Incident Summary (5594218) Final

SUPPORTING INFORMATION	Incident Date			May 26, 2016
	Location			Abbotsford
	Regulated industry sector			Electrical – low voltage
	Impact	Injury	Qty injuries	0
			Injury description	N/A
			Injury rating	N/A
		Damage	Damage description	A receptacle and power bar were destroyed in a fire located in the bedroom of a residential townhouse unit. Fire and smoke damage to the bedroom and the basement.
			Damage rating	Moderate
	Incident rating			Moderate
	Incident overview			A fire occurred where a power bar was plugged in to a receptacle. The power bar was used to provide power to a portable heater and other portable electrical equipment located in a bedroom.
INVESTIGATION CONCLUSIONS	Site, system and components			The incident occurred in the basement of one unit of a five unit townhouse building. The basement was unfinished and part of it was being used as a bedroom. The south wall in the bedroom had one 15A, 120V duplex receptacle, and the east wall of the basement had one 15A, 120V duplex receptacle installed for the washer. These were the only two receptacles observed in the basement. Several power bars and extension cords were used to supply power to portable heaters, a hair dryer, a hair straightening iron, lamp, modem, plug in lights, a cell and laptop charger and other portable electrical equipment. Power bars, extension cords and multi-outlet devices are not intended to be used as a substitute for permanent wiring. Power bars, extension cords, a multi-outlet device, and portable equipment were plugged into 15A, 120V rated receptacles and branch circuits connected to 20A rated circuit breakers in the panel. Branch circuit wiring and receptacles are required to be protected by properly rated circuit breakers.
	Failure scenario(s)			The unfinished basement did not have the proper amount of receptacles and circuits required by the BC electrical code in order to be used as a bedroom living space. Power bars and extension cords were used as a substitute for permanent wiring and receptacles to provide power to a portable heater, and other portable electrical equipment for an extended period of time.

		Overtime improper use caused excessive heating at the connection point between the power bar attachment cord and the bedroom wall receptacle. Repeated over heating caused the tension of the receptacle contact parts to weaken and loosen creating a high resistance connection with less contact surface and pressure between the receptacle's contact parts and the power bar's contact blades. This would cause even more heat to build up at these contact points. The power bar cord end's contact blade heated to the point of melting apart creating a series arcing fault between the two points of the melted blade. The connection point between the power bar cord and the receptacle eventually over heated to the point where it melted the plastic molded cord end and ignited the adjacent cord, bedding material, box spring and mattress.
	Facts and evidence	Fire department area of origin determination: - Abbotsford fire department investigators determined the area of origin based on the fire damage and fire patterns was at the head of the bed along the wall in the immediate area of the receptacle. Site observation and photos support this determination (see figure 2 and 3). Witness statements of events leading up to the fire: - The occupants of the dwelling unit indicated the breaker for the basement receptacle circuit had been tripping monthly since occupying the unit over a period of approximately four and a half years. - They also indicated that in the winter time when the portable heaters were used or if the heater was used in combination with the hair dryer and hair straightening iron the breaker tripped more frequently. - The occupants reported smelling an odd burning smell of plastic in the bedroom where the fire occurred two months prior to the incident. Observation of the room and portable equipment used: - There was one 15A, 120V duplex receptacle installed on the south wall of the bedroom adjacent to the bed. - The exterior walls of the bedroom were finished but had no receptacles installed on them. - Five power bars, five extensions cords, and one multi-outlet device were in use throughout the basement area to provide power to heaters, a lamp, a modem, cell phone and laptop chargers, plug in lights, a hair dryer and hair straightening iron (see sketch attached – figure 14). - There was a power bar plugged into the bedroom receptacle. This power bar was involved in the incident. - The power bar involved in the incident was a certified product and approved for use in BC. - One of the power bars and extension cords not involved in the incident showed signs of heat damage (see figure 11 and 12) Electrical system and fire/heat damaged components: - The 15A branch circuit (2 conductor #12 awg aluminum, non-metallic sheathed cable) for the basement that supplied power to the receptacle in the bedroom that

		the power bar was plugged into is connected to a 20A circuit breaker in the panel (see figure 13). - The connection point between the receptacle and power bar on the bedroom wall at the head of the bed was extensively fire and heat damaged (see figure 4 and 5). - When separated from the receptacle one of the cord end attachment blades remained inside the receptacle (see figure 6 and 7). - The separated attachment blade is missing approximately 5mm of length (see figure 8). - The separated blade has a bulb formed on the exposed end indicating a high heat condition occurred at this point (see figure 7). - The plastic attachment cord end where the blade detached also has a bulb formed indicating a high heat condition occurred at this point as well (see figure 9 and 10).
	Causes and contributing factors	The cause of this incident is very likely an overheated connection between a receptacle and a power bar that was being used as a substitute for permanent wiring and was being overloaded over an extended period of time. The oversized 20A circuit breaker contributed by not providing the proper protection for the 15A circuit, receptacle, and portable equipment plugged into it. The breaker may have been installed by an unqualified person in an effort to solve a perceived nuisance breaker tripping problem. Failure of the occupants to recognize the warning signs related to tripping breakers and a burning plastic smell were also contributing factors.

Figure 1 - Unit where the fire occurred (red arrow).

Figure 2 – Basement bedroom and area of origin determined by fire department investigators (red outline). Box spring only - the mattress was removed by fire fighters at the time of the fire.

Figure 3 - Receptacle on the wall at the head of the bed where the fire originated (red arrow).

Figure 4 - Power bar cord end plugged into the wall receptacle at the head of the bed (red arrow).

Figure 5 - bedroom receptacle with power bar cord plugged into the bottom outlet (red arrow). This is the point of origin.

Figure 6 - receptacle with cord end removed. Cord end blade remained in the receptacle (red arrow).

Figure 7 - Receptacle removed from the outlet box. One of the cord end blades remains in the receptacle. A bulb is formed on the end of the receptacle blade (red arrow) indicating a high heat condition.

Figure 8 - Receptacle, cord end, and cord blade removed from the receptacle. Red arrow shows where the cord end blade was detached from the cord end. Red oval shows the receptacle opening where the blade was removed from.

Figure 9 - cord end with the detached blade. The red arrow shows where the blade was connected and the bulb on each end of the blade and attachment cord indicating a high heat condition occurred.

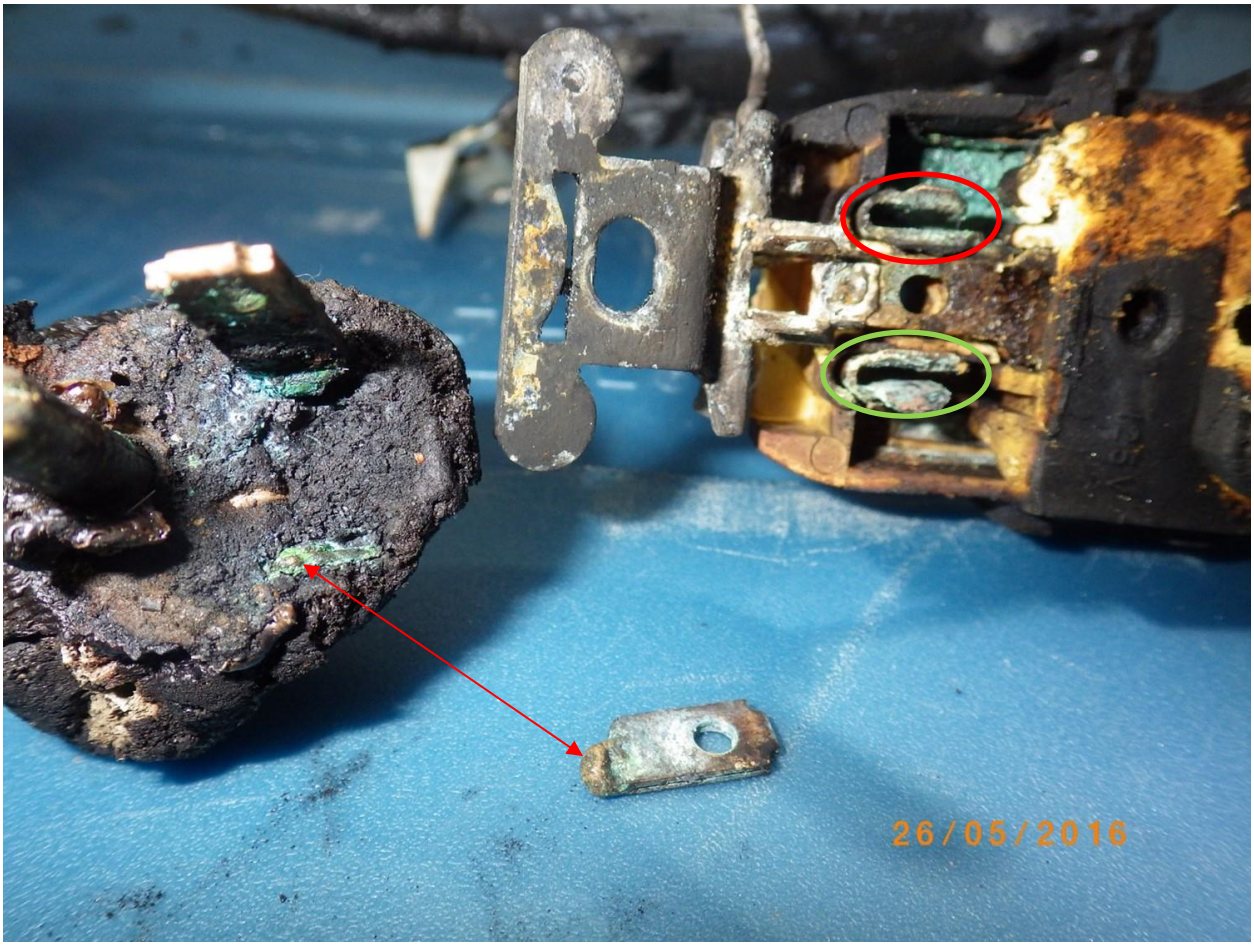

Figure 10 – The cord end, detached blade, and receptacle. The red arrow shows where the blade was attached to the cord end. The blade and the cord end have bulbs where the blade detached (red arrow) indicating a high heat condition occurred. This is the point of origin.

The receptacle opening where the blade was inserted (red oval) appears to be more open than the lower receptacle opening (green oval) indicating possibly a loose connection between the cord end blade and the receptacle creating a high resistance condition.

Figure 11 - One of the other power bars used in the bedroom shows signs of heat damage at one of the outlets (red arrow). This was likely caused by over loading of the power bar in the bedroom area. This example shows the improper use of power bars in the bedroom area.

Figure 12 - One of the extension cords used in the bedroom shows signs of heat and discoloration on the cord end (red arrows). This was likely caused by over loading of the extension cord in the bedroom area. This example shows the improper use of extension cords in the bedroom area.

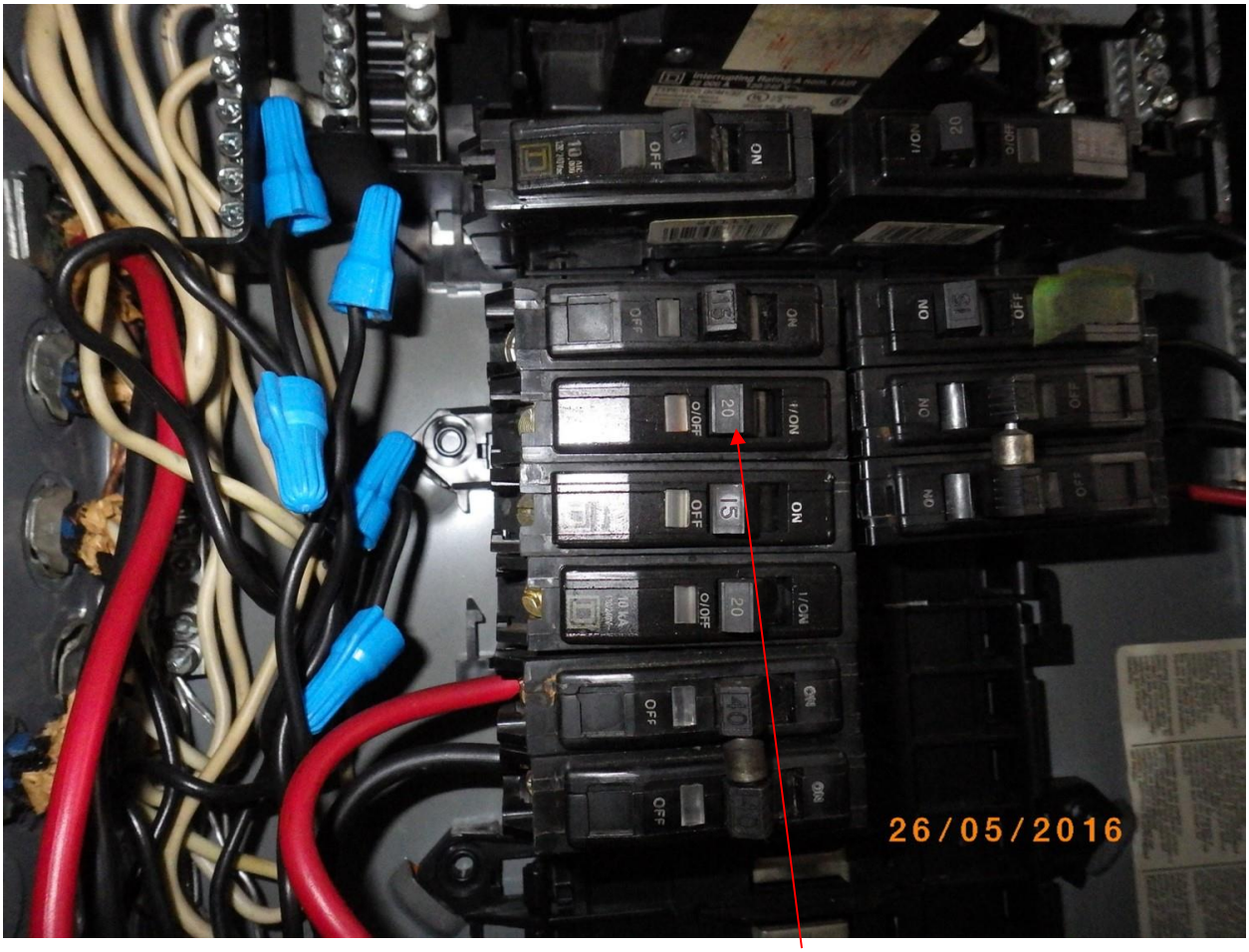

Figure 13 – This photo shows the circuit breakers in the electrical panel located in the basement of this unit. The circuits were previously disconnected from breakers by the restoration company's electrician to make the site safe. Circuit #7 (20A rated circuit breaker) was the circuit connected to the basement receptacle circuit (red arrow). This circuit breaker was over sized for the 15A rated branch circuit wiring and receptacle.

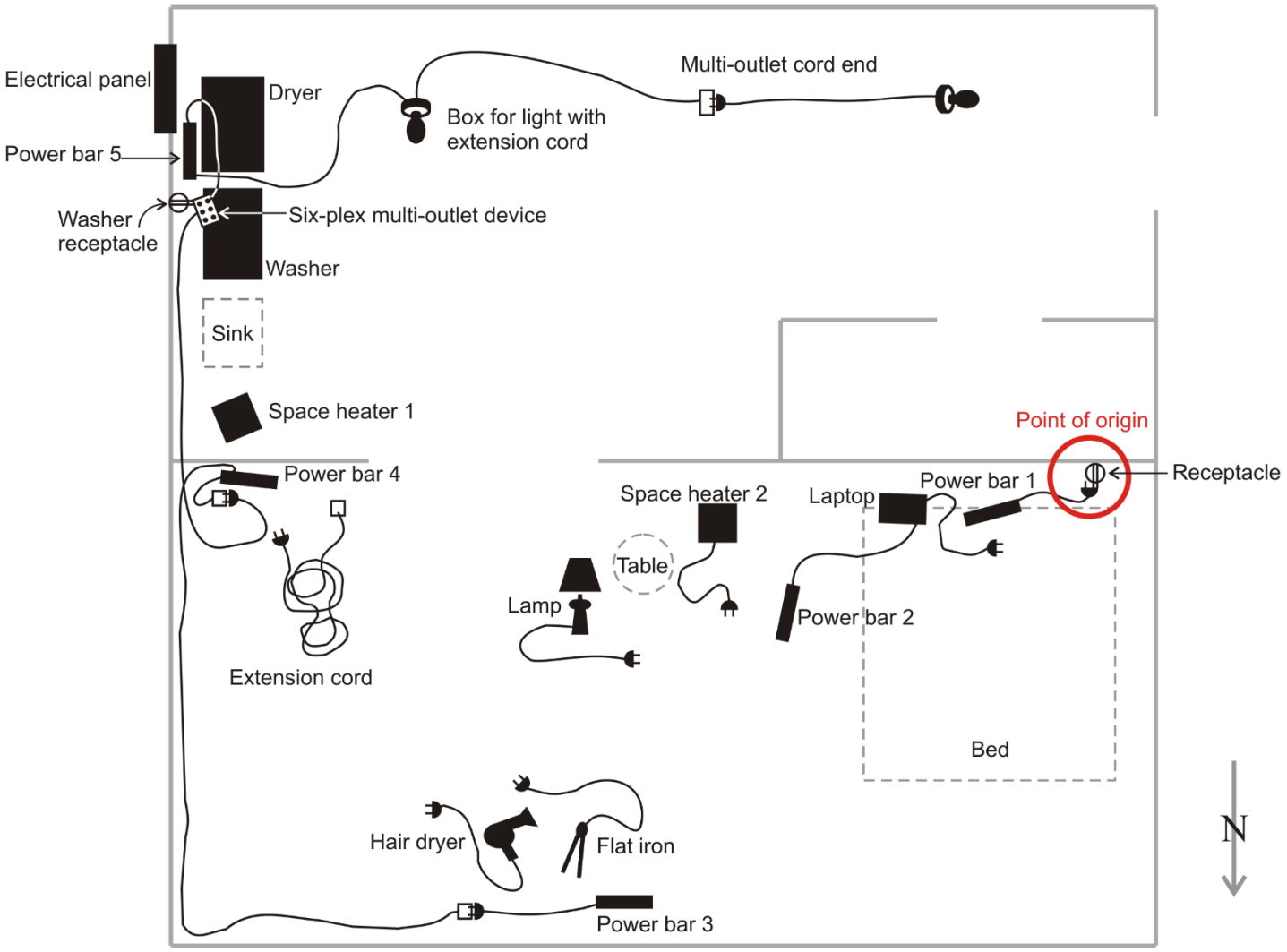

Figure 14 - Sketch of the incident scene - basement and bedroom area. Not to scale.