solutions	58	2.4

TABLE VI (Cont.)

PERCENTAGE PERFORMANCE AND AVERAGE RATING OF IMPORTANCE OF SPECIFIC TASKS

TASK STATEMENTS	Percent Performing	Average Level of Importance
Evaluate influence factors have on fertilizer effectiveness	54	2.5
Calibrate application equipment	83	2.9
Advise farmers on calibration of equipment	83	2.8
Select proper field travel speed and PTO speed	79	2.9
Adjust rate of application for specific conditions	83	2.9
Select proper method for applying fertilizers	75	2.9
Recognize signs of fertilizer injury	66	2.7
Transfer NH_3 from nurse tank to applicator	62	2.7
Transfer liquid fertilizer from nurse tank to applicator	75	2.8
Mean Rating	70.3	2.7
Operating Plant Equipment and Vehicles		
Interpret gauge readings on vehicles and equipment	83	3.0
Operate vehicles on public highways	83	2.9
Adjust equipment safety shields	75	2.8
Connect front end operated equipment	45	2.5
Connect hydraulic systems and hydraulic operated equipment	62	2.7
Correct potential equipment safety hazards	79	2.9
Hitch towed equipment	79	2.8
Identify equipment safety hazards	75	2.8
Install safety shields and safety devices	83	2.9
Interpret hand operating signals	70	2.7
Interpret operation and safety instructions in operator's manuals	79	2.8
Interpret safety symbols on equipment	79	2.8
Operate equipment under work conditions	87	2.8
Refuel vehicles	79	2.7
Use appropriate equipment and vehicles for specific jobs	87	2.9
Mean Rating	76.3	2.8
Delivering Fertilizers		
Complete delivery forms and reports	66	2.8
Determine location of delivery	87	2.9
Select appropriate delivery route	79	2.7
Load and unload bagged fertilizers	83	2.8

TABLE VI (Cont.)

PERCENTAGE PERFORMANCE AND AVERAGE RATING OF IMPORTANCE OF SPECIFIC TASKS

TASK STATEMENTS	Percent Performing	Average Level of Importance
Identify proper fertilizer to be delivered	87	3.0
Determine amount which may be safely loaded	87	2.9
Transfer liquid fertilizer from storage to nurse tank	79	3.0
Transfer NH_3 from storage to nurse tank	62	2.8
Tow nurse tanks to farms	79	2.8
Cover fertilizer buggies	70	2.5
Load fertilizer buggies	79	2.8
Transfer fertilizer from delivery equipment to customer's equipment	70	2.5
Mean Rating	77.3	2.8
Maintaining Building and Structures		
Apply metal and wood preservatives	83	2.5
Clean and oil electric motors	70	2.6
Repair and hang doors	70	2.3
Repair bracing in buildings and structures	66	2.2
Repair minor roof leaks	75	2.5
Replace belts and pulleys	87	2.7
Reset circuit breakers	87	2.7
Replace lighting fixtures	75	2.4
Replace fuses	83	2.7
Replace window panes	75	2.3
Repair wood panels and siding in storage areas and bins	75	2.5
Repair drop spouts	58	2.1
Replace safety screens	75	2.8
Remove trash from work areas	83	2.8
Mean Rating	75.9	2.5
Preparing Fertilizers		
Add ingredients at appropriate time	87	2.9
Break down blends for various weight amounts	75	2.7
Clean processing equipment between blending jobs	79	2.7
Distinguish between complete and elemental fertilizers	79	2.9
Distinguish between various forms of fertilizers	83	3.0
Elevate blended fertilizers to trucks or storage areas	87	2.9
Elevate ingredients for processing	79	2.9
Identify various fertilizer ingredients	79	2.9

TABLE VI (Cont.)

PERCENTAGE PERFORMANCE AND AVERAGE RATING OF IMPORTANCE OF SPECIFIC TASKS

TASK STATEMENTS	Percent Performing	Average Level of Importance
Interpret blending and preparation directions	87	3.0
Interpret labels on fertilizer ingredients	83	2.9
Locate needed ingredients	60	2.3
Make adjustments in blending equipment	78	2.7
Mix and blend fertilizers	86	2.9
Weigh ingredients	82	2.8
Mean Rating	80.3	2.8