

Occupational Fatalities Associated with Exposure to Epoxy Resin Paint in an Underground Tank — Makati, Republic of the Philippines

On October 31, 1988, three men who were plugging leaks in and waterproofing an underground water tank at a building in Salcedo Village, Makati, Republic of the Philippines, were overcome by paint fumes and died in the tank. The incident was investigated by the Philippines Department of Health Field Epidemiology Training Program.

The underground water storage tank measured 20 meters (66 feet) long by 6 meters (19.8 feet) wide by 3 meters (9.9 feet) high and was divided into three communicating compartments; entry and exit were through one access hole. Because of typhoon rains on the evening of October 30, the tank contained approximately 60 centimeters (2 feet) of water when the five-person crew began work at 8 a.m., although company procedures required that such tanks be dry before any waterproofing materials were applied. By 9 p.m., when the crew started to apply an epoxal waterproofing paint, the water was 10.2 centimeters (4 inches) deep. Two 60-centimeter (2-foot) diameter electrically powered exhaust fans were provided to ventilate the tank, but the workers did not use them because of concern for a possible electrocution hazard from the standing water. At approximately 10 p.m., one worker left the tank because he had become drowsy and nauseated and was vomiting. At 10:30 p.m., a second worker left the tank to obtain coffee. When these two workers returned to the tank at approximately 11:30 p.m., they found the three other crewmembers dead.

Autopsy reports attributed the cause of death to asphyxia. A toxicology report from the Philippines National Bureau of Investigation indicated that blood specimens from the three men who died were negative for alcohol, sulfur, cyanide, and phosphorus. Analysis of samples of the paint by the Philippines Department of Science and Technology confirmed the presence of an epoxy resin.

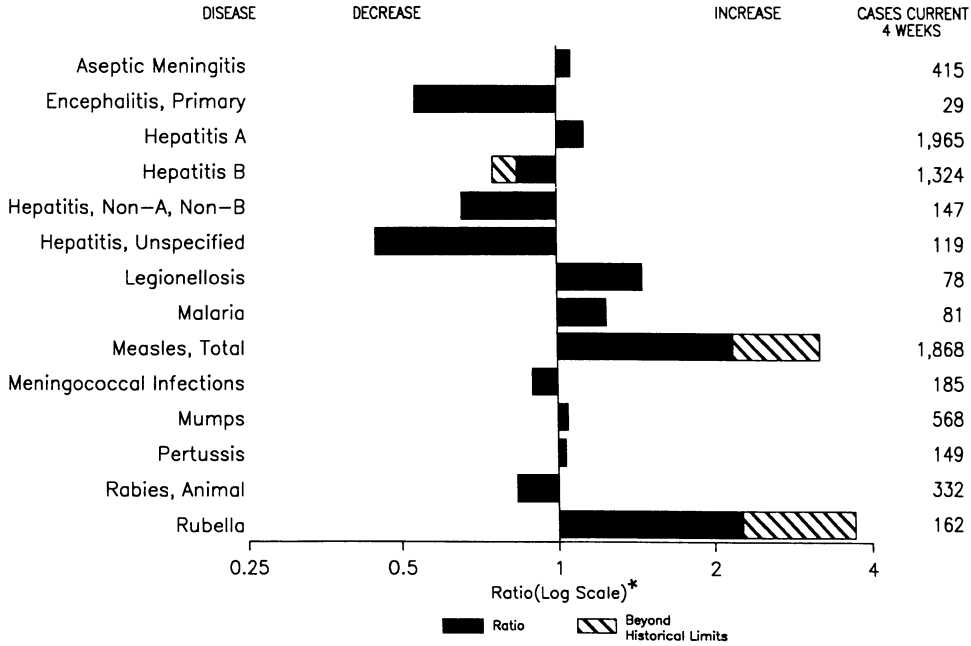
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Editorial Note: Epoxy-based waterproofing paints contain several types of toxic chemicals, and precautionary measures are required when these paints are used in a confined space. Constituents of epoxy resins will displace oxygen in a confined space and may have an independent narcotic effect on exposed workers. In this episode, the epoxy paint contained glycidyl ether, a reactive diluent used to decrease viscosity (1). Uncured glycidyl ether vapors are more dense than air and will settle to the bottom of a confined space, such as the water storage tank, thereby displacing oxygen. For this reason, in the United States, CDC's National Institute for Occupational Safety and Health (NIOSH) recommends use of appropriate personal protective equipment (i.e., a positive pressure-supplied air respirator and clothing) and adequate ventilation when persons work with (or assess the presence of) glycidyl ether in confined spaces.

In the United States, acute traumatic occupational deaths are monitored by NIOSH through the National Traumatic Occupational Fatalities (NTOF) data file (2). The

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FIGURE I. Notifiable disease reports, comparison of 4-week totals ending June 2, 1990, with historical data – United States



*Ratio of current 4-week total to mean of 15 4-week totals (from comparable, previous, and subsequent 4-week periods for past 5 years).

TABLE I. Summary – cases of specified notifiable diseases, United States, cumulative, week ending June 2, 1990 (22nd Week)

	Cum. 1990		Cum. 1990
AIDS	18,394	Plague	-
Anthrax	-	Poliomyelitis, Paralytic*	-
Botulism: Foodborne	1	Psittacosis	56
Infant	17	Rabies, human	-
Other	2	Syphilis: civilian	20,547
Brucellosis	16	military	121
Cholera	1	Syphilis, congenital, age < 1 year	-
Congenital rubella syndrome	1	Tetanus	21
Diphtheria	1	Toxic shock syndrome	139
Encephalitis, post-infectious	41	Trichinosis	13
Gonorrhea: civilian	276,543	Tuberculosis	8,413
military	3,854	Tularemia	23
Leprosy	76	Typhoid fever	139
Leptospirosis	15	Typhus fever, tickborne (RMSF)	72
Measles: imported	564		
indigenous	8,219		

*Three cases of suspected poliomyelitis have been reported in 1990; none of 13 suspected cases in 1989 have been confirmed to date. Nine of 14 suspected cases in 1988 were confirmed and all were vaccine-associated.

TABLE II. Cases of specified notifiable diseases, United States, weeks ending June 2, 1990, and June 3, 1989 (22nd Week)

Reporting Area	AIDS	Aseptic Mening- itis	Encephalitis		Gonorrhea (Civilian)		Hepatitis (Viral), by type				Legionel- losis	Leprosy
			Primary	Post-in- fectious			A	B	NA,NB	Unspeci- fied		
	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1989	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990
UNITED STATES	18,394	1,998	252	41	276,543	280,121	12,284	8,479	811	730	450	76
NEW ENGLAND	679	83	9	-	7,588	8,111	249	415	22	33	21	5
Maine	21	2	1	-	94	113	4	17	3	1	1	-
N.H.	40	8	-	-	80	72	5	22	2	2	3	-
Vt.	7	9	2	-	27	28	2	25	3	-	4	-
Mass.	378	28	2	-	2,952	3,160	184	274	9	29	9	4
R.I.	34	24	-	-	449	571	26	23	-	1	4	1
Conn.	199	12	4	-	3,986	4,167	28	54	5	-	-	-
MID. ATLANTIC	5,963	241	19	3	38,925	45,360	1,789	1,335	94	52	112	14
Upstate N.Y.	824	108	18	1	5,617	6,838	406	294	15	17	49	1
N.Y. City	3,396	49	1	-	16,758	19,197	215	436	15	20	16	10
N.J.	1,178	-	-	-	6,017	5,889	182	277	23	-	10	2
Pa.	565	84	-	2	10,533	13,436	986	328	41	15	37	1
E.N. CENTRAL	1,292	310	62	6	53,265	48,985	892	1,084	51	53	109	-
Ohio	286	78	15	2	16,186	12,169	103	199	14	7	39	-
Ind.	116	57	2	2	4,504	3,767	62	239	3	17	18	-
Ill.	570	52	21	2	16,698	15,668	407	169	16	14	7	-
Mich.	218	107	22	-	12,916	13,239	177	299	16	15	32	-
Wis.	102	16	2	-	2,961	4,142	143	178	2	-	13	-
W.N. CENTRAL	410	86	18	1	14,924	12,616	704	409	48	15	26	-
Minn.	57	8	9	1	1,845	1,295	112	50	15	-	-	-
Iowa	20	11	2	-	1,128	1,046	155	32	2	2	2	-
Mo.	252	36	1	-	8,760	7,350	241	247	12	10	17	-
N. Dak.	-	7	-	-	47	60	7	4	2	1	-	-
S. Dak.	1	3	2	-	84	112	37	4	2	-	-	-
Nebr.	24	11	3	-	770	713	43	18	3	-	4	-
Kans.	56	10	1	-	2,290	2,040	109	54	12	2	3	-
S. ATLANTIC	3,862	483	62	13	77,914	75,910	1,501	1,580	122	108	68	3
Del.	40	15	3	-	1,306	1,199	66	44	4	1	4	-
Md.	388	65	8	1	8,241	8,293	608	218	16	4	21	1
D.C.	302	2	-	-	4,730	4,667	12	28	4	-	-	-
Va.	333	74	22	2	7,425	6,308	120	97	18	82	6	-
W. Va.	31	9	5	-	579	558	9	41	3	1	1	-
N.C.	259	42	18	-	12,751	11,543	293	458	54	-	11	1
S.C.	139	7	-	-	6,194	6,916	20	253	9	6	10	-
Ga.	562	64	3	1	17,499	15,145	134	179	3	6	11	-
Fla.	1,808	205	3	9	19,189	21,281	239	262	11	8	4	1
E.S. CENTRAL	432	170	21	1	23,040	22,582	163	664	50	4	34	-
Ky.	76	46	5	-	2,459	2,081	43	228	16	3	15	-
Tenn.	144	35	12	1	7,128	7,168	80	353	22	-	10	-
Ala.	100	67	4	-	7,844	7,484	39	79	10	-	9	-
Miss.	112	22	-	-	5,609	5,849	1	4	2	1	-	-
W.S. CENTRAL	1,871	139	9	5	27,604	29,254	1,176	674	65	105	30	17
Ark.	157	5	-	-	3,642	2,943	228	34	3	10	7	-
La.	298	20	3	-	5,697	6,194	66	126	1	3	10	-
Okla.	96	14	1	5	2,503	2,483	261	66	14	10	10	-
Tex.	1,320	100	5	-	15,762	17,634	621	448	47	82	3	17
MOUNTAIN	466	89	8	-	5,007	5,807	1,977	621	59	61	23	-
Mont.	7	2	-	-	74	92	52	36	2	4	1	-
Idaho	14	-	-	-	44	89	37	35	8	-	3	-
Wyo.	2	1	1	-	75	48	22	8	3	1	-	-
Colo.	131	21	1	-	1,081	1,330	121	79	16	21	3	-
N. Mex.	40	4	-	-	518	596	302	70	2	2	2	-
Ariz.	161	36	4	-	2,293	2,078	1,133	194	15	25	8	-
Utah	46	15	-	-	176	186	152	39	10	3	1	-
Nev.	65	10	2	-	746	1,388	158	160	3	5	5	-
PACIFIC	3,419	397	44	12	28,276	31,496	3,833	1,697	300	299	27	37
Wash.	272	-	3	1	2,439	2,632	640	264	59	10	7	2
Oreg.	142	-	-	-	1,108	1,212	415	198	17	5	-	-
Calif.	2,925	361	37	10	24,101	27,059	2,648	1,180	217	280	19	29
Alaska	16	8	3	-	436	381	86	30	3	-	-	-
Hawaii	64	28	1	1	192	212	44	25	4	4	1	6
Guam	1	-	-	-	71	59	3	1	-	5	-	-
P.R.	744	33	4	-	347	497	73	104	1	19	-	-
V.I.	4	-	-	-	189	287	-	7	-	-	-	-
Amer. Samoa	-	1	-	-	26	11	12	-	-	-	-	5
C.N.M.I.	-	-	-	-	66	38	4	2	-	-	-	1

N: Not notifiable

U: Unavailable

C.N.M.I.: Commonwealth of the Northern Mariana Islands

TABLE II. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending June 2, 1990, and June 3, 1989 (22nd Week)

Reporting Area	Malaria	Measles (Rubeola)					Menin- gococcal Infections	Mumps		Pertussis			Rubella		
		Indigenous		Imported*		Total									
	Cum. 1990	1990	Cum. 1990	1990	Cum. 1990	Cum. 1989	Cum. 1990	1990	Cum. 1990	1990	Cum. 1990	Cum. 1989	1990	Cum. 1990	Cum. 1989
UNITED STATES	404	804	8,219	21	564	6,542	1,247	116	2,660	30	1,152	964	46	456	182
NEW ENGLAND	40	-	107	-	13	263	80	2	20	7	151	205	-	4	5
Maine	-	-	27	-	-	-	8	-	-	-	4	4	-	-	-
N.H.	4	-	-	-	8	5	2	-	6	-	10	5	-	1	3
Vt.	4	-	-	-	1	1	5	-	1	-	6	5	-	-	1
Mass.	23	-	4	-	1	36	43	1	7	7	122	181	-	-	-
R.I.	3	-	27	-	3	37	5	1	4	-	-	2	-	1	-
Conn.	6	-	49	-	-	184	17	-	2	-	9	8	-	2	-
MID. ATLANTIC	83	-	495	-	128	641	183	5	157	1	282	51	-	2	11
Upstate N.Y.	17	-	155	-	101	111	72	5	69	1	229	25	-	1	3
N.Y. City	30	-	43	-	15	52	23	-	-	-	-	2	-	-	6
N.J.	21	-	22	-	5	357	34	-	30	-	11	20	-	-	2
Pa.	15	-	275	-	7	121	54	-	58	-	42	4	-	1	-
E.N. CENTRAL	20	60	2,283	-	139	1,401	169	5	280	-	223	112	-	26	20
Ohio	5	-	213	-	2	492	58	-	54	-	62	1	-	-	3
Ind.	-	25	260	-	1	17	17	-	10	-	34	8	-	-	-
Ill.	6	-	881	-	9	849	38	1	90	-	67	46	-	17	16
Mich.	6	35	300	-	125	6	37	4	96	-	33	20	-	9	-
Wis.	3	-	629	-	2	37	19	-	30	-	27	37	-	-	1
W.N. CENTRAL	5	55	471	-	12	496	38	4	77	1	38	24	2	5	4
Minn.	1	43	163	-	3	3	9	-	-	-	6	-	-	1	-
Iowa	-	1	23	-	-	5	1	-	12	-	4	9	2	3	-
Mo.	4	1	61	-	-	299	13	-	37	1	22	13	-	-	3
N. Dak.	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
S. Dak.	-	1	14	-	8	-	2	-	-	-	1	1	-	-	-
Nebr.	-	-	95	-	1	110	5	-	2	-	1	-	-	-	-
Kans.	-	9	115	-	-	79	8	4	26	-	3	1	-	-	1
S. ATLANTIC	92	49	536	8	88	350	237	76	1,062	5	108	78	-	12	7
Del.	2	-	8	-	3	34	1	-	2	-	2	1	-	-	-
Md.	24	29	95	-	12	48	24	45	614	3	28	7	-	1	2
D.C.	10	-	8	-	7	9	11	-	20	-	13	-	-	1	-
Va.	20	16	64	-	2	12	28	6	64	-	9	4	-	-	-
W. Va.	1	-	6	-	-	28	8	2	40	-	9	10	-	-	-
N.C.	7	-	3	8†§	9	167	37	20	127	2	20	18	-	-	1
S.C.	-	-	3	-	-	-	18	1	19	-	5	-	-	-	-
Ga.	8	-	6	-	12	-	48	-	56	-	14	9	-	-	-
Fla.	20	4	343	-	43	52	62	2	120	-	8	29	-	10	4
E.S. CENTRAL	11	1	70	-	2	60	75	1	60	4	61	39	-	1	2
Ky.	2	-	4	-	-	2	21	-	-	-	-	1	-	-	-
Tenn.	6	-	32	-	-	29	31	1	29	4	28	14	-	1	2
Ala.	3	1	8	-	2	29	21	-	9	-	30	20	-	-	-
Miss.	-	-	26	-	-	-	2	N	N	-	3	4	-	-	-
W.S. CENTRAL	13	306	1,466	11	64	2,349	82	5	476	-	23	27	-	1	11
Ark.	1	-	8	4§	19	2	8	1	114	-	1	10	-	1	-
La.	-	-	10	-	-	6	25	2	81	-	4	4	-	-	5
Okla.	5	6	142	-	-	60	9	-	97	-	18	13	-	-	1
Tex.	7	300	1,306	7†	45	2,281	40	2	184	-	-	-	-	-	5
MOUNTAIN	11	5	398	2	57	179	39	8	213	4	106	307	10	61	31
Mont.	-	-	-	-	1	13	9	-	-	-	5	-	-	13	1
Idaho	2	-	15	-	5	1	4	1	107	2	23	40	6	25	29
Wyo.	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-
Colo.	1	2	46	2†§	31	58	12	1	16	2	49	19	-	3	-
N. Mex.	2	3	75	-	4	30	3	N	N	-	7	4	-	-	-
Ariz.	6	-	123	-	11	41	3	6	73	-	13	238	4	18	-
Utah	-	-	4	-	-	36	4	-	4	-	5	5	-	1	-
Nev.	-	U	135	U	3	-	4	U	11	U	4	1	U	1	1
PACIFIC	129	328	2,393	-	61	803	344	10	315	8	160	121	34	344	91
Wash.	13	-	7	-	38	33	41	4	31	4	43	24	-	-	-
Oreg.	6	-	-	-	-	6	37	N	N	-	3	5	-	-	1
Calif.	107	328	2,308	-	20	751	258	6	280	4	97	90	34	337	70
Alaska	1	-	75	-	2	-	6	-	-	-	-	-	-	-	-
Hawaii	2	-	3	-	1	13	2	-	4	-	17	2	-	7	20
Guam	1	U	-	U	-	1	-	U	-	U	-	1	U	-	-
P.R.	-	-	808	-	-	386	8	1	4	1	5	3	-	-	5
V.I.	-	-	-	-	-	4	-	-	5	-	-	-	-	-	-
Amer. Samoa	-	U	-	U	-	-	-	U	-	U	-	-	U	-	-
C.N.M.I.	-	U	-	U	-	-	-	U	5	U	-	-	U	-	-

*For measles only, imported cases includes both out-of-state and international importations.

N: Not notifiable U: Unavailable †International ‡Out-of-state

TABLE II. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending June 2, 1990, and June 3, 1989 (22nd Week)

Reporting Area	Syphilis (Civilian) (Primary & Secondary)		Toxic- shock Syndrome	Tuberculosis		Tula- remia	Typhoid Fever	Typhus Fever (Tick-borne) (RMSF)	Rabies, Animal
	Cum. 1990	Cum. 1989	Cum. 1990	Cum. 1990	Cum. 1989	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990
UNITED STATES	20,547	17,524	139	8,413	8,343	23	139	72	1,618
NEW ENGLAND	798	702	11	201	215	-	11	-	3
Maine	5	5	3	-	3	-	-	-	17
N.H.	32	3	1	3	14	-	-	-	2
Vt.	1	-	-	2	4	-	-	-	-
Mass.	301	215	6	106	109	-	10	-	-
R.I.	6	14	-	30	29	-	-	-	-
Conn.	453	465	1	60	56	-	1	-	1
MID. ATLANTIC	4,567	3,651	13	2,116	1,624	1	40	3	368
Upstate N.Y.	339	383	4	197	135	-	8	-	-
N.Y. City	2,033	1,479	4	1,219	943	-	21	-	-
N.J.	724	587	-	369	242	1	9	3	109
Pa.	1,471	1,202	5	331	304	-	2	-	242
E.N. CENTRAL	1,373	678	36	853	883	-	18	4	36
Ohio	236	51	14	120	177	-	4	2	3
Ind.	19	27	2	52	75	-	-	-	-
Ill.	513	302	5	430	380	-	10	-	13
Mich.	457	261	15	217	205	-	3	2	5
Wis.	148	37	-	34	46	-	1	-	15
W.N. CENTRAL	178	146	16	225	231	6	-	10	229
Minn.	43	11	-	39	49	-	-	-	94
Iowa	23	17	2	27	28	-	-	-	10
Mo.	88	73	11	107	95	5	-	9	10
N. Dak.	1	1	-	10	9	-	-	-	31
S. Dak.	1	-	-	6	12	-	-	-	55
Nebr.	6	16	2	12	10	1	-	-	3
Kans.	16	28	1	24	28	-	-	1	26
S. ATLANTIC	6,418	6,322	7	1,674	1,741	3	12	24	471
Del.	77	73	1	19	20	-	-	1	7
Md.	500	323	-	145	155	-	6	1	182
D.C.	397	402	1	54	70	-	-	-	-
Va.	362	228	-	152	152	1	-	2	85
W. Va.	7	7	-	31	33	-	-	-	12
N.C.	762	386	3	203	203	1	-	14	3
S.C.	338	328	1	193	185	1	-	5	56
Ga.	1,615	1,361	-	247	259	-	1	1	88
Fla.	2,360	3,214	1	630	664	-	5	-	38
E.S. CENTRAL	1,771	1,098	5	661	708	2	-	9	86
Ky.	30	24	-	173	155	-	-	-	24
Tenn.	721	460	3	178	197	2	-	7	22
Ala.	555	373	2	222	210	-	-	2	40
Miss.	465	241	-	88	146	-	-	-	-
W.S. CENTRAL	3,278	2,247	7	1,064	980	9	3	19	219
Ark.	196	146	-	110	101	6	-	1	12
La.	1,007	509	1	115	125	-	-	1	-
Okla.	95	36	6	86	84	3	1	15	68
Tex.	1,980	1,556	-	753	670	-	2	2	139
MOUNTAIN	383	325	19	192	203	1	7	2	73
Mont.	-	1	-	10	7	-	-	-	20
Idaho	6	-	1	6	8	-	-	-	-
Wyo.	-	-	1	1	-	-	-	-	27
Colo.	20	51	6	6	18	-	-	-	-
N. Mex.	20	12	4	43	36	1	-	2	5
Ariz.	269	88	5	91	93	-	5	-	19
Utah	4	10	2	12	19	-	-	-	-
Nev.	64	163	-	23	22	-	2	-	2
PACIFIC	1,781	2,355	25	1,427	1,758	1	48	1	133
Wash.	146	178	3	118	82	1	1	-	-
Oreg.	63	121	-	49	56	-	1	-	-
Calif.	1,558	2,048	21	1,175	1,526	-	43	1	111
Alaska	6	2	-	18	28	-	-	-	22
Hawaii	8	6	1	67	66	-	3	-	-
Guam	1	3	-	14	30	-	-	-	-
P.R.	150	232	-	43	135	-	-	-	19
V.I.	1	1	-	4	3	-	-	-	-
Amer. Samoa	-	-	-	6	2	-	-	-	-
C.N.M.I.	1	4	-	13	7	-	4	-	-

U: Unavailable

**TABLE III. Deaths in 121 U.S. cities,* week ending
June 2, 1990 (22nd Week)**

Reporting Area	All Causes, By Age (Years)						P&I**	Total	Reporting Area	All Causes, By Age (Years)						P&I**	Total
	All Ages	≥65	45-64	25-44	1-24	<1				All Ages	≥65	45-64	25-44	1-24	<1		
NEW ENGLAND	599	412	103	43	18	23	41		S. ATLANTIC	1,194	719	261	145	30	37	61	
Boston, Mass.	158	91	35	16	10	6	18		Atlanta, Ga.	140	86	35	17	1	1	3	
Bridgeport, Conn.	42	28	5	3	3	3	1		Baltimore, Md.	273	159	64	34	7	9	14	
Cambridge, Mass.	17	14	3	-	-	-	-		Charlotte, N.C.	77	49	10	13	4	1	6	
Fall River, Mass.	19	14	5	-	-	-	-		Jacksonville, Fla.	88	55	22	6	2	3	10	
Hartford, Conn.	57	40	10	6	-	1	4		Miami, Fla.	118	71	24	18	4	1	1	
Lowell, Mass.	25	21	2	1	-	1	4		Norfolk, Va.	45	29	10	2	1	3	6	
Lynn, Mass.	12	10	1	1	-	-	-		Richmond, Va.	54	35	10	7	-	2	3	
New Bedford, Mass.	33	28	5	-	-	-	-		Savannah, Ga.	62	35	15	9	-	2	4	
New Haven, Conn.	46	31	6	6	2	1	5		St. Petersburg, Fla.	73	52	9	3	2	7	4	
Providence, R.I.	56	45	7	3	-	1	2		Tampa, Fla.	56	34	11	6	2	2	6	
Somerville, Mass.	3	3	-	-	-	-	-		Washington, D.C.	182	93	48	29	7	5	4	
Springfield, Mass.	35	21	8	3	1	2	5		Wilmington, Del.	26	21	3	1	-	1	-	
Waterbury, Conn.	39	29	7	2	1	-	2		E.S. CENTRAL	751	475	160	62	29	25	39	
Worcester, Mass.	57	37	9	2	1	8	-		Birmingham, Ala.	123	78	24	8	7	6	1	
MID. ATLANTIC	2,365	1,538	436	269	61	60	144		Chattanooga, Tenn.	46	36	7	-	1	2	3	
Albany, N.Y.	46	34	9	3	-	-	2		Knoxville, Tenn.	82	50	22	7	2	1	3	
Allentown, Pa.	21	17	4	-	-	-	-		Louisville, Ky.‡	92	68	15	5	1	3	4	
Buffalo, N.Y.	100	52	21	18	4	4	3		Memphis, Tenn.	139	72	30	20	10	7	13	
Camden, N.J.	32	15	12	3	-	2	-		Mobile, Ala.	125	75	33	10	5	2	2	
Elizabeth, N.J.	18	13	2	2	-	1	3		Montgomery, Ala.§	51	39	8	3	-	1	4	
Erie, Pa.†	32	27	4	1	-	-	4		Nashville, Tenn.	93	57	21	9	3	3	9	
Jersey City, N.J.§	55	32	12	7	-	4	1		W.S. CENTRAL	1,771	1,094	352	197	80	48	87	
N.Y. City, N.Y.	1,273	798	238	174	37	26	64		Austin, Tex.	66	44	10	9	2	1	3	
Newark, N.J.	63	34	10	14	2	3	3		Baton Rouge, La.	48	32	6	6	2	2	2	
Paterson, N.J.	32	22	6	3	1	-	2		Corpus Christi, Tex.§	51	34	11	5	-	1	1	
Philadelphia, Pa.	308	203	63	25	11	6	25		Dallas, Tex.	181	88	45	23	14	11	8	
Pittsburgh, Pa.†	55	37	10	5	-	3	5		El Paso, Tex.	52	40	6	3	2	1	6	
Reading, Pa.	27	24	3	-	-	-	3		Fort Worth, Tex	78	53	15	6	3	1	5	
Rochester, N.Y.	136	102	19	4	5	6	23		Houston, Tex.‡	734	436	169	89	24	16	18	
Schenectady, N.Y.	20	15	4	1	-	-	2		Little Rock, Ark.	64	35	14	9	3	3	7	
Scranton, Pa.†	21	18	2	1	-	-	2		New Orleans, La.	152	94	21	17	17	3	-	
Syracuse, N.Y.	46	34	6	4	-	2	1		San Antonio, Tex.	175	117	28	18	7	5	17	
Trenton, N.J.	36	28	5	1	-	2	-		Shreveport, La.	81	60	9	7	2	3	11	
Utica, N.Y.	21	17	3	1	-	-	-		Tulsa, Okla.	89	61	18	5	4	1	9	
Yonkers, N.Y.	23	16	3	2	1	1	1		MOUNTAIN	649	427	118	52	26	25	37	
E.N. CENTRAL	2,065	1,346	430	151	54	84	96		Albuquerque, N. Mex.	78	51	14	8	3	1	2	
Akron, Ohio	38	28	7	2	-	1	-		Colo. Springs, Colo.	43	29	7	2	2	3	5	
Canton, Ohio	35	25	7	1	1	1	2		Denver, Colo.	110	76	17	8	-	9	5	
Chicago, Ill.§	564	362	125	45	10	22	16		Las Vegas, Nev.	104	65	19	10	6	4	6	
Cincinnati, Ohio	117	72	24	10	4	7	13		Ogden, Utah	20	19	1	-	-	-	6	
Cleveland, Ohio	129	79	35	6	4	5	6		Phoenix, Ariz.	118	79	20	9	6	4	6	
Columbus, Ohio	136	80	30	9	9	8	1		Pueblo, Colo.	21	10	7	2	2	-	1	
Dayton, Ohio	81	56	16	8	-	1	4		Salt Lake City, Utah	53	32	11	5	2	3	-	
Detroit, Mich.	194	97	47	24	12	14	4		Tucson, Ariz.	102	66	22	8	5	1	6	
Evansville, Ind.	40	32	6	1	-	1	3		PACIFIC	1,696	1,086	323	182	58	43	100	
Fort Wayne, Ind.	62	43	12	4	2	1	6		Berkeley, Calif.	21	17	1	3	-	-	3	
Gary, Ind.	18	12	3	3	-	-	-		Fresno, Calif.	73	44	13	11	2	3	7	
Grand Rapids, Mich.	92	74	10	4	-	4	4		Glendale, Calif.	22	15	4	2	1	-	-	
Indianapolis, Ind.	136	87	28	11	4	6	3		Honolulu, Hawaii	80	48	19	9	4	-	6	
Madison, Wis.	34	22	4	4	1	3	2		Long Beach, Calif.	66	37	14	10	-	5	7	
Milwaukee, Wis.	103	72	19	6	1	5	8		Los Angeles Calif.	418	272	76	44	18	5	18	
Peoria, Ill.	46	29	12	2	1	2	2		Oakland, Calif.	47	26	12	6	-	3	3	
Rockford, Ill.	43	34	7	1	-	1	7		Pasadena, Calif.	30	20	3	2	-	5	-	
South Bend, Ind.	36	26	6	2	2	-	3		Portland, Oreg.	108	78	17	6	2	5	3	
Toledo, Ohio§	98	68	21	4	3	2	6		Sacramento, Calif.	124	71	28	12	11	2	13	
Youngstown, Ohio§	63	48	11	4	-	-	6		San Diego, Calif.	143	84	24	19	10	5	14	
W.N. CENTRAL	653	469	123	40	10	11	36		San Francisco, Calif.	141	95	23	18	3	2	6	
Des Moines, Iowa	57	43	11	2	1	-	4		San Jose, Calif.	150	91	38	15	2	4	6	
Duluth, Minn.	22	20	2	-	-	-	2		Seattle, Wash.	183	120	38	20	4	1	3	
Kansas City, Kans.	28	21	5	2	-	-	-		Spokane, Wash.	42	30	7	3	1	1	6	
Kansas City, Mo.	107	75	17	9	1	5	7		Tacoma, Wash.	48	38	6	2	-	2	5	
Lincoln, Nebr.	27	22	4	-	1	-	2		TOTAL	11,743 ^{††}	7,566	2,306	1,141	366	356	641	
Minneapolis, Minn.	112	84	20	7	-	1	8										
Omaha, Nebr.	84	64	15	3	-	2	10										
St. Louis, Mo.	115	74	29	7	2	3	-										
St. Paul, Minn.	61	41	12	4	4	-	1										
Wichita, Kans.	40	25	8	6	1	-	2										

*Mortality data in this table are voluntarily reported from 121 cities in the United States, most of which have populations of 100,000 or more. A death is reported by the place of its occurrence and by the week that the death certificate was filed. Fetal deaths are not included.

**Pneumonia and influenza.

†Because of changes in reporting methods in these 3 Pennsylvania cities, these numbers are partial counts for the current week. Complete counts will be available in 4 to 6 weeks.

††Total includes unknown ages.

§Data not available. Figures are estimates based on average of past available 4 weeks.

Paint Exposure — Continued

NTOF data file uses death certificates as the source of information for work-related fatalities resulting from external causes of injury and poisoning (*International Classification of Diseases, Ninth Revision* [ICD-9], rubrics E800–E899). From 1980 through 1985, the NTOF data file included 286 deaths (an average of 48 work-related deaths per year) that involved workers in confined spaces with cause of death directly attributable to asphyxiation, explosion, or drowning. This figure probably underestimates the number of such confined-space-related fatalities in the United States because of misclassification and the lack of a specific ICD-9 code for “confined spaces” on the death certificate.

NIOSH defines a confined space as one that “by design has limited openings for entry and exit, unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy” (3). The water storage tank in the incident reported here not only met these criteria, but also contained dangerous air contaminants introduced by the workers through the use of epoxal waterproofing paint.

Companies, municipalities, and other organizations who assign workers to perform tasks within confined spaces should develop and implement a comprehensive program for working in confined spaces (3,4). Important considerations for such recommendations are whether 1) entry is necessary or the assigned task can be completed from the outside; 2) a confined space safe entry permit has been issued by the company; 3) warning signs are posted where they will be noticed by employees; 4) air quality in the confined space has been tested for safety according to basic criteria*; 5) employees and supervisors have been trained in the proper selection and use of appropriate respiratory protection (6,7), protective clothing, lifelines, and emergency rescue equipment; 6) employees have been trained to work in confined spaces and in confined space rescue procedures; and 7) ventilation equipment is available and/or used and air quality is tested when the ventilation system is operating.

In addition, confined space procedures for work performed inside tanks should specifically incorporate use of explosion-proof lighting and fixtures in and near flammable atmospheres[†] and use of nonflammable paints (when possible) for coating the interior of tanks.

References

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3. NIOSH. Criteria for a recommended standard...working in confined spaces. Cincinnati, Ohio: US Department of Health, Education, and Welfare, Public Health Service, CDC, 1979; DHEW publication no. (NIOSH)80-106.
4. NIOSH. A guide to safety in...confined spaces. Morgantown, West Virginia: US Department of Health and Human Services, Public Health Service, CDC, 1987; DHHS publication no. (NIOSH)87-113.
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*Oxygen concentration, $\geq 19.5\%$; concentration of flammable substances, $< 10\%$ of their respective lower explosive limits (i.e., the lowest concentration at which explosive combustion can occur); and toxic air contaminants, less than the concentration levels referenced in 29 CFR §1910.1000, subpart Z (5).

[†]Required by the National Electric Code Articles 501-9(a)(1) and 501-9(b)(1) (8) and the National Fire Protection Association Standard 33 (9).

Paint Exposure — Continued

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 8. National Fire Protection Association. The national electric code handbook: the national electric code 1990. Quincy, Massachusetts: National Fire Protection Association, 1989. (Article nos. 501-9[a][1] and 501-9[b][1]).
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Update: Serologic Testing for HIV-1 Antibody — United States, 1988 and 1989

In 1985, the first enzyme immunoassay (EIA) for detection of human immunodeficiency virus type 1 (HIV-1) antibody was licensed by the Food and Drug Administration; since then, the number of HIV-1 tests performed and the number of laboratories performing HIV-1 tests has increased steadily. Because of the need to assess the quality of existing laboratory technology and to ensure the quality of testing, the Model Performance Evaluation Program (MPEP) was implemented by CDC in 1986 to evaluate the performance of laboratories testing for HIV-1 infection (1). Approximately 1400 U.S. and international laboratories participated in the MPEP during 1988 and 1989. The total number of laboratories performing HIV-1 testing is unknown.

Laboratories in the MPEP voluntarily report results from coded plasma samples for which HIV-1-antibody reactivity has been determined through composite testing at CDC and verified at candidate reference laboratories (Table 1). Participants also complete survey forms describing laboratory characteristics and testing practices. This report summarizes data for the 752 U.S. MPEP laboratories that returned complete results in both May 1988 and August 1989*. Performance is described in terms of analytic sensitivity, analytic specificity, and overall analytic performance.[†] Performance was calculated based on a laboratory's test results for samples that were typical of most samples routinely tested for HIV-1 antibody.

Enzyme Immunoassays

The analytic sensitivity of EIAs for HIV-1 antibody performed for MPEP in 1988 was 99.7% (6545 reactive test results out of 6566 positive samples) (Table 2); analytic

*Provisional data for 1989.

[†]Analytic sensitivity is the proportion of reactive test results in positive specimens. To calculate analytic sensitivity, Western blot (WB) "indeterminate" test results are combined with nonreactive test results. Analytic specificity is the proportion of nonreactive test results in negative specimens. To calculate analytic specificity, WB "indeterminate" test results are combined with reactive test results. Overall analytic performance is the proportion of "correct" test results in all specimens tested. Because seroreactivity of included samples was defined as positive or negative, WB "indeterminate" test results are not considered "correct" for calculating overall analytic performance.



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Outbreak of Multidrug-Resistant Tuberculosis — Texas, California, and Pennsylvania

On January 9, 1986, a 30-year-old black man (patient 8 in Tables 1–3) presented to a hospital emergency room with an illness of 2 months' duration. The illness was characterized by cough, weakness, malaise, fever, night sweats, shortness of breath, and hemoptysis. The patient's chest radiograph showed extensive cavitory disease that was highly suggestive of pulmonary tuberculosis (TB). Sputum cultures were positive for *Mycobacterium tuberculosis*, and the organisms demonstrated resistance to isoniazid (INH), rifampin (RIF), and streptomycin (Table 2). The patient was treated with pyrazinamide (PZA), ethambutol, capreomycin (CAP), ethionamide (ETH), and an experimental drug (ofloxacin). Although totally compliant with this treatment regimen, the patient, after initial improvement, experienced relapse on therapy, and surgery was recommended. In March 1987, he died of postoperative complications of a right pneumonectomy. The patient had been hospitalized from the time of diagnosis to death (nearly 14 months). Autopsy revealed active disease in his left lung.

Subsequent epidemiologic investigation revealed that patient 8 had been a close contact of four persons (patients 1–4) who were being treated for infectious drug-resistant TB. All four persons were members of an extended family whose members interacted extensively and lived intermittently in three states. From July 1971 through May 1990, eight persons in and two close contacts of this extended family have been diagnosed with clinically active pulmonary TB. The most recent case was diagnosed in January 1989.

TABLE 1. Characteristics of patients with multidrug-resistant tuberculosis — Texas, California, and Pennsylvania

Patient no.	Relationship to index patient	Date first diagnosed	Age at diagnosis	State of diagnosis	Status
1	Index patient	Jul. 1971	41 yrs.	Texas	Died (Aug. 1987)
2	Relative	Apr. 1976	26 yrs.	Texas	Recovered
3	Relative	Jan. 1981	48 yrs.	Texas	Recovered
4	Relative	Oct. 1981	27 yrs.	Texas	Ill
5	Relative	Feb. 1982	4 mos.	California	Recovered
6	Relative	Oct. 1984	31 yrs.	Texas	Recovered
7	Relative	Apr. 1985	37 yrs.	Texas	Ill
8	Friend	Jan. 1986	30 yrs.	Texas	Died (Mar. 1987)
9	Friend	Apr. 1986	29 yrs.	Texas	Recovered
10	Relative	Jan. 1989	10 yrs.	Pennsylvania	Recovered