

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

CDC--MOUNT ST. HELENS VOLCANO HEALTH REPORT #17

August 8, 1980

Clinical Aspects of Respiratory Emergency Room Visits, Yakima, Washington, May 18-June 14, 1980

After the volcanic eruption and ashfall of May 18, 1980, the 2 hospitals in Yakima, Washington, had a transient increase in emergency room (ER) visits for the subgroup of respiratory problems related to airway diseases, including hyperventilation, airway irritation, cough, wheezing, shortness of breath (SOB), bronchitis, asthma, and chronic obstructive pulmonary disease (COPD)/emphysema. (CDC--Mount St. Helens Volcano Health Report #9, June 24, 1980, and Report #14, July 18, 1980). The weekly ER visits for these 2 hospitals for May 4-June 14, 1980, are summarized in Table 1.

To investigate the clinical aspects of the cases, and whether these respiratory problems were possibly related to the ashfall, available emergency room medical records of 90%-95% of these patients were reviewed for the 4-week period (May 18-June 14, 1980) after the May 18 eruption.

Many of the problems listed as cough, shortness of breath, and wheezing were given other cardiac or respiratory diagnoses, such as congestive heart failure and bronchitis. The following is a summary of patients with final diagnoses of hyperventilation, airway irritation, asthma, bronchitis, or COPD. A patient with multiple visits is counted only once.

Hyperventilation (Table 2)

The 16 patients who were diagnosed as hyperventilating or as having "hyperventilation syndrome," were predominantly females of adolescent age or older, and without pre-existing or chronic respiratory diseases. They arrived at the emergency rooms within a few days after the ashfall, complaining of dyspnea or SOB. Their lungs were generally clear to auscultation (i.e., without wheezes, rales, or rhonchi), and they would calm down after reaching the emergency room.

Airway Irritation (Table 2)

Thirteen patients had diagnoses relating to airway irritation--9 were diagnosed as having airway irritation secondary to volcanic ash, including pharyngeal irritation (5), upper airway irritation (3), and bronchial irritation (1); 2 had symptoms of upper respiratory infection (URI) and sinusitis which became aggravated by the ash; 1 complained of SOB while outdoors without a mask; and 1 complained of cough while handling building insulation. Four of these patients with

airway irritation had been working in the ash, or were involved in the clean-up efforts; their symptoms included SOB, sore throat, cough, sputum production, and a burning chest sensation upon deep breathing of air with suspended ash. None of them had evidence of wheezes, rales, or rhonchi on physical examination.

Asthma and Asthmatic Bronchitis (Table 3)

The records of 54 patients with asthma and 9 patients with asthmatic bronchitis were reviewed. A small number of patients visited the emergency room only for medications or out of anxiety--7 (18%) of 39 patients seen had no wheezes, rales, or rhonchi on chest auscultation. During the same period, however, most asthmatic patients had respiratory complaints, including cough (28%), dyspnea (31%), SOB (36%), and wheezing (46%). The majority (77%) of these patients were also found to have wheezes on physical examination and were treated in the emergency rooms. Only 1 patient had a recorded history of being exposed to ash outdoors, although 2 additional patients and their physicians recorded that they thought the asthmatic attacks were related to the ash. It should be emphasized that any information on ash exposure is found in only a few medical records. Only 2 (5%) patients were hospitalized, for 1 and 4 days, respectively.

For the third and fourth week (June 1-14, 1980) after the May 18 ashfall, the asthmatic patients who visited the emergency rooms in Yakima were younger (median age of 11 compared with the median age of 30 for the 2 preceding weeks) and a larger proportion of them were hospitalized (5 (21%) out of 24 compared with 2 (5%) out of 39 (5%) for the 2 weeks before). All the patients seen during this period had wheezes or rhonchi on physical examination. The patients were also hospitalized for a longer period of time (median length of stay 9 days compared with 3 days for the 2 weeks before).

Bronchitis (Table 3)

The medical records of 91 patients with a diagnosis of bronchitis were reviewed. The patients were of all ages, but with a preponderance of younger ages (median age 26). The main complaint was cough (73%), and other symptoms included nasal congestion or discharge (30%), sore throat (27%), sputum production (20%), dyspnea (15%), SOB (20%), wheezing (16%), and chest discomfort (23%). Wheezing was present in 25 (29%) of 85 non-hospitalized patients, and in 4 (67%) of 6 hospitalized patients. Six (7%) patients were hospitalized for a median of 4 days; 5 (83%) of the 6 were hospitalized during the first 2 weeks after the ashfall (May 18-31, 1980).

A number of the diagnoses were apparently based on history only and not on physical findings--25 (27%) patients had no evidence of wheezes, rales, or rhonchi at the time of chest examination.

Chronic Obstructive Pulmonary Disease (Table 3)

Thirty-two, predominantly male (75%) patients with a diagnosis of COPD visited the 2 emergency rooms in Yakima during May 18-June 14, 1980. The main symptoms were SOB (69%) and dyspnea (22%), the main

objective findings were wheezes (53%), rales (25%), rhonchi (28%), and respiratory distress (28%).

Twenty (62%) of them were hospitalized for a median of 5 days. The median age of those hospitalized was 71 years compared with 62 years for non-hospitalized patients. However, 7 of the 12 (58%) nonhospitalized patients had no wheezes, rales, or rhonchi on chest examination. Four of the 20 (25%) hospitalized patients also had negative chest findings, but they were admitted for cardiac or other medical reasons.

Two patients described SOB while working in the ash; only 1 of them had rhonchi on auscultation. Five of the hospitalized patients ascribed exacerbation of their symptoms to the volcanic ash.

Summary and Discussion

A review of over 200 medical records for patients who visited the hospital emergency rooms during the 4 weeks after the May 18, 1980, ashfall showed that the increased ER visits were in part due to anxiety or apprehension. However, the majority of patients had objective signs of respiratory problems.

Patients with asthma, representing the largest category of increased visits after the eruption, had symptoms of cough, dyspnea, SOB, and wheezing, although only a small proportion required hospitalization.

The increased incidence of bronchitis post-eruption is partially obscured by the relatively high background of reported bronchitis with URI or otitis. However, the major sign was wheezing, and a larger proportion of children and younger people were affected.

Although the total number of ER visits was not dramatically increased for patients with COPD/emphysema, these patients appear to be most severely affected in terms of hospitalization rate after the eruption.

Information on cigarette smoking, ash exposure, and the use of face masks was generally incomplete or lacking in the medical records of these patients with respiratory problems. A more detailed account of exposure to ash in such medical records would be invaluable to future investigations.

A questionnaire case-control study of the above groups to identify the risk factors associated with the development of the above acute respiratory problems is about to begin. Two control groups will be utilized: 1) neighborhood controls and 2) patients with chronic respiratory diseases who did not get ill in the post-eruption period.

Total Suspended Particulates in Addy, Washington, May-July 1980

Addy, with a population of 200, is located 50 miles northwest of Spokane between Chewelah and Colville. Addy received approximately 1/8 inch of ashfall from the May 18 eruption and an additional 1/4 inch from the July 22 eruption. The total suspended particulates (TSP) for May-July 1980, as reported by a private source to the Washington State Department of Ecology, is shown in Table 4.

After the July 22 eruption, the TSP peaked at $13,212 \mu\text{g}/\text{m}^3$ as the ash fell on the morning of July 23, 1980. The TSP level ($206 \mu\text{g}/\text{m}^3$) on July 29, 1980, a week after the last eruption, was still higher than the monthly mean TSP for this station (Table 5).

Harvest Time at Moses Lake and Ritzville

Harvesting is now under way in this area. It is over 2 months after the May 18 eruption and driving east along Interstate 90 from Seattle the first evidence of the ashfall is seen beyond the eastern side of the Cascades at Ellensburg. Traces of ash lie on the sides of the road around vegetation. Continuing eastward toward Moses Lake, or southward along Interstate 82 to Yakima, greater amounts of ash lie in the verges and coat the surrounding hills. After crossing the Columbia River at Vantage, the ashfall becomes noticeably thicker, and for about 25 miles before Moses Lake the median verges are covered by ridges of piled-up ash, at least a foot high in some places. Driving with the car windows open can be unpleasant, as trucks sweep past the accumulated ash and fling it into the air, occasionally forcing the unfortunate driver behind to frantically close his windows. For a length of the road, a sign warns of entry into a dust-storm area, a reminder of the conditions which can be met here irrespective of Mount St. Helens and its activity (the windiest times of the year are fall and spring). Near Moses Lake, if one drives off the road onto a track to obtain a close look at the ash in the fields fine particle dust swirls around the car and penetrates the interior even when the doors and windows are closed. The ash lies several inches deep in places, and just walking about kicks up a dust which covers the shoes and clothes.

The area around Moses Lake and Ritzville was the worst affected by any of the 4 ashfalls. At about 200 miles from Mount St. Helens, the ash in this area is visibly much finer than that remaining around Yakima, about halfway on a straight line between it and Mount St. Helens. In a desert area between Moses Lake and the Cascades, intensive irrigation of crops is being carried out, but further west toward Ritzville wheat and other crops are grown which are dependent upon rainfall only, a few inches heavier here on an annual average than nearer the Cascades. The effect of irrigation and also the unusual rainfall that the Ritzville area received after May 18 has resulted in some compaction of the ash and a surface crust, which prevents it from blowing away in light winds. Its depth is not uniform from place to place in the same area, and the crust is readily broken with light contact. The compacted ash has settled around the base of the crops, and it is only by looking closely that its depth (at least 1 inch) can be appreciated. Around Ritzville several white whirlwinds of volcanic dust can be seen crossing the fields at any time, especially in the late afternoon when the winds pick up, and some of these are large enough to send dust a few hundred feet into the air. Where the land has been plowed over, the ground is still whitened by the ash and, depending upon farming practices, it may be 2 to 4 years before the present ashfall becomes incorporated into the soil. Around farmhouses and in the towns, much clean-up has been

achieved, but ash remains on lawns, in corners, and on the sides of the roads, and forms small clouds when it is disturbed by lawnmowers, bicycles, or even pets passing over it. In Moses Lake, as much as 2 inches of ash is still to be found on some of the sidewalks.

Wheat Harvesters

Toward the end of July, wheat harvesting began in the area. The ashfall has had little, if any, effect on the crop. The operation of combine harvesters in the fields was anticipated to raise considerable amounts of volcanic dust into the air. In previous years, conditions were inevitably dusty during harvest because of the dryness of the fields. Combines may work singly or in groups, 1 behind the other and 50 to 100 yards apart, moving along adjacent parallel rows. A dense cloud of ash that follows each combine totally obscures the machine from view at certain angles. A light wind keeps much of the ash away from the combines that follow, and their speed ensures that the dust remains behind them most of the time. The cutting blades are normally set at some height off the ground so that the wheat is cut near the top of the stalks; as a result, the wheat grains collected in the combine are relatively free from ash. The collected grain is periodically discharged into a truck which pulls alongside the combine while it is moving. Some of the combines are equipped with air-conditioned cabs, the air inlets situated at the top of the vehicles. Drivers of combines without cabs will obviously be much more exposed to ash. Truck drivers also receive intermittent heavy exposures as they draw alongside the moving combines to receive the grain; the high temperatures in the field (>90 F) necessitates keeping the truck windows open for ventilation. Hauling the grain away over the ash-laden fields for storage is not in itself a dusty procedure. Heavy wear of machinery in this abrasive dust is expected.

NIOSH undertook personal environmental sampling of men harvesting on 4 farms in the area between July 29 and August 1. The results should be compared with those from a variety of occupations listed in the CDC --Mount St. Helens Volcano Health Report #12, from which the following statement is taken: "The NIOSH recommended criterion for occupational exposure is 50 μg of free SiO_2 in the respirable dust per cubic meter of air (50 $\mu\text{g}/\text{m}^3$). Respirable dust concentrations of 0.8 to 1.0 $\mu\text{g}/\text{m}^3$ of air and 5% to 6% free SiO_2 content will yield approximately 50 μg of free SiO_2 per m^3 . Based upon available epidemiologic data nearly all occupationally exposed workers could be exposed up to this concentration for 8 hours a day, 5 days a week, for many years without being expected to develop silicosis."

On the basis of this limited number of samples, drivers of combines with air-conditioned cabs or trucks without air conditioning are exposed below the NIOSH-recommended levels. However, drivers of combines without cabs are exposed above this limit. These drivers should wear half-faced, rubber-mask respirators as a precautionary measure. Workers who experience upper respiratory tract irritation from the dust or who have long-standing lung problems (e.g., asthma,

emphysema, or bronchitis) should take additional precautions when driving in trucks or air-conditioned cabs.

State Patrolmen

Five state patrolmen in Ritzville and Moses Lake were sampled during the same period as the harvesters. These men drive patrol cars and have to stand by the roadside when dealing with other drivers. The summary results are:

0.35 mg/m³ respirable dust (range 0.37 to 0.68).

1.14 mg/m³ total dust (range 0.45 to 2.60).

These persons, and others who work outdoors in a dusty environment, should wear dust masks.

Future Studies

NIOSH is planning to do more exposure measurements of combine drivers in both ash-affected and unaffected (control) areas, as well as of migrant fruit pickers. A further evaluation of exposures to loggers will begin at the end of August.

Further Eruption of Mount St. Helens

Mount St. Helens had a major eruption for the fifth time starting at 4:23 p.m. (PDT) on August 7, 1980. This was preceded by 4 hours of harmonic tremors of increasing frequencies. Plume rose to about 44,000 feet. A pyroclastic flow was observed to run half-way down the volcano in the direction of Spirit Lake. Another pulsation occurred at 7:10 p.m., when the plume rose to about 19,000 feet, and again at 10:32 p.m. with a plume of about 36,000 feet. The last pulsation was the strongest, and included 3 lesser bursts at 10:55 p.m., 11:00 p.m., and 11:30 p.m. By 3:30 a.m. the activity had decreased to very low levels.

The wind direction varied depending on the height and it was difficult to predict the direction of the plume. Contacts were made through the CDC Hospital Surveillance system to determine the extent of the ashfall. In western Washington, traces of ash fell in Centralia, Chehalis, Longview, and as far north as Renton and Kent. In eastern Washington, light amounts fell in Ellensburg and Wenatchee; there was no fallout reported east of the Columbia River. Coarse material fell in Randall, about 30 miles north of Mount St. Helens.

Further eruptions are expected.

Table 1. ER Visits for Respiratory Diagnoses for 2 Hospitals
in Yakima May 4-June 14, 1980

<u>Respiratory Diagnosis</u>	<u>May</u> <u>4-10</u>	<u>May</u> <u>11-17</u>	<u>*May</u> <u>18-24</u>	<u>May</u> <u>25-31</u>	<u>June</u> <u>1-7</u>	<u>June</u> <u>8-14</u>
Hyperventilation	0	0	10	4	2	1
Airway Irritation	0	0	9	2	1	1
Cough	2	5	11	8	5	3
Wheezing	1	1	3	1	3	3
Shortness of Breath	4	8	23	8	5	6
Asthma	17	4	38	15	17	17
Bronchitis	20	12	27	20	21	24
Chronic Bronchitis/ COPD/Emphysema	5	4	12	9	3	8
<u>Subtotal</u>	<u>49</u>	<u>34</u>	<u>133</u>	<u>67</u>	<u>57</u>	<u>63</u>
<u>Other Respiratory †</u>	<u>102</u>	<u>78</u>	<u>99</u>	<u>103</u>	<u>109</u>	<u>138</u>
<u>Total</u>	<u>151</u>	<u>122</u>	<u>232</u>	<u>170</u>	<u>166</u>	<u>201</u>

* First eruption, May 18, had primary impact in eastern Washington.

† Other Respiratory includes epistaxis, fever only, hay fever/allergy, URI/ cold/viral syndrome, tonsillitis, oral thrush, pharyngitis/laryngitis, sore throat, pneumonia, pneumonitis, pneumothorax, hemoptysis, other upper respiratory, and other pulmonary.

Table 2
Demographic and Clinical Characteristics of Patients with
Hyperventilation and Airway Irritation who Visited the
Emergency Rooms in Yakima, Washington, May 18-June 14, 1980

	Hyperventilation ER Visit	Airway Irritation ER Visit
Number of Patients	16	13
Initial ER Visit on:		
May 18-24	9	9
May 25-31	3	2
June 1-7	2	2
June 8-14	2	0
Age - range	11-81	22-77
- median	26	32
Sex - male:female	2:14	7:6
Pre-existing pulmonary conditions	2	0
Other Respiratory/ cardiac conditions	2	3
Patients on medications	1	1
Worked in ash/clean-up	2	4
Ash-related respiratory problem, according to:		
- Patient	2	7
- Physician	0	11
Symptoms:		
Fever	1	0
Nasal congestion/discharge	1	3
Earache	0	0
Sore throat	1	3
Cough	1	3
Sputum/phlegm	0	3
Dyspnea	5	1
Shortness of breath	7	7
Wheezing	0	1
Chest pain/discomfort	4	2
Anxiety	0	1
Other	11	3
Physical examination:		
Temperature 100°F+ (37.8° C+)	0	0
Respirations 24+/minute	5	0
Pulse 100+/minute	6	0
Anxiety	4	1
Coryza	0	1
Pharynx hyperemic	0	1
Cough	0	1
Respiratory Distress	0	0
Hyperventilating	9	1
Wheezes	0	0
Rales	1	0
Rhonchi	0	0
Intercostal retractions	0	0
Other	0	5
Chest clear	15	13

Table 3
Demographic and Clinical Characteristics of Patients with Asthma,
Bronchitis, and COPD Who Visited the Emergency Rooms in Yakima, Washington,
May 18-June 14, 1980

	Asthma		Bronchitis		COPD	
	ER Visit/ER Adm.	ER Visit/ER Adm.	ER Visit/ER Adm.	ER Visit/ER Adm.	ER Visit/ER Adm.	ER Visit/ER Adm.
Number of Patients	56	7	85	6	12	20
Initial ER Visit on:						
May 18-24	31	1	22	4	4	10
May 25-31	6	1	22	1	3	4
June 1-7	11	4	18	1	2	2
June 8-14	8	1	23	0	3	4
Age - range	1-82	12-80	0-83	1-67	42-85	51-87
- median	24	49	26	23	62	71
Sex - male:female	25:30	1:6	44:41	2:4	11:1	13:7
Pre-existing pulmonary conditions	46	6	12	3	11	13
Other Respiratory/ cardiac conditions	0	1	7	1	2	15
Patients on medications	34	5	10	1	5	13
Worked in ash/clean-up	1	0	1	0	2	1
Ash-related respiratory problem, according to:						
- Patient	4	0	5	0	1	5
- Physician	3	0	0	1	0	1
Symptoms:						
Fever	3	0	14	1	1	2
Nasal congestion/discharge	5	1	32	1	0	0
Earache	0	0	8	0	0	0
Sore throat	0	0	24	1	1	0
Cough	17	2	62	4	4	6
Sputum/phlegm	3	2	23	1	3	5
Dyspnea	16	2	11	3	2	5
Shortness of breath	24	5	15	3	8	14
Wheezing	25	5	13	2	1	3
Chest pain/discomfort	3	1	20	1	1	0
Anxiety	2	0	1	1	1	0
Other	8	1	13	2	3	8
Physical examination:						
Temperature 100°F+ (37.8° C)	1	0	10	2	0	0
Respirations 24+/minute	19	2	13	2	2	8
Pulse 100+/minute	19	4	23	4	3	7
Anxiety	0	0	2	0	0	0
Coryza	1	0	12	0	0	0
Pharynx hyperemic	1	0	18	0	1	1
Cough	1	0	16	0	0	1
Respiratory Distress	7	4	4	1	2	7
Hyperventilating	2	0	0	0	0	0
Wheezes	46	7	27	4	5	12
Rales	2	0	6	1	2	6
Rhonchi	6	4	13	2	2	7
Intercostal retractions	6	1	0	0	0	0
Other	10	1	17	0	4	9
Chest clear	7	0	25	0	7	4
Hospital Length of stay (days):						
Range	-	1-20	-	1-6	-	1-24
Median	-	4	-	4	-	5

Table 4
Total Suspended Particulates (TSP) for Addy, Washington,
May-July, 1980

<u>Date</u>	<u>Time Frame</u> (hours)	<u>TSP (ug/m³)</u>
5/3/80	0-2400	140
5/6/80	0-2400	62
5/9/80	0-2400	43
5/12/80	0-2400	118
5/15/80	0-2400	140
5/18/80*	0-2400	2,739
5/19/80	0-1700	2,656
5/20/80	0-0400	2,846
5/21/80	0-2000	4,059
5/23/80	0700-0900	268
6/2/80	0-2400	73
6/15/80	0-2400	85
6/8/80	0-2400	87
6/11/80	0-2400	84
6/14/80	0-2400	46
6/17/80	0-2400	54
6/20/80	0-2400	46
6/23/80	0-2400	73
6/26/80	0-2400	15
6/29/80	0-2400	53
7/23/80†	0-0800	13,212
7/23/80	0800-0900	8,494
7/23/80	0900-1200	2,709
7/23/80	1200-1500	1,572
7/23/80	1500-0800	953
7/24/80	1000-1215	160
7/24/80	1500-0800	243
7/29/80	0-2400	206

*First volcanic eruption with approx. 1/8 in. ashfall 5/18/80

†Fourth volcanic eruption with approx. 1/4 in. ashfall 7/22/80

Table 5
Mean Monthly TSP, Addy, Washington

<u>Month</u>	<u>Mean TSP (ug/m³)</u>	<u>Standard Deviation (ug/m³)</u>
April 1979	51	21
May 1979	46	24
June 1979	71	36
August 1979	55	32
September 1979	39	20
April 1980	53	36

Table 6
Total and Respirable Dust Concentrations
in Harvester Combines and Truck Cabins (8-Hour Sampling)

	<u>Number of Samples</u>	<u>Total Sample</u>		<u>Respirable Sample</u>	
		<u>Average</u> (mg/m ³)	<u>Range</u> (mg/m ³)	<u>Average</u> (mg/m ³)	<u>Range</u> (mg/m ³)
Combines					
With A/C Cabs	4	5.82	4.24-8.2	0.4	0.17-0.74
Without A/C Cabs	2	19.1	32.6-34.9	2.24	2.2-2.38
<u>Trucks</u>	5	2.1	1.7-2.75	0.35	0.21-0.5

CDC--Mount St. Helens Volcano Health Reports will be published once a week until further notice. Information in these reports represents the latest data reported to CDC; much of the information is preliminary in nature and subject to confirmation and change. It is distributed for the purpose of providing up-to-date health data from CDC and the many other groups involved in public health assessment. We hope to continue to receive relevant reports and data from others working on this problem.

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