

Section 2 - References  
#210-76-0175

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**Section 3 - Tables**

**Study I**

**#210-76-0175**

Study I

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TABLE 1.

## GRAIN HANDLERS POPULATION

	Working Population				Not Working			TOTAL
	WORKING TOTAL	STUDIED N	REF %	CC	VAC	SL		
ELEVATOR 1	37	35	95	2	0	2	1	40
ELEVATOR 2	23	22	96	1	0	1	0	40
ELEVATOR 3	17	12	71	1	4	1	1	19
ELEVATOR 4	81	49	60	15	17	4	4	89
ELEVATOR 5	18	17	94	1	0	2	2	22
ELEVATOR 6	21	17	80	4	0	1	2	24
ELEVATOR 7	44	39	89	3	2	4	1	49
ELEVATOR 8	37	24	65	10	3	1	2	40
ELEVATOR OPERATORS	278	215	77	37	26	16	13	307
STATE INSPECTORS	79	68	85	10	5	5	0	88
LONGSHOREMEN	40	27	68	4	8	0	0	39
TOTALS:	397	310	78	51	39	21	13	434

Working = At time of survey study.

CC = Unable to leave work to be tested, or not properly notified of examination time.

SL = Sick leave - 11 studied.

VAC = On vacation.

REF = Refused.

TABLE 2.

COMPARISON (CONTROL) POPULATION  
CITY SERVICES WORKERS

	(E)	(C)	n	Studied	
	Eligible	Contacted		% of C	% of E
Duluth City	322	273	137	50%	43%
Duluth Power & Light Co.	92	59	59	100%	64%
Superior City	64	54	43	90%	67%
Total	478	386	239	81%	50%

TABLE 3a

## CHARACTERISTICS OF THE POPULATIONS

	GRAIN HANDLERS N = 310	P	CONTROLS N = 239
Mean age (years)	40.8 ± 12.4	(NS)	40.8 ± 11.5
Mean weight (kg)	84.1 ± 14.1	(NS)	85.5 ± 13.6
Mean height (cm)	176.8 ± 7.0	(NS)	176.0 ± 6.9
Current smokers	49%	(NS)	44%
Ex-smokers	30%	(NS)	29%
Nonsmokers	21%	(NS)	26%

TABLE 3b.

## LEVEL OF EDUCATION

Highest Grade:	GRAIN WORKERS % of 310	CONTROLS % of
0-3	0	0
4-8	15%	6%
9-12	76%	85%
>13	10%	10%
Live or work on farm	11%	1%

TABLE 4

DISTRIBUTION OF SMOKING HABITS, HEIGHT, WEIGHT, AGE GROUP  
GRAIN WORKERS

Age (years)	Smokers				Ex-Smokers				Nonsmokers				All Groups		
	(no.)	(%)*	Height (cm)	Weight (kg)	(no.)	(%)*	Height (cm)	Weight (kg)	(no.)	(%)*	Height (cm)	Weight (kg)	(no.)	Height (cm)	Weight (kg)
20-29	47	53	177.1	78.3	19	22	178.1	82.2	22	25	179.4	83.5	88	177.9	80.4
30-39	35	67	178.5	84.8	9	17	177.3	81.5	8	15	176.2	83.4	52	177.9	84.0
40-49	42	52	175.9	83.7	20	25	177.0	87.7	19	23	175.3	89.5	81	176.0	86.1
50-64	29	33	174.8	78.2	44	49	176.3	86.3	16	18	176.0	84.5	89	175.7	83.3
20-64	153	49	176.7	81.2	92	30	176.9	85.3	65	21	176.9	85.5	310	176.8	83.3

\*Percent of smokers, ex-smokers, or nonsmokers for each group.

TABLE 4b

DISTRIBUTION OF SMOKING HABITS, HEIGHT, WEIGHT, AGE GROUP  
CONTROLS

Age (years)	Smokers				Ex-Smokers				Nonsmokers				All Groups		
	(no.)	(%)*	Height (cm)	Weight (kg)	(no)	(%)*	Height (cm)	Weight (kg)	(no.)	(%)*	Height (cm)	Weight (kg)	(no.)	Height (cm)	Weight (kg)
20-29	26	52	176.8	81.7	7	14	177.3	81.0	17	34	179.9	85.6	50	177.9	82.9
30-39	35	45	176.8	83.9	22	29	176.2	84.2	20	26	175.8	83.1	77	176.4	83.8
40-49	29	56	174.5	84.5	13	25	179.4	98.2	10	19	175.1	91.4	52	175.8	89.2
50-64	16	28	174.6	79.7	26	45	174.6	86.7	16	28	172.4	83.3	58	174.0	83.8
20-64	106	45	175.8	82.9	68	29	176.3	87.5	63	27	175.9	85.1	237	176.0	84.8

\*Percent of smokers, ex-smokers, nonsmokers for each group

TABLE 5

## SMOKING HABITS OF SMOKERS AND EX-SMOKERS

	GRAIN				CONTROL			
	SMOKER #153		EX-SMOKER #92		SMOKER #106		EX-SMOKER #70	
	n	%	n	%	n	%	n	%
<b>#CIGARETTES/ONLY</b>								
< 14	15	10	14	15	15	14	8	11
15 - 25	78	51	43	47	45	43	32	46
> 25	60	39	35	38	46	43	30	43
<b># PACK/YEARS</b>								
0 - 14.9	43	28	38	41	38	36	26	37
15 - 30	51	34	27	29	29	27	25	36
30.5 - 200	58	38	27	29	39	37	19	27
<b>SMOKE/YEARS</b>								
< 14.5	57	38	38	41	37	35	31	44
14.6 - 25.5	37	24	20	22	39	37	25	36
> 25.6	58	38	34	37	30	28	14	20
<b>INHALED SMOKE</b>	147	97			102	96		
<b>AGE STARTED</b>								
0 - 20	134	91	83	90	98	93	61	87
21 - 30	13	9	8	9	8	7	9	13
> 30	0	0	1	1	0	0	0	0

TABLE 6

SELECTED OCCUPATIONAL PAST HISTORIES IN GRAIN WORKERS AND CONTROLS

Job (code)	GRAIN WORKERS (310)				CONTROLS (239)			
	N	%	x yrs.	LOE Range	N	%	x yrs.	LOE Range
(10) Ore loaders or Cement Mixing Operation	12	4	9.3	2-18	13	5	2.8	.25-10
(11) Metal work foundries	28	9	4	.5-14	25	10	3.5	.33-24
(12) Coke gas plant	3	1	9	5-11	1	0	.5	.5
(16) Farming	16	5	12.4	1-36	4	2	2.8	1-5
(20) Welding	12	4	4.5	.3-14	17	7	4.3	.5-27
(22) Feed mill, grain mill Brewery	8	3	6.7	1-19	3	1	1.7	1-2
(7,9,6) Equipment operator, longshoremen, grain inspector					11	4	3	.25-7
Workers who had past history	77	25			55	23		

LOE = Length of employment

TABLE 7

PREVALENCE OF CHRONIC COUGH AND EXPECTORATION THAT MAY  
INDICATE PRESENCE OF CHRONIC BRONCHITIS

	<u>Grain Workers</u>		<u>Controls</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
<b>Chronic Bronchitis:</b>				
I 14E > 2 Yrs	151	49	43	18
II Yes to 14C+14E > 2 Yrs	119	38	27	11
III 13 > 2 Yrs	132	43	37	14
IV Yes to 14D+14E > 2 Yrs	132	43	36	15
V Yes to 13A or B or C	193	62	67	28
VI Yes to 14A or B or C	165	53	51	21
VII Yes to 13A	109	35	37	15
VIII Yes to 14A	116	37	36	15
IX Yes to V or VI	194	63	67	14

**COUGH AND PHLEGM:**

- 13a. Do you usually cough first thing in the morning?  
(Exclude clearing throat.) 1. Yes 2. No
- b. Do you usually cough at other times during the  
day or night? 1. Yes 2. No
- c. Do you cough as much as 4-6 times a day for 4 or  
more days out of the weeks? 1. Yes 2. No

IF YES TO EITHER 13a, b OR c, ANSWER d AND e:

- |   |                  |
|---|------------------|
| d. Do you <u>cough</u> on most days for as much as 3 months<br>of the year? | 1. Yes 2. No (x) |
| e. For how many years have you had this <u>cough</u> ?                      | _____ Years (x)  |

TABLE 7 (continued)

- 14a. Do you usually bring up phlegm from the chest first thing in the morning? (Not from the back of your nose. Count swallowed phlegm from the chest.) 1. Yes 2. No
- b. Do you usually bring up phlegm from the chest at other times during the day or night? 1. Yes 2. No
- c. Do you bring up phlegm like this as much as twice a day, 4 or more days out of the week? 1. Yes 2. No

IF YES TO EITHER 14a, b OR c, ANSWER d and e:

- |   |        |       |     |
|---|--------|-------|-----|
| d. Do you bring up <u>phlegm from the chest</u> on most days for as much as 3 months of the year? | 1. Yes | 2. No | (x) |
| e. For how many years have you raised <u>phlegm from the chest</u> ?                              | _____  | Years | (x) |



TABLE 8

PREVALENCE OF WHEEZING AND/OR CHEST TIGHTNESS (W &/OR CT)  
 THAT MAY INDICATE THE PRESENCE OF OCCUPATIONAL ASTHMA\*

	<u>Grain Workers</u> n=310		<u>Controls</u> n=239	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
<u>Occupational Asthma if:</u>				
I W &/or CT brought on or aggravated by exposure to dusts, gases or fumes at work (Yes to Q 28A or B or C)	183	59	31	13
II I and cough aggravated by or brought on by exposure to dusts, gases or fumes at work (Yes to Q 28A or B or C and Q 18A or B or C)	145	47	20	8
III II and dyspnea while performing job (Yes to Q 28A or B or C and Q 18A or B or C)	81	26	0	0
IV I and wheezing better when off work or vacation (Yes to Q 28A or B or C and Q 35A)	167	54	13	5
V IV and episodes of wheezing with dyspnea (Yes to Q 28A or B or C and Q 35A and Q 36)	72	23	2	1
<u>Grain Handlers Only</u>				
VI W &/or CT while at work (Yes to Q 25A)	165	53	-	-
VII W &/or CT brought on or aggravated by grain dust (Yes to Q 28A)	183	59	-	-
VIII W &/or CT and cough on exposure (Yes to Q 28A and Q 18A)	144	46	-	-
IX VIII and dyspnea on exposure (Yes to Q 28A and Q 18A and Q 44A)	102	33	-	-
X W &/or CT on exposure and wheezing better when off work or on vacation (Yes to Q 35A and Q 40)	165	53	-	-

See Questionnaire (Appendix IV) for text of questions.  
 Q = question.

TABLE 9.  
PREVALENCE OF RESPIRATORY SYMPTOMS AND SYMPTOM COMPLEXES IN ALL GRAIN WORKERS AND CONTROLS AND BY SMOKING CATEGORIES.

		TOTAL		P1	SMOKER		P1	P2	EXSMOKER		P1	P3	NONSMOKER		P1	P4
		N	%		N	%			N	%			N	%		
TOTAL	G	310	100		153				92				65			
	C	239	100		106				70				63			
CHRONIC BRONCHITIS I (Q14 > 2 YRS)	G	151	49	<.001	88	57	<.001	.05	40	43	<.001	NS	23	35	<.001	.005
	C	43	18		32	30		.001	5	7		NS	6	10		.005
CHRONIC BRONCHITIS II (Q14C > 2 YRS)	G	119	38	<.001	68	44	<.001	.100	30	33	<.001	NS	21	32	<.001	.100
	C	27	11		21	20		.010	4	6		NS	2	3		.005
COUGH FIRST THING IN A.M. (Q13A)	G	109	35	<.001	75	49	.005	.001	19	21	.001	NS	15	23	.05	.001
	C	35	15		31	29		.001	1	1		.10	5	8		.005
PHLEGM FIRST THING IN A.M. (Q14A)	G	116	37	<.001	71	46	.005	.005	26	28	.001	NS	19	29	.005	.05
	C	36	15		28	26		.001	3	4		NS	5	8		.005
DYSPNEA ON EXERTION GRADE I (Q38)	G	118	38	<.01	65	42	.05	NS	29	32	NS	NS	24	37	.005	NS
	C	64	27		32	30		NS	25	36		.001	7	11		.005
DYSPNEA ON EXERTION GRADE II (Q39)	G	23	7	<.05	11	7	NS	NS	9	10	NS	NS	3	5	NS	NS
	C	8	3		3	3		NS	4	6		NS	1	2		NS
HX OF WHEEZING AND/OR CHEST TIGHTNESS (Q21A)	G	200	65	<.001	110	72	.001	.05	53	58	.05	NS	37	57	.05	.05
	C	101	42		53	50		NS	29	41		NS	19	30		.05
WHEEZING AT NIGHT (Q33A)	G	61	20	.005	34	22	.05	NS	16	17	NS	NS	11	17	NS	NS
	C	24	10		12	11		NS	8	11		NS	4	6		NS
EPISODES OF WHEEZING AND DYSPNEA (Q36)	G	76	25	.001	48	31	.001	NS	20	22	.05	NS	8	12	NS	.005
	C	17	7		7	7		NS	7	10		NS	3	5		NS

TABLE 9 (cont.)

		TOTAL		P1	SMOKER		P1	P2	EXSMOKER		P1	P3	NONSMOKER		P1	P4
		N	%		N	%			N	%			N	%		
TOTAL	G	310	100		153				92				65			
	C	239	100		106				70				63			
CHEST ILLNESS* (63B, C or D)	G	123	40		60	39		NS	36	39		NS	27	42	.05	NS
	C	78	33	NS	42	40	NS	NS	23	33	NS	NS	13	21		.05
SYMPTOMS RELATED TO WORK EXPOSURE COUGH AND/OR EXPECTORATION (18A or B or C)	G	201	65		115	75		.005	52	57		NS	34	52	.001	.001
	C	41	17	.001	28	26	.001	.05	9	13	.001	NS	4	6		.005
DYSPNEA AT WORK (Q43)	G	113	37		61	40		NS	35	38		NS	17	26	.01	.1
	C	26	11	.001	13	12	.001	NS	8	11	.001	NS	5	8		NS
"OCCUPATIONAL ASTHMA" I	G	183	59		104	67		.01	45	50		NS	33	50	.001	.05
	C	31	12	.001	14	13	.001	NS	10	14	.001	NS	7	11		NS
"OCCUPATIONAL ASTHMA" II	G	145	46		89	58		.005	35	38		NS	21	32	.001	.001
	C	20	8	.001	12	11	.001	NS	5	7	.001	NS	3	4		NS
"OCCUPATIONAL ASTHMA" III	G	81	26		48	31		NS	22	24		NS	11	17	.005	.05
	C	0	0	.001	0	0	.001		0	0	.001		0	0		
"OCCUPATIONAL ASTHMA" IV	G	167	54		95	62		.05	45	49		NS	27	42	.001	.01
	C	13	5	.001	8	8	.001	NS	3	3	.001	NS	2	3		NS
GRAIN EXPOSURE ONLY - TOTAL COUGH (18A)	TOTAL	310			153				92				65			
	G	200	65		114	75		.005	52	57		NS	34	52		.005
WHEEZING (28A)	G	183	59		104	68		.01	46	50		NS	33	50		.05
DYSPNEA (44A)	G	151	49		84	55		NS	47	51		.05	20	31		.005

\*Cannot do usual activities because of chest illness more than twice in last 3 years.

Table 9 (cont.)

		<u>TOTAL</u>		<u>P1</u>	<u>SMOKER</u>		<u>P1</u>	<u>P2</u>	<u>EXSMOKER</u>		<u>P1</u>	<u>P3</u>	<u>NONSMOKER</u>		<u>P1</u>	<u>P4</u>
		<u>N</u>	<u>%</u>		<u>N</u>	<u>%</u>			<u>N</u>	<u>%</u>			<u>N</u>	<u>%</u>		
EYEBURNING (48A)	G	242	78		123	80		NS	69	75		NS	50	77		NS
NASAL STUFFINESS (48B)	G	246	79		126	82		NS	70	76		NS	50	77		NS
SORE THROAT (48C)	G	161	52		88	58		NS	43	47		NS	30	46		NS
GRAIN FEVER	G	99	32		47	31		NS	31	33		NS	21	32		NS

For definition of "Occupational Asthma" see Table 8 (Refer to Questionnaire - Appendix IV).

P - Significance of the difference in prevalence ( $\chi^2$  analysis). P1 grain workers vs. controls; P2 smokers vs. ex-smokers; P3 ex-smokers vs. nonsmokers; P4 nonsmokers vs. smokers. NS - Not significant P > .05.

TABLE 10

## MEDICAL HISTORY\*

	<u>Grain Workers</u>		<u>Controls</u>	
	N = 310		N = 239	
	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>
"Has your doctor ever told you you had...?"				
Bronchitis	53	17	36	15
Emphysema	6	2	2	1
Pleuresy	28	10	18	8
Tuberculosis - Lung	6	2	1	.5
Cancer of the Lung	0	0	0	0
Chest surgery	4	1	3	1
Chest injury	11	4	10	4
Sinus "trouble"	72	23	74	31
Farmer's Lung	0	0	0	0
Pneumonia or bronchopneumonia	68	22	60	25
Bronchial asthma	12	4	4	2
Heart "trouble"	20	6	15	6
High blood pressure	49	16	33	14
Allergic rhinitis - Hay fever	20	6	29	12**
Kidney "trouble"	24	8	15	6
Liver "trouble" or jaundice	17	5	13	5
Diabetes	6	2	11	5
"Have you ever suffered from...?"				
Eczema in childhood	13	4	10	4
Skin rashes	92	30	72	30
Painful or swollen joints	96	31	72	30

\*Number and proportion of grain workers and controls who answered yes to questions 64, 65a, 66a, 67, 68, 69, 70a and 71a.

\*\*p.05

TABLE 11

## FAMILY HISTORY (IMMEDIATE - BLOOD RELATIVES)

	<u>Grain Workers</u>		<u>Controls</u>	
	<u>N = 310</u> N	%	<u>N = 239</u> N	%
Chronic bronchitis	15	5	9	4
Emphysema	16	5	18	8
Asthma	33	11	25	10
Hay fever	20	6	27	11
Cystic fibrosis	1	.5	0	0
Cancer of the lung	12	4	17	8
Farmer's Lung Disease	0	0	1	.5
Other lung diseases	11	4	8	3

TABLE 12

PREVALENCE OF SELECTED SYMPTOMS OR SYMPTOM COMPLEXES  
IN GRAIN WORKERS AND CONTROLS AND BY SMOKING HABIT

	<u>Chronic Bronchitis</u>		<u>Occupational Asthma I</u>		<u>Dyspnea at Work</u>		<u>Nocturnal Asthma</u>	
	<u>%</u>	<u>P</u>	<u>%</u>	<u>P</u>	<u>%</u>	<u>P</u>	<u>%</u>	<u>P</u>
Controls - nonsmokers (63)	10	<.005	11	NS	8	NS	6	NS
Controls - smokers (106)	30		13		12		11	
Grain worker nonsmokers (65)	35	NS	50	<.001	26	<.05	17	NS
Grain worker smokers (153)	57	<.005	67	<.05	40	.1	22	NS

( ) Number of subjects per category.

TABLE 13

FACTORS BY WHICH GRAIN EXPOSURE OR SMOKING  
INCREASE THE ODDS\* (RISK) OF  
CHRONIC BRONCHITIS OR ASTHMA

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	<u>GRAIN HANDLING</u>	<u>SMOKING</u>
Chronic Bronchitis (I)	4.4	2.9
Chronic Bronchitis (II)	4.9	2.3
Occupational "Asthma" (I)	4.6	1.9
Occupational "Asthma" (II)	9.9	2.8
Nocturnal Asthma	2.2	1.8

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\*See text for explanation.



TABLE 14

## PREVALENCE OF SYMPTOMS IN GRAIN HANDLERS BY RANGES OF AGE

Age	29.9		30-39.9		40-49.9		50		P*
	N=88		N=52		N=81		N=89		
	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	
Chronic Bronchitis (I) (135)	31	35	18	35	43	53	43	48	NS
Cough on Exposure (200)	55	63	35	67	52	64	58	65	NS
Occupational Asthma VII (183)	47	53	31	60	51	63	54	61	NS
Dyspnea on Exposure (151)	35	40	27	52	41	51	48	54	NS
Eye Sx on Exposure (242)	78	89	44	85	60	74	60	67	.05
Nasal Sx on Exposure (246)	76	86	42	81	64	79	64	72	.05
Grain Fever (99)	22	25	16	31	29	36	32	36	NS
Cough in A.M. (109)	31	35	13	25	30	37	35	39	NS
Expectoration in A.M. (116)	30	34	14	27	34	42	38	43	NS
Wheezing at Night (50)	10	11	5	10	18	22	17	19	NS
Chronic Bronchitis + FEV <sub>1</sub> /FVC70% pred. (31)	2	2	1	2	11	14	17	19	.05
Occupational Asthma X (69)	14	16	13	25	21	26	21	24	NS
Occupational Asthma IX (97)	21	24	17	33	28	35	31	35	NS
Chest Illness† (123)	39	44	19	37	34	42	31	35	NS

( ) Number of subjects with the symptom.

†Cannot do usual activities because of chest illness more than twice in last 3 years.

\*Significance of the differences in symptom prevalence between age groups adjusting for smoking and length of employment by regression logistic analysis.

TABLE 15

## PREVALENCE OF SYMPTOMS BY LENGTH OF EMPLOYMENT CATEGORIES

Length of Employment in Years	5.5		5.6-10.5		10.6-15.5		15.6-20.5		20.6-25.5		25.6-30.5		30.6		P†
	N=93*		N=77*		N=32*		N=45*		N=22*		N=30*		N=11*		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Chronic Bronchitis (I) (135)**	27	29	34	44	22	69	16	36	12	55	16	53	8	73	NS
Cough on Exposure (200)**	55	59	50	65	25	78	26	58	15	68	19	63	10	91	NS
Occupational Asthma VII (183)**	41	44	45	58	26	81	31	69	15	68	17	57	8	73	.02
Dyspnea on Exposure (151)**	30	32	37	48	23	72	24	53	12	55	17	57	8	73	.003
Eye Sx on Exposure (242)**	73	78	65	84	27	94	36	80	14	64	17	57	10	91	.01
Nasal Sx on Exposure (246)**	71	76	61	79	28	88	33	73	19	86	25	83	9	82	NS
Grain Fever (99)**	21	23	20	26	16	50	22	49	7	32	10	33	3	27	NS
Cough in A.M. (109)**	24	26	30	39	12	38	15	33	8	36	14	47	6	55	NS
Expectoration in A.M. (116)**	21	23	29	38	13	41	20	44	10	45	14	47	9	82	.001
Wheezing at Night (50)**	9	10	11	14	8	25	5	11	7	32	5	17	5	45	NS
Chronic Bronchitis + FEV <sub>1</sub> /FVC70% (31)**	3	03	8	10	1	3	6	13	5	23	5	17	3	27	.02

TABLE 15 (cont.)

## PREVALENCE OF SYMPTOMS BY LENGTH OF EMPLOYMENT CATEGORIES (CONTINUED)

Length of Employment	5.5		5.6-10.5		10.6-15.5		15.6-20.5		20.6-25.5		25.6-30.5		30.6	P†	
	N=93*		N=77*		N=32*		N=45*		N=22*		N=30*		N=11*		
	<u>N</u>	<u>%</u>	<u>N</u>	<u>S</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	
Occupational Asthma X (69)**	13	14	14	18	11	34	8	18	9	41	11	37	3	27	.02
Occupational Asthma IX (97)**	17	18	26	34	14	47	12	27	10	45	12	40	5	45	NS
Chest Illness (123)**	34	37	31	40	17	53	16	36	8	36	15	50	2	18	NS

\*Number of workers in category

\*\*Number of workers with symptom.

†Significance of the differences in relative prevalence between length of employment categories adjusted for age and smoking by logistic regression analysis.

TABLE 16

## GRAIN WORKERS - JOB CATEGORIES

<u>CODE</u>	<u>N</u>
06 Inspectors	(94)
02 Annex Men	(90)
03 Laborers	
04 Transport	
05 Maintenance	(41)
07 Operators Outdoors	(31)
09 Longshoremen	(29)
01 Weighers	(20)
08 In House Firemen*	( 5)

\*Included in all analysis except when using job categories because of small number.

**PREVALENCE OF SYMPTOMS BY JOB CATEGORIES**

Job	# (305)	06 Inspector (94)		02 Indoor (90)		05 Maint (41)		07 Outdoor (31)		09 Longshore (29)		01 Weigher (20)		P*
		n	%	n	%	n	%	n	%	n	%	n	%	
Chronic Bronchitis (I)	135	32	34	39	43	21	51	16	52	14	48	2	60	NS
Cough on Exposure	200	53	56	59	66	29	71	23	74	20	69	15	75	NS
Occupational Asthma VII	183	47	50	50	56	26	63	19	61	22	76	16	80	NS
Dyspnea on Exposure	151	38	40	45	50	21	51	15	48	17	59	13	65	NS
Eye Sx on Exposure	242	69	72	69	77	33	80	25	81	27	93	15	75	NS
Nasal Sx on Exposure	246	78	83	66	73	32	78	24	77	26	90	17	85	.03
Grain Fever	99	30	32	20	22	13	32	11	35	18	62	6	30	NS
Cough in A.M.	109	32	34	30	33	17	41	10	32	9	31	10	50	NS
Expectoration in A.M.	116	31	33	32	36	18	44	11	35	14	48	9	45	NS
Wheezing at Night	50	14	15	8	9	9	22	4	13	7	24	7	35	NS
Chronic Bronchitis + FEV <sub>1</sub> /FVC70% pred.	31	9	10	7	8	6	15	4	13	2	7	3	15	NS
Occupational Asthma X	69	13	14	20	22	13	32	7	23	4	14	10	50	.05
Occupational Asthma IX	97	17	18	31	34	16	39	10	32	12	41	10	50	NS
Chest Illness	123	29	31	42	47	22	54	10	32	6	21	12	60	.01

\*P significance of differences in relative prevalence between job categories adjusted for age, smoking and LOE.

TABLE 18

## JOBS RANKED BY RELATIVE PREVALENCE OF SYMPTOMS\*

	<u>Inspectors</u> <u>06</u>	<u>Indoor</u> <u>02-04</u>	<u>Maint.</u> <u>05</u>	<u>Outdoor</u> <u>07</u>	<u>Longshoremen</u> <u>09</u>	<u>Weighers</u> <u>01</u>
Eye Symptoms	1	2	5	3	6	4
"Occupational Asthma VII"	1	3	5	4	2	6
Chest Illness†	2	4	5	3	1	6
Score	4	9	15	10	9	16
Ranking	1	3	5	4	3	6

\*Prevalence significantly different among jobs, adjusting for age, smoking and LOE.

†Chest illness affecting usual activities.

Highest rank value = highest relative prevalence of symptoms. Jobs are ranked using the z value from the regression analysis.

TABLE 19

## PREVALENCE OF SYMPTOMS BY ELEVATOR COMPANY

		I N=35	II N=22	III N=12	IV N=49	V N=17	VI N=17	VII N=39	VIII N=24	P*
Chronic Bronchitis (I)	N	20	8		4	22	10	5	18	11
	%	57	36	33	45	59	29	46	46	NS
Cough on Exposure	N	25	13	7	32	13	12	27	10	
	%	71	59	58	65	76	71	69	42	NS
Cheezing on Exposure	N	27	9	4	31	13	10	26	7	
Occupational Asthma VII%	%	77	41	33	63	76	59	67	29	.01
Dyspnea on Exposure	N	22	10	2	30	6	8	24	7	
	%	63	45	17	61	35	47	62	29	.02
Eye Symptoms on Exposure	N	29	17	7	36	15	16	33	15	
	%	83	77	58	73	88	94	85	63	NS
Nose Symptoms on Exposure	N	31	14	8	37	13	13	34	16	
	%	89	64	67	76	76	76	87	67	NS
Rain Fever	N	9	1	5	15	4	4	16	6	
	%	26	5	42	31	24	24	41	25	.05
Cough in a.m.	N	14	7	3	20	11	8	9	4	
	%	40	32	25	41	65	47	23	17	NS
Phlegm in a.m.	N	17	6	4	14	9	6	13	7	
	%	49	27	33	29	53	35	33	29	NS
Cheezing at Night	N	14	2	1	5	3	1	6	3	
	%	40	9	8	10	18	6	15	13	NS
Chronic bronchitis + FEV <sub>1</sub> /VC 70%	N	6	1	1	6	1	1	2	3	
	%	17	5	8	12	6	6	5	13	NS
Occupational Asthma X	N	14	3	1	14	6	4	11	4	
	%	40	14	8	29	35	24	28	17	NS
Occupational Asthma IX	N	15	5	1	21	6	5	16	4	
	%	43	23	8	43	35	29	41	17	.05
Chest Illness (C-D-E)	N	15	6	5	19	10	5	13	3	
	%	43	27	42	39	59	29	33	13	NS
Chest Illness (C-D)	N	18	8	2	26	8	7	20	6	
	%	51	36	17	53	47	41	51	25	NS

P\* - significance of differences in relative prevalence of symptom analyzed by regression analysis adjusting for age, smoking and LOE.

TABLE 20

**RANKING OF COMPANIES BY RELATIVE PREVALENCE OF SYMPTOMS  
ADJUSTED FOR AGE, SMOKING AND LENGTH OF EMPLOYMENT**

	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>V</u>	<u>VI</u>	<u>VII</u>	<u>VIII</u>	
Grain Fever	2	1	7	6	4	3	8	5	P<.05
Occupational Asthma VII	8	2	3	5	6	4	7	1	P<.01
Dyspnea on Exposure	<u>6</u>	<u>4</u>	<u>1</u>	<u>7</u>	<u>3</u>	<u>5</u>	<u>8</u>	<u>2</u>	P<.02
Subtotal Score	16	7	11	18	13	12	25	8	
Rating	(6)	(1)	(3)	(7)	(5)	(4)	(8)	(2)	
Cough on Exposure	7	2	3	5	6	4	8	1	
Eye Sx on Exposure	6	4	1	3	7	8	5	2	
Nose Sx on Exposure	7	1	2	4	6	5	8	3	
Chronic Bronchitis	5	4	8	1	7	3	2	6	
Early Cough	5	2	3	6	8	7	4	1	
Early Phlegm	7	1	5	2	8	4	6	3	
Wheezing at Night	8	2	3	4	6	1	7	5	
Wheezing and SOB	8	1	2	7	5	4	6	3	
Chest Illness*	6	3	5	7	8	2	4	1	
Chest Illness†	6	3	1	7	5	4	8	2	
CB and AO**	<u>8</u>	<u>2</u>	<u>1</u>	<u>7</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	
Subtotal Score	73	25	34	53	69	46	63	33	
Rating	(8)	(1)	(3)	(5)	(7)	(4)	(6)	(2)	
Total Score	89	32	45	71	82	58	88	41	
Overall Rating	(8)	(1)	(3)	(5)	(6)	(4)	(7)	(2)	

\*Much to a great deal.

\*\*Chronic bronchitis + airways obstruction

†Unable to do usual activity two or more times in last 3 years.

Rating highest value = highest adjusted prevalence. Companies are ranked by the z value from the regression analysis for each symptom.



TABLE 21

**GRAIN FEVER SYNDROME (GRAIN HANDLERS)**  
**N=115 (16 questionable)**

---

Number of episodes in work cycle:	N	% of 96 (19 no answer)
0-9	40	42
10-19	22	23
20-99	18	19
100-300	16	17
Fever and/or "chills" noticed:	N	% of 115
During work	37	32
After work	40	35
Either during or after work	38	33
Mostly noticed on:	N	% of 115
First day of work	15	13
Any day of the week	95	83
Any day but worse on first day	5	4
Associated respiratory symptoms:		
Nose	84	73
Cough	19	17
Wheezing	15	13
Dyspnea	7	6

---

Table 22

**PESTICIDE EXPOSURE AND RELATED  
HEALTH PROBLEMS IN GRAIN HANDLERS (N=310)**

	<u>N</u>	<u>%</u>
Exposed (ever)	294	95
Health problems from above symptoms:	168	54
a. Weakness	65	21
b. Fainted	7	2
c. Dizziness	88	28
d. Headache	116	37
e. Convulsions	0	0
f. Trouble breathing	51	16
g. Nausea	65	21
h. Stomach pain	12	4
i. Diarrhea	12	4
j. Cramps	5	2
k. Blurred vision	14	5
l. Jaundice	0	0
m. Other	17	5
Unable to do regular job because of symptoms:	28	17 *(of 167 that answered)
Had to be taken to doctor:	19	11 *(of 167 that answered)
Number of episodes:		51 (of 164 that answered)
0-5		21
6-10		4
11-20		9
21-50		5
51-100		2
100-300		
Type of pesticide:		(of 168 that answered)
Do not know	40	30
Carbon Tet.	103	61
Malathion	52	31
Methyl Bromide	51	30
Phostoxin	84	50
Other	1	1

TABLE 23

## PHYSICAL EXAMINATION

	GRAIN WORKERS N=310		CONTROLS N=238	
	N	%	N	%
<b>Chest Configuration</b>				
Normal	309	100	233	98
Kyphoscoliosis+	1		2	1
Pectum Excavatum	0		3	1
<b>Auscultation Posterior Chest</b>				
Normal	178	57	201	85
Ronchi (See table)	131	43**	37	16
Rales Bilateral	100	32**	30	13
Unilateral	31	10**	7	3
<b>Cardiac Auscultation</b>				
Normal	278	90	216	91
Murmur	15	5	14	6
Arrhythmia	6	2	3	1
Other	10	3	5	2
<b>Abdomen</b>				
	N=305		N=238	
Not palpable	171	56	184	77
Palpable*	132	43**	51	21
Hepatomegaly	2	1	3	1
(span 14 cm)				

+ reported as mild

\* On deep inspiration at rib costal margin, mid-clavicular line.

\*\* P<.005 - Significance of the differences between grain workers and controls by  $\chi^2$  analysis.

TABLE 24

## PREVALENCE OF RONCHI

	Total		Smoker		Ex-Smoker		Nonsmoker	
	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>	<u>N</u>	<u>%</u>
<b>Bilateral</b>								
<b>Grain Workers</b>	100	32*	55	36*	28	17*	17	26*
<b>Controls</b>	30	13	20	19	7	10	3	5
<b>Localized</b>								
<b>Grain Workers</b>	31	10*	18	12*	8	9	6	9*
<b>Controls</b>	7	3	3	3	4	6	0	0*
<b>Both</b>								
<b>Grain Workers</b>	131	43*	73	48*	36	26*	23	35*
<b>Controls</b>	37	16	23	22	11	16	3	5

\*P<.005 Significance of differences in prevalence of ronchi between grain workers and city workers.

**TABLE 25**  
**RESULTS OF PULMONARY FUNCTION STUDIES IN GRAIN-SMOKERS,**  
**EX-SMOKERS AND NONSMOKERS, BY AGE GROUP**

		Age Years														
		20-29			30-39			40-49			50-62			All Age Groups		
Test	Smoking Group	N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD
FEV <sub>1</sub>	Smoker	(47)	4484	606	(35)	4202	657	(42)	3393	677	(29)	3052	590	(153)	3849	853
	Ex-smoker	(19)	4587	376	( 9)	4175	963	(20)	3825	523	(44)	3190	782	( 92)	3713	877
	Nonsmoker	(22)	4726	592	( 8)	4239	358	(19)	3799	531	(16)	3443	750	( 65)	4079	782
	All	(88)	4567	564	(52)	4203	672	(81)	3595	638	(89)	3191	723	(310)	3857	853
FVC	Smoker		5437	750		5244	797		4565	726		4188	728		4917	892
	Ex-smoker		5549	461		5469	1240		4790	585		4330	702		4793	866
	Nonsmoker		5694	796		5032	625		4731	734		4881	901		5033	920
	All		5525	711		5250	857		4660	695		4311	747		4904	891
FEV <sub>1</sub> /FVC%	Smoker		82	5		80	6		73	9		72	9		77	8
	Ex-smoker		82	5		76	10		79	6		72	11		76	10
	Nonsmoker		83	6		84	9		80	7		76	7		81	7
	All		82	5		80	8		76	8		73	10		78	9
MMF	Smoker		276.9	61.4		250.4	68.5		171.8	74.0		142.1	54.5		216.4	85.0
	Ex-smoker		285.0	50.1		230.1	79.0		233.2	82.5		158.7	77.7		207.9	89.0
	Nonsmoker		299.6	69.4		288.7	91.7		220.2	51.0		185.9	71.0		247.1	82.0
	All		284.3	61.4		252.7	74.5		198.3	76.1		158.2	70.6		220.3	86.5
Vmax <sub>50</sub>	Smoker		4.94	1.25		4.35	1.28		3.18	1.53		2.86	1.31		3.93	1.59
	Ex-Smoker		5.28	1.45		4.08	1.51		4.16	1.48		3.08	1.47		3.87	1.68
	Nonsmoker		5.17	1.63		4.69	1.63		4.12	.88		3.52	1.39		4.40	1.50
	All		5.07	1.39		4.35	1.36		3.64	1.46		3.09	1.41		4.01	1.61
Vmax <sub>75</sub>	Smoker		1.98	.60		1.49	.52		.99	.45		.75	.30		1.36	.69
	Ex-smoker		2.11	.73		1.51	.53		1.23	.45		.87	.43		1.27	.70
	Nonsmoker		2.26	.94		2.06	.90		1.40	.29		1.05	.49		1.69	.84
	All		2.08	.72		1.58	.61		1.15	.45		.86	.42		1.40	.74

TABLE 25 (cont.)

RESULTS OF PULMONARY FUNCTION STUDIES IN GRAIN WORKERS-SMOKERS,  
EX-SMOKERS AND NONSMOKERS, BY AGE GROUP

Test	Smoking Group	Age, Years														
		20-29			30-39			40-49			50-62			All Age Groups		
		N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD
CV	Smoker	(45)	13	5	(32)	15	5	(41)	19	5	(29)	21	6	(147)	17	6
	Ex-smoker	(19)	13	7	( 9)	17	4	(20)	19	5	(39)	21	7	( 87)	18	7
	Nonsmoker	(22)	10	4	( 7)	16	7	(18)	18	5	(15)	21	5	( 62)	16	7
	All	(86)	13	5	(48)	15	5	(79)	19	5	(83)	21	6	(296)	17	6
$\Delta N_2/L$	Smoker	(45)	1.32	.83	(33)	1.39	.84	(41)	2.16	1.15	(29)	3.43	2.11	(148)	1.98	1.48
	Ex-smoker	(19)	.96	.55	( 9)	1.26	.91	(20)	1.33	.65	(39)	2.54	1.90	( 87)	1.79	1.52
	Nonsmoker	(22)	.86	.28	( 8)	.85	.54	(19)	1.17	.57	(15)	1.67	.82	( 64)	1.14	.64
	All	(86)	1.13	.70	(50)	1.28	.68	(80)	1.72	1.03	(83)	2.70	1.92	(299)	1.75	1.40
DLCO	Smoker	(40)	35.6	5.6	(32)	34.4	5.9	(40)	30.8	5.0	(28)	27.9	6.0	(140)	32.4	6.3
	Ex-smoker	(17)	39.3	4.3	( 9)	37.4	4.7	(19)	36.1	5.4	(44)	30.6	5.4	( 89)	34.2	6.2
	Nonsmoker	(14)	41.1	6.7	( 7)	38.0	5.0	(17)	35.2	3.4	(16)	33.8	6.0	( 54)	36.7	6.0
	All	(71)	37.6	5.9	(48)	35.5	5.7	(76)	33.1	5.3	(88)	30.3	6.0	(283)	33.8	6.4

( ) parenthesis - if not stated N = N of above function

TABLE 26

RESULTS OF PULMONARY FUNCTION STUDIES IN CONTROLS-SMOKERS,  
EX-SMOKERS AND NONSMOKERS, BY AGE GROUP

		Age, Years														
		20-29			30-39			40-49			50-62			All Age Groups		
Test	Smoking Group	N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD
FEV <sub>1</sub>	Smoker	(26)	4566	648	(35)	4282	572	(29)	3721	654	(16)	3209	778	(106)	4036	792
	Ex-smoker	( 7)	4408	420	(22)	4310	477	(13)	4055	461	(26)	3356	710	( 68)	3907	717
	Nonsmoker	(17)	4635	717	(20)	4404	570	(10)	4058	602	(16)	3605	348	( 63)	4208	689
	All	(50)	4567	640	(77)	4232	541	(52)	3869	614	(58)	3384	659	(237)	4045	750
FVC	Smoker		5507	794		5245	684		4667	720		4547	643		5045	801
	Ex-smoker		5020	511		5298	541		5133	493		4477	792		4924	725
	Nonsmoker		5580	917		5360	644		4929	759		4512	497		5136	816
	All		5464	814		5290	629		4834	696		4506	671		5034	745
FEV <sub>1</sub> /FVC%	Smoker		82	6		81	5		79	7		70	13		79	8
	Ex-smoker		88	4		81	6		78	5		74	11		78	9
	Nonsmoker		82	5		82	3		81	5		79	5		81	4
	All		83	5		81	5		79	6		74	10		79	8
MMF	Smoker		288	64.5		274.8	70.7		223.5	72.8		160.1	90.1		246.7	84.6
	Ex-smoker		317.7	50.2		272.4	82.2		235.7	60.2		180.5	81		234.9	88.1
	Nonsmoker		289.1	72.2		270.9	53.4		276.4	66.5		222.6	52.0		264.4	64.6
	All		292.5	65.1		273	69.4		236.7	70.4		186.5	79.4		248	81.3
Vmax <sub>50</sub>	Smoker		5.49	1.35		5.26	1.55		4.47	1.42	(16)	3.21	1.69	(106)	4.79	1.66
	Ex-smoker		6.36	1.02		5.12	1.52		4.35	1.34	(25)	3.54	1.50	( 67)	4.51	1.68
	Nonsmoker		5.22	1.55		5.08	.98		5.06	.95	(15)	4.48	1.29	( 62)	4.97	1.24
	All		5.52	1.40		5.17	1.40		4.55	1.32	(56)	3.70	1.56	(235)	4.76	1.57
Vmax <sub>75</sub>	Smoker		2.25	.71		1.93	.69		1.44	.65	(16)	3.21	1.69	(106)	1.71	.79
	Ex-smoker		2.61	.62		1.90	.63		1.42	.38	(25)	1.00	.43	( 67)	1.55	.73
	Nonsmoker		2.19	.75		2.01	.57		1.61	.53	(15)	1.25	.46	( 62)	1.81	.69
	All		2.28	.71		1.94	.64		1.47	.56	(56)	1.02	.44	(235)	1.69	.75

TABLE 26 (cont.)

RESULTS OF PULMONARY FUNCTION STUDIES IN CONTROLS-SMOKERS,  
EX-SMOKERS AND NONSMOKERS, BY AGE GROUP

Test	Smoking Group	Age, Years														
		20-29			30-39			40-49			50-62			All Age Groups		
		N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD	N	mean	SD
CV	Smoker	(25)	13	5	(35)	14	3	(28)	17	4	(14)	22	6	(102)	16	5
	Ex-smoker	( 7)	11	3	(22)	14	3	(13)	18	4	(23)	22	5	( 65)	18	6
	Nonsmoker	(16)	10	3	(18)	15	4	(10)	17	3	(14)	19	4	( 58)	15	6
	All	(48)	12	4	(75)	14	3	(51)	18	3	(51)	21	5	(225)	16	5
$\Delta W_2/L$	Smoker		1.32	.55		1.21	.60		1.87	.96	(15)	3.38	2.32	(103)	1.73	1.31
	Ex-smoker		1.12	.46		1.11	.43		1.23	.48	(23)	1.69	.76	( 65)	1.34	.63
	Nonsmoker		.84	.31		1.00	.31		1.19	.64	(14)	1.44	.71	( 58)	1.10	.54
	All		1.13	.51		1.13	.49		1.57	.86	(52)	2.11	1.59	(226)	1.46	1.02
DLCO	Smoker	(25)	32.7	6.2	(30)	30.4	6.2	(20)	31.1	7.3	(13)	21.6	6.7	( 88)	29.9	7.4
	Ex-smoker	( 5)	30.7	5.5	(21)	32.8	6.3	(11)	32.9	5.2	(21)	27.9	5.7	( 58)	30.9	6.1
	Nonsmoker	(16)	39.8	9.1	(20)	32.5	6.7	( 7)	37.0	5.9	(14)	27.9	7.0	( 57)	34.0	8.6
	All	(46)	35.0	8.0	(71)	31.7	6.4	(38)	32.7	6.7	(48)	26.2	6.9	(203)	31.3	5.6



TABLE 27.

RESULTS OF PULMONARY FUNCTION STUDIES  
IN GRAIN HANDLERS AND CONTROLS

	GRAIN HANDLERS			CONTROLS			P*
	N	$\bar{X}$	$\pm 1SE$	N	$\bar{X}$	$\pm SE$	
FEV <sub>1</sub> ml	(310)	3857	49	(237)	4045	49	.005
FVC ml	(310)	4904	51	(237)	5034	51	.05
FEV <sub>1</sub> /FVC %	(310)	77.6	.5	(237)	79.4	.8	.01
MMF /min	(310)	220	5	(237)	248	5	.005
Vmax <sub>50</sub> /sec	(310)	4.01	.09	(235)	4.76	.10	.005
Vmax <sub>75</sub> /sec	(310)	1.40	.04	(235)	1.69	.05	.005
CV %	(296)	17.1	.4	(225)	16.0	.36	.025
$\Delta N_2/$	(299)	1.75	.08	(226)	1.46	.07	.005
D <sub>L</sub> ml CO/m/Torr	(283)	33.8	.4	(203)	31.3	.5	.005

\*Significance of the difference by unpaired t-test.

TABLE 28

Pulmonary Function Test Values  
in Relation to Last Exposure to Grain Dust

<u>Last Exposure</u>	<u>FEV<sub>1</sub></u>		<u>FVC</u>		<u>MMF</u>	
	<u>x</u>	<u>SD</u>	<u>x</u>	<u>SD</u>	<u>x</u>	<u>SD</u>
Same day of testing	3902 ±	813	4938 ±	866	225.7 ±	85
Day before testing	3711 ±	948	4827 ±	975	200.7 ±	88
> 2 days before testing	3842 ±	891	4768 ±	877	227.6 ±	86*

\*Significantly different from MMF mean of "same day tested" by unpaired t-test.