FIRE LOSSES ASSOCIATED WITH METAL SHEATHED CABLES IN CONCEALED SPACES

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INTRODUCTION

A question has been raised regarding the suitability of the use of metal sheathed cables in concealed spaces or voids. This study looks at fire loss statistics, especially those issued by NFPA. Metal sheathed cables are normally of two kinds: AC cables, or armored cables, and MC cables, or metal-clad cables.

The National Electrical Code (NEC, NFPA 70) [1] defines a plenum as "A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system." However, in the section on "Ducts, Plenums, and Other Air-Handling Spaces" (300.22) the NEC also describes a space known as "Other Space Used for Environmental Air", which is not defined, but for which wiring method requirements exist. The section addressing this space (300.22(C)) applies to "space used for environmental air-handling purposes other than ducts and plenums as specified in 300.22(A) and (B)". The NEC further clarifies that this space "does not include habitable rooms or areas of buildings, the prime purpose of which is not air handling". Section 300.22(A) applies to "ducts used to transport dust, loose stock, or flammable vapors", which are used "for vapor removal or for ventilation of commercial-type cooking equipment". Section 300.22(B) applies to "Ducts or Plenums Used for Environmental Air". By default, therefore, the "Other Space Used for Environmental Air" is, in practice, the space that is otherwise known as a "plenum".

The NEC, in 300.22(C), states that the wiring methods for "Other Space Used for Environmental Air" shall be limited to "totally enclosed, nonventilated, insulated busway having no provisions for plug-in connections, Type MI cable, Type MC cable without an overall nonmetallic covering, Type AC cable, or other factory-assembled multiconductor control or power cable that is specifically listed for the use, or listed prefabricated cable assemblies of metallic manufactured wiring systems without nonmetallic sheath." It then continues as follows: "Other types of cables, conductors, and raceways shall be permitted to be installed in electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, rigid metal conduit without an overall nonmetallic covering, flexible metal conduit, or, where accessible, surface metal raceway or metal wireway with metal covers or solid bottom metal cable tray with solid metal covers."

NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems [2], regulates the use of materials contained in plenums. NFPA 90A uses the same definition for a plenum as the NEC. However, NFPA 90A does not use the concept of "Other Space Used for Environmental Air". Therefore, requirements associated with wiring in plenums in NFPA 90A need to correspond with requirements associated with wiring in "Other Space Used for Environmental Air" in the NEC. Wiring in NFPA 90A is primarily found in either: (a) a space between the top of the finished ceiling and the underside of the floor or roof above (known as "ceiling cavity plenum") or in (b) a space between the top of the finished floor and the underside of a raised floor (known as "raised floor plenum").

Fire loss statistics, including those issued by the National Fire Protection Association (NFPA), address losses in concealed spaces but do not address plenums, which are a subset of concealed spaces. This problem has been further complicated by coding changes associated with NFIRS (National Fire Incident Reporting System), when it introduced NFIRS 5.0; so that it is difficult to compare statistical data obtained until 1998 and newer statistical data.

Fire loss statistics have been researched for wiring in concealed spaces: (a) from 1980 to 1998 [3] and (b) for the period between 1999 and 2003 (due to a change in the loss coding characteristics) [4]. The studies address fires involving electrical wiring in concealed spaces above ceilings and below floors, both with and without electrical wire and cable insulation as the item first ignited. The statistical results will be presented and compared with general US fire loss statistics and with some subsets of such losses.

Statistics were also obtained on the use of metal sheathed cables in the years between 1990 and 2007 [5].

FIRE LOSS STATISTICS UNTIL 1998

An investigation was made, by Marty Ahrens, of the NFPA Fire Analysis and Research Division, to look at fires in concealed spaces involving electrical wires and cables [3]. She studied the following eight cases, for the years 1980-1998:

1. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the ceiling/floor assembly or concealed floor/ceiling space;
2. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the attic, ceiling/roof assembly or concealed roof/ceiling space;
3. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the ceiling/floor assembly or concealed floor/ceiling space and electrical wire and cable insulation was the form of material first ignited;
4. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the attic, ceiling/roof assembly or concealed roof/ceiling space and electrical wire and cable insulation was the form of material first ignited;
5. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the crawl space or substructure space;
6. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the wall assembly or concealed wall space;
7. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the crawl space or substructure space and electrical wire and cable insulation was the form of material first ignited, and
8. selected non-residential structure fires in which fixed wiring was involved in ignitions originating in the wall assembly or concealed wall space and electrical wire and cable insulation was the form of material first ignited.

A complete set of data from those investigations has been published [6], and Table 1 shows an overall summary of the results of these investigations, for the cases where wire and cable insulation was the form of material first ignited. As explained above, the data involves concealed spaces, of which plenums are a subset. The full data are shown in Tables X1 through X4, which present, respectively, the numbers (and percentages) of fires, fire fatalities, fire injuries and property damage losses. Thus, the data showed that wiring in concealed spaces was not responsible for any significant amount of fire losses. Consequently, in particular, metal sheathed wiring, in concealed spaces, including metal sheathed wiring in plenums cannot be responsible for causing large amounts of fire losses, as a total of 7 fire fatalities and 31 fire injuries were recorded over a 19-year period. Cables that were not enclosed in metal raceways were first allowed in plenums in the 1975 edition of the National Electrical Code, suggesting that their widespread use would have been low between 1975 and 1979 (before the statistics). Clearly, no fire fatalities and no fire injuries are acceptable, but the levels seen over the period from 1980 to 1998 are not a cause for excessive concern.

FIRE LOSS STATISTICS FOLLOWING 1998

As discussed above, NFIRS changed its approach to coding after 1998, with the introduction of NFIRS 5.0. It became important, thus, to see whether data following 1998 would show similar trends to data before 1998. Therefore, a new investigation was made more recently (August 2006) by Marty Ahrens [4], looking at four cases, for the years 1999 to 2003.

1. selected non-residential structure fires in which unclassified (other) electrical wiring was involved in ignitions originating in the ceiling/floor assembly or crawl space between stories;
2. selected non-residential structure fires in which unclassified (other) electrical wiring was involved in ignitions originating in the attic, vacant or crawl space above the top story or concealed roof/ceiling space;
3. selected non-residential structure fires in which unclassified (other) electrical wiring was involved in ignitions originating in the ceiling/floor assembly or crawl space between stories and electrical wire or cable insulation was the item first ignited, and
4. selected non-residential structure fires in which unclassified (other) electrical wiring was involved in ignitions originating in the attic, vacant or crawl space above the top story or concealed roof/ceiling space and electrical wire or cable insulation was the item first ignited.

Table 2 shows an overall summary of the results of these newer investigations. The statistics shown in Table 2 indicate that there were no fire fatalities and no fire injuries associated with fires in which "unclassified electrical wiring" were involved in concealed spaces, irrespective of whether electrical wire or cable insulation was or was not the item first ignited. This data is of a limited scope in that it covers only a five-year period, but it is important enough in that it shows no large losses (and very few fires altogether). In fact, a total of only 659 fires (just over 130 per year) occurred between 1999 and 2003 [7].

It is also important to place the data in Table 2 into perspective with regard to non residential USA structure fire issues. Data obtained from the NFPA Fire Analysis and Research Division on the overall problem, and shown in Table 3, indicate that there were 715 fire fatalities in non residential structures over the five years from 1999 to 2003 (including the 100 fire fatalities at the Station night club fire in West Warwick, RI, in 2003 and excluding the 2,451 civilian fire fatalities associated with the terrorist attacks of September 11, 2001). It also shows a total of 688,500 fires. It is important to point these numbers out, since the overwhelming numbers of fires and of fire fatalities occur in homes. In fact, in the USA over 3,000 civilians lose their lives in over 300,000 fires every year (see Table 4). Note also that the property damage values in Tables 1 and 2 are shown in thousands of dollars while those in Tables 3 and 4 are shown in millions of dollars.

CABLE USAGE AND FIRE LOSSES IN PLENUMS

The barrier that separates plenums from the rooms below are not required to exhibit high fire resistance ratings (they are typically 15 minute ratings). This means that fires penetrate quite easily from plenums into the rooms below. In spite of this, fires starting in plenums (or in cables in plenums) have not caused severe fire losses. Table 5 and the Figure included show the usage of AC cables and MC cables since 1990, showing a steady growth (especially for MC cables), from over 500 million feet in 1990 to over 1.5 billion feet in 2003. This three-fold growth in metal sheathed cable usage was not accompanied by an increase in fire fatalities. Moreover, the fire record indicates that between 1975, when cables in plenums outside metal raceways virtually did not exist, until 1998, by which time there were some 20 billion feet of installed plenum cables in the USA [8], the numbers of non residential structure fires actually decreased [7]. This indicates that the fire risk associated with cables in plenums must be low (as fire risk is associated with the combination of fire hazard and fire losses).

CONCLUSIONS

Fires associated with metal sheathed cables in concealed spaces have not been and continue not being a serious problem in the USA.

REFERENCES

1. NFPA 70, "National Electrical Code (NEC)", National Fire Protection Association, Quincy, MA.
2. NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems", National Fire Protection Association, Quincy, MA.
3. Ahrens, M., "Statistics of Non Residential Structure Fires in Which Fixed Wiring Was Involved in Ignitions, 1980-1998", Report to GBH International, National Fire Protection Association, Quincy, MA, 2001.
4. Ahrens, M., "Concealed Space Wiring Structure Fires in Selected Non Residential Occupancies, 1999-2003", Report to GBH International, National Fire Protection Association, Quincy, MA, August 2006.
5. National Armored Cable Manufacturers Association (NACMA) data, based on UL Armored and Metal-Clad Cable Certification Marks released, and machine footage reported, 2008.
6. Hirschler, M.M., "Statistics of Fires Involving Wire and Cable in Concealed Spaced and the Associated Fire Hazard and Fire Risk", in Proc. Fire Retardant Trends and Advances, Fall Fire Retardant Chemicals Association Technical Meeting, Oct. 14-16, 2001, pp. 1-19, FRCA, Lancaster, PA.
7. Hirschler, M.M., "Fire Losses, Fire Hazard & Fire Risk Associated with Plenum Cables", Proc. Interflam'2007, pp. 1129-37, London, UK, September 3-5, 2007, Interscience Communications, London, UK.
8. NFPA Air Conditioning Technical Committee Task Group Report, March 1998.

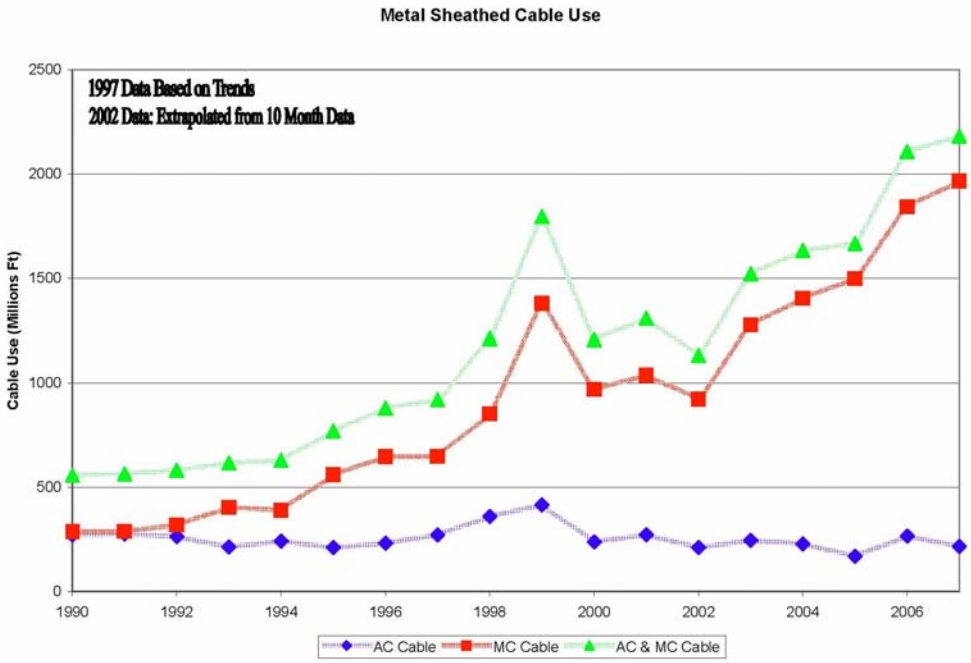
Metal Sheathed Cable Use
1997 Data Based on Trends
2002 Data: Extrapolated from 10 Month Data
Cable Use (Millions Ft)
2500
2000
1500
1000
500
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
AC Cable
MC Cable
AC & MC Cable

Table 1 - Summary of four studies of selected non-residential structure fires in which fixed wiring was involved in ignitions originating in a concealed space and electrical wire or cable insulation was the form of material first ignited, by year (1980-1998)

(Total Cumulative Losses)

Years: 1980-1998	**Fires**	**Civilian Deaths**	**Civilian Injuries**	**Property Damage (thousands of $)**
Totals	7422	7*	31	$213,061
Averages	390.6	0.4	1.6	$11,214
Under Floor Space				
Totals	1,219	0	2	$78,825
Averages	64.2	0.0	0.1	$4,149
Above Ceiling Space				
Totals	3,190	7	16	$92,455
Averages	167.9	0.4	0.8	$4,866
Crawl Space				
Totals	930	0	6	$12,857
Averages	48.9	0.0	0.3	$677
Wall Assembly Space				
Totals	2,083	0	7	$28,924
Averages	109.6	0.0	0.4	$1,522

*The 7 fatalities occurred in 1981 (4) and 1992 (3). Official details obtained by NFPA relating to 2 of those fires, resulting in 3 fatalities, follow.

1981: A short circuit in fixed wiring (BX cable) ignited rubber insulation on a wire in a concealed space above a roof in a bar and grill establishment in New York. The building had a new roof assembly over the old, which created the void where the fire started. The victim was sleeping in a basement apartment, after the flame spread through the attic.

1992: An electric short ignited the wire insulation in a drop ceiling area of a small grocery store in Ohio that was closed for the night. Following previous threats to the store owner, the store was heavily locked with bars and deadbolts. No smoke alarms were present. The fire was not noticed until the entire ceiling space was involved, and the fire broke out and spread throughout the store. Two male occupants, employed as security guards, were trapped and died of smoke inhalation as numerous security precautions delayed their escape.

Table 2 – Summary of Four Studies of Selected Non-Residential Structure Fires In which Unclassified (Other) Wiring Was Involved in Ignitions Originating in a Ceiling/Floor Assembly or Crawl Space Between Stories or in an Attic, Vacant or Crawl Space Above the Top Story or Concealed Roof/Ceiling Space by Year: 1999-2003 (Total Cumulative Losses)				
Years: 1980-1998	**Fires**	**Civilian Deaths**	**Civilian Injuries**	**Property Damage (thousands of $)**
Electrical Wire or Cable Insulation Was Material First Ignited				
Totals	173	0	0	$8,580
Averages	34.6	0	0	$1,716
All Fires				
Totals	659	0	0	$11,251
Averages	131.8	0	0	$2,250
Ceiling/Floor Assembly or Crawl Space Between Stories - Electrical Wire or Cable Insulation Was Material First Ignited				
Totals	136	0	0	$7,218
Averages	27.2	0	0	$1,444
Attic, Vacant or Crawl Space Above the Top Story or Concealed Roof/Ceiling Space - Electrical Wire or Cable Insulation Was Material First Ignited				
Totals	37	0	0	$1,362
Averages	7.4	0	0	$272
Ceiling/Floor Assembly or Crawl Space Between Stories - All Fires				
Totals	257	0	0	$5,278
Averages	51.4	0	0	$1,056
Attic, Vacant or Crawl Space Above the Top Story or Concealed Roof/Ceiling Space - All Fires				
Totals	402	0	0	$5,973
Averages	80.4	0	0	$1,195

Note: Table 2 shows the estimated number of non-confined structure fires (incident type 110-129, except 113-118) in selected nonresidential properties (property use 100-399 and 500-899) in which unclassified (other) electrical wiring (equipment involved in ignition 210) was involved in ignitions in ceiling and floor assemblies or crawl spaces between stories (area of origin 73) or in attics, vacant or crawl spaces above the top story, cupolas, concealed roof/ceiling spaces and steeples (area of origin 74). Fires in special properties and fires in unclassified or unknown-type properties (property use 900-999, and 000-009, respectively) are excluded from this analysis. Fires, civilian deaths, and civilian injuries are rounded to the nearest one; direct property damage is rounded to the nearest thousand dollars. The table is also separated in terms of electrical wire or cable insulation (item first ignited 81) being the material first ignited.

Table 3 – Non-Home Structure Fire Losses in the USA, by Year

Year	Fires	Civilian Deaths	Civilian Injuries	Property Damage[1]
				(millions of dollars)
1977	374,500	640[2]	4,670	$2,088
1978	355,500	335	4,585	$1,928
1979	340,000	470	6,025	$2,587
1980	331,000	475	5,025	$2,606
1981	316,500	360	6,575	$2,848
1982	292,000	380	5,125	$2,584
1983	243,000	420	5,400	$2,621
1984	242,500	450	4,275	$2,529
1985	253,500	380	4,175	$2,744
1986	234,500	330	4,175	$2,373
1987	221,500	310	3,850	$2,627
1988	206,500	325	4,200	$3,291
1989	189,500	320	3,750	$3,642
1990	169,500	350[3]	3,850	$2,556
1991	176,000	265	3,700	$2,857
1992	178,500	235	3,225	$3,182
1993	163,500	260	4,550[4]	$2,642
1994	176,000	165	3,650	$2,652
1995	159,500	345[5]	3,075	$3,356
1996	161,500	185	3,000	$3,064
1997	156,500	150	3,075	$2,634
1998	148,000	200	2,625	$2,444
1999	152,000	145	2,475	$3,525
2000	137,500	115	2,625	$2,976
2001[6]	138,000	110	2,025	$3,358
2002	130,000	105	1,950	$2,811
2003	131,000	240[7]	1,950	$2,729[8]
2004	130,500	115	1,825	$2,481
2005	130,000	75	2,025	$2,464
2006	128.000	125	1,850	$2.804

Table notes and table overall footnote:

[1] Individual incidents with large loss can affect the total for a given year. Note the following:
[2] Includes 165 deaths at the Beverly Hills Supper Club fire in Southgate, KY
[3] Includes 87 deaths at the Happy Land social club fire in New York City, NY
[4] Includes 1,024 injuries at the 1993 (not 2001) World Trade Center fire and explosion in New York City, NY
[5] Includes 168 deaths that occurred at the federal office building fire in Oklahoma City, OK.
[6] Does not include the events of 9/11/01, where there were 2,451 civilian deaths, 800 civilian injuries and $33.44 billion in property loss.
[7] This includes 100 fire deaths in the Station Nightclub Fire in Rhode Island and 31 deaths in two nursing home fires in Connecticut and Tennessee.
[8] This does not include the Southern California Wildfires.

The 1988 figure includes a Norco, Louisiana, petroleum refinery with a loss of $330 million. The 1989 figure includes a Pasadena, Texas, polyolefin plant with a loss of $750 million. The 1995 figures includes an Oklahoma City, OK, office building with a loss of $135 million, a Georgia manufacturing plant fire with a loss of $200 million and a Massachusetts industrial complex fire with a loss of $500 million. The 1992 figure includes the Los Angeles Civil Disturbance with a loss of $567 million.

Table 4 – Home Structure Fire Losses in the USA, by Year

Year	Fires	Civilian Deaths	Civilian Injuries	Property Damage[1] (millions of dollars)
1977	723,500	5,865	21,640	$2,037
1978	706,500	6,015	20,400	$2,094
1979	696,500	5,500	18,825	$2,377
1980	734,000	5,200	19,700	$2,848
1981	711,000	5,400	19,125	$3,128
1982	654,500	4,820	20,450	$3,147
1983	625,500	4,670	20,750	$3,205
1984	605,500	4,075	18,750	$3,362
1985	606,000	4,885	19,175	$3,693
1986	565,500	4,655	18,575	$3,464
1987	536,500	4,570	19,965	$3,599
1988	538,500	4,955	22,075	$3,897
1989	498,500	4,335	20,275	$3,876
1990	454,500	4,050	20,225	$4,157
1991	464,500	3,500	21,275	$5,463[1]
1992	459,000	3,705	21,100	$3,775
1993	458,000	3,720	22,000	$4,764[2]
1994	438,000	3,425	19,475	$4,215
1995	414,000	3,640	18,650	$4,264
1996	417,000	4,035	18,875	$4,869
1997	395,500	3,360	17,300	$4,453
1998	369,500	3,220	16,800	$4,273
1999	371,000	2,895	16,050	$4,965
2000	368,000	3,420	16,975	$5,525
2001	383,500	3,110	15,200	$5,516
2002	389,000	2,670	13,650	$5,931
2003	388,500	3,145	13,650	$5,949[3]
2004	395,500	3,190	13,700	$5,833
2005	381,000	3,030	13,300	$6,729
2006	396,000	2,580	12,500	$6,832

[1] Includes $1.5 billion in damage caused by the Oakland Fire Storm, most of which was lost to homes but for which no detailed breakdown by property type was available.
[2] Includes $809 million in damage caused by Southern California wildfires.
[3] Does not include the Southern California wildfires.

Table 5 - Usage of Metal Sheathed Cables (millions of feet)

Year	AC Cables	MC Cables	Total
1990	270	287	557
1991	275	288	564
1992	263	319	582
1993	213	403	616
1994	240	389	630
1995	210	559	770
1996	232	647	878
1997[1]	271	648	920
1998	359	852	1211
1999	415	1380	1795
2000	237	970	1207
2001	271	1037	1308
2002[2]	210	923	1132
2003	245	1276	1521
2004	228	1404	1632
2005	169	1498	1666
2006	265	1842	2108
2007	216	1966	2182

[1] 1997 data missing – Estimated from averages of 1990 through 2001.
[2] 2002 data: two months missing – Estimated from the data for remaining 10 months

Table X1. NFPA Statistics of Fires in Non Residential Concealed Space Structures Involving Ignition of Fixed Wiring With and Without Wire or Cable Insulation as Material First Ignited

	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#		#	%	#	
1977	348,000								
1978	331,500								
1979	315,000								
1980	307,500	619	0.20	173	0.06	309	0.10	77	0.03
1981	294,500	647	0.22	166	0.06	223	0.08	73	0.02
1982	270,500	707	0.26	185	0.07	246	0.09	67	0.02
1983	227,000	611	0.27	178	0.08	223	0.10	70	0.03
1984	225,000	617	0.27	201	0.09	243	0.11	86	0.04
1985	237,500	748	0.31	199	0.08	267	0.11	80	0.03
1986	218,500	640	0.29	167	0.08	271	0.12	49	0.02
1987	206,500	652	0.32	202	0.10	232	0.11	85	0.04
1988	192,500	646	0.34	221	0.11	205	0.11	65	0.03
1989	174,500	503	0.29	135	0.08	178	0.10	59	0.03
1990	157,000	523	0.33	147	0.09	182	0.12	64	0.04
1991	162,500	457	0.28	135	0.08	140	0.09	50	0.03
1992	165,500	557	0.34	134	0.08	136	0.08	51	0.03
1993	151,500	484	0.32	159	0.10	156	0.10	67	0.04
1994	163,000	534	0.33	185	0.11	196	0.12	70	0.04
1995	148,000	496	0.34	171	0.12	128	0.09	54	0.04
1996	150,500	487	0.32	148	0.10	131	0.09	50	0.03
1997	145,500	484	0.33	153	0.11	162	0.11	59	0.04
1998	136,000	546	0.40	131	0.10	111	0.08	43	0.03
1980-98	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#	%	#	%	#	%
Avg	196,500	577	0.29	168	0.09	197	0.10	64	0.03
Totals	3,733,500	#: 10,958		#: 3190		#: 3,739		#: 1219	

Table X2. NFPA Statistics of Fire Fatalities in Non Residential Concealed Space Structure Fires Involving Ignition of Fixed Wiring With and Without Wire or Cable Insulation as Material First Ignited

	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#	%	#	%	#	%
1977	370								
1978	165								
1979	205								
1980	229	0	0	0	0	0	0	0	0
1981	220	4	1.82	4	1.82	0	0	0	0
1982	260	0	0	0	0	0	0	0	0
1983	270	0	0	0	0	0	0	0	0
1984	285	0	0	0	0	0	0	0	0
1985	240	0	0	0	0	0	0	0	0
1986	215	0	0	0	0	0	0	0	0
1987	220	0	0	0	0	0	0	0	0
1988	215	0	0	0	0	0	0	0	0
1989	220	0	0	0	0	0	0	0	0
1990	285	0	0	0	0	0	0	0	0
1991	190	0	0	0	0	0	0	0	0
1992	175	3	1.71	3	1.71	0	0	0	0
1993	155	0	0	0	0	0	0	0	0
1994	125	0	0	0	0	0	0	0	0
1995	290	0	0	0	0	0	0	0	0
1996	140	0	0	0	0	0	0	0	0
1997	120	0	0	0	0	0	0	0	0
1998	170	4	2.35	0	0	0	0	0	0
1980-98	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#	%	#	%	#	%
Avg	211.8	0.58	0.27	0.17	0.08	0	0		0
Totals	4,024	#: 11		#: 7		#: 0		#: 0	

Table X3. NFPA Statistics of Fire Injuries in Non Residential Concealed Space Structure Fires Involving Ignition of Fixed Wiring With and Without Wire or Cable Insulation as Material First Ignited

	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#		#	%	#	%
1977	3710								
1978	3725								
1979	4400								
1980	3625	0	0	0	0	0	0	0	0
1981	5325	0	0	0	0	0	0	0	0
1982	4475	22	0.49	0	0	0	0	0	0
1983	4700	0	0	0	0	0	0	0	0
1984	3750	0	0	0	0	2	0.05	0	0
1985	3525	0	0	0	0	0	0	0	0
1986	3725	2	0.05	0	0	0	0	0	0
1987	3375	4	0.12	2	0.06	4	0.12	0	0
1988	3675	2	0.05	0	0	0	0	0	0
1989	3275	13	0.40	7	0.21	0	0	0	0
1990	3425	3	0.09	0	0	0	0	0	0
1991	3125	2	0.06	0	0	0	0	0	0
1992	2725	5	0.18	0	0	3	0.11	0	0
1993	3950	9	0.23	5	0.13	6	0.15	0	0
1994	3100	2	0.06	2	0.06	2	0.06	0	0
1995	2600	0	0	0	0	0	0	0	0
1996	2575	2	0.08	0	0	2	0.08	0	0
1997	2600	0	0	0	0	2	0.08	2	0
1998	2250	0	0	0	0	0	0	0	0
1980-98	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#		#	%	#	%
Avg	3,463	3.47	0.10	0.84	0.02	1.11	0.03	0.11	0.00
Totals	65,800	#: 66		#: 16		#: 21		#: 2	

Table X4. NFPA Statistics of Fire Losses in Non Residential Concealed Space Structure Fires Involving Ignition of Fixed Wiring With and Without Wire or Cable Insulation as Material First Ignited (Values in Millions of Dollars)

	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		#	%	#	%	#	%	#	%
1977	$1,946								
1978	$1,830								
1979	$2,435								
1980	$2,412	$15.63	0.65	$3.46	0.03	$17.29	0.72	$9.43	0.03
1981	$2,717	$26.30	0.97	$2.42	0.04	$8.58	0.32	$0.15	0.01
1982	$2,478	$16.38	0.66	$4.70	0.03	$4.30	0.17	$0.05	0.01
1983	$2,520	$12.12	0.48	$3.11	0.02	$7.25	0.29	$0.91	0.01
1984	$2,451	$9.48	0.39	$3.66	0.02	$41.14	1.68	$37.58	0.07
1985	$2,663	$12.76	0.48	$3.40	0.02	$5.61	0.21	$1.47	0.01
1986	$2,281	$28.10	1.23	$5.64	0.05	$9.14	0.4	$0.02	0.02
1987	$2,527	$12.19	0.48	$2.65	0.02	$7.42	0.29	$0.62	0.01
1988	$3,168	$17.67	0.56	$4.78	0.02	$18.05	0.57	$4.97	0.02
1989	$3,520	$15.77	0.45	$6.57	0.01	$8.01	0.23	$3.53	0.01
1990	$2,460	$22.83	0.93	$11.70	0.04	$7.75	0.31	$0.49	0.01
1991	$2,768	$12.39	0.45	$5.14	0.02	$3.80	0.14	$0.87	0.01
1992	$3,077	$18.61	0.6	$2.48	0.02	$2.23	0.07	$0.44	0.00
1993	$2,563	$14.48	0.56	$4.35	0.02	$4.48	0.17	$1.33	0.01
1994	$2,550	$11.41	0.45	$3.44	0.02	$7.71	0.3	$0.69	0.01
1995	$3,257	$15.87	0.49	$8.74	0.02	$7.62	0.23	$0.46	0.01
1996	$2,971	$16.29	0.55	$1.05	0.02	$4.30	0.14	$0.80	0.00
1997	$2,502	$13.13	0.52	$3.85	0.02	$15.15	0.61	$12.71	0.02
1998	$2,326	$25.85	1.11	$11.32	0.05	$6.18	0.27	$2.32	0.01
1980-98	Overall	Roof Conc. Space		Roof Conc. Space W&C		Floor Conc. Space		Floor Conc. Space W&C	
		$	%	$	%	$	%	$	%
Avg	$2,695	$16.70	0.62	$4.90	0.02	$9.80	0.36	$4.10	0.15
Totals	$51,211	#: $ 317		#: $92		#: $186		#: $78	