



Three farm workers killed in 15-passenger van rollover

On March 7, 2007, at about 06:20, a 15-passenger van owned by RHA Enterprises Ltd. carrying 16 farm workers plus the driver was travelling east on Highway 1 to Rainbow Greenhouses Inc. in Chilliwack, B.C. The vehicle collided with two transport trucks, rolled, and landed on its roof on the highway median (see Figure 1). Three workers were killed and 14 others injured.



Figure 1: The van after the incident.

Purpose of this report

The purpose of this online incident investigation report is to identify the causes and contributing factors of this incident to help prevent similar incidents and to support preventive actions by industry and WorkSafeBC. This online version is not the official WorkSafeBC report. It has been edited to remove personal identifying information and to focus on the main causes and underlying factors contributing to this incident.

Notice of Incident information

Number: 2007137101997

Outcome: Fatal (3 workers); injuries (14 workers)

Core activity: Farm labour supply

Region: Lower Mainland

Date of incident: March 2007

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1 Factual Information

1.1 Firms

Four firms were involved in this incident.

1.1.1 *RHA Enterprises Ltd.*

Driver 1/Worker 1 is the principal of RHA Enterprises Ltd., a labour supply company providing workers to Fraser Valley farms. This company has been operating in the Fraser Valley and providing Rainbow Greenhouses Inc. with workers for about three years. Driver 4 runs most of the firm's day-to-day business. RHA owns four vehicles that are used to transport workers: two 15-passenger full-size vans and two 7-passenger caravans. Driver 1/Worker 1 and Driver 4 normally use two vehicles at a time to transport workers. Other drivers and vehicles are used when needed. Driver 4 looks after the vehicle maintenance.

1.1.2 *Rainbow Greenhouses Inc.*

Rainbow Greenhouses Inc. has been in greenhouse operations for about 20 years. It employs about 150 full-time workers in a non-union workplace. Temporary workers are brought in as required from different labour contractors in the Fraser Valley. Rainbow Greenhouses has a verbal contract with RHA Enterprises: only a phone call is required to arrange for temporary workers on a day-to-day basis. For the day of the incident, the Rainbow Principal said that he had requested 24 workers from RHA Enterprises.

Rainbow Greenhouses does not keep records of which workers worked at its greenhouse on any given day. RHA Enterprises is paid for the total hours worked by all the temporary workers. RHA Enterprises in turn pays an hourly wage to the workers. The workers are not compensated for travel time, only for the hours worked.

1.1.3 *Mid-Valley Sand & Gravel Ltd.*

Mid-Valley Sand & Gravel Ltd. conducts a business in sand and gravel. At the time of the incident, Driver 2 was operating a dump truck and trailer owned by Mid-Valley Sand & Gravel. Driver 2 was not injured in the incident.

1.1.4 *Amix Salvage & Sales Ltd.*

Amix Salvage & Sales Ltd. conducts business in salvage and recycling. It operates a fleet of trucks and both mobile and fixed car crushers. At the time of the incident, Driver 3 was operating a flatbed truck carrying a box and trailer unit owned by Amix Salvage & Sales. Driver 3 was not injured in the incident.

1.2 Sequence of events

On March 7, 2007, Driver 1/Worker 1 set out in Vehicle 1, a 15-passenger van owned by RHA Enterprises, to pick up temporary farm workers. Between 05:00 and 06:10, she picked up Workers 2 to 17 from different locations in Abbotsford. See Figure 2 for workers' seating in the van. After the last worker was picked up, Vehicle 1 started on the trip to Rainbow Greenhouses in Chilliwack. Driver 1/Worker 1 accessed Highway 1 east at the McCallum on-ramp. Vehicle 1 entered Highway 1 ahead of Vehicle 3, the flatbed truck and trailer owned by Amix Salvage & Sales. Vehicle 3 was travelling east at a speed of about 90 kilometres per hour.

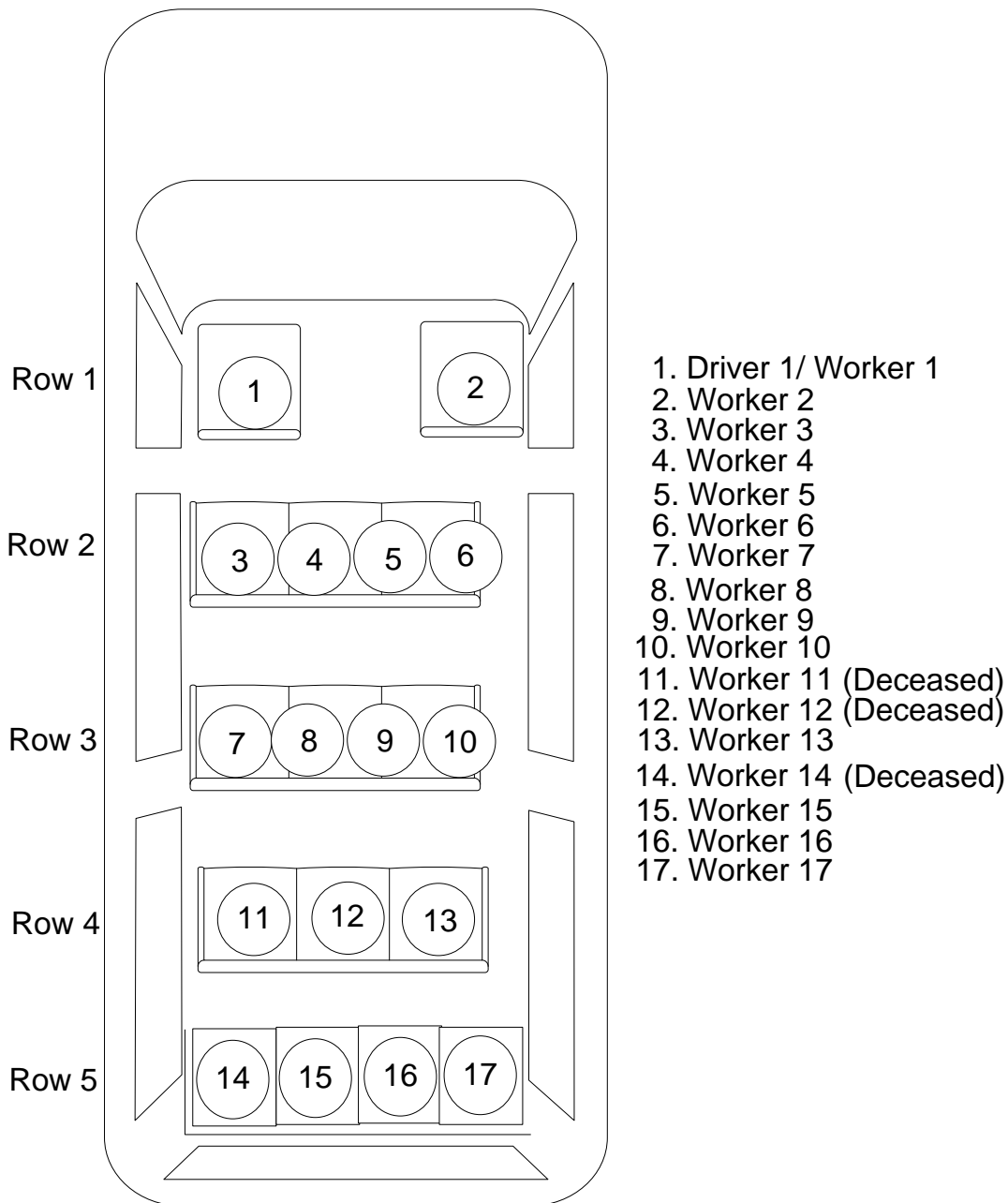


Figure 2: Seating locations of workers on the day of the incident.

At about 06:20, Vehicle 1 was travelling east in the curb lane of Highway 1 at approximately 90 km/h beside Vehicle 2, a dump truck and trailer owned by Mid-Valley Sand & Gravel. Vehicle 2 was also travelling east at approximately 90 km/h (see Figure 3) in the centre lane beside Vehicle 1.

Shortly after, as Vehicle 1 approached a concrete overpass, it moved on to the road shoulder heading towards the curb and guardrails (see Figure 4). Driver 1/Worker 1 attempted to correct the van's path by steering Vehicle 1 to the left. Vehicle 1 then struck the front right end of the trailer of Vehicle 2 (see Figure 5). Vehicle 1 then slowed down and moved back into the curb lane.

As Vehicle 1 slowed down, it was struck from behind by Vehicle 3 (see Figure 6). Vehicle 1 rolled and landed upside down on the centre median (see Figure 7). First responders from the Abbotsford fire department reported that when they arrived at the scene they found Vehicle 1 upside down on the highway median. Occupants were either inside the van or hanging out through the windows and doors.

Other motorists and emergency services attended to the occupants of Vehicle 1. Workers 11, 12, and 14 died. The other 14 workers in Vehicle 1 were injured and sent to hospital. Most sustained serious injuries.

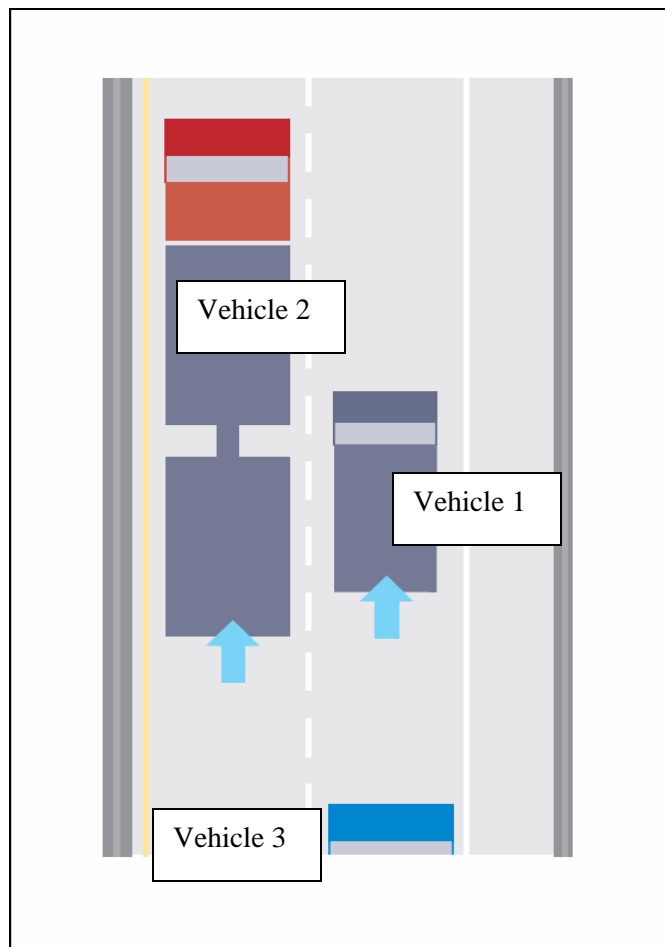


Figure 3: Position of the three vehicles before the incident.

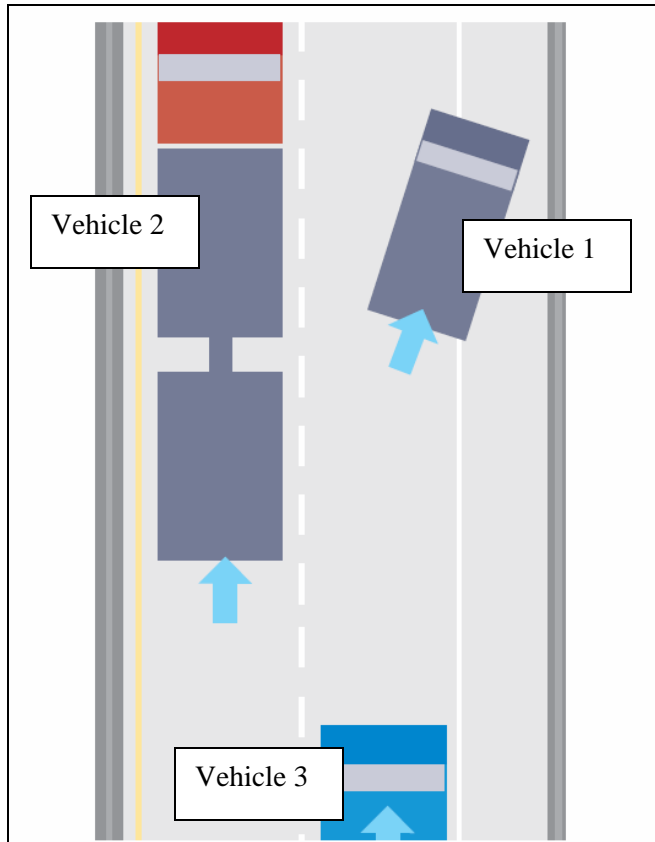


Figure 4: Vehicle 1 moved to the right.

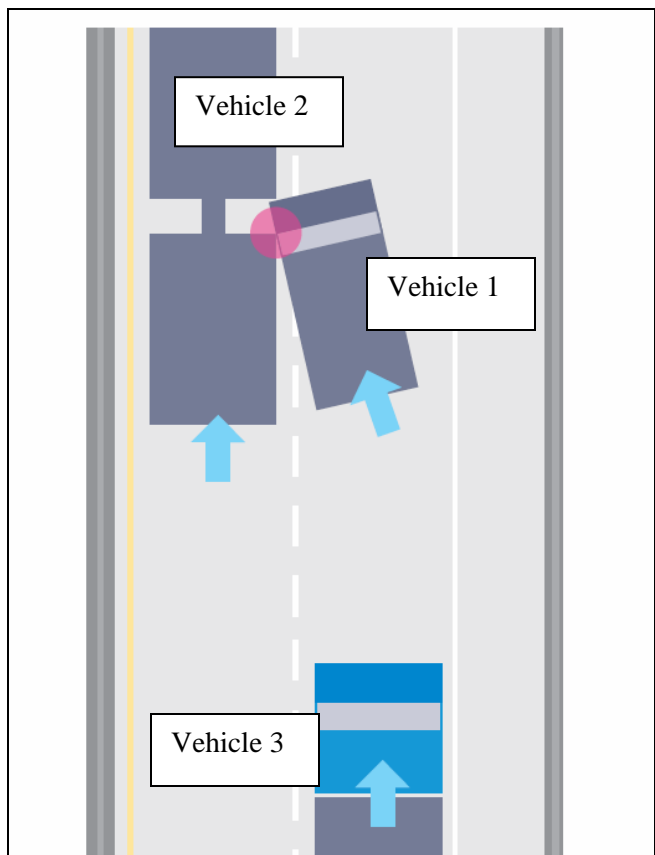


Figure 5: Vehicle 1 steered too far to the left and hit the trailer of Vehicle 2.

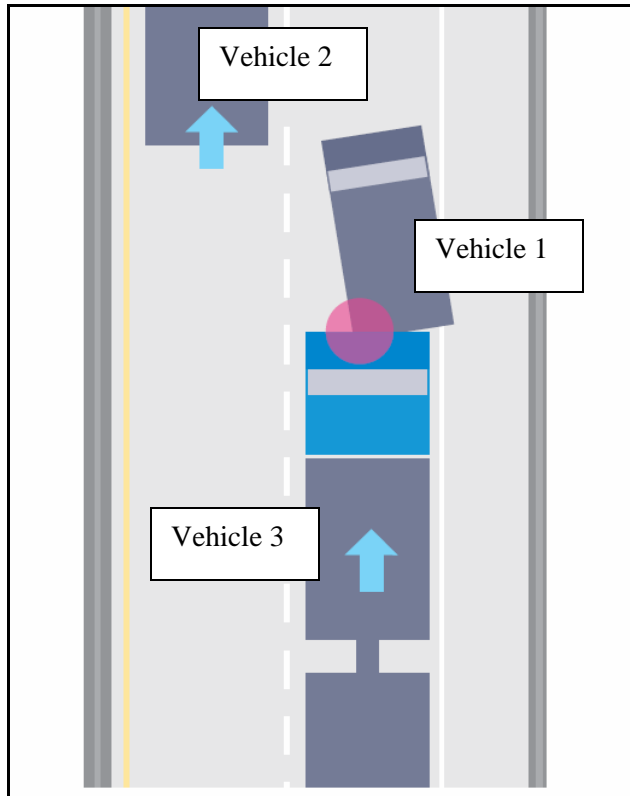


Figure 6: Vehicle 1 slowed down and was struck from behind by Vehicle 3.

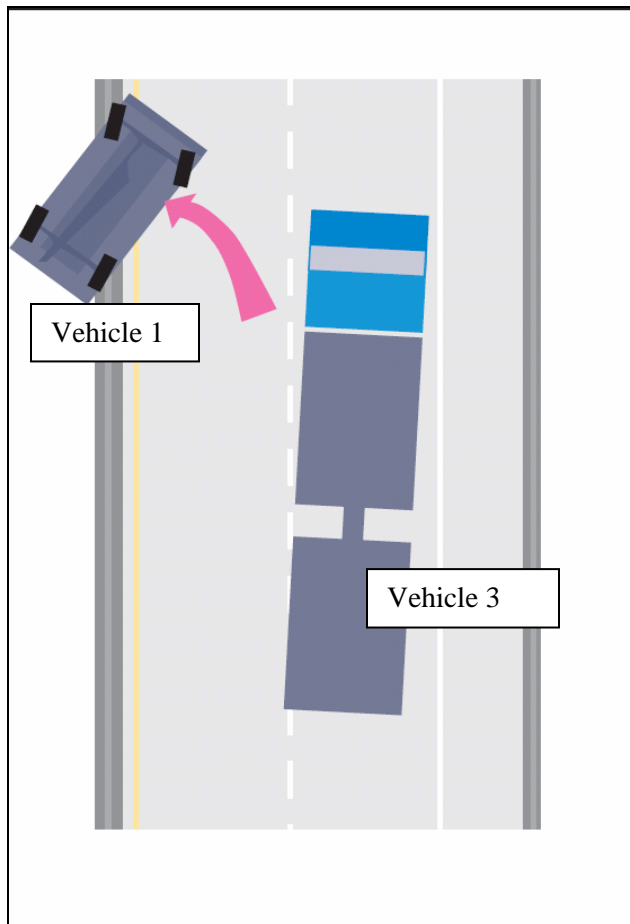


Figure 7: Vehicle 1 rolled and landed upside down on the median.

1.3 Incident site

The incident occurred on Highway 1 eastbound on a concrete overpass just before the Highway 11 exit. The road has a downward slope of 6 percent just before the overpass. The road shoulder widens to about 10 feet over the concrete overpass (see Figure 8).

It was raining heavily. Visibility was poor. The roads were wet. Rainwater was flowing down the slope at the entrance to the concrete overpass.



Figure 8: The concrete overpass, showing the road shoulder.

1.4 Vehicle 1

Vehicle 1 was a 15-passenger Dodge Ram 350 van manufactured in May 1998. The odometer read 377,437 kilometres. The vehicle was equipped with a factory compliance plate (see Figure 9). RHA Enterprises purchased Vehicle 1 in 2004.

Vehicle 1 was registered as a commercial vehicle. It had a seating capacity of 15: a driver and 14 passengers. At the time of the incident, the vehicle was carrying 17 people. Vehicle 1 was registered with the Insurance Corporation of British Columbia (ICBC) in rate class 670. This rate class includes passenger vehicles with a capacity of 2 to 21 passengers inclusive.



Figure 9: Compliance plate.

The WorkSafeBC engineer and lead investigator inspected Vehicle 1’s condition after the incident. The following sections describe their findings.

1.4.1 Braking system/components

The vehicle was equipped with a vacuum-assisted power hydraulic anti-lock braking system (ABS) with front disc and rear drum brakes. There was no evidence of fluids leaking around the brakes. The front disc surfaces were not scored. The condition of the brakes was not a factor in the incident.

The parking brake was the foot-actuated type, with a parking brake pedal located to the left of the main brake pedal, next to the left kick panel. The parking brake applied and released normally when tested.

1.4.2 Tires

Both the left and right front tires were LT245/75R16 LRE Bridgestone, M773 SWP II, M+S radial tires. Each tire had a tread depth of 4 millimetres. The B.C. *Motor Vehicle Act* accepts a minimum of 1.5 millimetres tread groove depth for tires on vehicles with a Gross Vehicle Weight Rating (GVWR) of less than 5,500 kilograms. (The manufacturer’s GVWR for this vehicle is 3,947 kilograms.)

Both front tires were pressurized to 54 psi. The manufacturer’s compliance plate recommends the front tires be inflated to 45 psi. The tire side wall indicated the maximum pressure to be 80 psi. Both front tires were over-inflated.

The left rear tire was an LT245/75R16 LRE Bandag, Retread, with Bridgestone M773 SWP II, M+S radial casing. Figure 10 shows the retread stamp, although information is missing. The tread depth was 15 millimetres. The tire bead had been displaced from the rim in the incident. The manufacturer’s compliance plate recommends the rear tires be inflated to 80 psi, which is also the maximum pressure indicated on the tire side wall. The tire had inner liner damage consistent with having been run under-inflated or flat before the incident. As part of the investigation, the left rear tire was remounted on the rim and inflated to 80 psi. The tire lost 24 psi of pressure over four weeks. Further investigation showed there was a small leak at the valve stem.



Figure 10: Retread stamp on left rear tire.

The right rear tire was an LT245/75R16 LRE Goodyear, Workhorse Extra Grip, M+S Radial Tire. The tread depth was 13 millimetres, and the tire pressure was 59 psi. The manufacturer's compliance plate recommends the rear tires be inflated to 80 psi, the maximum indicated on the tire side wall. The tread depth was adequate, but the tire was under-inflated.

1.4.3 Seating and seat belts

The manufacturer's GVWR is 3,947 kilograms. An RCMP investigator found the vehicle's unloaded weight to be 2,570 kilograms. The front axle levelled at 1,330 kilograms, and the rear axle levelled at 1,240 kilograms. The weight of the passengers and their belongings was estimated to be 1,109 kilograms. The total weight at the time of the incident was estimated to be 3,670 kilograms, which is less than the GVWR.

The vehicle was designed for 15 occupants in five rows. At the time of the incident, rows 2 and 3 each carried four passengers, one more than they were designed for (see Figure 2 on page 4).

Row 1

Row 1 seats two people. The driver's bucket seat is located at the front on the left, and the front passenger bucket seat is located on the right. Both of these seats were bolted to the floor with the manufacturer's original attachment points. The driver's seat did not show any damage other than the backrest, which was tilted forward (see Figure 11). The passenger seat backrest had tilted backwards (see Figure 12). Both these seats had their original upholstery.

The driver's seat and the front passenger seat were each equipped with a combination shoulder/lap seat belt. At the time of the inspection, the seat belts were fastened. There was no noticeable damage to either seat belt, which appeared to be the manufacturer's original belts. Worker 2 in the front passenger seat was wearing her seat belt at the time of the incident. Driver 1/Worker 1 was also wearing her seat belt.



Figure 11: Driver's seat.



Figure 12: Front passenger seat.

Row 2

Row 2 was equipped with a removable seat for three passengers, but it carried four passengers at the time of the incident. The seat was secured to the floor with the manufacturer's original equipment. This seat had its original upholstery (see Figure 13). Seat belt anchor points were located on the left side of the seat above the window and under the seat on the seat's lower rear horizontal cross-member. There were no seat belts fitted on this seat. There was no armrest on the right side of the seat, although marks on the side of the seat suggest that the vehicle had been manufactured with an armrest. The backrest had tilted backward.



Figure 13: Rows 2 and 3.

Row 3

Row 3 was equipped with a removable seat for three passengers, but it carried four passengers at the time of the incident. The seat was secured to the floor with the manufacturer's original equipment. It had its original upholstery (see Figure 13). Seat belt anchor points were located on the left side of the seat above the window and under the seat on the seat's lower rear horizontal cross-member. There were no seat belts fitted on this seat. There was no armrest on the right side of the seat, although marks on the side of the seat suggest that the vehicle had been manufactured with an armrest. The backrest of this seat had been reinforced with 5/16-inch plywood. The rear of the seat was lower than the front (see Figure 13).

Row 4

This row was equipped with a removable seat for three passengers. The seat was secured to the floor with the manufacturer's original equipment. The bottom of the seat had its original upholstery. However, the backrest had been re-upholstered with a different fabric.

Seat belt anchor points were located on the left side of the seat above the window and under the seat on the seat's lower rear horizontal cross-member. There were no seat belts fitted on this seat. There was no armrest on the right side of the seat, although marks on the side of the seat suggest that the vehicle had been manufactured with an armrest. The back of the backrest of this seat had been reinforced with 5/16-inch plywood.

The backrest was reinforced with flat steel straps attached with seven hex head fasteners to the left and right sides of the backrest. In the incident, the backrest had been tilted back so that it was almost level with the top of the bottom seat cushion. The support under the seat cushion had been pushed up and to the right. The plywood on the back of the seat backrest showed damage consistent with the occupants of row 5 striking the plywood with excessive force during the incident (see Figure 14).

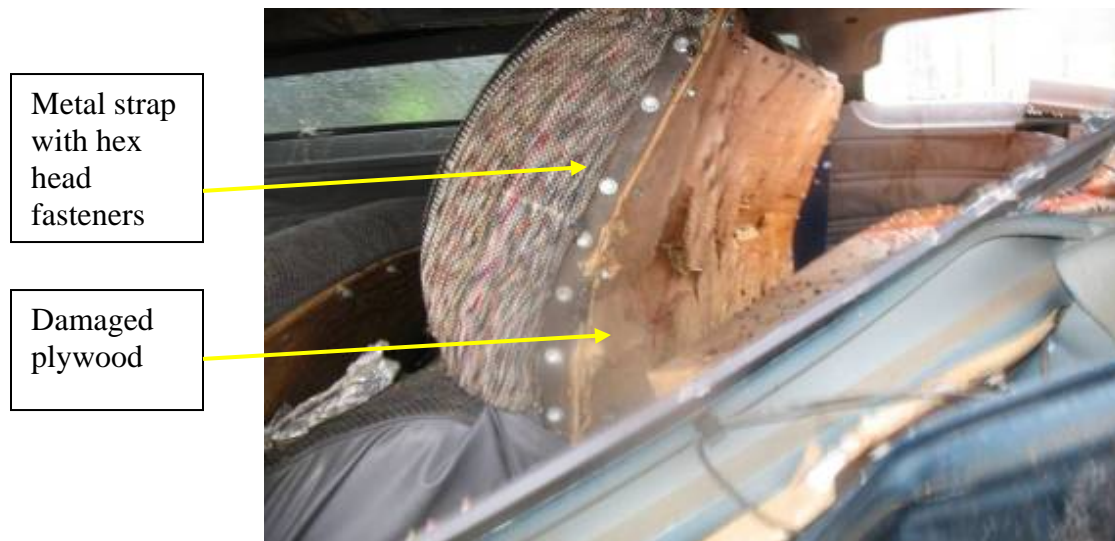


Figure 14: Row 4, showing damaged plywood.

Row 5

Row 5 was equipped with a bench seat for four passengers. The seat was bolted to the floor with the manufacturer's original attachments. The seat frame was the manufacturer's original, but the padding and upholstery had been removed. The frame had been modified with steel and lumber. Three steel straps (¼ x 2 inches) had been welded to the seat frame and bottom rests. Holes had been drilled through the steel straps so that lumber could be fastened to the straps. Pieces of lumber—2 x 3 inches and 2 x 6 inches and each 68 inches long—had been secured to the steel straps using carriage bolts, flat washers, lock washers, and nuts. The nuts had been tightened from underneath and behind the seat. The lumber was used to provide a seating surface and a backrest for passengers (see Figures 15 and 16).

Several finishing nails protruded from the seating area lumber, suggesting that some form of padding had at one time been secured for passengers' comfort. Seat belt anchor points were located on the left side of the seat above the window, on the right side in the corner, and under the seat on the vehicle floor. There were no seat belts on this seat.

The absence of the seat belts is discussed in the analysis in section 2.6. The other modifications to the Row 5 seat bench were not found to be a contributing cause of the incident or a factor in the severity of the injuries sustained.



Figure 15: Front of row 5.



Figure 16: Rear of row 5.

1.5 Vehicle 2

Vehicle 2 was a dump truck and trailer combination belonging to Mid-Valley Sand & Gravel. The dump truck was a 2007 Kenworth, and the trailer was a 2003 K-line. The dump truck and trailer of Vehicle 2 were empty. The collision did not damage the dump truck. The trailer had some damage to the front right corner (see Figures 17 and 18).



Figure 17: Vehicle 2 truck-trailer combination.



Figure 18: Damage to front of trailer.

1.6 Vehicle 3

Vehicle 3 belonging to Amix Salvage & Sales was a 2006 Kenworth flat bed with a box and self loader towing a 2007 Midland box trailer (see Figure 19). The box on the flatbed and the trailer were empty. The front end of the truck was damaged when it hit Vehicle 1 (see Figure 20). The trailer unit was not damaged.



Figure 19: Vehicle 3 combination.



Figure 20: Damaged front end of Vehicle 3.

1.7 Employer health and safety programs

1.7.1 RHA Enterprises

RHA Enterprises has a written health and safety program; however, it has not been implemented. None of the workers interviewed had been given an orientation or introduced to the health and safety program. Most of the workers are recent immigrants from India and speak little or no English. They are sent out to various workplaces as temporary agricultural workers. These workers depend mostly on RHA Enterprises, the labour contractor, for information, education, and instructions.

1.7.2 Rainbow Greenhouses

Rainbow Greenhouses has a health and safety program for its full-time employees. A health and safety committee meets regularly to discuss health and safety matters. The Rainbow Principal stated that his company does not include RHA Enterprises' workers in its occupational health and safety activities, nor does it provide them with an orientation. There is no legislative requirement for a farm employer such as Rainbow Greenhouses to address the transportation of temporary workers by the labour contractors or to inspect worker transportation vehicles.

1.8 Qualifications of drivers at RHA Enterprises

1.8.1 Driver 1/Worker 1

Driver 1/Worker 1 is the principal of RHA Enterprises. She has regularly transported workers to different Fraser Valley locations for a few years.

At the time of the incident, Driver 1/Worker 1 held a B.C. driver's licence. However, the *Motor Vehicle Act* specifies that a commercial class 4 unrestricted licence is required to operate a commercial vehicle to transport more than 10 but fewer than 25 workers. Before a commercial class 4 licence is granted, a candidate, after passing the knowledge and road signs tests, is required to practice with an appropriate licensed driver and/or attend a driver training school. The road test for a class 4 licence includes the pre-trip inspection of the vehicle. The written test includes questions on information in the manual *Driving Commercial Vehicles*. This manual is available on ICBC's web site:

www.icbc.com/licensing/lic_utility_resman_commercial.asp

The lead investigator questioned Driver 1/Worker 1 about the mechanical condition and operation of Vehicle 1. The information she provided demonstrated that she had limited knowledge regarding requirements for conducting adequate pre-trip inspections on the worker transport vehicles. The information provided suggests she did not conduct regular and adequate inspections. For example, she appeared to be unaware of the importance of correct tire pressure and the significance of this on the handling and rollover resistance of a 15-passenger van.

1.8.2 Driver 4

Driver 4 is employed by RHA Enterprises. He holds a B.C. driver's licence and is qualified to drive workers. Driver 4 showed limited knowledge of pre-trip vehicle inspections and of the effects of tire pressure on the handling and rollover resistance of a 15-passenger van. He told the lead investigator that he had been conducting weekly inspections on the transport vehicles but did not keep records.

Most of the witnesses informed the lead investigator that Driver 4 controls the business operations of RHA Enterprises. RHA Enterprises mostly provides temporary labour to Rainbow Greenhouses in Chilliwack.

1.9 Overloading of worker transport vehicle

Driver 4 told the lead investigator that on the day before the incident, March 6, 2007, Rainbow Greenhouses requested 20 temporary workers for March 7, 2007; they were to start work at the Rainbow site at 07:00. Driver 4 also told the lead investigator that, in consultation with Driver 1/Worker 1, he arranged to use a 15-passenger van and a 7-passenger Caravan to transport workers on the morning of March 7, 2007. Fourteen workers would be transported in the full-size 15-passenger van and 6 workers would be transported in the Caravan. However, on the day of the incident, Driver 1/Worker 1 drove the 15-passenger van carrying 16 passengers, not 14. Driver 4 was the other driver. Instead of the 7-passenger Caravan, he drove another 15-passenger van. He set out after Vehicle 1 and was carrying the rest of the workers. Driver 4 told the lead investigator that he was carrying three workers; however, that number could not be confirmed.

Driver 4 told the lead investigator that the day of the incident was the first and only time that Vehicle 1 was overloaded with passengers. However, one worker said that RHA Enterprises regularly overloaded the vehicles with extra passengers. She said that the day before the incident, on March 6, 2007, 22 workers were transported in a 15-passenger van. Some workers were sitting on the floor. Other workers confirmed that there had been overloading in the past.

Less than two weeks before the incident, on February 22, 2007, a WorkSafeBC Prevention Officer visited Rainbow Greenhouses, but the worker transport vehicle involved in the incident was not at the site. The prevention officer spoke with an RHA Enterprises Representative and issued an inspection report the next day outlining the regulatory requirements for transporting workers to and from work sites. The inspection report states that seat belts must be worn by all occupants and that the vehicles should not be overloaded.

1.10 WorkSafeBC's jurisdiction and inspection of vehicles

The 16 workers in the van were being transported by the employer (Driver 1/Worker 1) to the job site. They are considered to be workers under the *Workers Compensation Act*. As workers, they are covered by the health and safety provisions of the *Workers Compensation Act* and the Occupational Health and Safety Regulation.

Every vehicle used on a public highway in British Columbia must comply with the laws, regulations, and standards administered by both the B.C. Ministry of Transportation and Transport Canada. WorkSafeBC prevention officers do not have the authority to stop a vehicle on a public road. However, for a vehicle to be considered appropriate for transporting workers, it must also comply with the requirements of the Occupational Health and Safety Regulation. The provisions of Part 17 (Transportation of Workers) of the Regulation sets out the requirements that apply to all persons, including operators of vehicles, engaged in transporting workers on behalf of the employer.

In the past the Workers' Compensation Board (now WorkSafeBC) had participated in a joint effort to perform roadside inspections of vehicles owned or operated by farm labour contractors. These

inspections were conducted jointly by the RCMP, the Motor Vehicle Branch, the Gas Safety Branch, the Workers' Compensation Board, and the Ministry of Labour. These roadside inspections of farm labour contractors were stopped in 1997.

2 Analysis

The analysis looks at Driver 1/Worker 1's loss of control of Vehicle 1 and the factors that may have contributed to the loss of control and to the seriousness of the injuries.

2.1 Loss of control of the vehicle

In the incident Vehicle 1 moved to the right onto the paved shoulder as it approached the concrete overpass. It appears that Driver 1/Worker 1 over-corrected the steering, turning too far to her left; as a result, Vehicle 1 approached the centre lane. Vehicle 1 struck the right front corner of the trailer of Vehicle 2. The collision caused Vehicle 1 to move back into the curb lane. Vehicle 1 decelerated rapidly. Vehicle 3 was behind and could not slow down, striking the left rear of Vehicle 1. Vehicle 1 may have spun around before eventually stopping upside down on the concrete median.

It cannot be determined with certainty why Vehicle 1 drove onto the right shoulder as it approached the concrete overpass or why Vehicle 1 then went too far to the left into the centre lane. A fully loaded 15-passenger van can display tricky handling characteristics at highway speeds. The following sections discuss the factors that most probably contributed to Driver 1/Worker 1's loss of control of the vehicle.

2.2 Driving conditions

On the day of the incident, it was raining hard. The road was very wet, and water was flowing down the slope just before the concrete overpass. The rain and spray from traffic reduced visibility. The additional spray from traffic (large truck) in the passing lane may have caused Driver 1/Worker 1 to crowd to the right of the roadway, eventually driving onto the road shoulder.

It is possible that as Vehicle 1 approached the concrete overpass, it hydroplaned and slid sideways towards the curb and the railings. The subsequent steering correction could have resulted in further loss of control.

2.3 Condition of the tires

The improper inflation of the tires and the depth of the tread were considered to determine whether they were factors in the loss of control of Vehicle 1.

2.3.1 Inflation

The front tires were over-inflated, 54 psi instead of the factory recommended 45 psi. The ICBC manual *Driving Commercial Vehicles* states: "Overinflating a tire causes excess wear in the centre part of its tread. An overinflated tire has less tread surface in contact with the road surface. Less contact between your tire and the road means less traction." When the amount of contact between the tire and the road surface is reduced, steering control is also reduced.

The right rear tire was under-inflated to 59 psi instead of the manufacturer's recommended 80 psi.

Examination of the left rear tire shows that this tire too was likely under-inflated before the incident. The bead had dislodged from the rim in the incident. If the tire had been inflated to 80 psi, the bead would not have dislodged without evidence of major trauma (for example, a blowout, marks of major impact, or other apparent physical damage). This evidence was not found. The rim damage on a small section on one edge is inconsistent with running flat for any significant distance. This suggests the tire pressure was low but the tire was not flat before the incident. Markings inside the tire and rubber powder inside the assembly are evidence of the tire having been run under-inflated at some time. The tire on its rim assembly dropped from 80 psi to 56 psi over four weeks. In summary, the left tire's deflation without apparent signs of trauma, the evidence of having at some time been run under-inflated, the tire on its rim assembly losing air, and no evidence that tire pressure is routinely checked all make it probable that the left rear tire was low before the incident.

An under-inflated rear tire will adversely affect the vehicle's expected steering response. This is probably one of several factors that resulted in the vehicle handling problems when Driver 1/Worker 1 over-steered Vehicle 1 back from the shoulder and ended up crowding the centre lane.

In addition, the road was wet. *Driving Commercial Vehicles* states: "Underinflating a tire causes excess wear on the outer edges of its tread. In wet conditions, an underinflated tire will not squeeze the water out from between the tire and the road as well as a properly inflated tire. A tire that is underinflated has a greater chance of riding on a film of water (hydroplaning)."

As part of its mandate for the federal government of the United States of America, the National Highway Traffic Safety Administration (NHTSA) conducts studies into motor vehicle and highway safety. NHTSA studies have shown that poor tire maintenance, which includes improper inflation and inadequate tread, can lead to loss of vehicle control and rollovers. Low tire pressure can also increase stopping distances and the chance of hydroplaning. Hydroplaning occurs when water between a vehicle's tires and the road significantly decreases traction, preventing the vehicle from responding to steering, braking, or accelerating. The results of the NHTSA studies on tire pressure in 12- and 15-passenger vans are available on the NHTSA web site (Traffic Safety Facts: Research Note, May 2005): www-nrd.nhtsa.dot.gov/Pubs/809846.PDF

2.3.2 Tread depth

The front tires had a tread depth of 4 millimetres. Although these meet the legal minimum of 1.5 millimetres, the front tires had considerably less tread than the rear tires. The front tires would therefore be more likely to hydroplane. The rear tires had tread depth of 13 millimetres (right) and 15 millimetres (left). The discrepancy of tread depth between the front and rear tires—particularly when the rear tires have significantly deeper tread—permits more movement at the interface between the rear tires and the road. This additional movement may result in oversteering of the vehicle and the deterioration of the vehicle's handling characteristics.

2.4 Stability of 15-passenger vans

Fifteen-passenger vans are commonly used to transport workers. Research on the stability of these vehicles when loaded has been carried out by the NHTSA. The issue regarding stability of these vehicles is a controversial one. NHTSA studies show that the risk of rollover for 15-passenger vans dramatically increases as the number of occupants increases from fewer than 5 to more than 10. This increased risk occurs because the passengers' weight raises the vehicle's centre of gravity and also shifts it towards the

rear of the van. As a result, the vehicle has less resistance to rollover and is also more difficult to control at highway speed after abrupt steering. The NHTSA warns that more than 15 occupants should never be allowed in a 15-passenger van. In this incident, there were 17 occupants in the van, and this study suggests that each additional occupant after 10 may decrease the van's stability. The NHTSA web site has a bulletin called *Reducing the Risk of Rollover Crashes in 15-Passenger Vans*:

www.nhtsa.dot.gov/cars/problems/studies/15PassVans/

Two models of 15-passenger vans were tested by NHTSA in June 2004. The study investigated the effects of different load conditions on the dynamic rollover resistance of a 2003 Ford E-350 and a 2004 GMC Savana 3500. The GMC Savana was tested with the factory-equipped electronic stability control (ESC) both enabled and disabled. The ESC unit can detect when the vehicle is about to travel in a direction different from the steer wheel position; the ESC unit then automatically applies the brake on the appropriate wheel to help the driver maintain control. This NHTSA study indicates that the installation of ESC on 15-passenger vans may have important safety benefits in some, but not necessarily all, driving manoeuvres. The study found that the static stability factors and dynamic rollover resistance of the vans degraded as the number of occupants increased. *Testing the Dynamic Rollover Resistance of Two 15-Passenger Vans with Multiple Load Configurations* is available on the NHTSA web site:

www.nhtsa.dot.gov/cars/problems/studies/15PassVans/15-PassVanStabilityControl.pdf

Vehicle 1 was not equipped with ESC. We do not know if ESC would have made a difference in this incident. Preliminary analysis of Canadian crash data by Transport Canada indicate that ESC could prevent approximately 30 percent of all crashes involving loss of control. Transport Canada is continuing to evaluate ESC in tests of various vehicles under different scenarios. More information is available on Transport Canada's web site, although none of the research is specific to 15-passenger vans: www.tc.gc.ca/roadsafety/tp/tp14651/vs200701/menu.htm.

In November 2004, the NHTSA published an update on its action plan for the safety of 15-passenger vans. This update refers to several of its research reports and includes a list of the U.S. states that have restrictions on the use of these vans for transporting students to and from school and to school activities. NHTSA Action Plan for 15-Passenger Van Safety: November 2004 Update is available on the NHTSA web site:

www.nhtsa.gov/cars/problems/studies/15PassVans/15passvan.html

The NHTSA has also published a consumer advisory on 15-passenger vans with links to several studies:

www.nhtsa.gov/cars/problems/studies/15PassVans/15PassCustomerAdvisory.htm

2.5 Passenger overloading

Driver 1/Worker 1 and Driver 4 told the lead investigator that the vehicles had never been overloaded with passengers in the past. However, some of the workers told the lead investigator that the vehicles had regularly carried more than 15 passengers. The 17 occupants on the day of the incident was 2 more than the manufacturer's recommendation. In his inspection report in February 2007, the Prevention Officer had informed the RHA Enterprises Representative that the vans were not to be overloaded.

The Rainbow Principal stated that he had asked RHA Enterprises to supply 24 workers to Rainbow Greenhouses on the day of the incident. RHA Enterprises had arranged for Driver 1/Worker 1 and Driver 4 to use one 15-passenger van and one 7-passenger van to transport those workers. If 24 workers

were requested and would be transported in those vehicles, then one or both of the vehicles would be carrying more than the recommended number of passengers. In addition to the possibility that the van was less stable with the added passengers, the overloading meant that more workers were placed at risk of injury.

2.6 Seat belts in 15-passenger vans

2.6.1 Seat belts required in 15-passenger vans used to transport workers

The van in question was licensed as a commercial vehicle and insured for “school bus or private bus use.” A “private bus use” designation is defined as follows by the Insurance Corporation of British Columbia, and reflects the use to which the van was put in the circumstances of this incident:

“**Private bus use**” means the use of a motor vehicle to transport, without direct compensation, passengers who have a connection with the business activities of the owner or lessee of the motor vehicle.

The van was designed to carry up to 15 passengers and, accordingly, fell within the definition of “bus,” as stipulated by the *Motor Vehicle Act*, RSBC 1996, c. 318. As the definition in the *Motor Vehicle Act* states, a bus falls within the broader definition of “motor vehicle”:

“**bus**” means a motor vehicle designed to carry more than 10 persons

Only Driver 1/Worker 1 and Worker 2 in the front row had seat belts. Fifteen workers in Vehicle 1 were not restrained. The van was initially manufactured with seat belts at rows 2 to 5; however, those seat belt assemblies (other than in the front two seats) had been removed. Driver 4 told the lead investigator that the van was not equipped with seat belts when it was purchased by RHA Enterprises. Despite inquiries to determine the van’s prior ownership, WorkSafeBC has not been able to independently verify when, or by whom, the seat belts were removed. However, whether or not the current owner or a previous owner had removed the seat belts, it was a contravention of section 220 of the *Motor Vehicle Act* to operate the van with the manufacturer’s seat belts removed. Section 220(3) prohibits the use of motor vehicles (which, by definition, includes buses) on a highway in which the seat belt assemblies have been removed:

- (3) A person must not drive or operate a motor vehicle on a highway in which a seat belt assembly required under this section or the *Motor Vehicle Safety Act* (Canada) at the time the motor vehicle was manufactured, assembled or imported into Canada has been removed, rendered partly or wholly inoperative, or modified to reduce its effectiveness.

Most of the workers at RHA Enterprises are recent immigrants to Canada. Due to language barriers, they rely mostly on the labour contractor (RHA Enterprises) for information and training. When interviewed, these workers lacked knowledge of local laws and regulations. Most of the workers interviewed told the lead investigator that they were not aware of the seat belt requirement while travelling in the employer’s vehicles. A few of the workers had expressed to Driver 1/Worker 1 and/or Driver 4 their concern over the lack of seat belts. They were told that seat belts were not required because the vehicle was registered with ICBC as a bus.

2.6.2 Seat belts reduce injuries

If all the workers had worn seat belts, the number of fatalities and severity of injuries might have been reduced. Most of the workers were thrown around inside the van during the incident. A 1999 study prepared by Transport Canada illustrates that between 1993 and 1997, almost 40 percent of fatally injured drivers and almost 18 percent of those seriously injured were not wearing seat belts. *Unbelted Fatally and Seriously Injured Drivers – Canada, 1993-1997* is available on the Transport Canada web site:

www.tc.gc.ca/roadsafety/tp/tp13563/menu.htm

NHTSA published a technical report in 2004 analyzing accidents involving 15-passenger vans. The study found that an unrestrained occupant of such a van in a single-vehicle accident is approximately three times as likely to be killed as a restrained occupant: *Analysis of Crashes Involving 15-Passenger Vans* is available on the NHTSA web site:

www-nrd.nhtsa.dot.gov/Pubs/809735.PDF

2.7 Driver training and knowledge

In British Columbia, a commercial class 4 driver's licence is required to transport more than 10 workers. It is possible that, due to lack of training and knowledge, Driver 1/Worker 1 lacked the ability to control Vehicle 1 in the emergency. Appropriate training might have provided Driver 1/Worker 1 with an understanding of issues relating to vehicle safety and potential risks of overloading. Training might also have provided practical experience in maintaining control in adverse conditions.

3 Conclusions

3.1 Findings as to causes

3.1.1 Vehicle rollover

A 15-passenger van carrying 17 workers veered onto the right shoulder as it travelled east on Highway 1. The driver tried to steer back into the lane but steered too far to the left and collided with another vehicle in the centre lane. This collision pushed the passenger van back towards the right lane. As the passenger van slowed down, it was hit from behind by a third vehicle. The impact caused the van to spin out of control, eventually rolling over and stopping upside down with its roof on the highway median. Three passengers were killed and 14 others were injured.

3.1.2 Lack of seat belts

If proper seat belts had been provided and if the workers had worn them, the number of fatalities and the severity of the workers' injuries might have been reduced.

3.2 Findings as to underlying factors

3.2.1 Loss of vehicle control

The following factors likely contributed to the loss of vehicle control:

- Road conditions: Poor visibility and the wet road may have caused the driver of the passenger van to steer onto the shoulder of the highway.
- Poor tire maintenance: Improperly inflated tires, with poor tread on the front tires, may have permitted the passenger van to hydroplane on the wet road. It is possible that hydroplaning contributed to loss of vehicle control.
- Lack of driver training and knowledge: The driver of the passenger van lacked adequate knowledge and training to safely operate a 15-passenger commercial vehicle in adverse conditions.
- Vehicle stability issues: The risk of rollover for a 15-passenger van increases when there are more than 10 occupants because the centre of gravity shifts towards the rear of the van.

4 Health and Safety Action Taken

WorkSafeBC—in conjunction with the RCMP and the Commercial Vehicle Safety and Enforcement branch of the B.C. Ministry of Transportation—renewed roadside inspections of farm worker transport vehicles after the incident.

5 Orders Issued after the Investigation

WorkSafeBC issued seven orders after the investigation. An order requires an employer to take steps to comply with the *Workers Compensation Act* or Occupational Health and Safety Regulation, to take measures to protect worker health and safety, or to fix a hazardous condition. An order is not intended to identify fault on the part of the employer but to ensure that unsafe conditions are identified and corrected and that the employer complies with the Act and the Regulation. An employer may ask the Review Division to review an order; the Review Division may confirm, vary, or cancel an order.

In addition to issuing orders, WorkSafeBC may recommend proceeding with an administrative penalty against an employer. In order to protect the privacy of individuals, this report does not give details of any penalty proceeding arising from this incident as that would identify the employer. Penalties are fines for health and safety violations of the *Workers Compensation Act* and/or the Occupational Health and Safety Regulation. For information on when penalties are considered and how the amount of the penalty is calculated, see the [penalty FAQs](#) on WorkSafeBC.com. [Companies that have been penalized](#) are also listed on the web site.

5.1 Orders to RHA Enterprises Ltd.

This section summarizes the orders to the farm labour supply company. The investigation found that this employer was in contravention of the following sections of the Occupational Health and Safety Regulation:

- [Section 4.3\(1\)\(a\)](#) and (b)(ii), which state that the employer must ensure that each machine and piece of equipment in the workplace is capable of safely performing the functions for which it is used and is selected, used, and operated in accordance with safe work practices.
- [Section 17.11\(1\)](#), which states that a worker transportation vehicle must be operated by a competent driver licensed under the provisions of the *Motor Vehicle Act*, and if required, the *Highway (Industrial) Act*.
- [Section 17.11\(5\)](#), which states that a worker transportation vehicle must be inspected before first use on a work shift, and properly maintained to ensure it is safe for use.
- [Section 17.11\(6\)](#), which states that any defect which might affect the safety of workers must be corrected before using the vehicle.

The employer was also in contravention of the following sections of the *Workers Compensation Act*:

- [Section 115\(2\)\(e\)](#), which states that an employer must provide to its workers the information, instruction, training, and supervision necessary to ensure the health and safety of those workers in carrying out their work and to ensure the health and safety of other workers at the workplace.
- [Section 115\(1\)\(a\)\(i\)](#), which states that every employer must ensure the health and safety of all workers working for that employer.

The employer was ordered to ensure the health and safety of its workers, including but not limited to the following:

- Ensure that the worker transport vehicles are equipped with the required number of seat belts.
- Do not overload worker transport vehicles with passengers.
- Ensure that worker transport vehicles are operated by properly licensed operators in accordance with the *Motor Vehicle Act*.
- Inspect the worker transport vehicles before use and maintain the vehicles in safe operating conditions and in accordance with the manufacturer's recommendations.
- Correct any defect on a worker transport vehicle that might affect the safety of the workers before using the vehicle.
- Provide to the employer's workers the information, instruction, training, and supervision necessary to ensure the health and safety of those workers in carrying out their work and to ensure the health and safety of other workers at the workplace.

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