
National Nuclear Security Administration



Accident Investigation Report

**Office of Secure Transportation
Vehicle Accident Resulting in a Fatality and
Serious Injuries to Four Additional Federal
Agents near Okemah, Oklahoma
on October 5, 2018**

January 2019

Disclaimer

This report is an independent product of the Accident Investigation Board appointed by Theodore A. Wyka, Cognizant Secretarial Officer for Safety, Office of Safety, Infrastructure and Operations. The Board was appointed to perform an accident investigation and to prepare an investigation report in accordance with the Department of Energy Order 225.1B, *Accident Investigations*.

The discussion of the facts as determined by the Board and the views expressed in the report do not assume, and are not intended to establish, the existence of any duty at law on the part of the U.S. Government, its employees or agents, contractors, their employees or agents, or subcontractors at any tier, or any other party.

This report neither determines nor implies liability.

Release Authorization

On October 15, 2018, an Accident Investigation Board was appointed to investigate the October 5, 2018, motor vehicle accident that resulted in one fatality and four serious injuries. The Board's responsibilities have been completed with respect to this investigation. The analysis and the identification of the contributing causes, the root cause, and the Judgments of Need resulting from this investigation were performed in accordance with the Department of Energy Order 225.1B, *Accident Investigations*, dated March 4, 2011.

The report of the Accident Investigation Board has been accepted, and the authorization to release this report for general distribution has been granted.

Theodore A Wyka

Theodore Wyka
Cognizant Secretarial Officer for Safety
Office of Safety, Infrastructure and Operations

January 25, 2019

Date

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Executive Summary

Introduction

On October 5, 2018, a van was involved in a highway accident on Interstate 40 (I-40) at mile marker 225.4 near Okemah, Oklahoma (OK). The van was carrying five Office of Secure Transportation (OST) Federal Agents (FA) returning from a week-long training exercise held at Fort Chaffee in Fort Smith, Arkansas (AR). The accident resulted in the death of one of the Federal Agents. The other four were severely injured. Due to the severity of this accident and in accordance with U.S. Department of Energy (DOE) Order (O) 225.1B, *Accident Investigations*, Theodore Wyka, Cognizant Officer for Safety, National Nuclear Security Administration (NNSA), appointed an Accident Investigation Board (the Board) on October 15. The Board began its investigation on October 22 and completed its review on December 10, 2018.

Accident Description

On October 5, 2018, at approximately 0848 Central Daylight Time, a Federally-owned 2013 Chevrolet Express 3500, 15-passenger van (Van 1) was involved in a serious highway accident along Interstate-40 (I-40) near Okemah, OK. Van 1 was carrying five Office of Secure Transportation Federal Agents returning from a week-long training exercise held at Fort Chaffee in Fort Smith, Arkansas. Information obtained from the Oklahoma Traffic Collision Report indicated that a westbound Dump Truck was traveling in the right lane of I-40.

The Dump Truck had slowed and moved to the left lane to cross the center median and make an illegal U-turn, and in doing so, entered the path of Van 1. The driver of Van 1, FA 2, attempted evasive action by swerving right and braking hard but was unable to avoid the collision. At the time of the braking, Van 1 was traveling in excess of the posted 55 mph speed limit in a construction zone. Van 1 struck the rear of the Dump Truck. As a result of the speed at the time of the collision, the van sustained extensive front damage resulting in severe trauma to all of the van occupants. The Board concurs with the OHP final report that not all occupants were wearing seat belts.

Information obtained from interviews with several personnel at the scene indicated that the Federal Agent seated in the third bench seat of the van was able to extricate himself from the van. The other four Federal Agents were extricated with the assistance of non-OST individuals at the scene. In particular, a U.S. Air Force Staff Sergeant (Airman), was primarily responsible for extricating three of the injured personnel, directing the extraction of the fourth, and assisted in providing aid at the scene.

A fire in the front area of the van quickly spread to the rest of the van. The van was fully engulfed in flames and completely destroyed. Initial triage assessment and medical aid was provided by OST Federal Agents in other OST vehicles who were returning from the same

week-long training exercise. FA 6 (paramedic), FA 7 (EMT basic), and FA 8 in Van 2; and Squad Commander 2 (a registered nurse) in Suburban 1 arrived at the accident scene within minutes and began immediate medical care. The accident resulted in one fatality. The other four Federal Agents were transported to hospitals via medical evacuation helicopters with serious injuries.

Accident Investigation Process

The Board reviewed and analyzed the circumstances surrounding the accident to determine its cause and understand lessons learned to reduce the potential for recurrence of similar accidents. Because the accident occurred in the public domain on Interstate 40 in Okemah, OK, the Oklahoma Highway Patrol (OHP) had jurisdiction and conducted an extensive investigation of the accident. The Board relied heavily on the OHP report of the accident – including witness statements, photos, dash cam video/audio, and accident reconstruction. The OHP Trooper 1, who led the investigation, was extremely cooperative and helpful in the Board's efforts. Additionally, due to the severity of the injuries to the personnel in the van, the Board was not able to personally interview any of the Federal Agents in Van 1. However, the Board had access to the OHP reports of interviews with FA 3 and FA 5 provided by the OHP.

Based on their investigation and analysis, the Board agrees with the OHP that the proximate cause of the collision was an unsafe lane change by the Dump Truck driver. The Board also identified that the speed of the van in the construction zone directly contributed to the cause of the collision. In addition, the team identified several issues that potentially increased the severity of the injuries sustained in the collision. The team's conclusions and judgment of needs related to these issues are identified and documented in the report.

On October 5, 2018, at approximately 0848¹ a Federally-owned 2013 Chevrolet Express 3500 15 passenger van (Van 1) was involved in a highway accident on Interstate 40 (I-40) at mile marker 225.4 near Okemah, Oklahoma (OK). The van was carrying five Office of Secure Transportation (OST) Federal Agents returning from a week-long training exercise held at Fort Chaffee in Fort Smith, Arkansas (AR). The accident resulted in the death of one of the Federal Agents. The other four were severely injured.

The National Nuclear Security Administration (NNSA), under the requirements of the U.S. Department of Energy (DOE) Order (O) 225.1B, *Accident Investigations*, appointed an Accident Investigation Board (the Board) to determine the cause(s) of the accident and to identify actions to prevent recurrence. The Board was appointed on October 15, 2018.

This section of the accident investigation report describes the organization and mission, and the scope, purpose, and methodology of the accident investigation. Section 2.0. presents the accident facts and analyses developed by the Board, and Section 3.0. summarizes the Board's Judgments of Needs (JONs) regarding the accident. Board members' signatures and the participating Board members, advisors, and consultants are listed in Sections 4.0. and 5.0., respectively. Documentation of the Board's appointment and its various analyses is provided in Appendices A through E.

1.1. Background and Mission

1.1.1. National Nuclear Security Administration

Established by Congress in 2000, NNSA is a semi-autonomous agency within DOE responsible for enhancing national security through the military application of nuclear science. NNSA maintains and enhances the safety, security, and effectiveness of the U.S. nuclear weapons stockpile without nuclear explosive testing; works to reduce the global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the U.S. and abroad.

The NNSA missions include:

- Ensuring the U.S. maintains a safe, secure, and reliable nuclear stockpile through the application of unparalleled science, technology, engineering, and manufacturing;
- Working to prevent nuclear weapon proliferation and reduce the threat of nuclear and radiological terrorism around the world. The agency endeavors to prevent the

¹ All times listed within this report are Central Daylight Time (CDT) unless specifically noted.

development of nuclear weapons and the spread of materials or knowledge needed to create them;

- Playing a key role in preventing, countering, and responding to a terrorist or other adversary with a nuclear or radiological device; and
- Providing militarily effective nuclear propulsion plants and ensures their safe, reliable and long-lived operation.

1.1.2. Office of Secure Transportation

The OST is responsible for providing safe and secure transportation of nuclear weapons, nuclear weapon components, and special nuclear material in support of the national security of the U.S. These classified shipments can contain nuclear weapons or components, enriched uranium, or plutonium. The cargo is transported in highly modified secure tractor-trailers and escorted by armed Federal Agents in other vehicles who provide security and national incident command system response in the event of emergencies. The OST is led by an Assistant Deputy Administrator (Figure 1-1). The OST Assistant Deputy Administrator reports to the Deputy Administrator for Defense Programs in NNSA Headquarters.

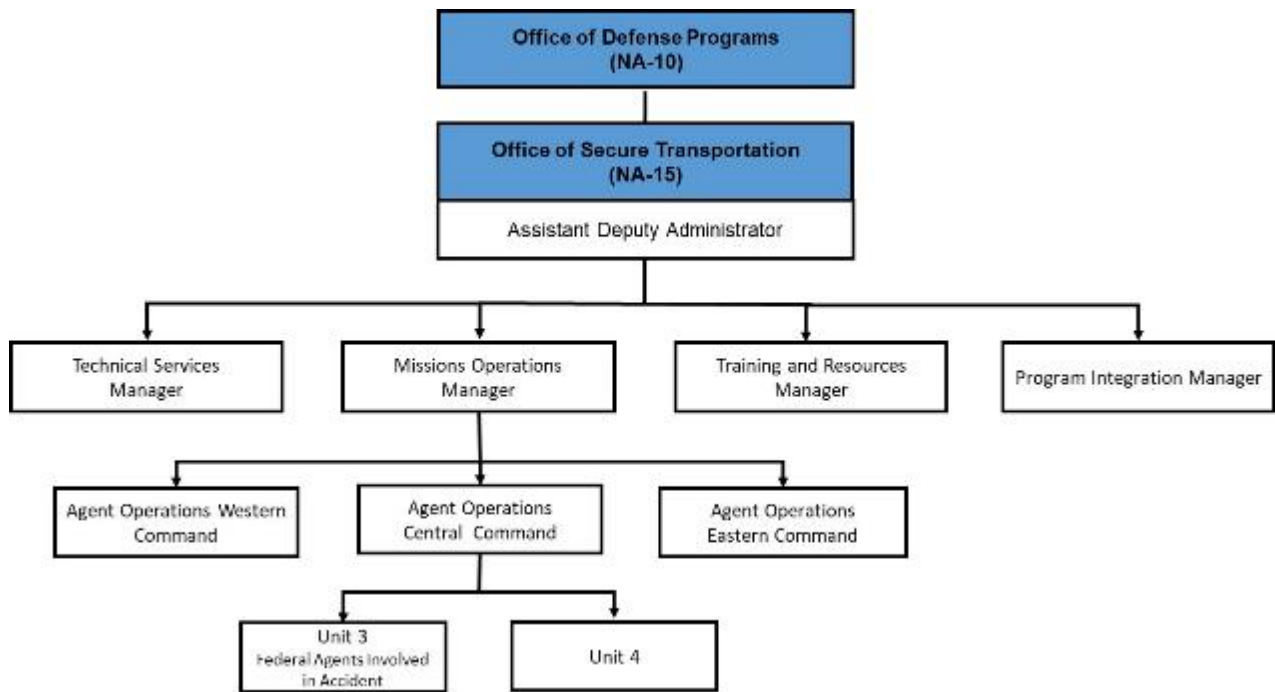


Figure 1-1. Office of Secure Transportation Organization

1.2. Delay in Appointing an Accident Investigation Board

One of the requirements of DOE O 225.1B, *Accident Investigations* is that “Within three calendar days of the accident occurrence, the Appointing Official must formally appoint DOE Federal employees to an AIB.”

The accident occurred on October 5, 2018, the Friday of a three-day weekend due to the Federal Holiday on Monday. The following week there were discussion as to whether or not a DOE Accident Investigation was required since the accident occurred on a public highway and the Oklahoma Highway Patrol was investigating the collision. Several options were considered for conducting an investigation. On October 15, 2018 an Accident Investigation Board was appointed.

The delay in the formal appointment of the Board did not affect the quality of the investigation. Time was needed to set up the logistics of the Board and to allow for OST personnel to begin the grieving process for their fallen and injured comrades. The funeral for the deceased Federal Agent occurred on Friday, October 12, 2018. In addition, the Oklahoma Highway Patrol (OHP) was conducting its traffic and accident reconstruction as part of the accident so no evidence was lost because of the delay. The Board traveled and began its investigative activities on Monday, October 15, 2018.

1.3. Accident Investigation Process

Because the accident occurred in the public domain on I-40 in Oklahoma, the OHP investigated the accident. As such, the Board was tasked with leveraging the results of the OHP investigation as part of their investigation process. The Board relied heavily on the OHP report of the accident – including witness statements, photos, OHP vehicle dash cam video/audio, and accident reconstruction. The OHP Trooper (Trooper 1), who led the investigation, was extremely cooperative and helpful in the Board’s efforts. Additionally, due to the severity of the injuries to the personnel in the van, the Board was not able to personally interview any of the Federal Agents in Van 1.

The Board reviewed and analyzed the circumstances surrounding the accident to determine its cause and understand lessons learned to reduce the potential for recurrence of similar accidents. This analysis also included an assessment of potential deficiencies in safety management systems. In addition, the Board was requested to specifically identify all relevant facts; determine direct, contributing, and root causes of the event; develop CONs; and identify Judgments of Need to support the prevention of recurrence. The terminology used in DOE/NNSA accident investigations is defined in Figure 1-2.

The Board conducted its investigation using the following methodology:

- Facts relevant to the accident were gathered through interviews, documents and evidence reviews, and examination of physical evidence allowing the Board to develop the chronology

and identify the facts of the accident. An independent vehicle accident consultant was also used by the Board.

- Event and causal factor charting, barrier analysis, change analysis, and human performance improvement techniques were used to analyze the facts, draw conclusions, and identify the cause(s) of the accident.
- Based on the analysis of information gathered and the conclusions that were drawn, JONs were identified to prevent recurrence.

A causal factor is an event or condition in the accident sequence that contributes to the unwanted result. There are three types of causal factors:

The **direct cause** of an accident is the immediate event(s) or condition(s) that caused the accident.

Root causes are the causal factors that, if corrected, would prevent recurrence of the same or similar accidents. Root causes may be derived from or encompass several contributing causes. They are higher-order, fundamental causal factors that address classes of deficiencies, rather than single problems or faults.

Contributing causes are events or conditions that collectively with other causes increased the likelihood or severity of an accident but that individually did not cause the accident.

Contributing causes may be longstanding conditions or a series of prior events that, alone, were not sufficient to cause the accident, but were necessary for it to occur. Contributing causes are the events and conditions that “set the stage” for the event and, if allowed to persist or recur, increase the probability of future events or accidents.

Event and causal factors analysis includes charting, which depicts the logical sequence of events and conditions (causal factors that allowed the accident to occur), and the use of deductive reasoning to determine the events or conditions that contributed to the accident.

Barrier analysis reviews the hazards, the targets (people or objects) of the hazards, and the controls or barriers that management systems put in place to separate the hazards from the targets. Barriers may be physical or administrative.

Change analysis is a systematic approach that examines planned or unplanned changes in a system that caused the undesirable results related to the accident.

Error precursor analysis identifies the specific error precursors that were in existence at the time of or prior to the accident. Error precursors are unfavorable factors or conditions embedded in the job environment that increase the chances of error during the performance of a specific task by a particular individual or group of individuals.

Figure 1-2: Accident Investigation Terminology

1.3.1. Event Categorization and Reporting

The Occurrence Reporting and Processing System (ORPS) report for this event (N--OST-OST-TSS-2018-0003) was categorized on October 5, at 0921 as a 2(A) any occurrence due to DOE Operations resulting in a fatality or terminal injury. The OST Emergency Operations Center (EOC) was notified on October 5, at 0852, and the initial ORPS notification report was filed on the same day at 0921.

2.0 Facts and Event Analysis

On October 5, at approximately 0848, a Federally-owned 2013 Chevrolet Express 3500 15-passenger van (Van 1) was involved in a serious highway accident along I-40 near Okemah, OK. Van 1 was carrying five OST Federal Agents returning from a week-long training exercise held at Fort Chaffee in Fort Smith, AR.

The Dump Truck had slowed and began to move to the left lane to cross the center median and make an illegal U-turn. The Dump Truck made an unsafe lane change and entered the path of Van 1. The Van Driver (FA 2) attempted evasive action by swerving right and braking hard but was unable to avoid the collision. At the time of the braking, Van 1 was traveling in excess of the posted 55 mph construction zone speed limit. Van 1 struck the rear of the Dump Truck.

Information obtained from interviews with witnesses and the OHP Report indicated that FA 5, who at the time of the accident was seated at the rear of Van 1 in the third bench seat, was able to extricate himself from Van 1. The other four Federal Agents were extricated from the vehicle with the assistance of non-OST individuals who had stopped immediately following the accident.

Initial triage assessment and medical aid was provided by OST Federal Agents in other OST vehicles who were returning from the same week-long training exercise. FA 6 (paramedic), FA 7 (EMT basic), and FA 8 in Van 2; and Squad Commander 2 (a registered nurse) in Suburban 1 arrived at the accident scene within minutes and began immediate medical care.

This accident resulted in one fatality (FA 1). Four other Federal Agents (FA 2, FA 3, FA 4, and FA 5) were transported to hospitals via medical evacuation helicopters (medevac helicopters) with serious injuries.

2.1. Chronology of Events

The OST conducted an Operational Readiness Training (ORT) for Agent Operations Central Command (AOCC), Unit 3, at the OST Training Command (TRACOM), at Fort Chaffee, from October 2 through October 4. The purpose of the ORT was to simulate OST mission operations in a large scale, dynamic Force on Force environment to enhance and to maintain unit proficiency in required skills, while identifying strengths and areas needing improvement. The training consisted of multiple scenarios used to instruct/evaluate participants on convoy operations tasks.

On Monday, October 1, OST AOCC Unit 3 departed Amarillo, Texas (TX) and headed for Fort Chaffee. Unit 3 was required to report to Fort Chaffee at 1600 for an initial Safety and Security Briefing at 1800. Unit 3 Federal Agents traveled in multiple vehicles:

- One Box Truck (containing professional gear);
- Three Suburban SUVs;

- Three pickup trucks;
- One sedan;
- One Chevrolet Tahoe;
- One Privately Owned Vehicle (POV); and
- Five 15-passengers vans.

The occupants of Van 1 stayed in barracks at Fort Chaffee during the training, while the rest of Unit 3 stayed at hotels in Fort Smith.

On October 2, OST AOCC Unit 3 reported for the ORT training at Fort Chaffee at 1100; the training concluded at approximately 2400 after an accountability and equipment turn-in activity.

On October 3, OST AOCC Unit 3 reported for the ORT training at Fort Chaffee at 1100; training concluded at approximately 2400 after an accountability and equipment turn-in activity.

Exercises for both days were considered normal for the type of training involved. No heat stress was experienced by Unit 3 members and only minor first aid/injuries resulted from the week-long exercise activities.

On October 4, OST AOCC Unit 3 reported for training at Fort Chaffee at 0900. The exercises conducted that day included training for junior Federal Agents and a separate training activity for up and coming AOCC leaders. The training concluded at 1800 with an accountability and equipment turn-in activity. Weapons and most tactical gear were cleaned and verified.

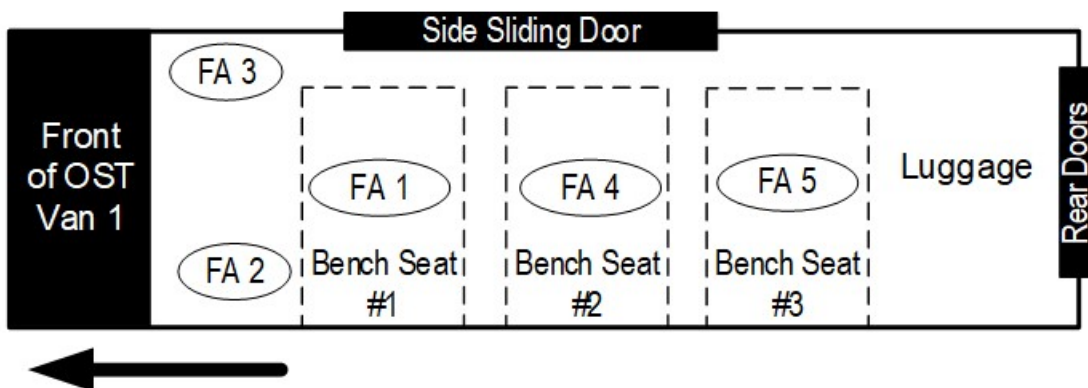
At the completion of training at Fort Chaffee, the Federal Agents had the option of packing tactical bags in the Box Truck or taking them back in their respective vehicles. Four of the Federal Agents in Van 1 opted to take their tactical bags with them. Departure time and vehicle assignments were discussed that night, but not formalized.

On October 5, Unit 3 Federal Agents departed Fort Chaffee and Fort Smith for the OST AOCC in Amarillo.

Table 2-1. Times of Departure from Ft. Chaffee Returning to OST AOCC on Friday, October 5

Time (CDT)	Vehicle	Point of Departure
~0600	Box Truck	Ft. Chaffee
~0600	Van 3	Ft. Smith ²
~0630	Van 1	Ft. Chaffee
~0630-0700	Van 2	Ft. Smith
~0630-0700	Suburban 1	Ft. Smith
~0630-0700	Suburban 2	Ft. Smith
~0630-0700	POV 1	Ft. Smith
0700	Van 4	Ft. Smith

At the time of the accident, the Federal Agents in Van 1 are believed to have been seated in the following locations (Figure 2-1): FA 2 - driver; FA 3 was seated in the front passenger seat, to the right of FA 2; FA 1 was seated immediately behind FA 2, on the left side; FA 4 was seated immediately behind FA 1, on the left side; and FA 5 was seated immediately behind FA 4, on the left side.



Definitive locations of the Federal Agents in the bench seats were not determinable as all occupants were removed before arrival of police.

Figure 2-1. Location of Federal Agents in Van 1 at the Time of the Accident

At approximately 0848, after passing through a lane closure area where construction activities were taking place, Van 1 attempted to pass a Dump Truck. The Dump Truck was owned by a contractor to Oklahoma Department of Transportation and was hauling concrete refuse from the construction zone to a dump site in Henryetta, OK, east of the work zone.

According to the Oklahoma Traffic Collision Report, the Dump Truck was stopped or slowing moving westbound on the shoulder of I-40, after the lane closure ended. The Dump Truck driver moved to the right lane in preparation for making an illegal U-turn across the center median of I-40 to travel to a dump site east of the construction zone. Van 1 was approaching the Dump Truck in the right lane and moved to the left lane to pass the slow moving dump truck. The Dump Truck continued to move to the left lane to cross the center median at a location where there was an opening in the cable barrier – directly in the path of the approaching Van 1. The Dump Truck driver stated that as he moved into the left lane, he noticed a van moving up behind him at a high rate of speed. Upon realizing that that the Dump Truck had moved into the path of the van, the driver of Van 1 braked hard as he swerved to the right in an evasive action. About the same time, the Dump Truck driver attempted to move back into the right lane to avoid colliding with the van. At this point, Van 1 struck the rear of the Dump Truck, sustained extensive front end damage and burned post impact. The OHP Traffic Collision Report indicated that there were no improper actions by the driver of Van 1.

At the site of the accident, I-40 is a divided highway, two lanes eastbound and two lanes westbound, with shoulders and a grass median dividing eastbound from westbound traffic. The accident site is near Okemah, OK. The construction work consisted of the removal and replacement of a portion of the right-hand, westbound lane. Weather conditions were clear; it was daylight; visibility was not obscured by objects, fog, or smoke; and the roadway was dry asphalt (Figure 2-2, Insert Photo B).

At the work area, the right lane was closed, and all westbound traffic was shifted to the left lane. I-40 westbound right lane opened back up near mile marker 225.4, approximately 0.6 miles east of the accident.

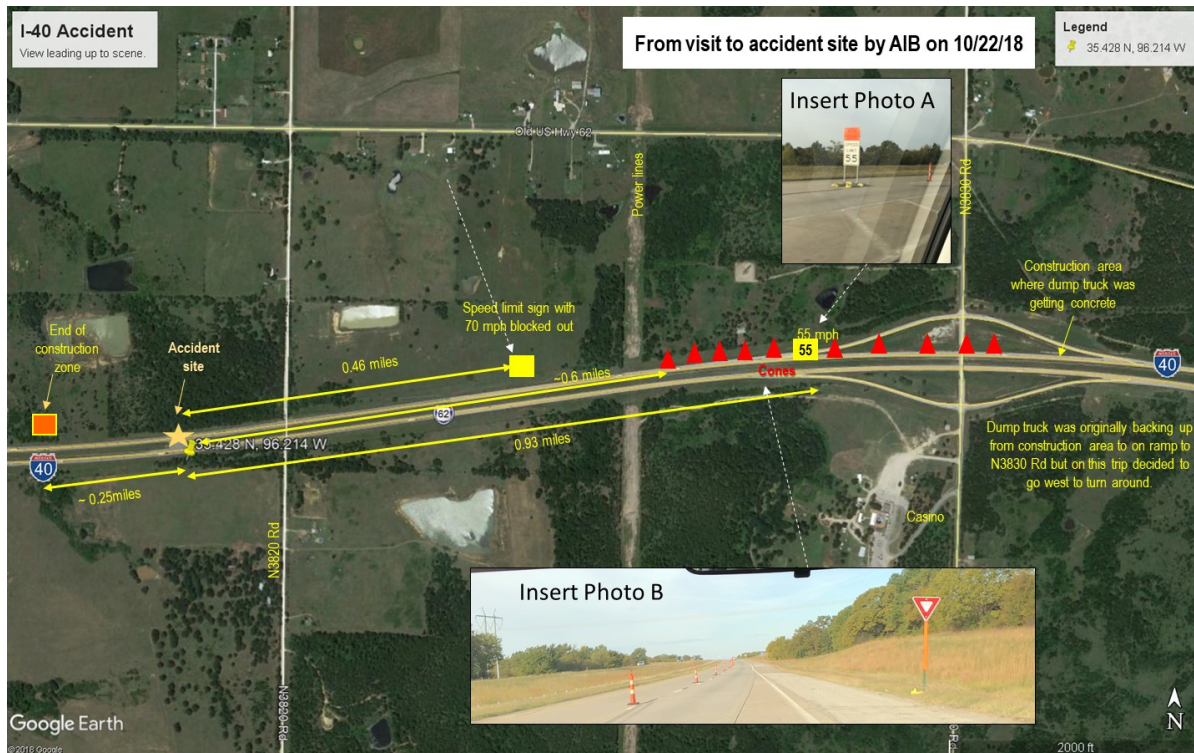


Figure 2-2. Annotated Aerial View of Accident Location

The accident occurred in the termination area of an active work zone where the lane closure had ended and both lanes were open (about 0.6 miles from the end of the lane closure noted by cones in Figure 2-2, Insert Photo B),² and approximately 1,272 feet east of the end work zone signs where the speed limit returned to 70 mph (noted by orange rectangle in Figure 2-2). The posted speed limit was 55 mph in the work zone.

In an interview with OHP, FA 5 stated that after the accident, he crawled to the side sliding door, opened it, and fell out of the Van 1. FA 5 also stated he saw fire dripping from underneath the van.

At approximately 0849, the first call was made to the 911 Call Center by a civilian bystander; the caller indicated there had been an accident with injuries, and one of the vehicles was on fire. Around the same time, an active duty Air Force Staff Sergeant (Airman) currently assigned to the Defense Intelligence Agency, was traveling eastbound on I-40 with his wife and children. The Airman did not see the initial impact but saw the immediate aftermath - the recoil of Van 1 off the back of the Dump Truck. Upon stopping his vehicle, the Airman ran across the median to render aid.

² Photo inserts in Figure 2-2 were taken at about the same time of day and similar weather conditions as existed the day of the accident.

The Airman stated that FA 2 was in the driver's seat and FA 3 was in the front passenger seat, and that both were wearing seat belts. The Airman went directly to FA 2 to help FA 2 extricate from the vehicle. The front driver's window was broken but FA 2 was pinned in the vehicle between the seat and the dashboard preventing the Airman from extricating FA 2.

The Airman noted that the vehicle was on fire and stated that he had to make a triage decision. The Airman proceeded to cut FA 2's seat belt with a knife; directed two bystanders to assist FA 2 escape the burning vehicle; and then focused his efforts on helping FA 5, who was outside the passenger side of Van 1, trying to extricate FA 4 from the van.

The Airman took FA 5 to the side of the road and returned to Van 1, and extracted FA 4 from the van. He placed FA 4 next to FA 5 on the right side of the road. He cleared FA 4's airway, confirmed he was breathing, and directed FA 5 to stay with FA 4 and alert him of any changes to FA 4's condition.

The Airman returned to the van to extract FA 1. FA 1 was seated on the floor of the van, directly behind the driver's seat, with his back against the left wall of the van, but the Airman had to remove luggage that was on top of FA 1 to remove him. The Airman extracted FA 1 from the van and placed him next to FA 4 and FA 5.

The Airman then returned to the van and assisted FA 3 in extracting himself from his seat. As the Airman was unable to open the front passenger door, he attempted to break the passenger window with the butt of his knife. After several attempts, the Airman dropped the knife and entered the van through the side sliding door. He pulled FA 3 backwards through the open space between the driver and front passenger seats, and dragged FA 3 out through the side sliding door to safety.

The fire had progressed, and while the Airman was extracting FA 3, flames had begun to appear at FA 2's feet. Once FA 3 was successfully extracted, the Airman ran to secure a fire extinguisher. When he returned to Van 1 with a fire extinguisher, the Airman discovered that FA 2 had been successfully extracted and immediately went to the aid of FA 3 and FA 4 (Figure 2-3).

[Upon arrival of the Federal Agents, the Airman concentrated his efforts on FA 2, as directed by the Federal Agents, and remained with FA 2 until FA 2 was medically evacuated.]

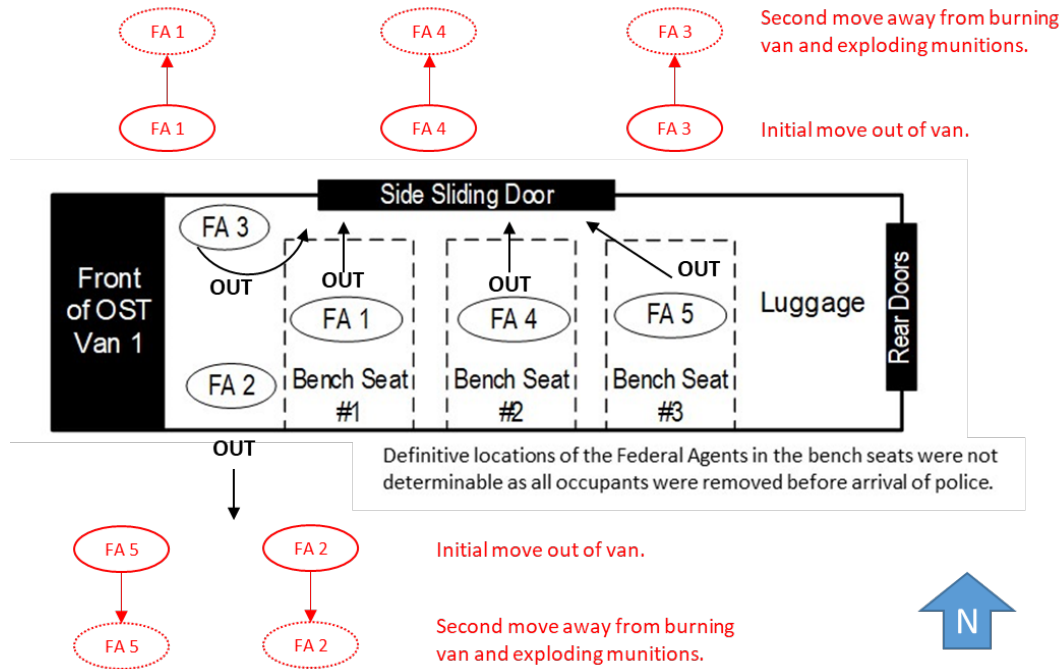


Figure 2-3. Extrication of Occupants of Van 1 after the Accident

OST Van 2 (FA 6, FA 7, and FA 8), OST Suburban 1 (Unit 3 Squad Commander 1, Squad Commander 2, and Squad Commander 3), OST Suburban 2 (DELTA Team), and POV 1 (two Federal Agents) were 0.25 miles east and several vehicles behind Van 1, in stopped traffic (Figure 2-4).

From Van 2's position on the road in the right lane of westbound I-40, the Federal Agents could see the accident site, smoke, and debris between the stopped traffic. Van 2 moved to the right shoulder and drove to the scene of the accident with the intent of rendering aid to whoever was involved in the accident, unaware at the time that the accident involved an OST vehicle. Upon arriving at the accident scene, the Federal Agents in Van 2 realized the accident involved an OST vehicle. Upon seeing Van 2 moving towards the scene of the accident, Suburban 1 and Suburban 2 which were stopped in traffic in the left lane, turned onto the left shoulder and proceeded to the accident. POV 1 also pulled up on the right shoulder to assist in rendering aid.

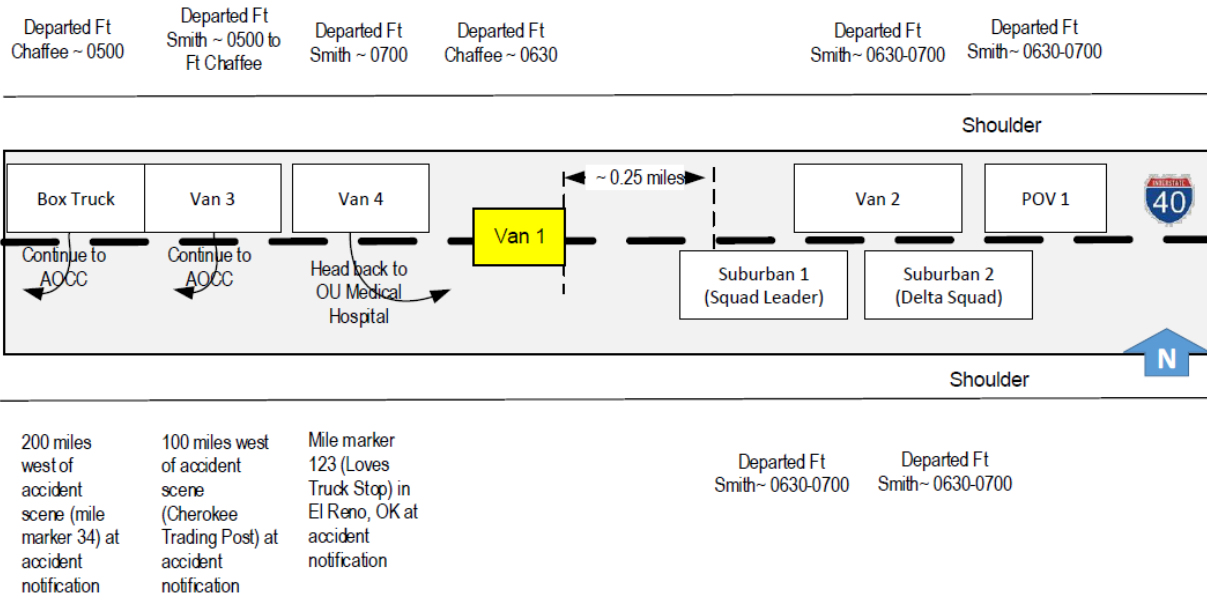


Figure 2-4. Location of OST Vehicles at the Time of Notification/Recognition of the Accident

OST Van 2 occupants included FA 6, an OST Paramedic with military background; FA 7, OST EMT-Qualified; and FA 8, with basic medical training.³ OST Suburban 1 occupants included Squad Commander 2, a Registered Nurse.

Upon their arrival to the scene of the accident, FA 6, assisted by FA 7, initiated triage assessment and medical aid. FA 4 was identified as the most severely injured; FA 4 was able to respond to verbal stimuli but remained unable to communicate verbally. FA 6 indicated that FA 1 was alert and oriented but having difficulties breathing. FA 1 complained of pain and shortness of breath. FA 1 had multiple lacerations on the face and head. FA 3 was alert and oriented, but complained of severe pain.

Federal Agents in Suburban 2 noted FA 2 on the left side of Van 1 and immediately rendered medical treatment. FA 2 and FA 5 were alert and oriented upon the initial assessment, with FA 2 having multiple deformities to his legs and shortness of breath. FA 5 had a primary complaint of back and hip pain.

Suburban 1 arrived at the scene of the accident and proceeded forward on the left shoulder of the road, parking behind Suburban 2. Suburban 1 Federal Agents observed FA 5 was being moved to the median by Suburban 2 Federal Agents. Suburban 1 Federal Agents retrieved additional medical equipment from Van 2. Squad Commander 2 assisted with patient care, while Squad Commander 1 and Squad Commander 3 performed administrative notifications and patient tracking.

³ All OST Federal Agent personnel have completed at least basic medical training.

At approximately 0853, Squad Commander 1 placed a call to the OST Transportation and Emergency Control Center (TECC) in Albuquerque, NM, to inform them that Van 1 was on fire, but did not know what Federal Agents were involved in the accident.

At 0853, the Okemah Fire Department (OFD) Rescue 8 was dispatched.

At 0854, the first OHP State Trooper arrived at the scene of the accident.

At 0855, Squad Commander 2 contacted the OST EOC and provided them with information regarding the accident.

At approximately 0855, Van 1 was fully engulfed in flames; because of this, and munitions going off in Van 1, FA 2, and FA 5 were moved further to the left of Van 1, while FA 1, FA 3, and FA 4 were moved further to the right of the van (Figure 2-3).

At 0856, OFD Unit CO3 was dispatched.

At 0858, FA 6 placed a call to the 911 Call Center requesting two medevac helicopters. FA 6 made a second call, upgrading the request to a total of four medevac helicopters due to the level of trauma and the unavailability of local medical assets.

At 0858, OFD Unit OFD 5 was dispatched and on its way to the scene of the accident.

At approximately 0900, the OST Federal Agents in the OST Box Truck, Van 3, and Van 4 received a call informing them of the accident. As some Federal Agents did not have Government-furnished phones with them and there were no radios in the vehicles, the calls were placed to the Federal Agents' personal phones.

When the Box Truck received notification of the vehicle accident, it was on I-40 at mile marker 34 – approximately 200 miles west of the accident scene. The Box Truck continued to the AOCC and reported arriving at 1215.

When Van 3 received notification of the vehicle accident, it was at the Cherokee Trading Post, approximately 100 miles west of the accident scene. After receiving notification of the accident, Van 3 continued to the AOCC, arriving at 1230.

When Van 4 received notification of the vehicle accident, it was on I-40, mile marker 123, at the Love's Truck Stop in El Reno, OK. After receiving notification of the accident, Van 4 proceeded to the University of Oklahoma (OU) Medical Center in Oklahoma City, OK, to assist with injured FA 5.

Between 0902 and 0906, Squad Commander 1 placed multiple calls to the OST EOC. Squad Commander 1 informed the EOC that First Aid was being administered to the injured Federal Agents, two out of the five Federal Agents were in critical condition, and multiple OHP Troopers were on the scene of the accident.

At approximately 0903, OFD Unit CO2 was dispatched.

At 0906, the first ambulance arrived on the scene; personnel were instructed by FA 6 to bring cardiac equipment and oxygen to FA 4's location.

At approximately 0907, OFD Unit OFD 6 was dispatched.

The second ambulance arrived at 0909 and the third local EMS ambulance arrived shortly after; personnel in both ambulances were directed by FA 6 to care for FA 1 and FA 2. Local EMS increased the request for medevac helicopters to a total of five.

After the initial triage assessment, FA 6 returned to FA 4 since FA 4 was the most critical at the time. FA 6 reassessed FA 4 and identified diminished breath sounds on FA 4's left side. Local EMS administered oxygen to FA 4.

Care of FA 1 was transferred from FA 6 to local EMS Paramedics; FA 1 was re-triaged by local EMS and taken to the first ambulance location for treatment and transport. FA 1's primary complaint was still that of respiratory difficulty.

FA 6 continued monitoring the rest of the injured Federal Agents. FA 7 had started intravenous therapy on FA 3, who was subsequently moved closer to the second ambulance for care by local EMS personnel.

FA 2 and FA 5 were alert and oriented; FA 2 was reassessed by FA 6, while FA 5 was being reassessed by other Federal Agents.

At 0928, the first medevac helicopter arrived on scene. At that time, FA 4 was scheduled to be the first one to be transferred via medevac helicopter to a medical facility.

At approximately 0929, Squad Commander 1 placed a call to the EOC informing them that the injured Federal Agents would be transferred via medevac helicopter to different hospitals.

Within an hour of notification of the accident, the AOCC management and staff began contacting all Unit 3 vehicles, including POVs to ensure everyone was accounted for and had been informed of the accident.

Continuing the triage assessment, FA 6 went back to check on FA 1. FA 6 noted that FA 1's condition had deteriorated rapidly and that FA 1 had gone into cardiac arrest. Local EMS began CPR and placed FA 1 on a chest compression system and cardiac monitor to perform advanced cardiac life support. Due to FA 1's maxillofacial trauma, FA 6 performed a surgical cricothyrotomy, but it had no effect. The chest compression system was paused and FA 1's cardiac rhythm was interpreted as asystolic. Life support for FA 1 was terminated and the request for a fifth medevac helicopter was cancelled.

At 0934, Squad Commander 3 informed the EOC that FA 1 was deceased.

As the medevac helicopters arrived, the care of FA 2, FA 3, FA 4, and FA 5 was transferred from FA 6 to the medical air evacuation personnel. FA 4 was the first to be airlifted, followed by FA 2 and FA 3, to Saint Francis Hospital in Tulsa, OK. FA 4 arrived at Saint Francis Hospital at 1020, followed by FA 3 at 1021, and FA 2 at 1050.

FA 5 was airlifted to the OU Medical Center and arrived at the facility at 1050.

The body of FA 1 was transported via ambulance to the Creek Nation Community Hospital.

Squad Commander 1, Squad Commander 2, and Squad Commander 3 left the accident scene in Suburban 1 for Saint Francis Hospital to assist the injured Federal Agents and their families. Additional Federal Agents went to OU Medical Center to assist FA 5 and his family. FA 6, FA 7, and FA 8 arrived at the Creek Nation Community Hospital to await the arrival of the Oklahoma City Medical Examiner. Upon the arrival of the Medical Examiner, the body of FA 1 was released into his care.

At approximately 1040, additional OHP Troopers arrived at the scene of the accident and began the official OHP investigation. The OST Deputy Director of Training and Training staff were on the scene with the OHP.

At 1200, a Federal Agent called the TECC and was instructed to photograph the accident scene and bag everything up at the accident scene.

At 1951, the AOCC placed a call to the TECC and reported that all OST Federal Agents, except those transferred to hospitals, were accounted for and back at the AOCC.

2.1.1. Event Categorization and Reporting

The ORPS report for this event (N--OST-OST-TSS-2018-0003) was categorized on October 5, at 0921 as a 2(A) any occurrence due to DOE Operations resulting in a fatality or terminal injury. The OST EOC was notified on October 5, at 0852, and the initial ORPS notification report was filed on the same day at 0921.

2.2. DOE Management Response

The TECC was informed of the accident by Squad Commander 1 shortly after 0900. The TECC followed their General Convoy Checklist to ensure the proper actions and notification were conducted. This was not an OST operational mission, so a generic checklist was used. Squad Commander 1 gave the TECC the initial who, what, where, and when of the accident.

The TECC staff contacted the Operations Duty Officer, Emergency Response Duty Officer, Emergency Manager, and the Safety Duty Officer to inform them of the accident. As time allowed, the TECC made notifications to other essential personnel. The designated Emergency Manager was off-site, so the Manager of the Office of Mission Operations performed duties as

the Emergency Manager until the designated Emergency Manager was at the EOC. The Emergency Manager determined that this accident was not an operational emergency, as defined by DOE O 151.1D, *Comprehensive Emergency Management System*. Nevertheless, he decided to partially activate the EOC at 1040 to help facilitate notification and monitor emergency response on the accident scene. The TECC and EOC collaborated on the response to the accident. The OST Assistant Deputy Administrator was notified of the accident, who then notified NNSA Headquarters in Washington, D.C. Additionally, the DOE Watch Office was notified.

The EOC and TECC staff continued to receive information from the accident scene. The Director of the AOCC worked with his command leadership staff to contact family members of the injured Federal Agents. The Emergency Manager obtained NNSA senior management approval and authorized invitational travel orders to allow immediate family members to be reimbursed for travel expenses and hotel costs at the location of where the injured Federal Agents were taken. The AOCC senior staff immediately began contacting all the families/wives of the injured agents and sent senior staff members to FA 1's home to stay with his wife.

Since this accident was in the public domain, the OHP was in charge of the initial accident investigation and scene preservation. At the request of the Federal Agents, the OHP State Trooper on the scene allowed some of the burned equipment to be removed from Van 1 and taken back to the AOCC. The OHP determined this equipment was not relevant for the OHP investigation.

OST staff initiated a report in the DOE ORPS on October 5. However, the report was not received until Friday October 12 because formatting errors prevented the report from being accepted into the ORPS database. Because of the fatality and serious injuries, the EOC notified the DOE Federal Employee Occupational Safety and Health (FEOSH) coordinator.

The EOC was declared deactivated at approximately 1442; however, the Emergency Manager requested that all EOC personnel be available for follow-up actions if requested.

The injury reports and the fatality report were entered into the DOE Computerized Accident/Incident Reporting System (CAIRS) database workspace, reviewed by OST management, and approved for production.

On Tuesday, October 9,⁴ OST management initiated efforts to appoint an Accident Investigation Board in accordance with DOE O 225.1B. It was determined that NA-50, the NNSA Office of the Associate Administrator for Safety, Infrastructure and Operations, would appoint the Board. The NNSA Cognizant Secretarial Officer for Safety was the Appointing Official for the Board. The appointing memo was signed on October 15.

⁴ Monday October 8 was a Federal Holiday, Columbus Day.

The Board interviewed many of the OST Federal Agents that were involved in the response to the accident and OST staff and management at AOCC. The Board directed OST personnel to refrain from discussing the accident with each other and personnel outside of OST, to help ensure the information from testimonies was not unintentionally corrupted.

ANALYSIS

The OST emergency response performed well and facilitated the rapid notification and response to the accident. Even though this was not a typical operational emergency, the partial activation of the EOC was beneficial to ensure proper support personnel with the correct subject matter expertise was available to respond to the accident.

The Board requested OST personnel refrain from discussing the accident with each other and personnel outside of OST to help ensure the information from testimonies was not unintentionally corrupted.

The Board requested OHP conduct a ‘sweep’ of Van 1 and to see if there was any evidence of expended ammunition. Suspect material was in fact found and determined by OTS to be expended munitions. This is further discussed in Section 2.4.7. “Accountability” of this report.

CON 1: The Board concluded that the emergency response provided by all OST personnel on the scene was effective and instrumental in preventing a greater loss of life to the injured Federal Agents.

2.3. Accident Analysis

The Board used several analytical techniques to determine the causal factors of the accident, including change, barrier, and error precursor analysis. Causal factors are the events or conditions that produced or contributed to the occurrence of the accident. Section 2.5. “Examination of Evidence” of this report provides further discussion on causal factors identified by the analyses.

The Board then assessed the causal factors, categorizing them as either direct, contributing, or root causes. The direct cause is the immediate events or conditions that caused the accident. Contributing causes are the events or conditions that collectively increased the likelihood or severity of the accident, but did not individually cause the accident. Root causes are the events or conditions that, if corrected, would prevent recurrence of similar accidents. The direct, contributing, and root causes, as identified by the Board, are included at the end of this section.

Based on the identified causal factors, the Board developed JONs. “Judgments of Need” are documented in section 3 of this report.

2.3.1. Barrier Analysis

Barrier analysis is associated with contact of hazards that results in the occurrence of an accident or event. For an accident/event to occur, there must be an exposure of the hazard to the target (worker). A hazard is the potential for unwanted energy flow that results in an accident or other adverse consequence. A target is a person or object that a hazard may damage, injure, or fatally harm. A barrier is any means used to control, prevent, or impede the hazard from reaching the target, thereby reducing the severity of the resultant accident or adverse consequence. Barriers are a part of a system or work process to protect personnel and equipment from hazards.

The Board reviewed multiple potential barriers that may have kept this accident and its subsequent results from occurring. Appendix B contains a summary of those barriers the Board determined to be ineffective. This analysis identified causal factors, including the ergonomics of the 15 passenger vans, lack of seat belt use by the passengers in the bench seats, and Van 1's speed as the van was attempting to pass the Dump Truck. The analysis also identified several barriers that, due to the nature of the event, were not deemed ineffective, but that were overcome by the events involved in the accident. These barriers are not included in Appendix B, as the Board did not consider them as significant causes of the accident.

2.3.2. Change Analysis

Change is anything that disturbs the balance of a system, which is operating as planned. Change is often the source of deviations in system operations. Change can be planned, anticipated, and desired, or it can be unintentional and unwanted. Change analysis examines planned or unplanned changes that caused undesired results or outcomes. The process analyzes the difference between what is normal (or ideal) and what actually occurred.

The Board analyzed multiple changes identified during the investigation, which are summarized in Appendix C. The analysis identified several causal factors, including:

- Ergonomics of the 15 passenger vans for long distance travel;
- Lack of seat belt use by the bench seat passengers;
- Impacts to seats by the bench seat passengers; and
- Lack of oversight that might have identified the ergonomic issues and lack of consistent seat belt usage.

2.3.3. Error Precursor Analysis

An error precursor is a behavior-shaping factor or performance-shaping factor. Using a checklist of potential error precursors in four categories, the Board reviewed each error precursor and identified if and where it was in existence in relation to the accident. The analysis resulted in the

identification of 14 distinct error precursors on the day of the accident. One of the identified error precursors occurred multiple times on the day of the accident. Appendix D identifies the error precursors resulting from the analysis. Section 2.4.8., “Human Performance,” provides a more detailed description of error precursors and the analysis.

2.3.4. Events and Causal Factor Analysis

An events and causal factors analysis was performed in accordance with the DOE Workbook Conducting Accident Investigations. The events and causal factors analysis begins with analyzing the facts using deductive reasoning to identify the events or conditions that were in place at the time of the accident. The events and causal factors identified are then included on the Events and Causal Factor chart. A summary of the chart is located in Appendix E.

Causal factors identified as either direct, contributing, or root causes, as determined by the Board, are identified on the chart.

The Board concluded that the direct cause of this accident was:
Van 1 collided with the rear of the loaded Dump Truck that was attempting an illegal U-Turn.

The Board identified four contributing causes for the accident and its consequences. The contributing causes are:

- The van driver was unable to take effective evasive and timely actions to avoid the accident.
- The Federal Agents in the bench seats were not using occupant protection (seat belts).
- Van 1 was driving in excess of the posted speed limit in the construction zone.
- Munitions may have contributed to the rapid propagation and intensity of the fire in the van.

The root cause for the accident was:

The Dump Truck pulled in front of Van 1 while the driver of the Dump Truck attempted to make an illegal U-Turn.

2.4. Examination of the Evidence

The Board arrived at the Pantex Site where the AOCC is located on October 16, eleven days after the accident occurred. Documents, combined with oral interviews, provided the Board with valuable information pertaining to management systems and practices that were in place at the time of the accident. Interviews with personnel also provided detailed descriptions of the activities that occurred on the day of the accident and during the emergency response.

The Board examined physical evidence that was directly related to the accident, including evidence at the scene of the accident, and a locked storage area in Okemah where the vehicle was towed and stored. However, some evidence was removed from the scene by OST, with

permission from the OHP, but before being properly documented in their undisturbed state. This evidence includes tactical gear in the back of Van 1, a knife found next to Van 1, and loose munitions near Van 1 that was found by the tow truck driver. This evidence was not critical to OHP's investigation as to the events leading to the accident but may have been critical to the Board's investigation.

2.4.1. Fitness for Duty

This section examines all those components within the category of fitness for duty that would provide insight into the physical and mental condition of the occupants of Van 1 that could have contributed to the accident or mitigated the consequences of the accident.

All OST Federal Agents, because of their mission, are in the DOE/OST Human Reliability program (HRP) as an element of their condition for employment. As part of the OST HRP program Federal Agents are required to be honest and to have: A DOE/NNSA "Q" access authorization; successful completion of initial and annual supervisory review, medical assessment, management evaluation, and a DOE/NNSA personnel security review; an initial drug test and random, unannounced drug tests for the use of illegal drugs at least once each 12 months; and an initial alcohol test and random, unannounced alcohol tests at least once every 12 months. Additionally, the Federal Agents are subject to not consuming alcohol ten-hours prior to reporting for duty.

All Federal Agents must complete the Nuclear Materials Courier Basic (NMCB) training which includes an intensive driving program. The Federal Agents learn to operate tractor-trailer vehicles, which is documented in OST Form (F) 3410.02, *Record of Tractor/Trailer Operator Certification Form*.

In addition to the tractor-trailer driving requirements, the Federal Agents spend many hours driving escort vehicles. Federal Agents who successfully complete the NMCB training, graduate with a Commercial Driver's License (CDL) and they have to maintain their CDL. OST requires driving re-certification on the tractor-trailer every two years.

The Federal Agents have annual HRP certification physicals. The HRP medical examinations fulfill the requirements for their CDL medical requirements.

There is substantial evidence that speed limits are obeyed during OST missions. Safe driving is emphasized in all OST training and operations. Violations of traffic laws can negatively affect a Federal Agent's CDL.

Since a CDL is a condition of employment the Federal Agents are careful to obey the traffic laws. Additionally, OST has an incentive program that gives substantial cash rewards for safety driving as documented in OST Standard Operating Procedure (SOP) 2.00.01A, Safe Driving Award Program.

OST DM 7.02A, *Official Duty Driving Limits*, specifies limits for driving on non-operational⁵ trips. The document states:

“While driving government-owned vehicles, privately owned vehicles, or rental vehicles on official duty status: A driver shall not exceed 10 hours of drive time or 600 miles in one calendar day; two or more drivers in the same vehicle shall not exceed 14 hours total drive time (or 800 miles) in one calendar day; drivers shall be afforded the opportunity to receive eight hours of sleep in one calendar day and prior to driving a full day; drivers shall take at minimum a 15-30 minute break every three hours of drive time; normal work duty and drive time combined shall not exceed 14 hours in one calendar day; and trips shall be coordinated so that no driving occurs between the hours of 10:00 p.m. and 5:00 a.m.”

The training on Thursday, October 4, prior to the Federal Agents returning to AOCC, was lighter than the two previous days, with training operations completing at approximately 1800, more than 12 hours before departure.

Prior to the accident, two witnesses testified that they observed Van 1 for several miles prior to the construction zone and noted that Van 1 was moving with the speed of the traffic, which was from 70-75 miles per hour (mph).

ANALYSIS

All of the Federal Agents are in HRP and therefore have to attain a high standard for fitness for duty.

The toxicology report for the driver of Van 1, FA 2, indicated no concerns. The Board determined that alcohol or drug use were not factors in this accident. The testimony indicates that the Federal Agents in Van 1 had adequate rest prior to leaving Fort Chaffee on Friday morning, October 5. The Board determined that fatigue was not a factor in the accident.

The Federal Agents have a very extensive drive certification and training program. The Board determined that FA 2 was well qualified and was not at fault in the accident. There was nothing FA 2 could have done to avoid the accident.

Witness statements confirm that the van was driving with the speed of the traffic prior to the construction zone. Therefore, excessive speeding or reckless driving was not a factor prior to the construction zone.

⁵ OST vehicles are grouped into two main categories for management purposes: DOE-owned vehicles (subdivided into operational, training, and non-operational), and vehicles leased from GSA.

2.4.2. The Vehicles

The Dump Truck involved in the accident was a 1996 Kenworth with Minnesota license tag number YBP5657 (Figure 2-5). The Dump Truck is owned by Winding Road Construction Company of Big Fork, Minnesota. At the time of the accident, the Dump Truck was loaded with slabs of concrete removed from the highway as part of the construction project on I-40 near Okemah.



Figure 2-5. Photo of Dump Truck Involved in the Accident

A post-accident inspection of the Dump Truck by the OHP revealed the brake lights and turn signals (front and rear) were not functioning. The upper taillight/brake light was barely visible from the rear and the yellow warning lights mounted on the outside mirrors were not visible from the rear.

The OST vehicle (Van 1) involved in the accident was a white, 2013 Chevrolet Express 3500 Model GC3000 15 passenger van. Figure 2-6 shows a van of similar make and model. Van 1 was a General Service Administration (GSA) vehicle that was ordered by GSA for OST in April 2013 and delivered new shortly after. Van 1's GSA plate number was G431311N. Van 1 was self-insured by the U.S. Government. Based on monthly mileage logs through September 2018, and the known trip to Fort Chafee the first week in October, the estimated mileage for Van 1 at the time of the accident was approximately 56,000 miles.



Figure 2-6. Photo of Similar Make and Model Van

The van came equipped with access and egress via the driver's door, passenger door, sliding door on the right side, and two doors in the rear. It was outfitted with driver and right passenger airbags, and head curtain side airbags. The driver and passenger seats had seat belts with shoulder harnesses. Each of the bench seats included three sets of seat belts with shoulder harnesses. The van had four-wheel power disk brakes. It also had an engine governor that was set at the factory default speed of 98 mph. The van did not contain a fire extinguisher. There is no way to tie-down or otherwise contain or restrain cargo placed in the back of the van.

A review of Van 1's maintenance records indicates that the vehicle had been properly maintained and serviced. Routine, on-going maintenance included items such as an oil change, filter change, etc. Four new tires were installed on Van 1 on April 26, 2017, at approximately 44,800 miles. Van 1 was last serviced on May 17, 2018, when it received an oil change. The mileage on Van 1 at that time was 54,725. Van 1 was involved in a minor accident while parked in a Love's Travel Stop in Claude, TX in April 2018. The damage to Van 1 was entirely cosmetic, and it was determined that the OST driver was not at fault.

The rear most bench seat of Van 1 had been removed to allow more room for cargo storage. The seating configuration at the time of the accident was two individual front seats for the driver and the front passenger, and three bench seats behind the driver and passenger seats. Measurements taken from a similar make and model of the van used by the AOCC are as follows:

- Bench seats are 54 inches wide and there are three seat belts per bench seat – each with a shoulder harness.
- The distance from the front of the first bench seat to the back of the driver seat was a maximum of 11 inches at the time of the accident (based on position of front seat and size of the driver).

- The distance from the front of the first bench seat to the back of the passenger seat was approximately nine inches (based on the position of the passenger seat for the size of the passenger).
- The distance from the front of the second bench seat to the back of the first bench seat is eight inches on the left side and nine inches on the right side.
- The distance from the front of the third bench seat to the back of the second bench seat is nine inches on both sides.
- The distance from the third bench seat to the passenger side wall is 14 inches.
- The distance from the second bench seat to the passenger side wall is 10 inches.
- The distance from the first bench seat to the passenger side door is 13 inches.

After the accident, Van 1 was completely engulfed in flames (Figure 2-7). The intensity of the fire was verified through interviews with witnesses at the scene, as well as reviews of the dash cam video and audio from the first responding OHP State Trooper. The fire was confirmed to have started in the front of the vehicle but quickly spread to the remainder of the van – igniting the fuel tank. Several witnesses at the scene, including two law enforcement officers and the local fire chief, stated that they heard what sounded like rounds going off from inside Van 1 and “fireworks like” explosions from the passenger area.

One of the law enforcement officers at the scene stated that he believed the fire spread quickly after the initial explosion(s). Some witnesses stated they were told by Federal Agents at the scene of the accident to be careful because there were “rounds going off” inside of Van 1. An unknown Federal Agent at the scene was heard on dash cam audio identifying himself as a Federal Agent and telling someone that the sounds they heard were rounds going off. Other related comments by Federal Agents at the scene were also heard on dash cam audio.



Figure 2-7. Photo Taken by Airman of Van on Fire Shortly After the Collision

The OHP performed a post-crash investigation of the contents of Van 1. At the request of the Board, the items were sent to OST headquarters for safe storage. An investigation of the contents of Van 1 by the Board, with the assistance of an OST munitions expert, revealed they included remnants of munitions – some of which were verified to have ignited during the fire. Further discussion of the presence of munitions in Van 1 is described in Section 2.4.7. “Accountability” of this report.

As part of the investigation, the Board acquired the services of an independent vehicle accident consultant. His report indicated that vehicle fires are rare and, based on research and his experience, most vehicle fires are caused by mechanical or electrical system failures. It is estimated that of all vehicle fires, only three percent are due to collisions. Furthermore, only two percent of vehicle fires start in the fuel tank or fuel line.

The Board conducted two post-accident inspections of Van 1 at the storage area in Okemah. Numerous measurements and photos were taken and sent to the independent vehicle accident consultant for his analysis. Van 1 was a total loss due to the extreme nature of the fire and the extensive damage from the accident.

The front end of Van 1 was severely crushed, pushing the engine back into the occupant compartment. There was also significant damage to the backs of the first and second bench seats, presumably from the occupants of the seats behind them impacting the backs of the seats.

The Board confirmed that with the exception of the driver's seat, all the seats remained securely fastened to the floor of the van (Figure 2-8). Accident scene photos indicate the driver's seat bent up and forward, [The driver's seat was removed at the crash site at the request of the OHP investigating officer to see if there were any remnants of the airbag control module under it so the Board could not verify if it had broken loose.]



Figure 2-8. Bottom Frame of Van Seat

The airbag control module, also known as the airbag electronic crash unit, was destroyed as a result of the high intensity fire and no information could be obtained from it. The seat belt pretensioner devices were also destroyed, and they could not be removed for examination to determine if they had been activated. It could not be determined if the airbags had actuated because there were no remaining remnants of the airbags due to the fire (Figures 2-9 and 2-10).



Figure 2-9. Side View of Van Damage from Fire and Collision



Figure 2-10. Inside View of Van Damage from Fire and Collision

Based on a review of accident scene photos, the independent vehicle accident consultant stated in his report that he believed the skid marks left by Van 1 indicated that the wheels locked, which may indicate a malfunction of the Anti-Lock Brakes (ABS). The report from Trooper 1 of the OHP did not indicate that the ABS failed. In response to a follow-on request from the Board, OHP State Trooper 1 stated that it was his opinion the skid marks were from anti-lock braking with weight shift and he did not believe the anti-lock function of the brakes failed.

ANALYSIS

The AOCC has a variety of vehicles at their disposal. There are mission vehicles and other support vehicles that are not used in direct support of missions. Examples of support vehicles include vans similar to the one in the accident, SUVs, panel trucks, box trucks, and pickup trucks. These support vehicles are used to transport personnel to training events, local transportation of personnel on the Pantex site and the Amarillo area, and transportation of other Federal Agents that are in a mission status but in a required overnight rest status at AOCC.

The 15 passenger type vans were ordered by OST because they must have the capacity to support all of the above needs with a limited number of vehicles. In discussions with AOCC management, they stated that they would rather use air transportation for personnel or put them in a Suburban or similar full-size SUV, but their ability to do that is limited. The Board has drawn conclusions in Section 2.5.8. "Human Performance" of this report related to the use of the 15 passenger vans for long trips.

The Board determined that Van 1 was properly maintained and there were no indication of any safety issues during the pre-trip vehicle inspections that would have precluded use of Van 1.

Regarding Van 1's ABS, the Board believes there was nothing to indicate the system was not functioning properly. The opinions of the independent vehicle accident consultant and the OHP differed regarding the function of the ABS during the accident. The OHP investigator based his opinion upon viewing evidence at the actual accident site, whereas the independent vehicle accident consultant had to rely solely on photographs to conduct his analysis. Therefore, the Board is supporting the opinion of the OHP, concluding there is no reason to believe the ABS did not function properly.

With regards to the post-accident fire, the Board considered multiple witness statements concerning the fire and explosions in the vehicle, including witness statements from law enforcement officers and fire personnel at the scene, and statements made by Federal Agents that were recorded on the OHP dash cam audio. The Board also considered the munitions found in the post-accident inspection performed by OHP. Based on that evidence, the Board definitively accepts that the munitions in Van 1 contributed to the rapid spread of the fire in the van.

Per OST Federal Agents requirements, munitions are strictly forbidden from being in the vans, or within the possession of the Federal Agents at any time while in travel status. The munitions may have caused the fire to spread much quicker and be more intense, and certainly presented a hazard to the victims and responders once the vehicle was consumed by fire. Further discussion of the presence of munitions in Van 1 is described in Section 2.4.2. "The Vehicle" and Section 2.4.7. "Accountability" of this report.

CON 2: The Board concluded that the munitions in the van may have caused the fire to propagate faster.

CON 3: The Board concluded that the munitions in the van presented a significant danger to the occupants of the van, the civilian "good Samaritans" that assisted with the rescue and emergency response personnel; and could have caused additional serious injury or loss of life at the scene.

2.4.3. Traffic Collision Investigation

As noted earlier, the Board relied upon the OHP Traffic Collision Report, prepared by OHP Trooper 1, to provide the facts related to the accident. The following three pages contain an excerpt from the OHP Traffic Collision Report⁶ with the names of Federal Agents redacted as was the name of the Dump Truck driver.

⁶ The OHP Traffic Collision Report uses Vehicle 1 to represent the Dump Truck and Vehicle 2 to represent the OST Van 1.

FACTS

- 1) On Friday, October 5, 2018 at approximately 08:48 AM, a two vehicle collision occurred on Interstate 40, westbound lanes, mile marker 225.4, Okfuskee County.
- 2) The collision occurred in an active work zone, workers were present. The work zone included a closure of the outside (right lane). The collision occurred in the termination area of the work zone, the lane closure had ended and both lanes were open. The collision occurred approximately .6 miles west of where the lane closure ended (at the 226 MM sign) and approximately 1272 feet east of the end work zone signs. The posted speed limit was 55 mph.
- 3) The dump truck driver was driving a 1996 Kenworth dump truck bearing Minnesota tag YBP5657 and public VIN# 1NKWX90X9S724896 westbound. The dump truck driver was hauling concrete slab debris from the work zone to a dump site in Henryetta. The dump truck was loaded and had a gross weight of 58,000 lbs. The dump truck driver was alone in the truck.
- 4) FA 2 was driving a 2013 Chevrolet Express passenger van bearing US government tag G431311N and public VIN# 1GAZG1FA8D1168728 westbound. The van was occupied by four other passengers: FA 3-front seat passenger, FA 1-second row passenger, FA 4-third row passenger, and FA 5-fourth row passenger. All van passengers were Department of Energy agents who were returning to Amarillo after completing training at Fort Chaffee.
- 5) The dump truck was on the shoulder, west of where the lane closure ended, either stopped or moving slowly. There were an unknown number of vehicles in front of the van as it came out of the lane closure. The van had moved to the outside lane and was advancing on the dump truck. The dump truck began to move to the outside lane from the shoulder, so the van moved to the inside lane. The dump truck continued to move left into the inside lane, into the path of the advancing van. The van driver began to steer right, impacting the rear of the dump truck.
- 6) Trooper 2, Trooper 3, Trooper 4, and Lieutenant 1 were dispatched to the collision. Okfuskee Sherriff deputies and Creek Nation officers assisted with initial scene and traffic mitigation. Traffic homicide Unit Troopers OHP Trooper 1, Trooper 5, and Lieutenant 2 responded to investigate the collision. OHP Trooper 2 was the first trooper on the scene and his in-car video recording system recorded video of post collision events.
- 7) FA 1 died as a result of injuries sustained in the collision. FA 2, FA 3, FA 4, and FA 5 were severely injured in the collision. FA 5 was transported by Creek Nation EMS to the Creek Nation Hospital in Okemah. FA 2, FA 3, and FA 4 were flown by air ambulance to St. Francis Hospital in Tulsa. FA 5 was flown by air ambulance to OU Medical Center in Oklahoma City.
- 8) The dump truck driver was uninjured in the collision. The dump truck driver stated to OHP Trooper 5 he was driving 55 mph in the outside lane. The dump truck driver was going to turn across the median at a location where there was an opening in the cable barrier. This was his first attempt to turn at that location. The dump truck driver stated there was nobody in the left lane so he moved to the left lane. As he began to slow to make a left turn into the median, the van approached him from the rear at a high rate of speed and struck the rear of the dump truck. The dump truck driver drew a diagram of his movement and showed his truck occupying the left lane then being struck in the rear by the van.

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- 9) The dump truck driver was taken by OHP Trooper 2 to the Henryetta Hospital for evaluation. Trooper 6, a drug recognition expert (DRE) met the dump truck driver at the hospital. The dump truck driver voluntarily submitted to a blood test and an evaluation to determine if he was under the influence of drugs or alcohol. Blood kit #172130 was used to collect three vials of the dump truck driver's blood. OHP Trooper 6 submitted the blood kits via mail to OSBI for analysis. OHP Trooper 6 determined the dump truck driver was not under the influence of drugs or alcohol at the time of the collision. Subsequent toxicology for blood kit #172130 indicated a negative result for any intoxicating substance.
- 10) OHP Trooper 1 and OHP Trooper 5 photographed the collision scene and took 101 photos of the scene and vehicles. OHP Trooper 1 used a small unmanned aerial vehicle to map the post collision scene, taking 228 photos. The photos were used to create a high resolution orthomosaic of the scene. OHP Trooper 5 utilized a Sokkia DX 205 AC/T robotic total station with Juniper version 9.4.92, a computer aided design program used in collision reconstruction. OHP Trooper 1 produced a near to scale, scene based on rendering of the collision from the data points and orthomosaic.
- 11) OHP Trooper 4 conducted a post collision inspection of the dump truck. The inspection of the dump truck revealed the brake lights and turn signals (front and rear) were not functioning. The upper taillight/brake light was barely visible from the rear and the yellow warning lights mounted on the outside mirrors were not visible from the rear. Seven of the ten brakes on the dump truck were found to be out of alignment.
- 12) The area of impact was determined to be near the center of the westbound lanes. The van left approximately 99 feet of tire marks, terminating at an area of numerous gouge marks and scrapes in the pavement. The van came to rest approximately 36 feet west of the impact and the dump truck came to a controlled stop approximately 63 feet west of the area of impact. The area where the dump truck driver was turning was approximately 50 feet wide from pavement edge to end of cable barrier. The rear impact on the dump truck and the position of the dump truck post impact indicates the dump truck driver was likely moving back to the right lane prior to impact.
- 13) Post impact the van began to burn. An eastbound motorist (the Airman), stopped and removed van passengers, rendering aid to the injured. Numerous small explosions were heard by witnesses and responding personnel. The small explosions were determined to be ammunition and other ordinance burning in the fire. DOE agents who were traveling a few minutes behind the van informed emergency workers the van contained guns and ammunition. After the fire was extinguished, DOE agents took custody of all the bags which had been removed from the van, then searched the van, removing unknown items.
- 14) FA 2 and FA 3 were wearing seat belts according to the Airman. FA 1 was seated in the floor behind the driver's seat and FA 5 was trying to pull FA 4 from the van when the Airman first approached it. The second row and third row bench seat frame was deformed in a manner indicating FA 4 and FA 5 impacted the seat back from behind; this suggests FA 4 and FA 5 were not restrained. Additionally, medical records for FA 4 and FA 5, and the Medical Examiner's report for FA 1 show no evidence of injury/bruising commonly associated with wearing a seat belt.
- 15) FA 5 and FA 3 were interviewed and provided their account of the collision. FA 2 refused interview through his wife – OHP Trooper 1 contacted FA 2's wife by telephone on Tuesday, October 23, 2018. FA 4 remains in a coma.
- 16) Fatigue was determined to not be a contributing factor in the collision. The DOE agents went to bed around 9:30 pm and left Fort Chaffee around 6:00 am. According to FA 5, he was driving and they stopped at a gas station in Henryetta where FA 2 began to drive. The dump truck driver stated he had slept from 9:30 pm to 5:00 am. There was no evidence to suggest intoxication or inattention by either driver.

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17) The speed of both vehicles cannot be accurately determined because the post collision movement of the dump truck was controlled. The airbag control module in the van was totally destroyed in the fire and the engine control module in the dump truck was not capable of storing data, therefore no crash data for this collision was obtained.

18) The proximate cause of the collision was determined to be an unsafe lane change by the dump truck driver. This is in violation of Oklahoma statute T47 OS11-309.2.

Whenever any roadway has been divided into two or more clearly marked lanes for traffic, the following requirements in addition to all other consistent herewith shall apply.

1. A vehicle shall be driven as early as practicable entirely within a single lane.
2. The vehicle shall not be moved from the lane until the driver has first ascertained that the movement can be made with safety and then given signal, not less than the last one hundred (100) feet traveled by the vehicle, of his intention to change lanes.

By his own admission, the dump truck driver was attempting to execute a turn across the center median which is in violation of Oklahoma statute T46 OS11-311:

Whenever any highway has been divided into two or more roadways by leaving an intervening space or by a physical barrier or clearly indicated dividing section so constructed as to impede vehicular traffic, every vehicle shall be driven only upon the right-hand roadway unless directed or permitted to use another roadway by official traffic control devices or peace officers. No vehicle shall be driven over, across or within any such dividing space, barrier or section, except through a permanent opening in the dividing space, barrier or section or at a permanent cross-over or intersection as established unless specifically prohibited by public authority. No vehicle shall be driven over, across, or within any temporary opening in a dividing space, barrier or section or at a temporary cross-over or intersection unless specifically authorized by a public authority or at the direction of a peace officer.

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Figure 2-11. Excerpt from OHP Traffic Collision Report

OHP Trooper 1's report (Figure 2-11) has been supplemented with maps, photos, and calculations performed by the Board's independent vehicle accident consultant, and by reviews of medical records by DOE's Chief Medical Officer to provide additional context.

Figure 2-12 provides an overview of the accident site to provide context for the accident that occurred along I-40 west-bound at mile marker 225.4 Okfuskee County (noted by gold star in Figure 2-12 west of N3820 Road).

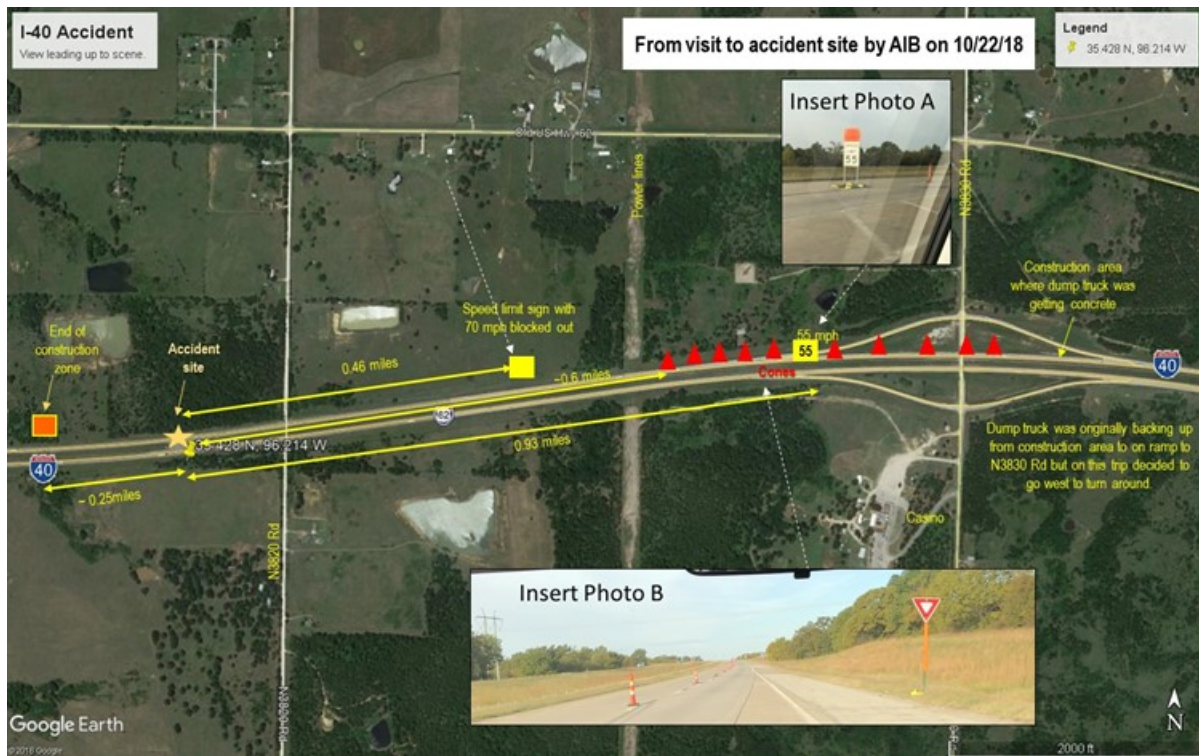


Figure 2-12. Annotated Aerial View of Accident Location

The accident occurred in the termination area of an active work zone where the lane closure had ended and both lanes were open (about 0.6 miles from the end of the lane closure noted by cones in Figure 2-12 and Insert Photo B)⁷ and approximately 1,272 feet east of the end work zone signs where the speed limit returned to 70 mph (noted by orange rectangle in Figure 2-12). The posted speed limit was 55 mph in the work zone.

The Dump Truck was a 1996 Kenworth dump truck described in Section 2.4.2. "The Vehicle" with a single driver and no occupants (Figure 2-13). The Dump Truck was hauling concrete slab debris from a construction area in the work zone to a dump site in Henryetta (east of the accident site).

⁷ Photo inserts in Figure 2-12 were taken at about the same time of day and similar weather conditions as existed the day of the accident.

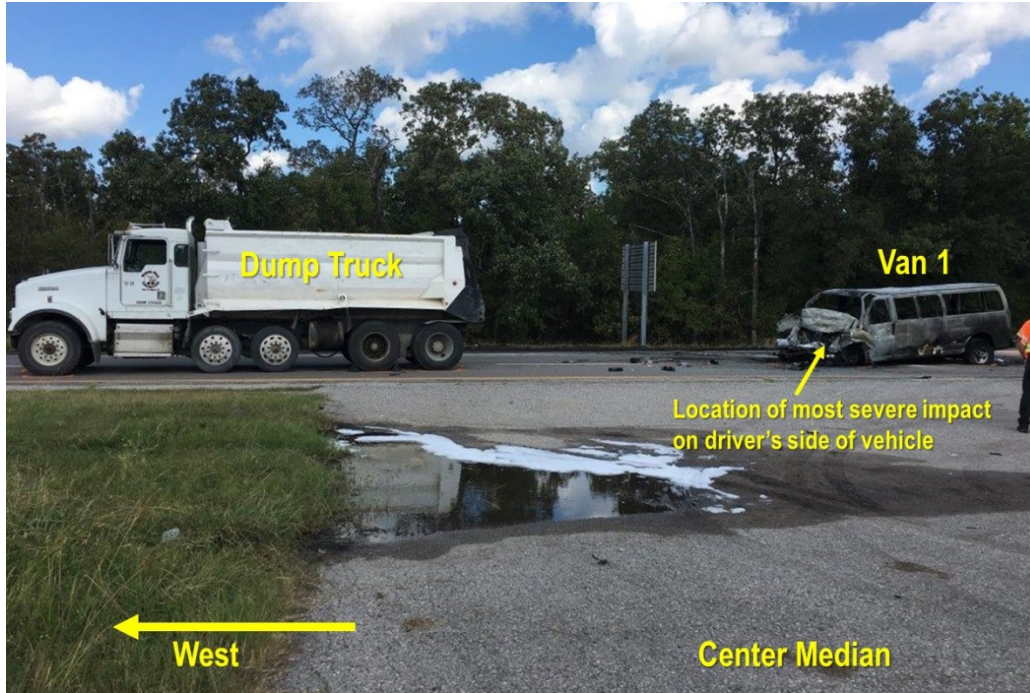
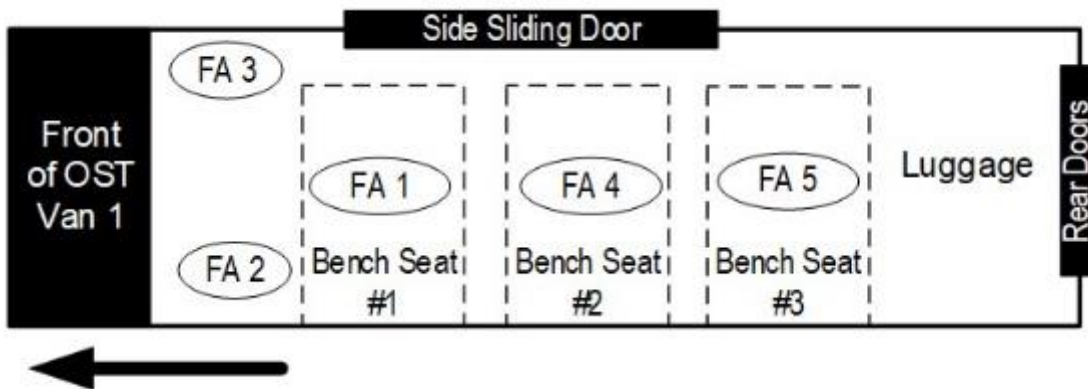


Figure 2-13. Photo Taken at the Accident Scene

Van 1 was a 2013 Chevrolet Express passenger van described in Section 2.4.2., “The Vehicle.” The last bench seat was removed allowing room for storage of luggage (Figure 2-14). The van was occupied by five Federal Agents who were returning to Amarillo after completing training at Fort Chaffee, AR. The seating location of the five Federal Agents at the time of impact is shown in Figure 2-14. The definitive locations of the Federal Agents in the bench seats were not directly determinable by the Troopers because all occupants had been removed from the vehicle before their arrival.



Definitive locations of the Federal Agents in the bench seats were not determinable as all occupants were removed before arrival of police.

Figure 2-14. Location of Occupants at the Time of the Collision

According to the OHP Report, the Dump Truck was on the shoulder, west of where the lane closure ended, either stopped or moving slowly. There were an unknown number of vehicles in front of the van as it came out of the lane closure. After the lane closure ended, the Dump Truck was in the right lane near the shoulder. The Dump Truck driver began moving towards the left lane to cross the center median at a location where there was an opening in the cable barrier. As he approached the break in the barrier, he slowed to complete the U-turn. Van 1 driver noticed the Dump Truck and sped up to pass. The Dump Truck driver stated that as he moved into the left lane, he noticed a van moving up behind him at a high rate of speed. Van 1 driver realized that the Dump Truck had moved into the path of the van, braked hard as he swerved to the right in an evasive action. About the same time, the Dump Truck driver attempted to move back into the right lane to avoid colliding with the van. At this point, Van 1 struck the rear of the Dump Truck. The Dump Truck came to a controlled stop approximately 63 feet west and approximately eight feet south of the initial impact area. Van 1 came to rest approximately 36 feet west of the initial area of impact (Figure 2-15).

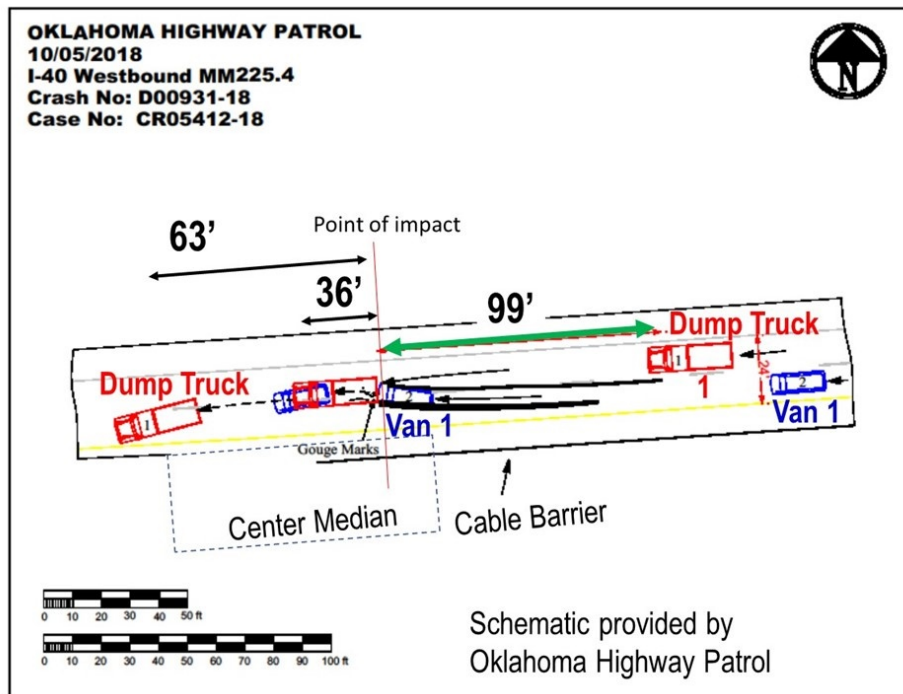


Figure 2-15. Schematic of Collision Scene from OHP Department of Public Safety

According to the OHP Report, the road conditions at the time of the accident were dry, the asphalt road was level, weather was clear, it was daylight, and there were no visibility obscurations [straight road in a locality that was not built up (Insert Photos B and C in Figure 2-12)]. The road conditions were used to determine the speed of the Dump Truck at the time of impact and the speed of Van 1.

The Dump Truck driver stated to an OHP Trooper that he was driving 55 mph in the right lane and was going to turn across the median at a location where there was an opening in the cable barrier. He further stated that when he looked, there was nobody in the left lane so he moved to the left lane (Figure 2-16). As he began to slow to make a left turn into the median, Van 1 approached him from the rear at a high rate of speed and struck the rear of the Dump Truck. There was no indication of lane change provided by the Dump Truck because the brake lights and turn signals were not operating on it. The front seat passenger in Van 1, FA 3, stated that he recalls the Dump Truck veering back to the right at the last moment in an attempt to avoid the collision but ended up in the path of Van 1 who was steering right to avoid the Dump Truck.

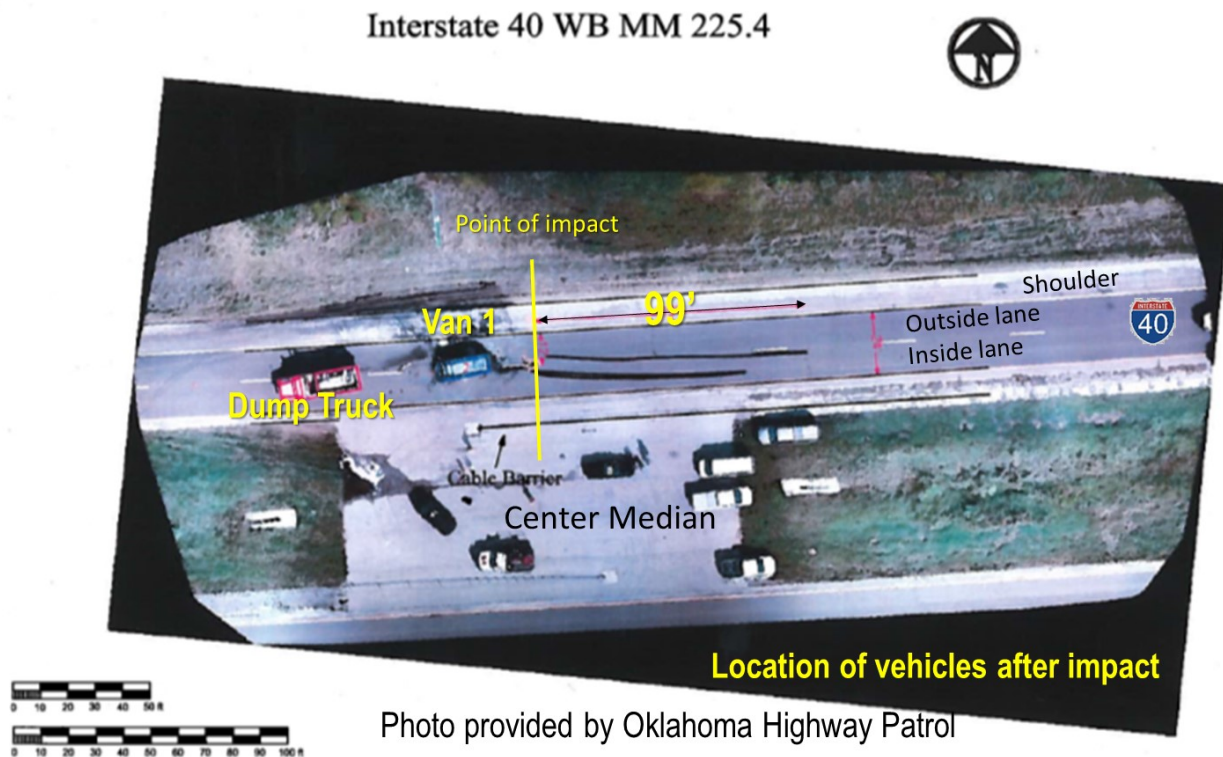


Figure 2-16. Drone Photo of Collision Scene from Oklahoma Highway Patrol Collision Report

There was no evidence of the driver of the Dump Truck was under the influence of alcohol or drugs based on drug recognition expert (DRE) analysis and blood test. Fatigue was ruled out as a contributing factor to the accident by both the Dump Truck and Van 1 drivers. The OST Federal Agents stated that they went to bed around 2130 and left Fort Chaffee between 0600 and 0630 and that according to FA 5, he was driving and they stopped at a gas station in Henryetta where FA 2 began to drive. The Dump Truck driver stated he had slept from 2130 to 0700.

The OHP Report did not provide an indication of the speed of the vehicles prior to the collision. In his interview with OHP Trooper 1, FA 5 estimated that Van 1 was going approximately 70 – 75 mph. The airbag control module in Van 1 was totally destroyed in the fire. If intact, this module would have provided information related to vehicle speed at impact when the airbags were deployed. The engine control module in the Dump Truck was not capable of storing data.

A detailed analysis was performed by the Board’s independent vehicle accident consultant using Engineering Dynamics Corporation HVE-2D 2018 (EDCRASH), build date October 22, 2018.

The consultant used EDCRASH including vehicle and year specific industry acceptable values (i.e., stiffness coefficients, inertial data, weight distribution and related parameters).

Measurements to support the analysis were taken at the Okemah storage facility where Van 1 was taken after the accident (Figure 2-17 and 2-18).

The independent vehicle accident consultant’s analysis indicated that the speed of the Dump Truck was between 27 mph to 35 mph at time of impact based on post-crash controlled braking using a range for braking efficiency. His analysis also indicated a speed loss of 60 to 65 mph to Van 1 due to impact. Accounting for 99 feet of skid marks, the independent vehicle accident consultant determined that the speed of Van 1 prior to taking evasive actions was between 75 to 80 mph (exceeding the posted 55 mph speed for the construction zone by 20 to 25 mph).

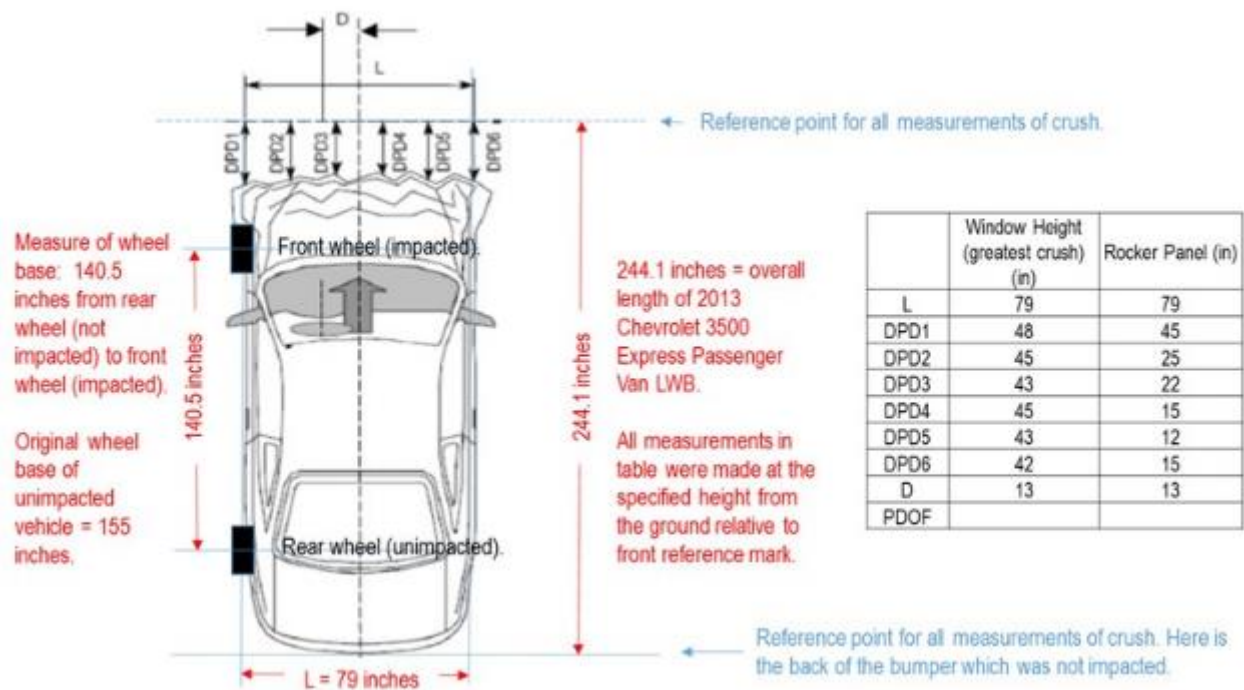


Figure 2-17. Vehicle Deformation Measurements to Support EDCRASH Analysis

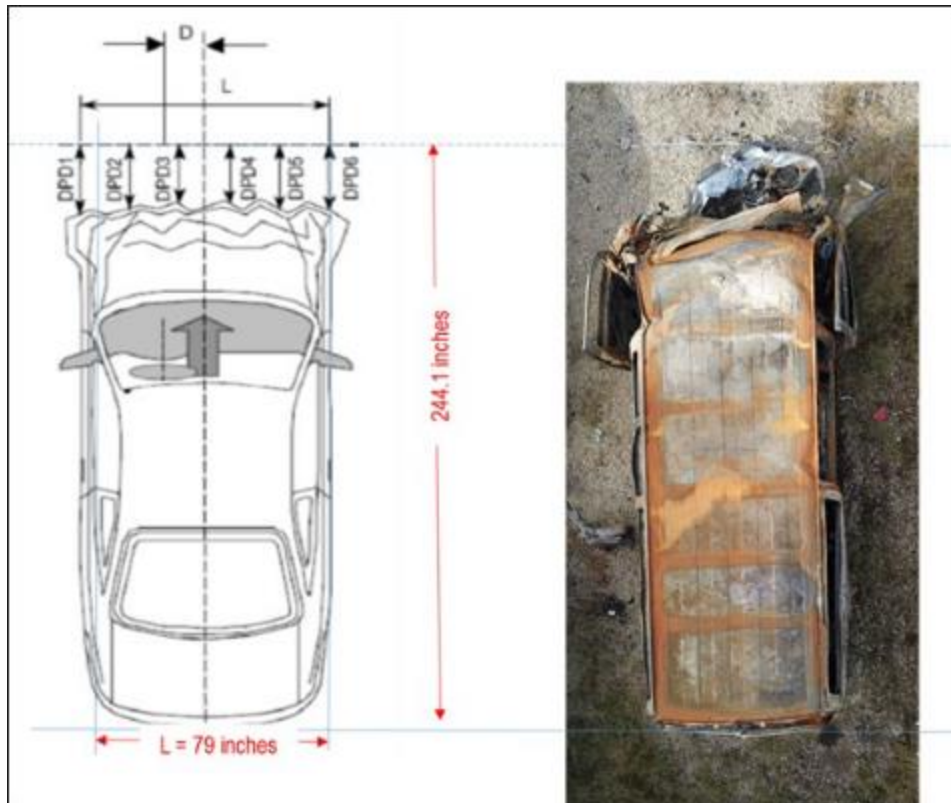


Figure 2-18. Vehicle Deformation Measurements to Support EDCRASH Analysis Relative to Van

According to the OHP Report, the cause of the accident was the Dump Truck driver changing lanes unsafely (violation of OK statute T47 OS11-309.2) while attempting to turn across the center median (violation of OK statute T47 OS11-311).

According to the OHP Report, FA 1 died as a result of injuries sustained in the accident. FA 2, FA 3, FA 4, and FA 5 were severely injured in the accident. The body of FA 1 was transported by Creek Nation EMS to the Creek Nation Hospital in Okemah. FA 2, FA 3, and FA 4 were flown by medevac helicopters to St. Francis Hospital in Tulsa. FA 5 was flown by medevac helicopter to OU Medical Center.

Specific descriptions of the Federal Agent's injuries were provided by the DOE's Chief Medical Officer and reviewed by the Board's independent vehicle accident consultant to help in determination of accident conditions. A summary of the injuries to the Federal Agents is included in Section 2.4.6. "Emergency Response" of this report.

ANALYSIS

There were many indicators that the movements made by the Dump Truck driver was the primary cause of this accident. These included the illegal U-turn made attempting to cross the median and the slowing of the Dump Truck without significant indication

OHP Trooper 1's report noted that the Dump Truck driver violated two OK Statutes (T47 OS11-309.2 and T47 OS11-311), indicating that the attempted U-turn by the Dump Truck driver was illegal. The Dump Truck driver, by his own admission, stated he was attempting to execute a turn to cross the median to head back to the dumpsite in Henryetta which was east of the accident site. According to the driver, this was the first time he had attempted the U-turn maneuver. Earlier attempts to return to the dumpsite in Henryetta involved backing up to a highway exit that was closed as a part of the construction project.

A post-accident inspection of the Dump Truck by OHP revealed that the brake lights and turn signals (front and rear) were not functioning; the upper taillight/brake light was barely visible from the rear; and the yellow warning lights mounted on the outside mirrors were not visible from the rear. This lack of signaling capability is evidenced in OHP Trooper 1's Accident Report.

According to OHP Trooper 1's report, the rear impact on the Dump Truck and the position of the Dump Truck post-impact indicates that the Dump Truck driver was likely moving back to the right lane in response to seeing Van 1 approaching at a high rate of speed. This movement put the Dump Truck into the path of Van 1, which at the time had also steered right in an attempt to pass the truck on the right. This is evidenced by the location of the collision near the center of the westbound lanes, the fact that the primary area of impact on Van 1 occurred in the front on the driver's side, and the impact of Van 1 into the Dump Truck on the left (driver's side) tailgate (Figures 2-17, 2-18, and 2-19).

The fact that the well trained and experienced OST van driver (FA 2), was unable to fully execute a maneuver to avoid the Dump Truck indicates that the Van 1's speed above the posted speed limit increased the probability of the accident. Van 1's speed resulted in a short closing distance between Van 1 and the Dump Truck, reducing the driver's reaction time and exacerbated the level of injuries to the occupants of the vehicle. This was evidenced by the severe extensive front end damage with direct damage distributed across the front, left aspect (Figure 2-19). This included extensive crush and deformation. Direct contact damage width spanned the entire front end and extended rearwards past the A-pillar (Figure 2-20). The damage pattern included longitudinal deformation to the bumper, grille, both headlight assemblies, both front fenders, hood, engine compartment components, windshield header, roof, and surrounding components. There was also extensive induced damage on the interior of the vehicle and across the roof – based on photo examination.

To further examine the effect that the speed of the van had on the accident, the Board requested additional information from Trooper 1 of the OHP. Regarding this request from the Board as to the effects of the speed on the injuries sustained, Trooper 1 stated in an email:

“Speed doesn't always equate to injury. The delta V, or change in velocity, a vehicle and the occupants undergo is what results in injury and death-speed loss over milliseconds. The generally accepted delta V when we start to see death is 35

mph. If the van was travelling 55 mph when braking began (99 feet of braking), the speed at impact would have been approximately 28 mph (at 55 mph the van would still have impacted the truck). The van's delta V would have been lower than 28 mph because the truck was moving the same direction as the van. If the van was travelling at 55 mph it would have experienced a much lower negative delta V, and I believe we would have seen less serious, more survivable injuries to the passengers-especially the unrestrained passengers.”

Assuming the van was moving at 55 mph and followed the same path, it would have impacted the truck at approximately 28 mph. But in reality, a slower speed may have resulted in the driver being able to steer and avoid the truck, or impact it differently-not a full frontal impact. A slower speed may have also allowed for more controlled steering and a shorter stopping distance.



Figure 2-19. Photo Showing Extensive Damage to Front of Van



Figure 2-20. View of Van from Driver's Side Showing Damage to A-Pillar and Crushing of Top of Van

Through numerous interviews and discussions with OHP Trooper 1 and the Airman, it was clear that, although not the first to arrive on the scene, the Airman was the first emergency trained person to arrive and take control of the accident site and organize the extraction of the Federal Agents from the van. The Board determined that his efforts reduced the level injuries suffered by the Federal Agents and perhaps saved additional lives.

CON 4: The Board concluded that the actions of the Dump Truck driver was the cause of the accident.

CON 5: The Board concluded that the speed of the van decreased the driver of the van's ability to respond to the Dump Truck's lane change, thereby increasing the probability of the collision.

CON 6: The Board concluded that the speed of the van exacerbated the level of injuries of the occupants in the van.

2.4.4. Traffic Safety

The OST flows down the motor vehicle safety requirements identified in DOE O 440.1B, *Worker Protection Program for DOE Federal Employees (Including the National Nuclear Security Administration)*, and the NNSA issued Policy Letter NAP-6A, *Federal Employee Occupational Safety and Health Program*, through a series of manuals, policies, SOPs, and training.

DOE O 440.1B specifies vehicle safety requirements applicable to the OST Accident Investigation. Specifically, Attachment 1, Section 8, has several requirements pertaining to the implementation of a general motor vehicle safety program by DOE elements, including: minimum driver licensing requirements (including appropriate testing and medical qualification); requirements for the use of seat belts, abiding by speed limits and other traffic rules, and requirements for motor vehicle maintenance and inspection

Additionally, NNSA issued NAP-6A that promulgates the FEOSH Program. NAP-6A, Section 3.1.8, *Motor Vehicle Safety* states:

“Supervisors should assure that employees are properly licensed to operate any assigned motor vehicles and/or powered industrial equipment. All employees are required to wear seat belts and observe posted speed limits and other traffic rules. Supervisors should support awareness campaigns and incentive programs to encourage safe driving by employees both on and off the job.”

OST vehicles are grouped into two main categories for management purposes: DOE-owned vehicles (subdivided into operational, training, and non-operational), and vehicles leased from GSA. OST addresses the motor vehicle safety requirements in DOE O 440.1B and NAP-6A for non-operational and GSA-leased vehicles through the following OST documents:

- OST M 7.09, *Worker Protection Management Program Manual*, requires OST managers/supervisors to ensure operators of government vehicles and government-leased vehicles have a valid license for the type of vehicle they operate, and are physically and medically qualified to operate vehicles. OST personnel who operate vehicles on-duty shall: comply with the applicable laws, speed limits, and traffic control signs and devices; ensure all vehicle occupants utilize seat belts whenever the vehicle is in motion; drive defensively and exercise caution; and drive at a safe speed appropriate to road and weather conditions, but not exceed the posted speed limits.
- OST M 8.07C, *Property Management System*, Section 3.2.6., “Government Vehicle Operators’ Instructions” states that employees must be informed of their responsibilities for safe driving, and compliance with applicable laws and regulations.
- OST Directive Memorandum 7.02A, *Official Duty Driving Limits*, supplements the requirements identified in OST M 7.09 and M 8.07C. OST promulgated DM 7.02A, which includes driving duration limits guidelines for OST Federal Agents while driving

government-owned vehicles, privately-owned vehicles, or rental vehicles on official duty status. This limit was set to a maximum of 10 hours of driving time for individual drivers, or 14 hours for more than one driver, with a minimum of a 15-30 minute break every three hours of drive time.

- OST Policy (P) 7.01D, *Accident Review Committee Roles and Responsibilities*, describes the roles and responsibilities of the OST Accident Review Committee (ARC) in support of the execution of OST SOP 2.00.01A. The ARC reviews all pertinent information on accidents involving OST employees to determine if the accident was preventable or non-preventable. The ARC reviews OST vehicle accidents and causes to enhance vehicle accident reporting and trending, makes safe driving recommendations, and implements corrective actions that could reduce the likelihood of future vehicle accidents on a quarterly basis. Further analysis of ARC reviews is provided in Section 2.4.4, “Traffic Safety” of this report.
- OST SOP 2.00.01A, *Safe Driving Award Program*, reinforces motor vehicle safety through the establishment of a Safe Driving Award (SDA) Program that provides cash incentives and recognition to OST Federal Agents as defined by the National Safety Council’s *Guide to Determine Motor Vehicle Accident Preventability*.

ANALYSIS

The Board verified that the OST Federal Agents involved in the vehicle accident had valid and current Class A CDLs, as required by OST M 7.09. Additionally, the OST Federal Agents received training, and were tested on safe and correct driving techniques. OST 02.03.01.07 AA, *Safe Driving Techniques Lecture*, includes information on speed management, night and adverse weather driving procedures, and stopping strategies.

The Board reviewed the maintenance records for Van 1 for the years 2013-2018. The records showed that Van 1 was being properly maintained and serviced, and had new tires installed on April 26, 2017.

The Board verified that OST ensures its employees meet their responsibilities for safe driving by requiring that operators of government vehicles and government-leased vehicles have a valid license. Neither OST M 7.09 nor OST M 8.07C specify additional training or instructions for the safe operation of non-operational vehicles; however, OST Federal Agents undergo additional training on safe driving techniques as part of their official duties.

The Board confirmed that, based on the departure time from Fort Chaffee at approximately 0630 and the time of the accident at 0848, the driver of Van 1 was well within the 10-hour driving limit established by OST DM 7.02A.

OST-F B 401.01, *Non-Operational Vehicle Mileage Log*, requires drivers of non-operational vehicles to walk around the vehicles before and after use. The Board confirmed compliance with this requirement through a review of several non-operational vehicles’ mileage logs. OST-F B

401.1 forms were completed by OST Federal Agents the day they left the AOCC for training at Fort Chaffee, and the day they returned to the AOCC. However, OST-F B 401.01 does not provide instructions as to what safety equipment a driver of a non-operational vehicle must inspect before and after a trip.

Through interviews conducted with OST Federal Agents, the Board determined that Federal Agents understood the DOE and OST requirements for driving non-operational vehicles, including the mandatory use of seat belts, observation of posted speed limits, and other traffic rules.

The Board determined, through interviews with witnesses who were in the flow of traffic with Van 1 that, with the exception of exiting the construction zone, the driver of Van 1 was following the posted speed limit and operating Van 1 in compliance with all DOE and OST rules and requirements.

The lack of use of seat belts by FA 1, FA 4, and FA 5, as documented in Section 2.4.5. “Occupant and Cargo Restraints” and Section 2.4.8. “Human Performance” of this report, clearly indicated that the driver did not execute his responsibility to ensure all passengers in Van 1 were wearing seat belts. Additionally, while the driver was following the posted speed limit for most of the trip, his decision to accelerate the van when exiting the ‘active’ construction zone, but while still in the construction zone, resulted in the van being in excess of the posted construction zone speed limit.

While the OHP Traffic Collision Report showed that no improper actions were taken by FA 2 during the collision, Trooper 1 informed the Board that his goal was to determine the immediate, or direct cause of the accident. Trooper 1 did not evaluate any contributing causes.

Based on documentation reviewed and interviews conducted with OST Federal Agents, the Board determined that DOE and OST requirements regarding mandatory use of seat belts, observation of posted speed limits, and other traffic rules are well known. The speed of Van 1 in the construction zone and the lack of use of seat belts by some Federal Agents in the van indicates a disregard of these requirements, and increased the probability of the accident and exacerbated the level of injury to FA 1, FA 4, and FA 5.

2.4.5. Occupant and Cargo Restraints

There are multiple documents that indicate that the use of seat belts is an established requirement for government vehicles. OST makes these requirements to use seat belts known to agents in safety briefings and OST driver training. These documents include:

- Executive Order 13043, *Increasing Seat Belt Use in the United States*;
- GSA 5910.1D ADM, *Use of Safety Belts in Motor Vehicles*;

- DOE O 440.1B, *Worker Protection Program for DOE (Including NNSA) Federal and Contractor Employees, Section 8, Motor Vehicle Safety*;
- DOE Handbook (HDBK)-7251-2016, *DOE Handbook Fleet Management, Sept 2016, Section 6.1, Motor Vehicle Operator Requirements*; and
- NAP-6A, NNSA Policy Letter, *Federal Employee Occupational Safety and Health Program, Section 3.1.8 Motor Vehicle Safety*;

In addition, OST DM 7.02A indicates the following:

While driving government-owned vehicles, privately owned vehicles, or rental vehicles on official duty status:

14.2.3 OST personnel who operate vehicles or motorized equipment on-duty shall:

14.2.3.4 Ensure all vehicle occupants utilize seat belts whenever the vehicle is in motion.

14.7.2 Other Vehicles: Drivers of vehicles not included above must ensure that the vehicles they drive are in a safe operating condition and that all safety equipment is in good condition. As a minimum, the following should be in safe, working condition:

14.7.2.1 Seat belts and shoulder harnesses.

According to the OHP Traffic Collision Report, seat belts were used by the driver and front passenger of Van 1. This was evidenced by witness statements from individuals who stopped and assisted at the scene, and corroborated by a review of forensic information by the independent vehicle accident consultant and through medical reviews of hospital reports. The independent vehicle accident consultant and Trooper 1 both stated that due to the impact, the front seat occupants would have been ejected from Van 1 if they had not been wearing seat belts. A Board member, who inspected Van 1 in the Okemah storage facility after the accident, located the driver's seat belt tongue still attached to its metal receiver. This is consistent with witness testimony that the seat belt of the Van 1 driver had to be cut to remove him.

The OHP Traffic Collision Report states that FA 1, FA 4, and FA 5 were not using seat belts at the time of the collision based on the deformation of bench seat 1 and bench seat 2; and medical records for FA 4 and FA 5, as well as the OK Medical Examiner's report for FA 1, show no evidence of injury/bruising commonly associated with wearing a seat belt.

The degree of deformation of bench seat 1 and 2 (first and second bench seats) is apparent in Figure 2-21, which compares a side view of the seats from an un-impacted comparable van to Van 1, and the angle of seats before and after the accident. In Figure 2-22, by comparing bench seats 1 and 2 to bench seat 3, the location of greatest deformation is in bench seat 1 and bench

seat 2. Additionally, the degree of deformation in the driver's seat (Figure 2-23) indicates significant impact from behind the seat.

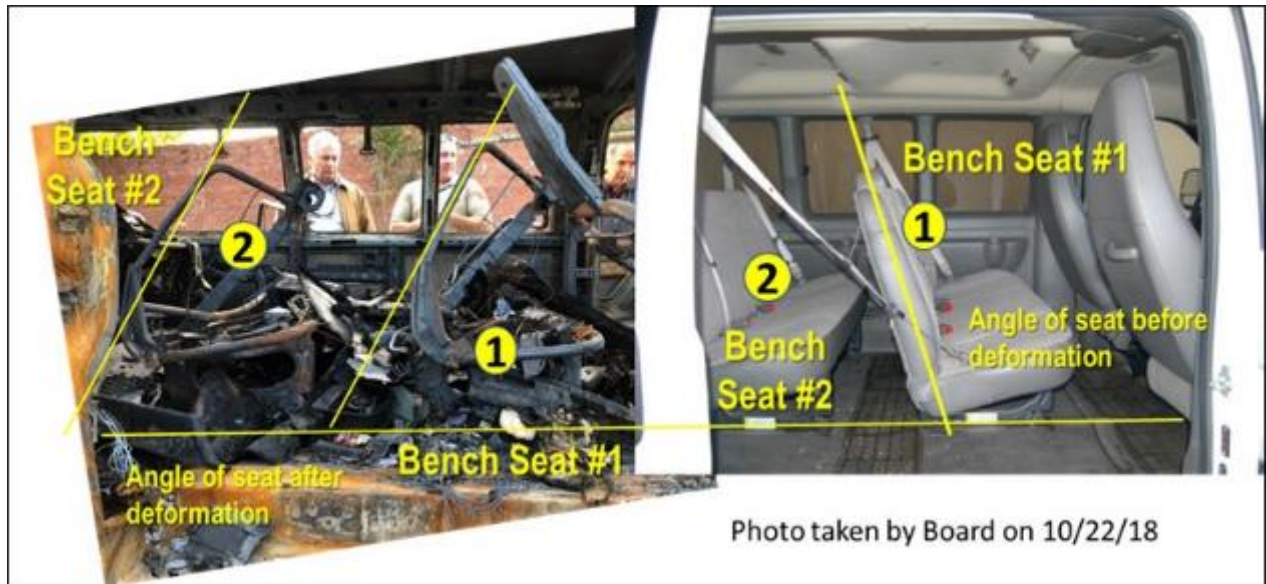


Figure 2-21. Comparison of Van Seats and Deformation of Bench Seat by Occupant Impact (Side View)



Figure 2-22. Deformation of Bench Seats by Occupant Impact (Frontal View)



Figure 2-23. Driver's Seat Deformation Due to Rear Impact

There is no established policy for the use of cargo restraints or cargo limitations for GSA vehicles used as they were on the day of the accident.

Tactical bags are intended to carry the Federal Agents' personnel tactical equipment – but not weapons, ammunition, or munitions. The Board examined a typical tactical bag for a Federal Agent and it weighed approximately 60 pounds. Testimony from other Federal Agents indicate that is a typical approximate weight for a tactical bag.

There were four tactical bags stored in the rear of the van, behind the third bench seat. One of the Federal Agents placed his tactical bag in the Box Truck that was returning to AOCC. The other four Federal Agents put their tactical bags in Van 1, so they did not have to wait for the Box Truck to return to the AOCC. They could stow their gear in their lockers and leave to go home as soon as they returned.

Testimony received by the Board from the Airman was that he removed bags from on top of FA 1 to get him out of Van 1. He stated that, to the best of his recollection, these were not extremely heavy bags and mostly seemed to be personal luggage. At least one of these tactical bags, originally located in the luggage area (Figure 2-24), was thrown out of the side door on the passenger side of the Van 1 (Figure 2-25).

The tactical bags and the gear left inside them was significantly destroyed by the fire. The tactical bags were retrieved by Federal Agents after the accident and taken back to the AOCC. When the Board requested to see the contents of the bags, they were informed that the bags had

been taken to the OST facilities at Ft. Chafee and would have to be shipped to AOCC. Subsequent to this request, the Board was informed that the bags were at AOCC. The Board was shown three plastic bags and were told they contained the contents of the tactical bags. The Board confirmed that what was in those bags was typical tactical gear that Federal Agents would have, and that it was severely damaged by fire.



Figure 2-24. Photo of Back of Van Showing Impact of Tactical Gear behind Bench Seat 3



Figure 2-25. Tactical Bags Removed from Front of Van to Access FA 1

ANALYSIS

According to discussions with OHP Trooper 1, occupants toward the front of vehicles in frontal crashes typically absorb most of the energy from the collision. As the energy dissipates towards the back of a vehicle, less energy is transferred to the occupants sitting there, and therefore, less severe injuries occur. OHP Trooper 1 and the independent vehicle accident consultant also stated that if the driver and front passenger had not been wearing seat belts, they would have been ejected from the vehicle and their injuries would have been substantially greater. Based on a comparison of injuries of FA 2 and FA 3 with FA 1, FA 4, and FA 5, the Board concluded that the lack of seat belt use exacerbated the injuries to FA 1, FA 4, and FA 5. This is reinforced by statistics from the U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA), where they indicate that 70 percent of 15 passenger van occupants killed in crashes from 2007-2016 were unrestrained.

Several Federal Agents interviewed during the investigation suggested that the deformation of the bench seats could have been caused by tactical bags thrown forward by the force of the accident, as opposed to unbelted Federal Agents. The Board does not believe the evidence supports that the deformation was due to the impact of tactical bags stored in the back of Van 1 (Figure 2-24). The degree of deformation of bench seat 1, bench seat 2, and the driver's seat is much greater than bench seat 3, which would have had the most impact by the tactical gear in the storage area if it was thrown forward. Bench seat 3, at the back of the van, shows the least amount of deformation (Figure 2-25). Additionally, a review of a similar van coming back from a training event indicated the tactical bags were basically restrained between the rear doors and the back of the rear bench seat. The type of impact in the accident would not create a force that would have caused the bags to vertically lift two to three feet and then fly forward. Finally, if tactical gear did cause the deformation of bench seats 1 and 2, the flying bags would have caused much more traumatic injuries to FA 5 who was sitting immediately in front of the luggage area. FA 5 was the least medically impacted occupant of the van. Discussions with OHP Trooper 1 confirmed the Board's analysis.

The fact that FA 1, FA 4, and FA 5 were not using seat belts at the time of the collision is contrary to DOE, NNSA, and OST policy for seat belt use while operating a government vehicle on official business. In addition to violating requirements, the Board drew additional conclusions in Section 2.4.8. "Human Performance" of this report as to why the occupants sitting in the bench seats were not wearing seat belts.

Even though luggage was removed from Van 1 in extricating FA 1, there is no direct evidence that the tactical bags from the luggage area were thrown forward, nor can it be determined, based on medical examination, if any bags caused bodily injury to any of Van 1's occupants. The Board believes that the tactical bag laying on the side of the road that was not taken from the rear of the van likely slid up the side of the van towards the front due to impact. The rear bench seat did not go from side to side of the van and there would have been room for one bag to slide up the passenger side from the rear of the van.

The bags on top of FA 1 did impede the ability to get him out expeditiously. The Board determined that while cargo restraints may be prudent under some circumstances, they would not have mitigated the consequences of this accident.

CON 7: The Board concluded that the lack of use of seat belts exacerbated the level of injury of FA 1, FA 4, and FA 5.

2.4.6. Emergency Response

This section provides a more detailed discussion on the role OST personnel and other first responders played in supporting the emergency response following the accident. The occurrence of the accident on a public roadway introduced potential for a combination of first responders and law enforcement personnel from multiple organizations and jurisdictions. This report does not assess the emergency services provided by responding agencies outside of OST. Section 2.2. “Management Response” of this report, addresses the TECC and EOC response to this accident.

As stated in Section 2.2., the Airman arrived at the scene. Although he was not the first civilian to arrive, he was the first to arrive at the scene with emergency response training. He first assessed the condition of FA 2. He found that FA 2’s legs were pinned under the dashboard of Van 1 and that he could not release FA 2’s seat belt, the Airman cut the seat belt with his pocketknife. He was still unable to free FA 2’s legs from under the dashboard.

The Airman noted that the vehicle was on fire and stated that he had to make a triage decision. The Airman proceeded to cut FA 2’s seat belt with a knife; directed two bystanders to assist FA 2 escape the burning vehicle; and then focused his efforts on helping FA 5, who was outside the passenger side of Van 1, trying to extricate FA 4 from the van.

The Airman took FA 5 to the side of the road and returned to Van 1, and extracted FA 4 from the van. He placed FA 4 next to FA 5 on the right side of the road. He cleared FA 4’s airway, confirmed he was breathing, and directed FA 5 to stay with FA 4 and alert him of any changes to FA 4’s condition.

The Airman returned to the van to extract FA 1. FA 1 was seated on the floor of the van, directly behind the driver’s seat, with his back against the left wall of the van, but the Airman had to remove luggage that was on top of FA 1 to remove him. The Airman extracted FA 1 from the van and placed him next to FA 4 and FA 5.

The Airman then returned to the van and assisted FA 3 in extracting himself from his seat. As the Airman was unable to open the front passenger door, he attempted to break the passenger window with the butt of his knife. After several attempts, the Airman dropped the knife and entered the van through the side sliding door. He pulled FA 3 backwards through the open space

between the driver and front passenger seats, and dragged FA 3 out through the side sliding door to safety.

Additional OST Federal Agents arrived within two minutes and immediately began to provide assistance to the injured Federal Agents. FA 6 (Paramedic), and FA 7 (EMT-Basic) arrived on the scene in Van 2 a minute later, with Squad Commander 2 (a Registered Nurse) arriving in Suburban 1 approximately two minutes after Van 2.

Following extrication of the injured, FA 6 and FA 7 conducted initial triage assessments, while other OST personnel and non-OST individuals assisted FA 6 and FA 7. FA 6 and FA 7 began providing medical treatment to FA 1, FA 3, and FA 4 on the right side of the highway, and then moved to the median to assist FA 2 and FA 5. The Airman following the direction of FA 6, attended to FA 2 until he was placed in a medevac helicopter, and airlifted from the scene.

As Van 1 became engulfed in flames, popping sounds were heard, and sparks were shooting from the van. A Federal Agent identified that there were munitions in the van and that people should get back. The injured Federal Agents were moved away from Van 1 more than once for safety.

Based on the initial triage, four patients were identified as Category "Red," with one patient Category "Yellow." All Van 1 Federal Agents were identified as multi-system trauma patients with varied presentations of head, chest, and extremity injuries. FA 1, FA 2, and FA 4 were having difficulty breathing. FA 1, FA 2, FA 3, and FA 5 were alert and communicative; and complaining of pain. FA 4 was not able to communicate verbally, but was responding to verbal stimulus. Centered on his condition at this time, FA 4 was identified to be the highest priority case.

At 0858, FA 6 requested two medevac helicopters be sent to the scene, but his authority to make the request was not recognized by the local 911 operator. An Oklahoma State Trooper subsequently requested four medevac helicopters.

Upon arrival of local Emergency Medical Services personnel, the injured Federal Agents received oxygen. Local Emergency Medical Service personnel requested a fifth medevac helicopter be sent to the scene. FA 6 transferred care for FA 1 to the local EMS personnel, while he continued his support to the other injured Federal Agents. When FA 6 returned to check on FA 1, he found that FA 1's medical condition deteriorated, and immediately began emergency procedures to save him. These proved to be unsuccessful and FA 1 passed away as a result of "multiple blunt force injuries."

Under the direction of FA 6, FA 7, and Squad Commander 2, other OST Federal Agents and local EMS personnel on the scene continued to provide medical treatment on FA 2, FA 3, FA 4, and FA 5. This care continued until care was transferred to the emergency medical personnel in the medevac helicopters.

Due to the extent of their injuries, FA 2, FA 3, FA 4, and FA 5 were all taken individually to hospitals in medevac helicopters. FA 4 was still considered to be the most severely injured and was the first to be airlifted from the scene, followed in order by FA 2, FA 3, and FA 5.

FA 2, FA 3, and FA 4 were airlifted to St. Francis Hospital, in Tulsa, OK. FA 5 was identified as the least severely injured and was airlifted to the University of Oklahoma Medical Center in Oklahoma City, Oklahoma.

The body of FA 1 was taken to the Muskogee (Creek) Nation Hospital, and then transferred to the Oklahoma City Medical Examiner for examination. An autopsy was not performed at the discretion of the Oklahoma City Medical Examiner; however, computerized tomography (CT) scans were conducted and used in the Medical Examiner's determination.

The nature and severity of the Federal Agents' injuries were evaluated by the DOE's Chief Medical Officer. These reviews were based upon reviewing medical records to determine the relative roles played by vehicular safety systems in mitigating injuries. No on-board or eyewitness camera/video was available for review.

2.4.6.1. Occupants Conditions and Physical Data

The following identifies the location and condition of each of the Federal Agents in Van 1 based on the review of medical documents by DOE's Chief Medical Officer.

Federal Agent 1 (FA 1)

Position: Bench Seat Row 1

Notes: An autopsy was not performed at the Oklahoma City Medical Examiner's (OCME) discretion, but CT scans identified minor injuries of left head and severe injuries of bilateral chest. Died as a result of "multiple blunt force injuries" according to OCME report, most likely relating to extensive chest injuries progressing following transfer of care to local EMS.

- Per OCME regarding medical evidence or report of seatbelt/restraint use, "It isn't noted in our file if the deceased was wearing a seatbelt."

Federal Agent 2 (FA 2)

Position: Driver

Notes: Sustained severe injuries of upper back, bilateral chest, abdomen, and extremities.

- No indications regarding seatbelts/restraints in medical records, but restrained per eyewitness accounts.
- Headrests on front seats were rotated 30 degrees as identified Section 2.4.3. "Traffic Collision Investigation" of this report.

Federal Agent 3 (FA 3)

Position: Front Passenger

Notes: Sustained severe injuries of left head and extremities.

- Stated belted in ER and restrained per eyewitness accounts.
- “EMS reports patient was restrained.”

Federal Agent 4 (FA 4)

Position: Bench Seat Row 2

Notes: Sustained severe injuries of left head, neck, chest, and extremities.

- “Unknown if restrained or not was potentially ejected from vehicle.”

Federal Agent 5 (FA 5)

Position: Bench Seat Row 3 (right side)

Notes: Sustained minor injuries of left head and major injury of right pelvis.

- ER left blank, but “EMS reports patient unrestrained” and “seatbelt not worn” and restrained per ENT consultant.
-

Blood alcohol testing was negative for all van occupants. Drug testing performed inconsistently with negative results for FA 1; results reflecting only medications administered by EMS for some, and no results for others.

As FA 6, FA 7, and other OST personnel were assisting with the emergency medical procedures, Squad Commander 1 and Squad Commander 3 were primarily in contact with, and providing information on the status of the injured Federal Agents to the TECC located at OST Headquarters in Albuquerque. These included, but was not limited to:

- Squad Commander 1 was the first to place a call to the TECC at 0851, informing personnel at the TECC of the accident.
- Squad Commander 1 informed the TECC that first aid was being administered to the injured Federal Agents; that two out of the five Federal Agents were in critical condition; and that multiple Oklahoma State Troopers were on the scene at 0855.
- Squad Commander 3 informed the TECC at 0934 that FA 1 had passed away and did not expect that there would be an autopsy conducted on FA 1. FA 1 was expected to be transported to the OU Medical Center. At the same time, Squad Commander 3 informed the TECC that FA 5 would be taken by ambulance to the hospital.
- At 1038, Squad Commander 1 placed a call to the TECC requesting a Signal 30 – Emergency Accident Investigation callout.

- At 1212, Squad Commander 3, who was at St. Francis Hospital where FA 2, FA 3, and FA 4 were transported, placed a call to the TECC to provide an update on the conditions FA 2, FA 3, and FA 4.
- At 1715, the TECC contacted FA 6, who identified that he had information to present on the medical actions taken that day. He had developed a Triage Assessment Report and had given it to Squad Commander 3. This would be shared with management once it was sanitized by the OST Medical Director.

ANALYSIS

The Federal Agents did very well in their treatment of the injured Federal Agents. Based on the severity of all of the injuries to the injured Federal Agents in Van 1, the results of this accident would have been far worse had the OST medically trained personnel not been present at the scene. The Federal Agents worked together to conduct immediate and continuing emergency lifesaving medical operations on all five Federal Agents in Van 1 until care was transferred to the medical crews that then transported them via medevac helicopters to Tulsa and Oklahoma City. The body of FA 1 was taken to the Muskogee Creek Indian Nation Hospital, where it was transferred to the custody of the Oklahoma City Medical Examiner for examination.

CON 1: The Board concluded that the emergency response provided by all OST personnel on the scene was effective and instrumental in preventing a greater loss of life to the injured Federal Agents.

2.4.7. Accountability

When Unit 3 arrived at Fort Chaffee the evening of October 1, sanitization of the tactical gear was performed. This process is defined in Section 11.2 of OST M 7.08, *General Safety Plan for Training Activities and Exercises*. This is a rigorous process to ensure that live ammunition is not co-located with blank ammunition for training exercises and requires that Controllers ensure that all tactical vests, travel bags, and vehicles entering the safe zone are inspected for live-fire weapons, ammunition, and prohibited items. The Multiple Integrated Laser Engagement System (MILES) weapons utilize blank ammunition. Failure to properly conduct sanitization could lead to serious injuries and/or fatalities. Sanitization of tactical gear and vehicles was not performed following the conclusion of training events on October 4 because it is only required prior to a training event, not after.

While on training missions, accountability for professional gear (high value equipment, weapons, and gear) remained formal, while accountability for personnel was localized at the transporting van level.

As part of the training evolution from the AOCC at the Pantex site, accountability was focused on high value equipment (i.e., night vision goggles). There were no OST weapons deployed

with Team 3 for this exercise. High value items were required to be transported by the OST Box Truck, which by practice also carried the individual Federal Agent's tactical gear. The MILES weapons and gear used at the training site are stored at Fort Chaffee and did not need to be transported from AOCC.

Instructions to the Federal Agents on the way to training prior to departing on Monday, October 1 was to report at Fort Chaffee at 1600. No particular vehicle agent assignments outside of the Box Truck were made nor who was in what vehicle noted outside the occupants of each van (i.e. once the occupants determined which van they were riding in. Accountability was focused only on ensuring no occupants were left behind but with no documented accountability of occupants in each van at AOCC.

If the Fort Chaffee barracks are available, the agents are required to stay there, but during this particular training evolution, OST Nuclear Material Courier Basic was training on site and the barrack availability was limited to five of the Federal Agents. The five Federal Agents in Van 1 stayed at Fort Chaffee.

At the end of the day, after cleaning the weapons on Thursday, October 4, the MILES gear was accounted for and stored at Fort Chaffee. On October 4, prior to dispersing for the night, Squad Commander 1, who was responsible for this Unit 3 Training Evolution, gave general instructions to all Agents to depart by 0700 the next day, store the tactical gear in their lockers upon returning to the AOCC, and to take their time. Each Agent was individually responsible to report back to their Squad Commanders when they had stored their tactical gear and were departing the AOCC.

The Box Truck was loaded, locked and secured on Fort Chaffee prior to the Box Truck driver and passenger departing for the hotel. On the return trip back to Amarillo, FA 2, FA 3, FA 4, and FA 5 transported their tactical gear in Van 1 so they could leave AOCC after storing their tactical gear in their lockers; therefore, they would not have to wait for the Box Truck. FA 1 who had other tasks he needed to do upon returning to AOCC and was in no rush, put his tactical gear into the Box Truck.

When departing from Fort Chaffee to the AOCC on Friday October 5, there was no accounting of who was in which van beyond the van-level. This led to confusion both initially at the scene, and later when reporting back to the TECC in Albuquerque, New Mexico, of which agents were in the Van 1. At approximately 0902, after notification of the accident, the TECC requested accountability of all Team 3 Federal Agents. OST managers and supervisors initiated calls to various Federal Agents using cell phones in attempt to find out which vehicle and Federal Agents were involved. Agent accountability continued in subsequent phone calls to identify what hospitals Federal Agents were going to in support of the injured and their arriving families. The final government vehicle arrived at AOCC at 1931 with the exception of the Federal Agents remaining at the hospitals. It was not until 1951 the night of the accident that full accountability for all Federal Agents on the training mission was declared.

Transportation of munitions is normally performed by OST Munitions Contractors who also issue munitions for training at Fort Chaffee. No munitions were authorized to be transported by the OST Agents for this exercise. In addition, OST M 5.16D, *Munitions Management System*, forbids the transport of privately owned munitions in DOE-owned/rented vehicles or allowed on DOE property. Due to numerous verbal reports of munitions being in Van 1, and the possibility of small arms munition going off during the fire, the Board requested that OHP survey Van 1 for evidence of possible munitions. Two pyrotechnic munitions were found in a post-accident survey by the OHP.

ANALYSIS

The lack of a rigorous sanitization of tactical gear at the end of the training evolution contributed to the expended munitions not being discovered and hence their presence in the van during the fire. Small arms munitions are even more likely to go undiscovered without a rigorous sanitation post exercise as no positive evidence of expenditure is required unlike the pyrotechnics. This recurring problem has been verbally expressed to OST Management by the OST Munitions contractor but still remains unresolved. The hazard of munitions going off was stated as a concern by many of the non-OST responders and in witness statements. The munitions going off was one of the reasons for moving the injured agents further away from the van as well as the heat of the fire.

One of the pyrotechnic munitions was found behind the third bench seat and another was found between the second and third bench seats. The munitions found was verified by an OST munitions contractor as not having been expended prior to the fire.

There were numerous types munitions issued as part of the training exercise. There were three different types of the pyrotechnic munition of the type found in the post fire that were issued for training, all which had expenditures reported (totaling 311). Per OST M 5.16D, all munitions issued for training must be reconciled at the end of each business day with the exception of loaded magazines that will be reconciled at the end of the event. There was no means to accurately verify 100 percent expenditure of small arms munitions other than user certification in writing. As part of the reconciliation, users of OST munitions must collect residue of certain munitions to provide positive evidence of expenditure to the original Munitions Issue Point which included the type found in Van 1. OST Federal Agent then signed a formal document acknowledging that munitions listed were in fact expended.

2.4.8. Human Performance

The goal of human performance is to facilitate the development of an organizational structure that recognizes human attributes and develops defenses that proactively manage human error and optimize the performance of individuals, leaders, and the organization. The Department's DOE-HDBK-1028-2009, *Human Performance Improvement Handbook Volumes 1 and 2*, describe the Human Performance Program and tools available for use by DOE organizations. Much of the

information provided in this section of the report is based on the analysis of the events, conditions, processes, and barrier information documented throughout the rest of the report.

A review of human performance is a review of individual's capabilities, task demands, human nature, and operating environment to determine if the organization supports them for success. For purposes of this investigation, the Board looked at human performance to determine if it played a part in causing the accident, and/or if it played a role in mitigating the consequences, given the accident occurred.

In most cases, for a significant event to occur, multiple breakdowns in defenses must first occur. Human error is not a cause of failure, alone, but rather the effect or symptom of deeper trouble in the system. Error-prone tasks and work environments are usually created by latent organizational weaknesses - undetected deficiencies in organizational processes or values or equipment flaws that create workplace conditions that provoke error (error precursors) or degrade the integrity of controls (flawed controls/barriers). Undetected organizational deficiencies plague human performance for the entire organization in every aspect of their jobs

2.4.8.1. Error Precursors

Error precursors are unfavorable conditions that increase the probability for error during a specific action and create what are known as error-likely situations. An error-likely situation typically exists when the demands of the task exceed the capabilities of the individual or when work conditions exceed the limitations of human nature. Human nature comprises all mental, emotional, social, physical, and biological characteristics that define human tendencies, abilities, and limitations. For instance, humans tend to perform poorly under high stress and undue time pressure. Error-likely situations such as these are also known as error traps. Error precursors exist in the work place before the error occurs, and thus are manageable. If identified before or during the performance of work, the conditions can be changed or managed to reduce the chance for error(s) leading to an event.

The Board conducted an Error Precursor Analysis based on the information obtained from documents and personal interviews as documented throughout this report. The results of that analysis are included in Appendix D. The analysis resulted in the identification of 14 different error precursors on the day of the accident. One of the identified error precursors existed more than one time that day. The following is a discussion of some of the more predominant error precursors:

Task Demands

The following four error precursors were identified by the Board in this section: time pressure (in a hurry), repetitive actions/monotony, interpretation requirements, and unclear goals, roles and responsibilities. Although the Board determined these error precursors existed, they do not believe that they prevailed at a level to cause the accident or increase the consequences.

Work Environment

The following five error precursors identified by the Board in this section: changes/departure from routine, lack of alternative indication, adverse physical climate (habitability), poor equipment layout/poor access, and meaningless rules. The Board believes the most relevant were adverse physical climate (habitability) and poor equipment layout/poor access. The Board believes these two error precursors are related with respect to the use of the 15 passenger vans to transport personnel over long distances – and were contributors to the consequences of the accident – particularly for the passengers in the bench seats.

Section 2.4.2. “The Vehicle” of this report, discusses the reasons for having the 15 passenger vans. Although not inherently unsafe, these vans are not particularly suitable for long distance travel because they are not conducive for passengers sitting upright in close configuration and being properly restrained with seat belts for a long distance. The Board verified this through close inspection and measurements in an OST van of similar make and model of the van in the accident. Although physically possible to sit upright in the bench seats, normal human behavior is to get as comfortable as possible for a long trip. This is evidenced by the fact that there were no more than five passengers assigned to any of the 15 passenger vans – one passenger for each of the front seats and one passenger for each bench seat. This allows the passengers in the bench seats to stretch out sideways if they wish – with their legs stretched out across the bench seat. However, this does not allow passengers to be properly “buckled in” with seat belts and shoulder harnesses. The Board believes this was the case in the van involved in the accident based on FA 5’s testimony to the OHP, the position of FA 1 after the accident, the damage to the bench seats and a review of the analysis of injuries by the independent vehicle accident consultant and DOE’s Chief Medical Examiner.

In addition to the seat belt issue, egress from the 15 passenger vans in an emergency situation can be very difficult – particularly from the rear bench seats and for individuals of above-average physical stature.

Individual Capabilities

The Board identified one error precursor in this section: lack of knowledge (faulty mental model). Although the Board determined this error precursors existed, they do not believe that it prevailed at a level to cause the accident or increase the consequences.

Human Nature

The following three error precursors were identified by the Board in this section: habit patterns, assumptions, and inaccurate risk perception. The Board believes that the most predominant error precursors in this section are inaccurate risk perception and habit patterns. Specifically, these error precursors are related to the fact that the individuals in the two front seats of the van were wearing seat belts but the individuals in the back were either not wearing seat belts or not wearing them properly and effectively.

A 2017 study by the Insurance Institute for Highway Safety (IIHS) indicates that 28 percent of adults do not wear a seat belt in the back seat of a car because they believe that the rear seat is safer than the front seat. Adults in the age group of 35 – 54 are the worst offenders, with 40 percent indicating they do not wear a seat belt in the back of the car. The back seat of a vehicle is not inherently safer than the front seat of a vehicle, and believing that is due to having an inaccurate risk perception. As shown by the study by IIHS, this is not abnormal behavior and reinforces that standards for seat belt use by all passengers be effectively communicated and reinforced within OST.

2.4.8.2. Vision, Beliefs and Values

Vision, beliefs, and values of an organization form the foundation on which personnel perform and conduct themselves. They reflect the culture of the organization, articulating who they are and what they represent. Values, in particular, should never be compromised. When everything else is changing or in flux in an organization, adherence to values should remain steadfast. Culture and values drive behavior and can have the same impact on performance and results as the requirements, processes, and practices that guide an organization's operations. Every person and/or group in an organization operates based on his or her core beliefs and values. They are the fundamental basis of human behavior. That is why they are so important.

In normal human behavior, mission support behaviors naturally take precedence over prevention behaviors, unless there is a strong safety culture – nurtured by strong leadership. People like being successful and getting things done. Sometimes leaders err when they *assume* people will be or are safe. However, this is not always the case, particularly if there are latent organizational weaknesses within the organization undermining the desired behavior. Safety and prevention behaviors do not just happen. They are value-driven, and may not choose the desired behaviors because of what is believed or perceived to be a stronger mission focus.

Lacking the establishment and reinforcement of clear standards and expectations, workers will establish their own standards of behavior based on their beliefs and values, sometimes reinforced by peers and supervisors. These standards of behavior may not be the standards of behavior that the organization or leadership expects, or believes are being applied. For example, not wearing a seat belt in the back seat of a vehicle, or having prohibited articles in a vehicle or on their person.

Within OST, achieving and maintaining this safety culture is a particular challenge because, by the nature of their job, Federal Agents may intentionally be placed into unsafe situations. They continuously train and practice being in these potentially unsafe situations and it drives some of their core behaviors. However, these core behaviors must also be balanced with safety-focused behaviors during day-to-day activities. These safety-focused behaviors can be difficult to maintain, and even more difficult to change if they reflect an undesired behavior. Changing these behaviors requires a focused, consistent, and persistent effort.

During the investigation of the accident, the Board found several examples where personnel did not adhere to formal standards and expectations. While it may be easy to point a finger at

individuals for not following rules, leadership must ensure that they are confident that these examples of individuals not following formal standards and expectations or what they believe should have been done, are isolated cases. There were a number of individuals involved, and a number of times choices were made or actions taken that were counter to expectations (the rules). For whatever reasons, personnel did not take the proper actions or adhere to the stated standards. In some cases, there were supervisory personnel either aware or involved in these situations. The Board concluded this is due to a latent organizational weakness(s) within OST that should be addressed by management.

CON 8: The Board concluded that the use of 15 passenger vans for long distance travel promotes an environment where vehicle occupants are less-likely to properly restrain themselves.

CON 9: The Board concluded that the specific behavioral standards and expectations, particularly in non-operational areas, are not always effectively communicated, adhered to, and/or reinforced throughout the organization.

2.5. Integrated Safety Management Implementation

OST implements Integrated Safety Management (ISM) as identified in DOE P 450.4A, *Integrated Safety Management*, and further defined in DOE O 450.2, *Integrated Safety Management*. OST defines its ISM system in *NNSA Office of Secure Transportation Integrated Management System Description*, Revision 3. The five core functions of ISM are: Define Work, Analyze Hazards, Develop/implement Controls, Perform Work, and Feedback and Improvement. In addition, OST has added three safety culture elements to their ISM definition: Leadership, Employee and Worker Engagement, and Organizational Learning.

2.5.1. Define Work

The current method of transporting Federal Agents to training exercises at Fort Chaffee and back to Amarillo was using multiple vehicles such as 15 passenger vans, large SUVs and some POVs. The equipment and most tactical bags were transported via a box truck. No specific documented scope was defined for this part of the training evolution. On October 4, prior to dispersing for the night, Squad Commander 1, who was responsible for this Unit 3 Training Evolution, gave general instructions to all Agents to depart by 0700 the next day, store the tactical gear in their lockers upon returning to the AOCC, and to take their time.

As discussed in Section 2.4.7. “Accountability” of this report, this resulted in confusion when trying to determine accountability of personnel following the accident.

2.5.2. Analyze Hazards

The OST SOP 7.00.06B, *Site Safety Plan*, provides the standard method for developing Site Safety Plans for OST exercises, training, and testing events. The Environment, Safety, and Health Branch (ESHB) of the Safety, Security, and Emergency Management Division (SSEMD), provides safety support to all OST exercise, training, and testing activities.

As required by the referenced documents and the OST Integrated Safety Management Program, all exercise, training, testing, and workplace environments shall be analyzed for hazards, and suitable preventive and/or mitigative measures shall be identified and implemented to ensure that safety risks are maintained within a level of management acceptance. The SOP 7.00.06B and OST M 7.07C, *Operational Risk Management Manual*, requires the use of an OST Risk Management Worksheet to analyze hazards, potential accident sequences, and unmitigated risks; assigning a responsive set of controls; and determining residual risk (mitigated). Appendix B: OST Day-of-Execution ORM Form in OST M 7.07, specifically lists vehicle operations general hazards to consider. While vehicle safety hazards during the training events at Fort Chaffee would be addressed as part of the OST Risk Management Worksheet, transportation to and from Fort Chaffee was not considered as being applicable.

2.5.3. Develop/Implement Controls

Section 8 of Attachment 1 of DOE O 440.1B, requires that DOE Elements implement a Motor Vehicle Safety Program to protect the safety and health of all drivers and passengers in Government-owned or -leased motor vehicles and powered industrial equipment. Section 10.1 of OST M 7.08A addresses traveling to and from training areas. Since there are no mission safeguard responsibilities associated with this travel, OST carries limited operational equipment. Primary hazards associated with these activities are those associated with normal vehicle operation and road /traffic conditions. Following established traffic laws, ensuring vehicles are roadworthy, and employing rest/drive procedures in accordance with OST DM 7.02 are considered sufficient preventive and mitigative controls. More details of applicable regulations and directives and competence commensurate with responsibilities are provided in Section 2.5.4, “Perform Work” of this report.

2.5.4. Perform Work

A Motor Vehicle Safety Program is tailored for the individual DOE Element but must address eight defined elements including requirements for the use of seat belts and provisions of other safety devices. Section 14 of OST M 7.09 defines the Motor Vehicle Safety Program which specifically requires that OST personnel who operate vehicles or motorized equipment on-duty shall:

- Comply with the applicable laws, speed limits, and traffic control signs and devices;
- Ensure all vehicle occupants utilize seat belts whenever the vehicle is in motion;

- Drive defensively and exercise caution especially when driving on unfamiliar roads, at night, and in inclement weather; and
- Drive at a safe speed appropriate to road and weather conditions but not exceed the posted speed limits.
- Feedback and Improvement

2.5.5. Feedback and Improvement

The OST ISM description identifies several methods of feedback and improvement. Specific to vehicle safety, OST reviews on a quarterly basis OST vehicle accident reports as defined in OST P 7.01D. The OST ARC is formally organized and chartered to review all OST accidents involving Federal and contractor employees to determine if corrective actions are needed to minimize chances of recurrence. The ARC is also chartered to provide accident trending and recommended safe driving practices. The ARC supports the execution of OST SOP 2.00.01A by reviewing all pertinent information of an accident involving Federal Agents to determine if the accident was preventable or non-preventable per the National Safety Council's Guide to Determine Motor Accident Preventability.

Each of the ARC reports has a cover page signed by the OST Assistant Deputy Administrator, which includes his observations and comments. The Board reviewed quarterly meeting results going back to June 2014. The majority of accidents reported involved collisions of OST vehicles with stationary objects:

As noted in the Section 2.4.7 "Accountability" of this report, there have been cases where munitions were not properly accounted for after reconciliation had occurred. In one case, munitions of the type found in the van were found among brass and residue from a training event and in another case a similar live munition was transported back in a cargo trailer from Fort Chaffee to Eastern Command in the tactical gear of an Agent. This recurring problem has been verbally expressed to OST Management by the OST Munitions contractor but still remains unresolved. Further discussion of the presence of munitions in Van 1 is described in Section 2.4.2. "The Vehicle" and Section 2.4.7. "Accountability" of this report.

In interviews with AOCC OST Agents and Management a common opinion stated was the use of 15 passenger vans for long trips such as the ones from AOCC to Fort Chaffee was uncomfortable for the bench seat passengers. In discussions with the OST Assistant Deputy Administrator, Deputy Assistant Deputy Administrator, Operations Chief, and OST Fleet Manager, none were aware that the use of 15 passenger vans for long trips was a common complaint among Federal Agents.

At the beginning of Calendar Year 2016, the new OST Fleet Manager found that a lot of the OST GSA fleet consisted of 1990-1994 model vans with over 300,000 miles on them, and that they were costing on average \$10,000 per vehicle in maintenance costs. The AOCC Command Planner prepared a "white paper" on the efficiency and safety of continual usage of E-plated

1996 non-operational vans by AOCC and recommended that AOCC replace current non-operational fleet with newer GSA 15 passenger vans. The AOCC Command Planner has been an Agent for 12 years and was well aware of the Agents complaints about the 15 passenger vans, but based his decision upon funding constraints and other options. He considered the use of passenger buses such as the case with Idaho National Laboratory which provides them to visiting Agents; however, buses are not necessarily safer than the 15 passenger vans in a collision and there are other negative impacts to consider as well. The AOCC Command Planner estimated that he would need a minimum of 15 Suburbans to replace the current 15 passenger vans. Currently, AOCC has five Suburbans in its fleet.

Per Section 2.1.2.2 of DOE-HDBK-7251-2016, a planning process at the site level should be utilized. The planning process provides the sites the opportunity to completely review and analyze requirements. One of the Guiding Principles of ISM is Balanced Priorities. As part of the planning process for the acquisition of vehicles, 13 considerations are provided in the DOE Handbook including:

“The reasons for use, the cargo or number of passengers to be transported, the frequency and types of trips and the geographical locations of trip destinations.”

Another consideration should be:

“Vehicle selection that prioritizes occupant safety, and 10 CFR 851.22, Worker Safety and Health Program, Hazard Prevention and Abatement requirements that hazard controls be employed and hazards addressed when selecting or purchasing equipment.”

ANALYSIS

Generally, for the transportation back from Fort Chaffee, AR to the AOCC in Amarillo, the five functions of ISM were implemented using the graded approach; however, not all the hazard controls were implemented and some improvement in feedback and improvement processes are needed.

Specific controls not implemented include the following:

- Comply with the applicable laws, speed limits, and traffic control signs and devices – **not implemented at the time of the accident is that the speed of Van 1 was in excess of the construction zone speed limit of 55 mph.**
- Ensure all vehicle occupants utilize seat belts whenever the vehicle is in motion – **not implemented fully in that three of the occupants: FA 1, FA 4, and FA 5 were not wearing their seat belts at the time of the accident as determined by forensic evidence.**

- Drive at a safe speed appropriate to road and weather conditions but not exceed the posted speed limits – **not implemented at the time of the accident is that the speed of Van 1 was in excess of the construction zone speed limit of 55 mph.**

As noted above, not all the OST Motor Vehicle safety requirements were implemented by the occupants of Van 1, which increased the probability of the accident, likely contributed to the extent of Federal Agent injuries, and possibly the fatality. An analysis of the contribution of unclear roles and responsibilities to the non-use of seat belts by three of the Van 1 occupants is provided in Section 2.4.8 “Human Performance” of this report.

Based upon the documented accidents in the Quarterly ARC reports, collisions between OST vehicles and non-OST vehicles, while rare for the miles traveled, do occur. The ARC quarterly trending analyses tracks preventable accidents by organization and type. The types of preventable accidents are categorized into ten groups. The largest number of accidents (57) reported in the ARC reports reviewed for the past several years involved “Hit Objects,” the second largest (36) involved “Backing,” and the third largest (14) involved “Hit Other.”

The last ARC report dated August 27, 2018, for the Calendar Years 2009-2018 identified the total number of preventable side swipes as eight and the number of struck by other as eight. The exclusion of non-preventable OST accidents from tracking and trending artificially gives the impression of a lower rate of occurrence. If the non-preventable collisions with other vehicles were trended, side swipes and rear end accidents would become the third largest category of accident types. The OST Assistant Deputy Administrator noted in his observations in the August 27, 2018, ARC cover letter that “drivers need to be continually aware of their surroundings to help reduce the number of preventable accidents.” While this is a good observation, based upon the total number of side swipes more/refresher training on defensive driving may have been warranted prior to the collision.

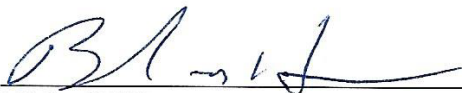
Although not analyzed in the AOCC white paper, one of the primary mission needs for the 15 passenger vans was the need to transport up to 40 visiting agents from AOCC to local hotels. The white paper did not factor in the long distance use of the 15 passenger vans to transport Agents to Fort Chaffee and back nor the human performance precursors related to use of the 15 passenger vans for long distance travel as discussed in Section 2.4.8 of this Report.

3.0 Judgments of Need

Judgments of Need (JON) are the managerial controls and safety measures determined by the Board to be necessary to prevent or minimize the probability or severity of a recurrence. These JONs are linked directly to the causal factors, which are derived from the facts and analysis. They form the basis for corrective action plans that must be developed by line management. The Board's JONs are listed below:

- **JON 1:** OST needs to establish and implement a process to sanitize Federal Agent bags after training events.
- **JON 2:** OST needs to ensure that personnel follow the established directives on what is permissible to be transported in non-operational vehicles.
- **JON 3:** OST should thoroughly evaluate their organization to determine why specific behavioral standards and expectations are not being met. Based on that evaluation, OST should take action to ensure that behavioral standards and expectations, particularly in non-operational areas, are effectively communicated, adhered to, and reinforced throughout the organization.
- **JON 4:** OST needs to review the current use of non-operational vehicles for extended trips, and assure that the vehicle are conducive to long trips and the use seat belts.

4.0 Board Signatures



Michael Hillman
Board Chairperson
Office of Environment, Health, Safety and Security
Office of Nuclear Safety



Nathan Morley
Board Member/Trained Accident Investigator
National Nuclear Security Administration
Office of Safety, Infrastructure and Operations



Dean Triebel
Board Member
National Nuclear Security Administration
Office of Secure Transportation, OST Operations



J. Raúl Castañeda
Board Member/Trained Accident Investigator
National Nuclear Security Administration
Production Office – NPO Operations

5.0 Board Members, Advisors, and Consultants

BOARD MEMBERS

Michael Hillman. Mr. Hillman is a Nuclear Engineer in the Office of Nuclear Safety Policy and Technical Support. Mr. Hillman served as the team leader for the investigation of the Experimental Breeder Reactor II Contamination Incident of 1991 and the investigation of worker exposure from Hanford High-Level Waste Tanks in 1992. During this time period, he also served as the Director of the Environmental Health and Safety Site Representative Program.

Mr. Hillman has served on multiple Chief of Defense Nuclear Safety Biannual Reviews. He currently serves as the Departmental lead for the Readiness Review Program. Since 2015, Mr. Hillman has served at the Team Leader or Senior Advisor for all Operational Readiness Reviews and Readiness Assessments at Los Alamos National Laboratory and Sandia National Laboratories. While serving in these positions, Mr. Hillman has overseen the training of new Readiness Review Team Leaders and Team Members.

Prior to joining DOE, Mr. Hillman served as a U.S. Nuclear Regulatory Commission Regional Inspector, Shift Technical Advisor at Three Mile Island, and a Conduct of Operations consultant at the Peach Bottom Nuclear Power Station. Mr. Hillman is a degreed Electrical Engineer and a qualified Naval Nuclear Engineer.

Nathan A. Morley, CQA, CQMOE, is currently in the Office of Nuclear Safety Services (NA-512) within the Office of the Associate Administrator for Safety, Infrastructure and Operations (NA-50). He received a Bachelor of Science degree in Nuclear Engineering from the University of New Mexico in 1986, has been certified by the American Society for Quality, as a Quality Auditor since 1999, and as a Manager of Quality/Organizational Excellence since 2006. He is also a Senior Member in the American Society for Quality. Mr. Morley has also achieved the Quality Assurance and Senior Technical Safety Manager qualifications within the Department of Energy's Technical Qualification Program. Mr. Morley has completed the DOE Accident Investigation training and has participated in the conduct of five other accident investigations at various NNSA sites.

Dean F. Triebel. Mr. Triebel is a Nuclear Engineer currently assigned as the Chief of the Environment, Safety and Health Branch for the Office of Secure Transportation (OST). Mr. Triebel is a trained Accident Investigator who has been a board member on two previous accident investigation boards, one of which involved a fatality. He has served on nuclear safety basis and readiness reviews at Sandia National Laboratories, Pantex Plant and the Los Alamos National Laboratory.

Mr. Triebel is a part of the Technical Qualification Program and maintains the Senior Technical Safety Manager qualification. Mr. Triebel is retired from the U.S. Marine Corps reserve.

J. Raúl Castañeda-Hernández. Mr. Castañeda has over twenty-seven years of experience with DOE. He served as an Electrical Engineer at the DOE Oak Ridge Operations, Uranium Enrichment Division, and the Paducah Site Office. He later served as a DOE Office of Environmental Management Project and Construction Manager, and as a Facility Representative. In March 2005, Mr. Castañeda transferred to the DOE NNSA Production Office at Pantex, where he has been a certified Facility Representative since December 2006. Mr. Castañeda received a Bachelor of Science degree in Electrical Engineering in 1990, and a Master of Business Administration degree in 2004. Mr. Castañeda also completed the DOE Accident Investigation training.

Mr. Castañeda has participated in or led several Readiness Assessment Teams for various Nuclear Explosive Operations, Construction and Environmental Remediation Projects. He was the NNSA-wide representative for the Class of 2011 Sandia National Laboratories Weapon Intern Program and the Office of Personnel Management Federal Executive Institute Leadership for a Democratic Society in 2017.

ADVISORS AND CONSULTANTS

Douglas Eddy. Mr. Eddy joined the Department of Energy (DOE) Livermore site staff in April 1992 and has served in a variety of positions overseeing Lawrence Livermore National Laboratory (LLNL) operations. He is currently the Livermore Field Office Senior Technical Safety Advisor. He has served as Safety Basis Review Team Leader for numerous LLNL Documented Safety Analysis annual updates, nuclear Safety Basis modifications, Justification for Continued Operations, and Evaluation of the Safety Situation submittals for Potential Inadequacy of Safety Analyses. Mr. Eddy has led multidisciplinary review teams and has authored technical reports for the assessments of *Nuclear Facility Safety Class and Safety Significant System Functional Requirements and Performance Criteria*, and Joint Los Alamos Field Office (LFO) and LLNL Team reviews of *LLNL Nuclear Facility Alarms and Plutonium Contamination Control Practices* at the LLNL Plutonium Facility. In 2017, reviewed a Joint LFO-NA-51 for Cause Assessment of the LLNL Vehicle Safety and Traffic Operations Program. He also has served on two DOE Accident Review Boards and has been trained as both a DOE Accident Investigator and as an Aircraft Accident Investigator.

Mr. Eddy has twenty-six years of military operational experience including six years active duty as a nuclear qualified Electrical Operator/Shutdown Reactor Operator in the U.S. Naval Reactors program and 20 years in the Naval Reserves Naval Coastal Warfare community in a variety of operational and technical leadership positions including Civil Engineering Support Equipment operator training, licensing, accident investigation, and maintenance retiring in 2004 as an engineering Chief Warrant Officer 4.

Richard S. Hartley, Ph.D., P.E. Dr. Hartley, Ph.D., P.E., a principal engineer in the Performance Excellence Organization for Consolidated Nuclear Security (CNS), has developed a causal factors investigation process that was adopted in part by the DOE in the current version of

the DOE *Accident Investigation Manual* and has developed a practical methodology to aid in the journey to become a High Reliability Organization. Dr. Hartley has conducted 17 event investigations and has provided expert testimony at the NTSB hearing on the Washington Metro Area Transit Authority collision of June 2009 and the Metro-North Rail Accident in May 2013 and has peer reviewed investigation reports on the Deepwater Horizon event (*Macondo Well, Deepwater Horizon – Lessons Learned for Improving Offshore Drilling Safety and Evaluating the Effectiveness of Offshore Safety and Environmental Management Systems*) on behalf of the National Academy of Engineering. Dr. Hartley received his Ph.D. in Nuclear Engineering, his M.S. in Nuclear Engineering, and his B.S. in Physics. He holds Professional Engineering Licenses in Ohio and Texas and is a certified Six Sigma Blackbelt. Dr. Hartley comes to DOE after 20 years' experience in the United States Air Force.

Michael A. Schoener. Mr. Schoener has over 40 years of experience in the areas of management, facility operations, training, organizational development, and facilitation. He provides management consulting services for electric utilities, process industries, craft labor unions and government agencies. Mr. Schoener has been the President of MAS Consultants for over 25 years - a firm that has been the primary provider of DOE Accident Investigation Program support for over 10 years. He has been involved in numerous assessments and reviews at a variety of commercial and DOE nuclear facilities over the past 35 years. These reviews have included accident investigations, incident reviews, operational readiness assessments and management assessments. He has also been the manager of technical training at a commercial nuclear utility, and manager of training and procedures for the startup of a troubled DOE nuclear facility. He developed and administers the one-week Nuclear Executive Leadership Training (NELT) program for senior DOE executives, oversaw the initial development of the DOE Technical Qualification Program (TQP) and worked with DOE-Headquarters to start-up the Human Performance Center. He has worked with several organizations at DOE production sites and laboratories to assist in the implementation of human performance initiatives. Mr. Schoener has a Bachelor of Science in Construction Management, graduating Magna Cum Laude. He served six years in the Navy Nuclear Power Program.

Medical Advisor	Dr. Michael Ardaiz, Chief Medical Officer U.S. Department of Energy Office of the Associate Under Secretary for Environment, Health, Safety and Security
Automotive Safety and	Amit Reizes, PE, CSP, Forensic Engineer Expert Forensic Engineering Services
Administrative Coordinator	Meredith K. West, Project Enhancement Corporation
Technical Editor	Susan M. Keffer, Project Enhancement Corporation Trained Accident Investigator

Appendix A. Appointment of an Accident Investigation Board



Department of Energy
National Nuclear Security Administration
Washington, DC 20585



October 15, 2018

MEMORANDUM FOR MICHAEL HILLMAN
BOARD CHAIRPERSON
DOE OFFICE OF ENVIRONMENT, HEALTH, SAFETY
AND SECURITY

FROM: 
THEODORE WYKA
COGNIZANT SECRETARIAL OFFICER FOR SAFETY
APPOINTING OFFICIAL
OFFICE OF SAFETY, INFRASTRUCTURE & OPERATIONS

SUBJECT: Federal Accident Investigation Board into the Office of Secure
Transportation (OST) Motor Vehicle Accident on October 05,
2018, in Oklahoma involving five agents with one fatality and
four seriously injured

In accordance with the requirements of DOE O 225.1B, *Accident Investigations*, I am establishing a Federal Accident Investigation Board (AIB) to investigate the Office of Secure Transportation (OST) Motor Vehicle Accident on October 05, 2018, in Oklahoma involving five agents with one fatality and four seriously injured. I have determined the event meets the criteria of DOE O 225.1B, Appendix A; item 2.a.(4) (any Accidents involving Federal or contractor employees driving vehicles while on official Government business, on or off Government property, if the consequences result in meeting any of the criteria above) for the conduct of an accident investigation.

You are appointed as the Board Chairperson. The AIB will be composed of the following members:

- Michael Hillman, DOE Office of Environment, Health, Safety and Security – Chairperson
- Nathan Morley, Office of Safety, Infrastructure and Operations - Trained Accident Investigator
- Dean Triebel - Office of Secure Transportation - OST Operations
- Raul Castaneda – National Nuclear Security Administration Production Office - NPO Operations – Trained Accident Investigator

All members of the AIB, by this letter, are released from their normal regular duty assignments to serve on the AIB, during the period the AIB is convened.

Dr. Michael Ardaiz will serve as Medical Advisor to the AIB.



The scope of the AIB's investigation is to include, but not be limited to, identifying all relevant facts, determining direct, contributing, and root causes of the event. This includes management and organizational systems, policies, and line management oversight processes in accordance with DOE Integrated Safety Management core functions and guiding principles, and developing conclusions, and determining the judgments of need that might prevent recurrence.

The scope of the investigation includes, but is not limited to, reviewing and leveraging the State of Oklahoma's reports of the accident, interviewing individuals as appropriate, reviewing documentation related to the accident and OST training, as well as applicable Department of Energy's (DOE) programs and oversight activities involving OST agents. Furthermore, I expect the outcome of the investigation to include the following:

- A comprehensive articulation of the facts including timeline, involved organizations, actions, and outcomes;
- An assessment of the motor vehicle accident facts and circumstances, and recommendations regarding identified judgments of need; and,
- Human Performance Improvement (HPI) and causal analysis supporting the identified judgments of need.

The investigation shall address the core analytical techniques discussed in DOE O 225.1B, *Accident Investigations*, (i.e., events and casual factors, change analysis, and barrier analysis) and subsequently develop judgments of need that lead to corrective actions that might prevent or reduce the likelihood of recurrence. Lessons learned shall also be disseminated from the event as required by the Order.

The AIB shall provide my office with periodic reports on the status of the investigation. Please submit draft copies of the factual portion of the investigation report to me, within the Office of Safety, Infrastructure, & Operations, and OST for factual accuracy review prior to finalization. The Chairperson should provide the draft report to the Office of the Associate Under Secretary for Environment, Health, Safety and Security for quality review prior to public release.

The final report should be provided to me within 30 days of the receipt of the accident investigation report from the State of Oklahoma. Discussion of the investigation and copies of the draft report will be controlled until I authorize release of the final report. The AIB is to collect information prior to the release of the report from the State of Oklahoma, which constitutes the start of the 30-day clock for the AIB to conduct and conclude its activities.

The Office of Management and Budget (NA-MB) has allocated funds to the Office of Safety, Infrastructure & Operations (NA-50) for expenses and costs associated with this Investigation from appropriation 089-19/20-0313, Federal Salaries and Expenses Primary Fund, fund code 01657. Coordination for all funding needs, including allocations to

travel and necessary purchase requisitions for support services shall be coordinated with Shari Crandell, NA-50.

If you have any further questions, please contact Daniel Sigg, Deputy Associate Administrator for Safety at (505) 845-4404.

cc:

Matthew Moury, AU-1
Michael Ardaiz, AU-1
Colette Broussard, AU-23
Gary Staffo, AU-23
Garrett Smith, AU-30
Steve Erhart, NA-1.1
William White, NA-3
Douglas Fremont, NNSA-COS
Bruce Diamond, NA-GC
Nora Khalil, NA-EA
Charles Verdon, NA-10
Philip Calbos, NA-10
Geoffrey Beausoleil, NPO
Teresa Robbins, NPO
Carlos Alvarado, NPO
Susan Morris, NPO
Raul Castaneda, NPO
Vincent Fisher, NA-15
Dean Triebel, NA-15
Dennis Curtis, NA-15
James McConnell, NA-50
Daniel Sigg, NA-51
Daniel Schwendenman, NA-512
Nathan Morley, NA-512
Lynn Maestas, NA-513

Appendix B. Barrier Analysis

Barrier analysis is based on the premise that hazards are associated with all tasks. A barrier is any means used to control, prevent, or impede a hazard from reaching a target, thereby reducing the severity of the resultant accident or adverse consequence. A hazard is the potential for an unwanted condition to result in an accident or other adverse consequence. A target is a person or object that a hazard may damage, injure, or fatally harm. Barrier analysis determines how a hazard overcomes the barriers, comes into contact with a target (e.g., from the barriers or controls not being in place, not being used properly, or failing), and leads to an accident or adverse consequence. The results of the barrier analysis are used to support the development of causal factors.

Table B-1. Barrier Analysis

Hazard: Injury to Agents from Vehicle Collision		Target: OST Agents		
What were the barriers?	How did each barrier perform?	Why did the barrier fail?	How did the barrier affect the accident?	Context: ISM/HPI
DOE vehicle safety requirements (obey applicable traffic laws, seat belt use)	Due to ergonomic conditions of the bench seats in the van, occupants in the bench seats were not using the seat belts.	Seat belts used by driver and front seat passenger but not used for three passengers Only FA 2 and FA 3 were properly wearing their seatbelts.	Injuries that were more serious or death would have occurred by FA 2 and FA 3 if they were not wearing their seat belts. Lack of use of seatbelts resulted in more severe injuries to passengers on bench seats. CF The degree of injury to FA 1, FA 4, and FA 5 were a direct cause of not wearing seatbelts. CF	Failure to implement seat belt controls. Although the mandatory use of seat belts while operating GSA vehicles is well known, the lack of use of seat belts in the OST Van (Van 1) indicates a disregard of the seat belt requirements most likely aggravated by Human Performance Error Precursors (uncomfortable seats for long distances). CF

Hazard: Injury to Agents from Vehicle Collision		Target: OST Agents		
What were the barriers?	How did each barrier perform?	Why did the barrier fail?	How did the barrier affect the accident?	Context: ISM/HPI
OST vehicle safety requirements (obey speed limits).	<p>Van 1 was observed prior to entering the construction area of travelling around the posted speed limit of 70 mph, and traffic within the construction zone was travelling at reduced speed as required.</p> <p>Van 1 was still within the construction zone, but cones limiting traffic to one lane were removed, traffic was able to access both lanes of traffic, and traffic was increasing back to normal highway speed.</p> <p>Van 1 exceeding posted construction zone speed limit after road opened up to two lanes.</p>	Human nature to follow other traffic and go back to speed when both lanes were open.	Speed deminished reaction time and increased impact speed resulting in more severe injuries. CF .	
Baggage controlled.	<p>Tactical bags were placed in Van 1 behind the third bench seat.</p> <p>Personal bags (knapsacks/backpacks, coolers, laptops, etc.) were located primarily with the occupants.</p> <p>Bags moved from force of the accident.</p>	Baggage not constrained.	Could not determine if there was an impact with respect to injuries on the occupants from loose baggage.	None.

Hazard: Injury to Agents from Vehicle Collision		Target: OST Agents		
What were the barriers?	How did each barrier perform?	Why did the barrier fail?	How did the barrier affect the accident?	Context: ISM/HPI
Dump Truck driver obeying traffic laws.	Dump Truck driver started to make illegal U-turn to crossover highway (OK report).	Truck driver did not want to proceed seven miles to Okemah to turn around and he thought the left hand lane was clear.	<p>The Dump Truck moved in front of Van 1 passing on the left. CF</p> <p>Distance between the Dump Truck and Van 1 was drastically reduced in a shorter period than it took to stop or redirect Van 1. CF</p> <p>Maintaining a safe distance between Van 1 and the Dump Truck was not possible by FA 2. CF</p> <p>FA 2 could not avoid the impact with the Dump Truck. CF</p>	N/A (not DOE function)

Appendix C. Change Analysis

Change is anything that disturbs the “balance” of a system from operating as planned. Change is often the source of deviations in system operations. Change can be planned, anticipated, and desired, or it can be unintentional and unwanted. Change analysis examines the planned or unplanned disturbances or deviations that caused the undesired results or outcomes related to the accident. This process analyzes the difference between what is normal (or “ideal”) and what actually occurred. The results of the change analysis are used to support the development of causal factors.

Table C-1. Change Analysis

Factors	Accident Situation	Prior, Ideal or Accident-Free Situation	Difference	Evaluation of Effect
WHAT Conditions, occurrences, activities, equipment.	Dump Truck conducting illegal U-turn across traffic through median. Back up of other construction trucks at the closed exit previously used. Next available exit ~ seven miles away.	Back up to closed exit ramp within the construction zone. Go to next exit ramp. Find and take a direct route to the dumpsite that would not involve crossing active traffic lanes.	Had previously backed up to closed exit ramp within the construction zone. First time trying to conduct the U-turn. Would have stayed off active highway lanes. Would have taken longer to wait for construction exit to clear or use next exit.	If the Dump Truck would not have been slowing down trying to do a U-turn in the median with Van 1 trying to pass the Dump Truck on its left the incident would not have occurred. CF
	Personal luggage was not restrained in Van 1.	Personal luggage restrained in Van 1.	Luggage was found scattered throughout Van 1 as a result of the sudden stop.	There was potential impact of the occupants of Van 1. Luggage potentially impacted egress of Federal Agents.
	Baggage in the cargo area not controlled.	Baggage in the cargo area controlled.	Baggage would not be able to interact with Federal Agents.	No evidence that the luggage impacted the Federal Agents.

Factors	Accident Situation	Prior, Ideal or Accident-Free Situation	Difference	Evaluation of Effect
	Seat belts not worn by occupants in Van 1 bench seats.	Seat belts being used by all occupants of Van 1.	Bench seat passengers not restrained from violently coming in contact with back of seats in front of them FA 2 and FA 3 were restrained in the front passenger seats.	Van 1 passengers in bench seats impact seats in front of them causing serious/fatal injuries. <input type="checkbox"/> CF FA 2 and FA 3 injuries would have been more serious had they been not seat belted
	15 passenger vans received from GSA are ergonomically not appropriate for long drives.	Vehicles ergonomically appropriate for long drives.	Passengers in bench seats uncomfortable and non-conductive to wearing seat belts.	Current vans are ergonomically not appropriate and uncomfortable for long OST drives. <input type="checkbox"/> CF Encourages lack of seat belt use by passengers in the bench seats. <input type="checkbox"/> CF Van 1 passengers in bench seats did not wear seat belts resulting in serious/fatal injuries. <input type="checkbox"/> CF
WHEN Occurred, identified, facility status, schedule	None.			

Factors	Accident Situation	Prior, Ideal or Accident-Free Situation	Difference	Evaluation of Effect
WHERE Physical location, environmental conditions.	Van 1 in a construction zone.	Van 1 on unrestricted highway.	No construction vehicles present. No Dump Truck would be present to conduct the U-turn.	The Dump Truck and van would not have been in a position for the accident to occur.
WHO Staff involved, training, qualification, and supervision.	OST Federal Agents could not be identified as Federal Agents who can provide emergency medical assistance.	OST Federal Agents clearly identified.	OST Federal Agents were being questioned as to their authority OST initial request for air medevac questioned by 911 operator OST Paramedic needed to explain to emergency ground personnel their treatment role.	State Trooper needed to request air medevac support through his channels. Slight delay in air medevac response time to the scene. OST Federal Agents could not devote their complete attention to their patients.
	OST medical personnel were questioned on their paramedic and EMT qualifications to arriving civilian emergency response personnel.	OST medical could readily identify their medical qualifications as paramedics and EMT.	OST Paramedic needed to explain to emergency ground personnel OST emergency authority and capability to treat the injured Federal Agents. OST personnel could immediately identify their qualifications.	OST Paramedic needed to pause his care of the injured Federal Agents to address questions from emergency ground personnel.
HOW	Process to clearly identify Federal Agents in specific vehicles not conducted.	Process to clearly identify Federal Agents in specific vehicles conducted.	No one knew who all was in Van 1. Federal Agents leaving for Amarillo from various	Multiple calls were made to determine the location of all of the Federal Agents.

Factors	Accident Situation	Prior, Ideal or Accident-Free Situation	Difference	Evaluation of Effect
Control chain, hazard analysis monitoring.			locations and times without departure accountability. Unclear where all OST Federal Agents were for several hours after the accident.	It took approximately 11 hours until all Federal Agents, not in a hospital, could be accounted for. Unable to conduct timely and accurate accountability, and notification to OST members and families.
	Not sanitizing items coming back from Ft. Chaffee.	Sanitizing items both going to and coming from Ft. Chaffee.	Hazardous items such as ammunition and munitions were carried in luggage when returning to Pantex that would not be there when going to Ft. Chaffee.	Ammunition and other munition, was heard being expended in the Van 1 fire that could have caused injury to those in the area. Remnants of smoke grenades were found in Van 1 in violation of the OST and Pantex requirements.
OTHER	None.			

Appendix D. Error Precursor Analysis

Table D-1. Error Precursor Analysis

P1-TASK DEMANDS			P3-INDIVIDUAL CAPABILITIES		
X	A	Time Pressure (In a hurry)		A	Unfamiliarity with Task/First time
	B	High Workload (Memory Requirements)	X	B	Lack of Knowledge (faulty mental model)
	C	Simultaneous, Multiple Tasks		C	New Technique not used before
X	D	Repetitive Actions/Monotony		D	Imprecise Communications
	E	Irreversible Acts		E	Lack of Proficiency/Inexperience
X	F	Interpretation Requirements		F	Indistinct Problem-solving Skills
X	G	Unclear goals, Roles, or Responsibilities		G	“Unsafe” Attitudes for critical task
	H	Lack of or Unclear Standards		H	Illness/Fatigue (general health)
	I	Confusing Procedure/Vague Guidance		I	Unawareness of Critical Parameters
	J	Excessive Communication Requirements		J	Inappropriate Values
	K	Delays; Idle Time		K	Major Life Event: medical, financial, emotional
	L	Complexity/High Information Flow		L	Poor Manual Dexterity
	M	Excessive Time on Task		M	Low Self-esteem; Moody
	N	Long-term Monitoring		N	Questionable Ethics (bends the rules)
				O	Sense of Control/Learned Helplessness

P2 – WORK ENVIRONMENT			P4 – HUMAN NATURE		
	A	Distractions/Interruptions		A	Stress (limits attention)
X	B	Changes/Departure from Routine	X X	B	Habit patterns
	C	Confusing Displays/Controls	X	C	Assumptions (inaccurate mental picture)
	D	Work-arounds/Out-of-Service Instrumentation		D	Complacency/overconfidence
	E	Hidden System Response		E	Mindset
	F	Unexpected Equipment Conditions	X	F	Inaccurate Risk Perception

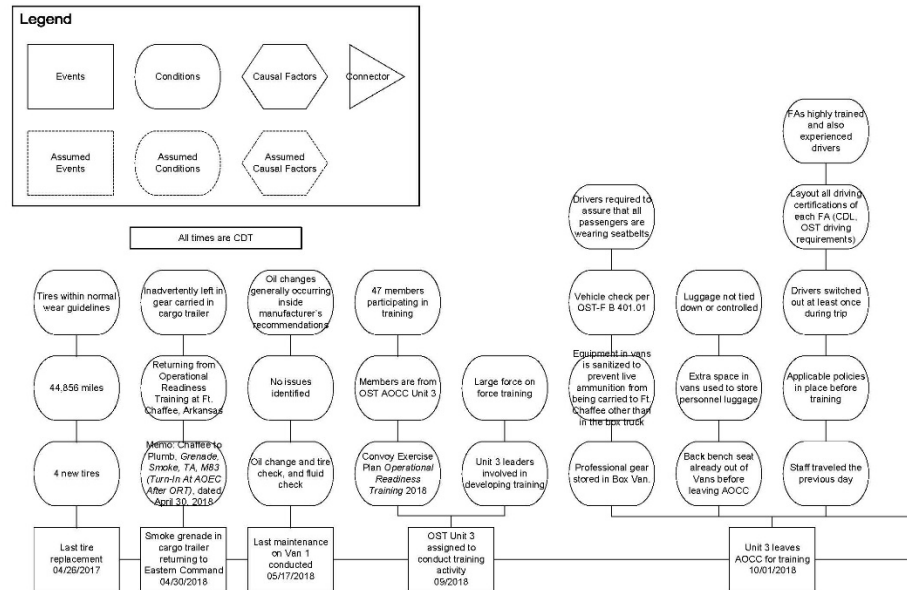
P2 – WORK ENVIRONMENT			P4 – HUMAN NATURE		
X	G	Lack of Alternative Indication		G	Mental Shortcuts (biases)
	H	Personality Conflicts		H	Limited Short-term Memory
	I	Backshift or recent shift change		I	Pollyanna effect
	J	Excessive Group Cohesiveness/Peer Pressure		J	Limited Perspective (bounded rationality)
	K	Production Overemphasis		K	Avoidance of Mental Strain
X	L	Adverse Physical Climate (habitability)		L	First day back from vacation/Days off
	M	No Accounting of Performance		M	Sugar Cycle (after a meal)
X	N	Poor Equipment Layout; Poor Access		N	Fatigue (Sleep deprivation, circadian rhythms)
	O	Fear of Consequences of Error		O	Tunnel Vision (lack of big picture)
	P	Mistrust among work groups		P	“Something is not right” (gut feeling)
X	Q	Meaningless Rules		Q	Pattern-Matching Bias
	R	Unavailable Parts or Tools		R	Social Deference (excessive courtesy)
	S	Acceptability of “Cook Booking” Practices		S	Easily Bored
	T	“Rule Book” Culture		T	Close-in-Time Cause – effect correlation
	U	Equipment Sensitivity (inadvertent actions)		U	Difficulty seeing own errors
	V	Lack of Clear Strategic Vision or Goals		V	Frequency and Similarity Biases
	W	Identical or Adjacent Displays/Controls		W	Availability Bias
X		Out-of-Service Warning Systems		X	Imprecise Physical Actions
	Y	Nuisance Alarms		Y	Limited Attention Span
	Z	Lack of Place Keeping		Z	Spatial Disorientation
				AA	Physical Reflex
				BB	Anxiety (involving uncertainty)

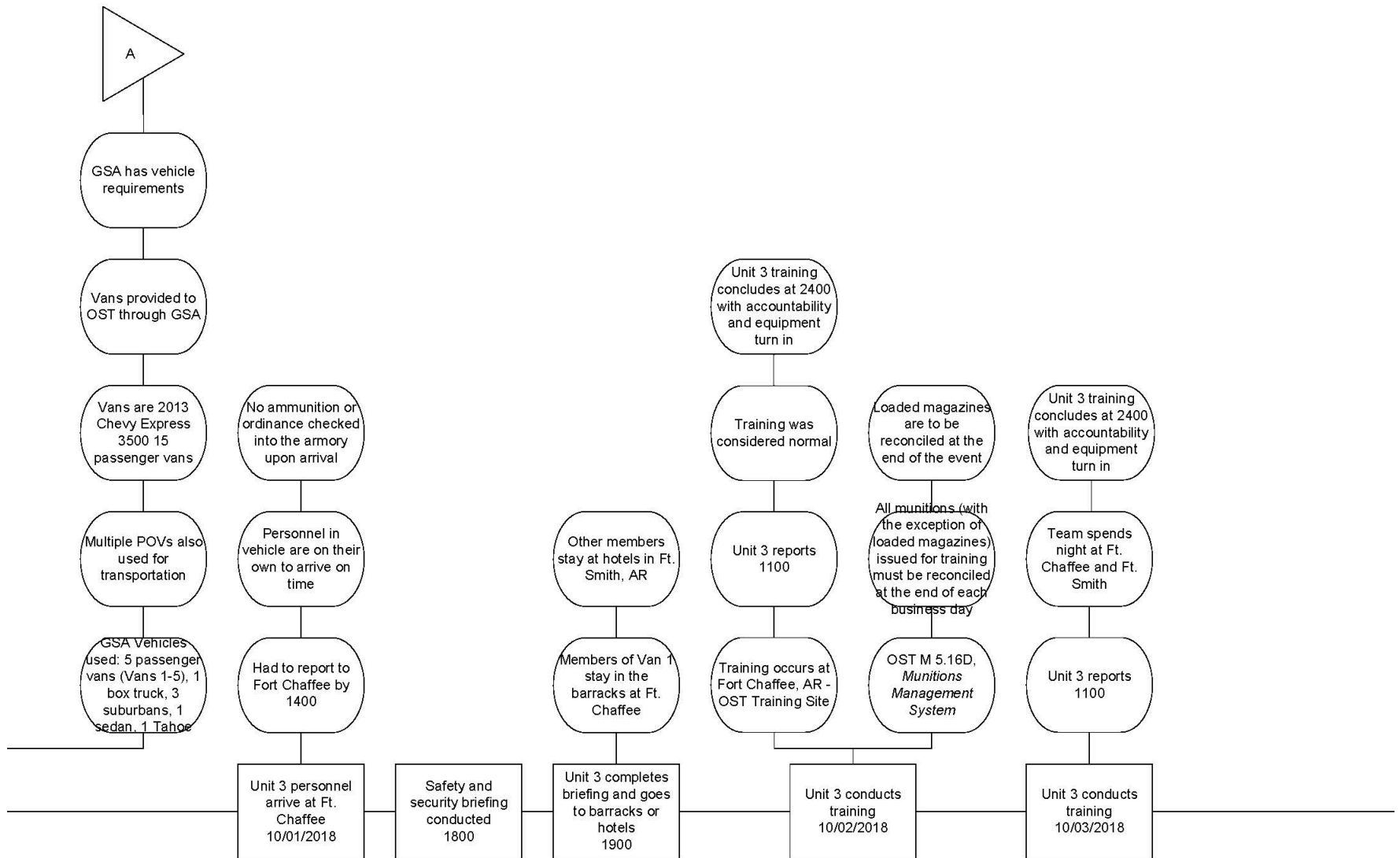
Precursor Code	Condition
P1-A	Four of the five agents in Van 1 put their tactical gear in Van 1 rather than the Box Truck so they did not have to wait for Box Truck to bring it back to the AOCC for them to put it in their lockers and leave to go home for a three-day weekend.
P1-D	Driving on an interstate highway can be a routine and monotonous task.
P1-F	Although the van was still in the posted construction zone, interpreting the end of the posted construction zone can be difficult when all other traffic is accelerating past the actual work area rather, than waiting to exit the posted construction zone.
P1-G	Is it clear that it is the driver's responsibility to ensure everyone is buckled up and that the driver has the <u>authority</u> to ensure everyone is buckled up? The driver of the vehicle was the most junior person in the van. Conclusion
P2-B	Changing from routine driving on a flat, two lane highway to a single lane work area and then back out to a flat, two-way highway again.
P2-G	The brake lights or turn signals were not functioning on the Dump Truck – they should have provided alternate indication to the van driver of the Dump Truck driver's action.
P2-L	The seating configuration in the van is not conducive to sitting properly and wearing seat belts for a long trip. Conclusion
P2-N	The seating configuration in the van is not conducive to sitting properly and wearing seat belts for a long trip. Also – egress from the back section of the van is difficult due to a very narrow aisle on the right side of the van. Conclusion
P2-Q	Everyone tends to speed up when leaving the actual work area with lane restriction, even though they are still in the “posted” construction area with reduce speed requirements.
P3-B	The driver was not anticipating the U-turn by the Dump Truck driver.
P4-B	OST drivers are trained to react and drive evasively on missions when the path is blocked or otherwise restricted.
P4-B	Inconsistent seat belt use when not in front of the vehicle on duty and off duty. The individuals in the front seats were properly buckled in but the individuals in the bench seats were not. Oklahoma State law does not require seat belt use in other than the front seats.
P4-C	Van driver thought (assumed) the Dump Truck was turning left but he veered to the right at the last moment.
P4-F	Inconsistent seat belt use when not in front of the vehicle. The individuals in the front seats were properly buckled in but the individuals in the bench seats were not.

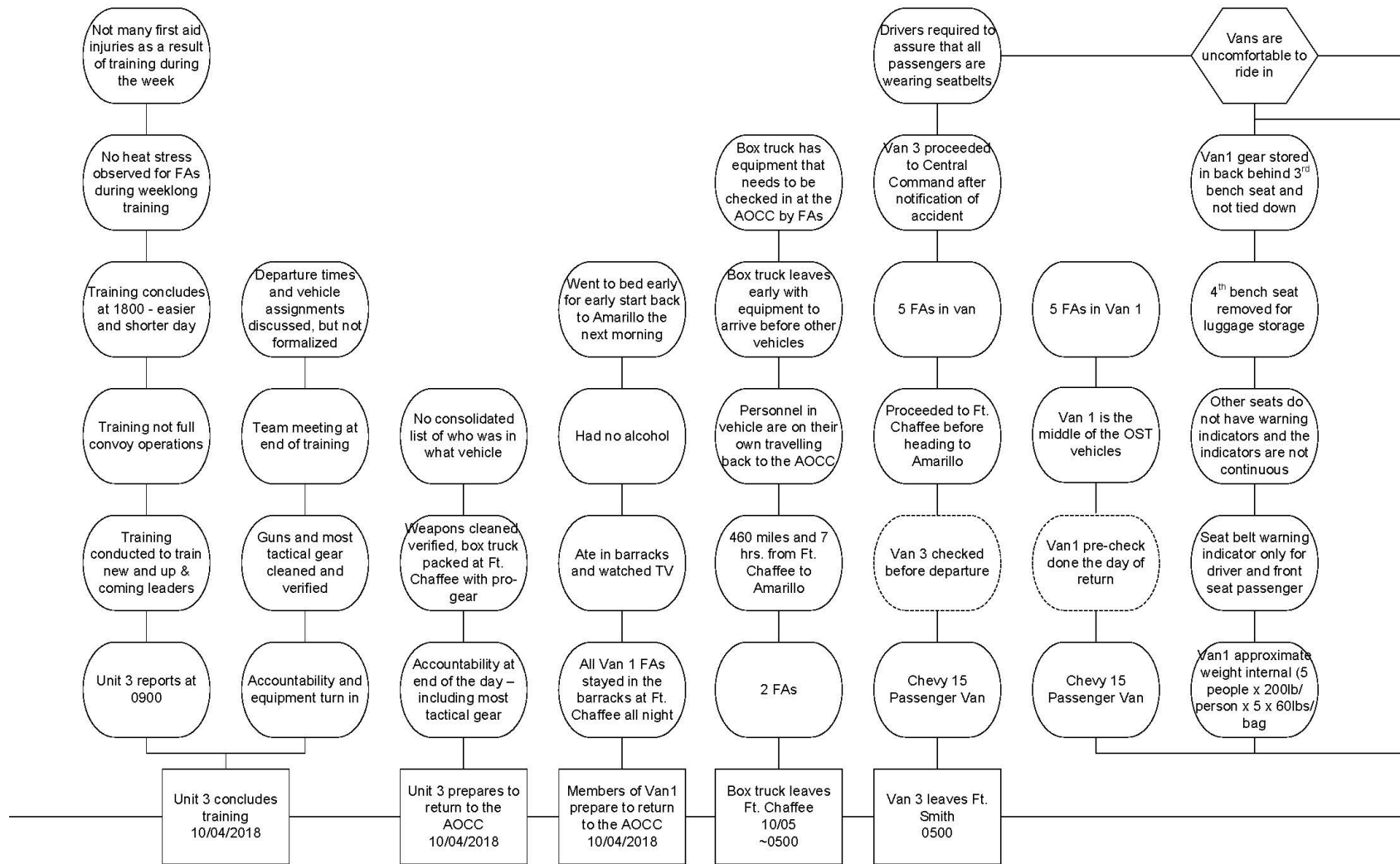
Appendix E. Events and Causal Factor Analysis

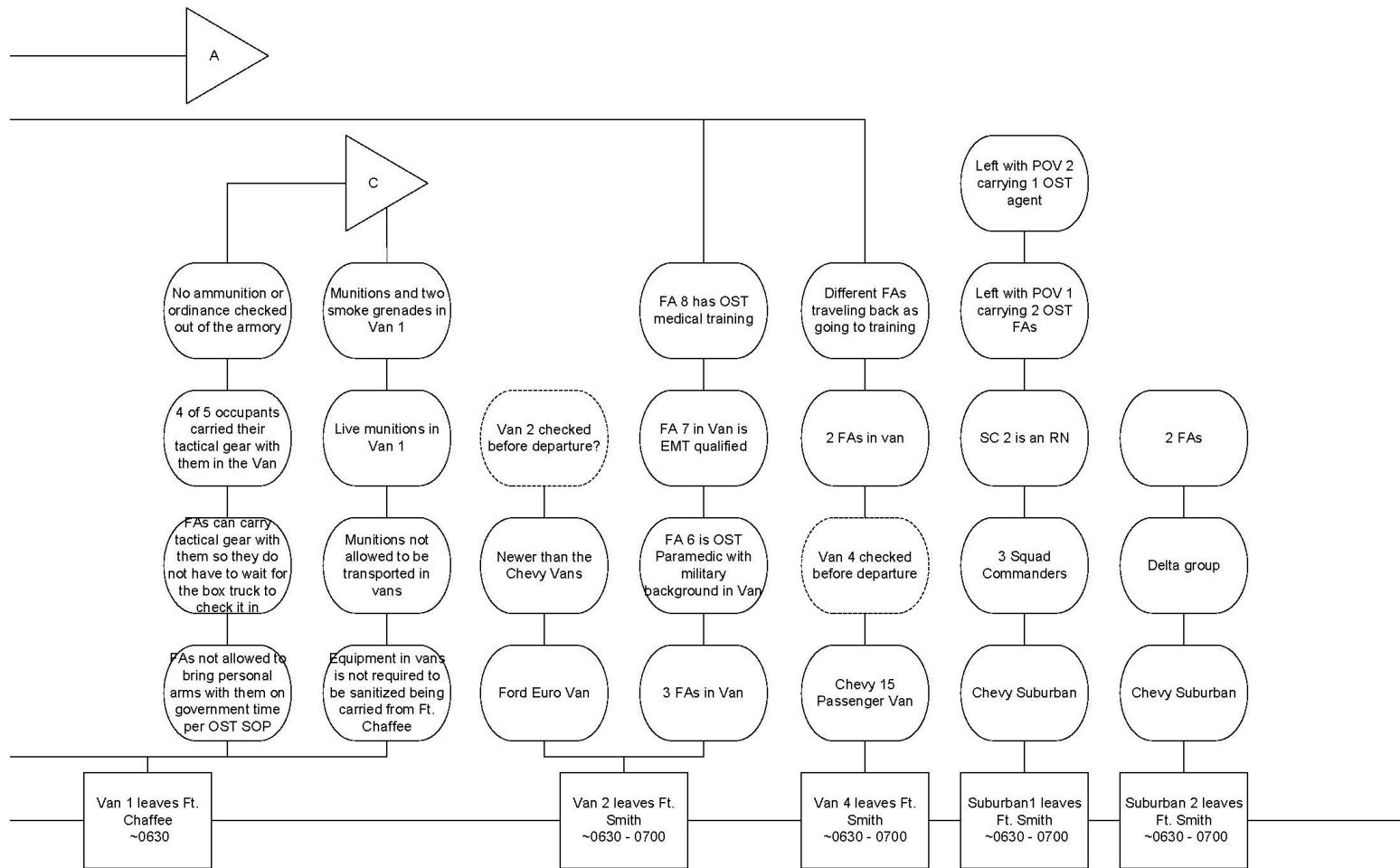
An events and causal factors analysis was performed in accordance with the DOE Workbook Conducting Accident Investigations. The events and causal factors analysis requires deductive reasoning to determine those events and/or conditions that contributed to the accident. Causal factors are the events or conditions that produced or contributed to the accident, and they consist of direct, contributing, and root causes. The direct cause is the immediate event(s) or condition(s) that caused the accident. The contributing causes are the events or conditions that, collectively with the other causes, increased the likelihood or severity of the accident, but which did not solely cause the accident. Root causes are the events or conditions that, if corrected, would prevent recurrence of this and similar accidents. The causal factors are identified in Table D-1.

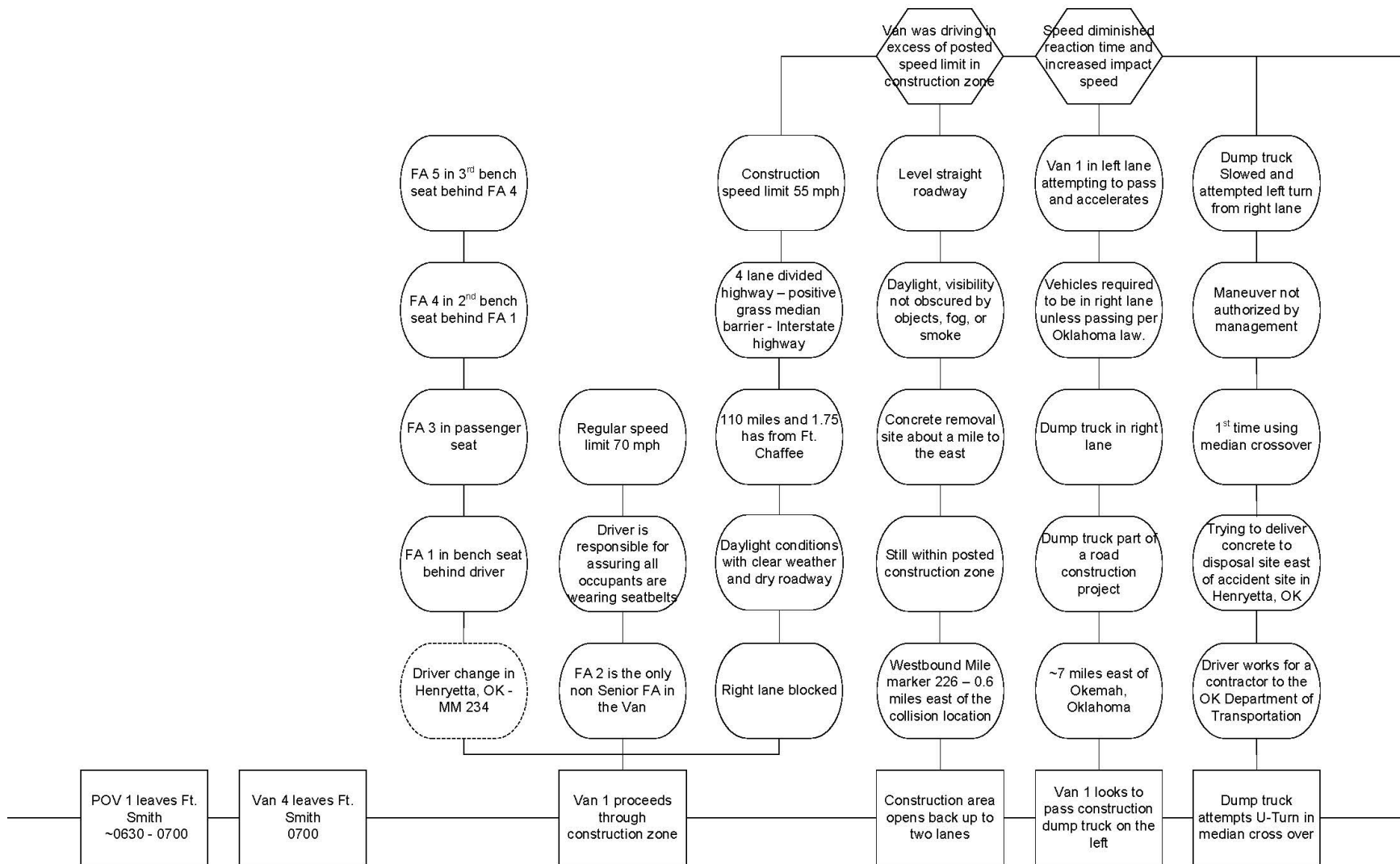
Table E-1. Events and Causal Factor Chart

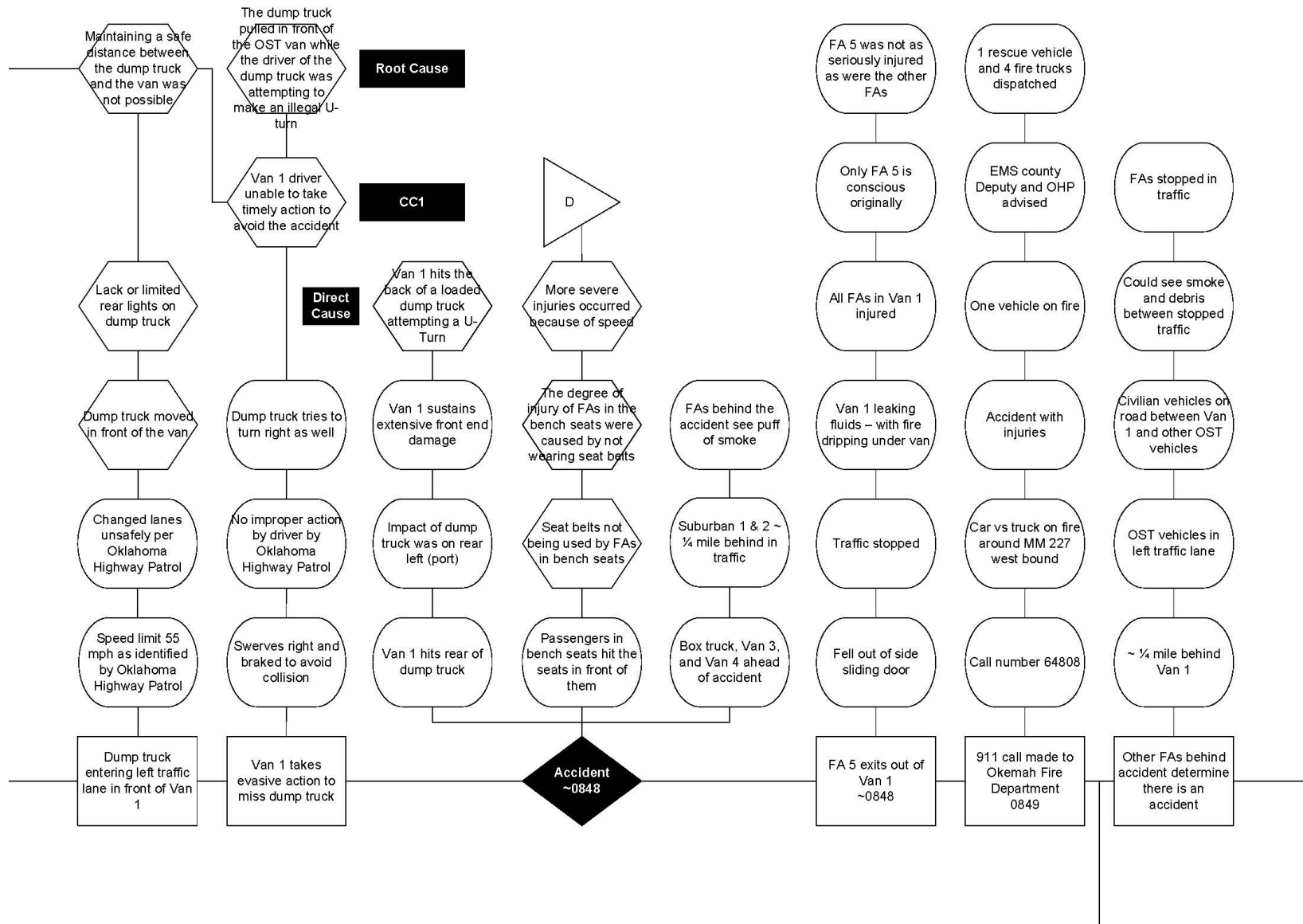


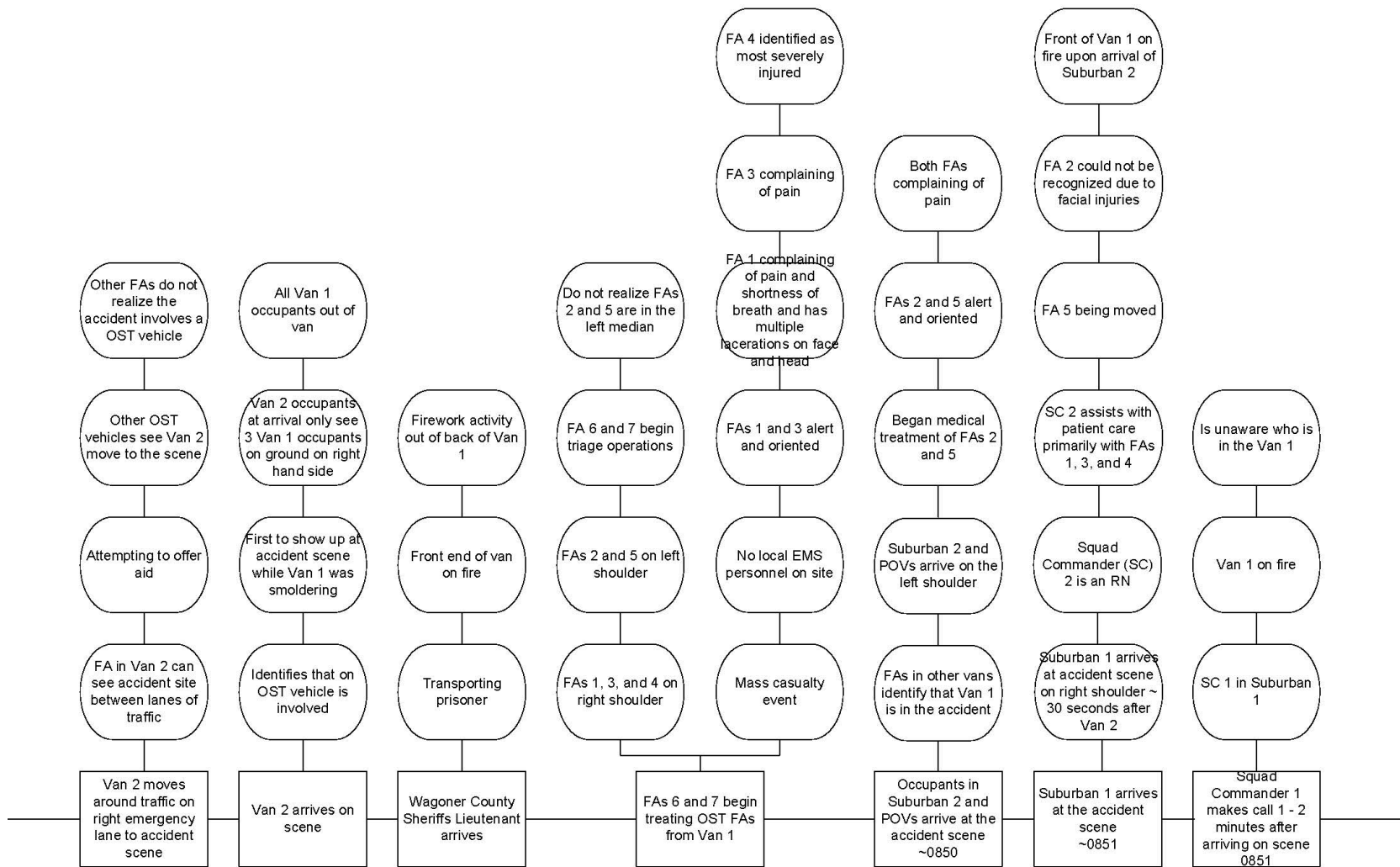


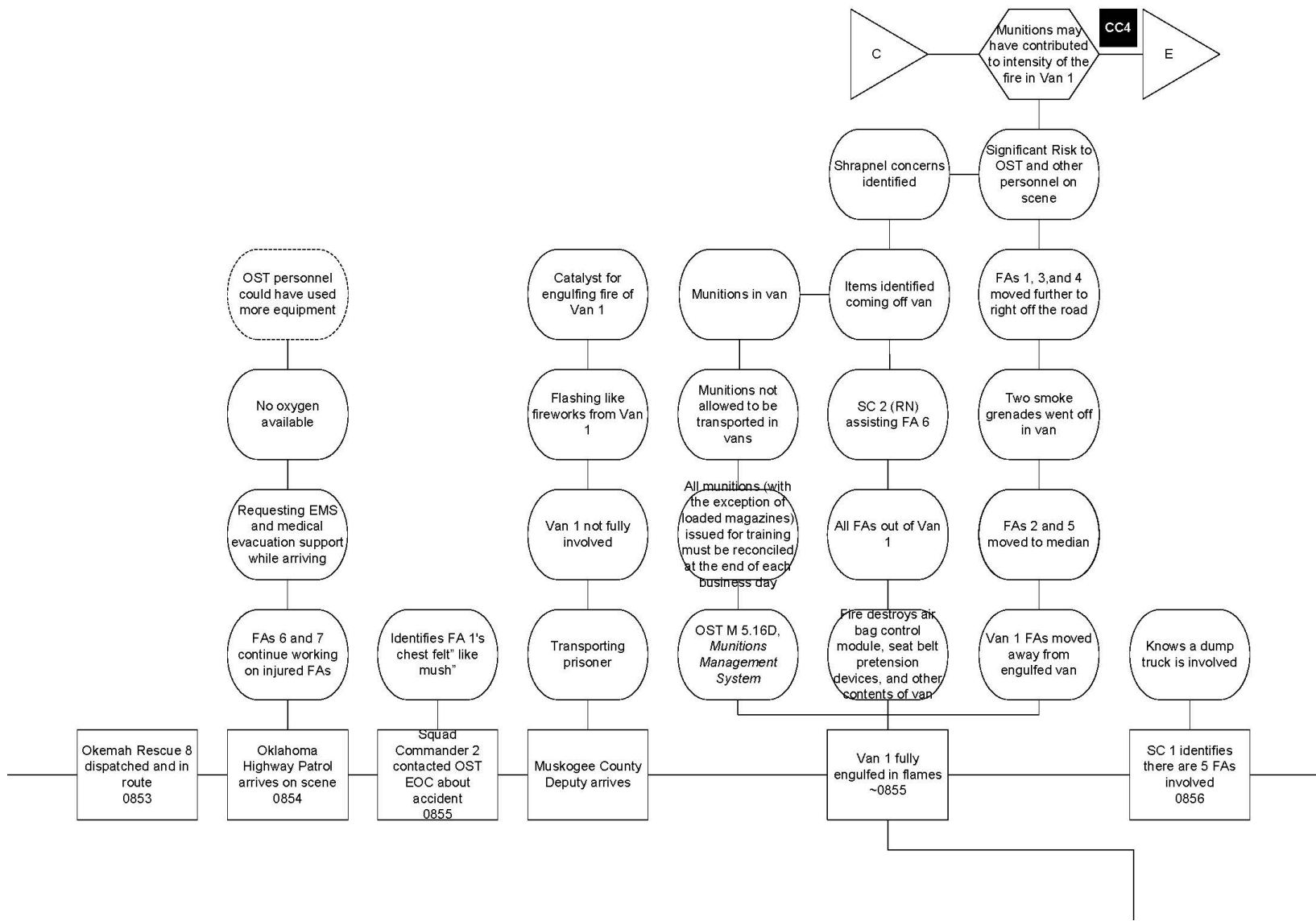


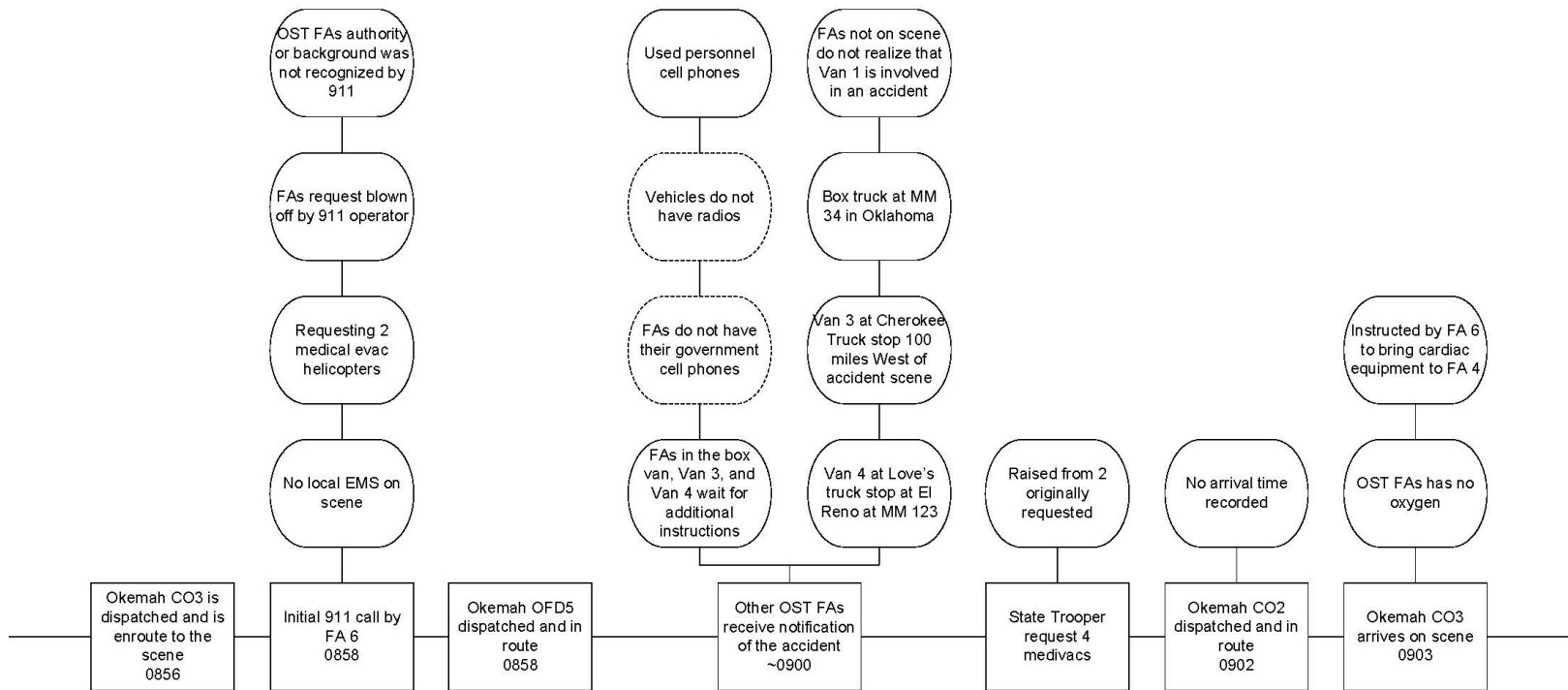


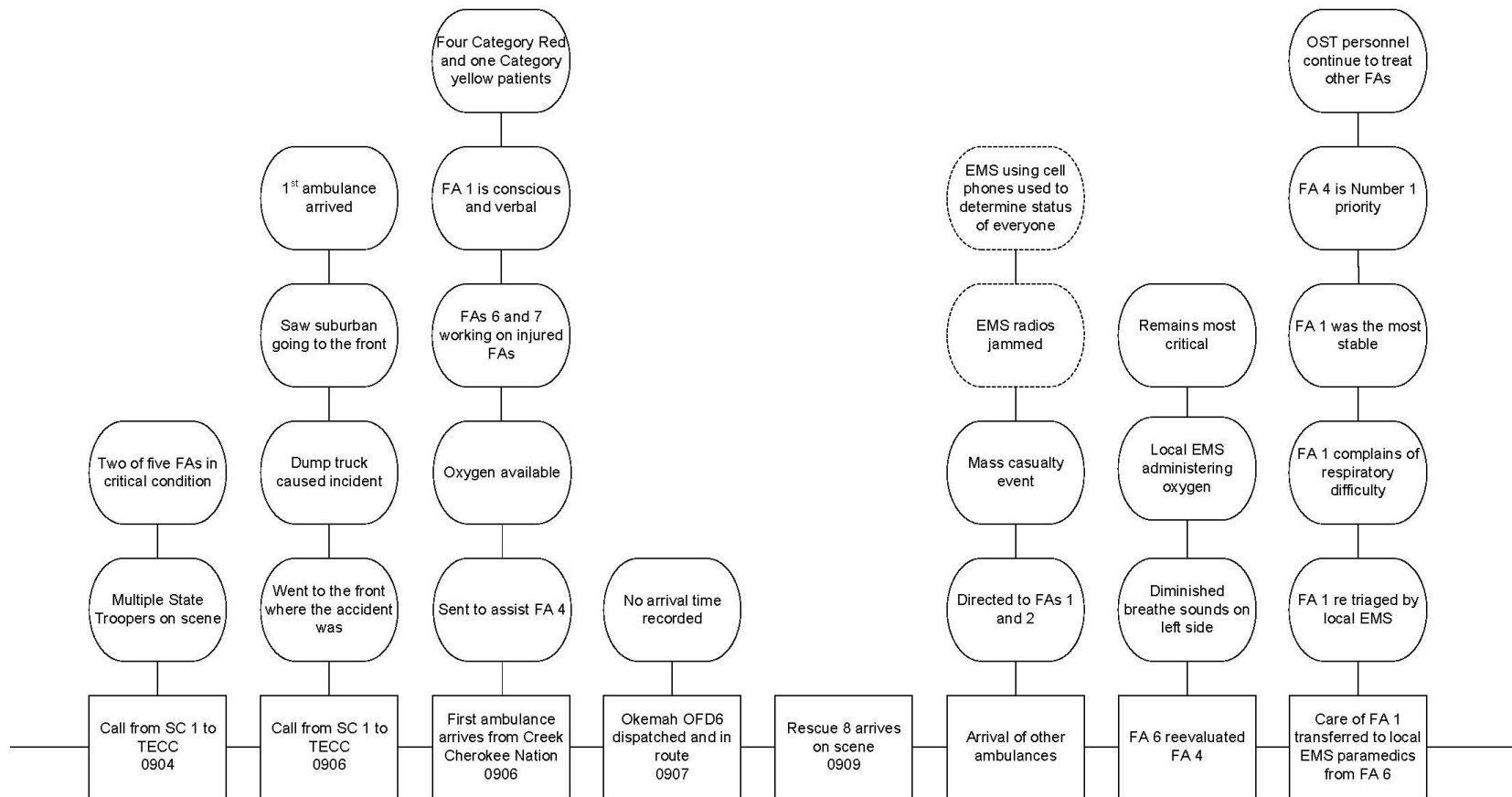


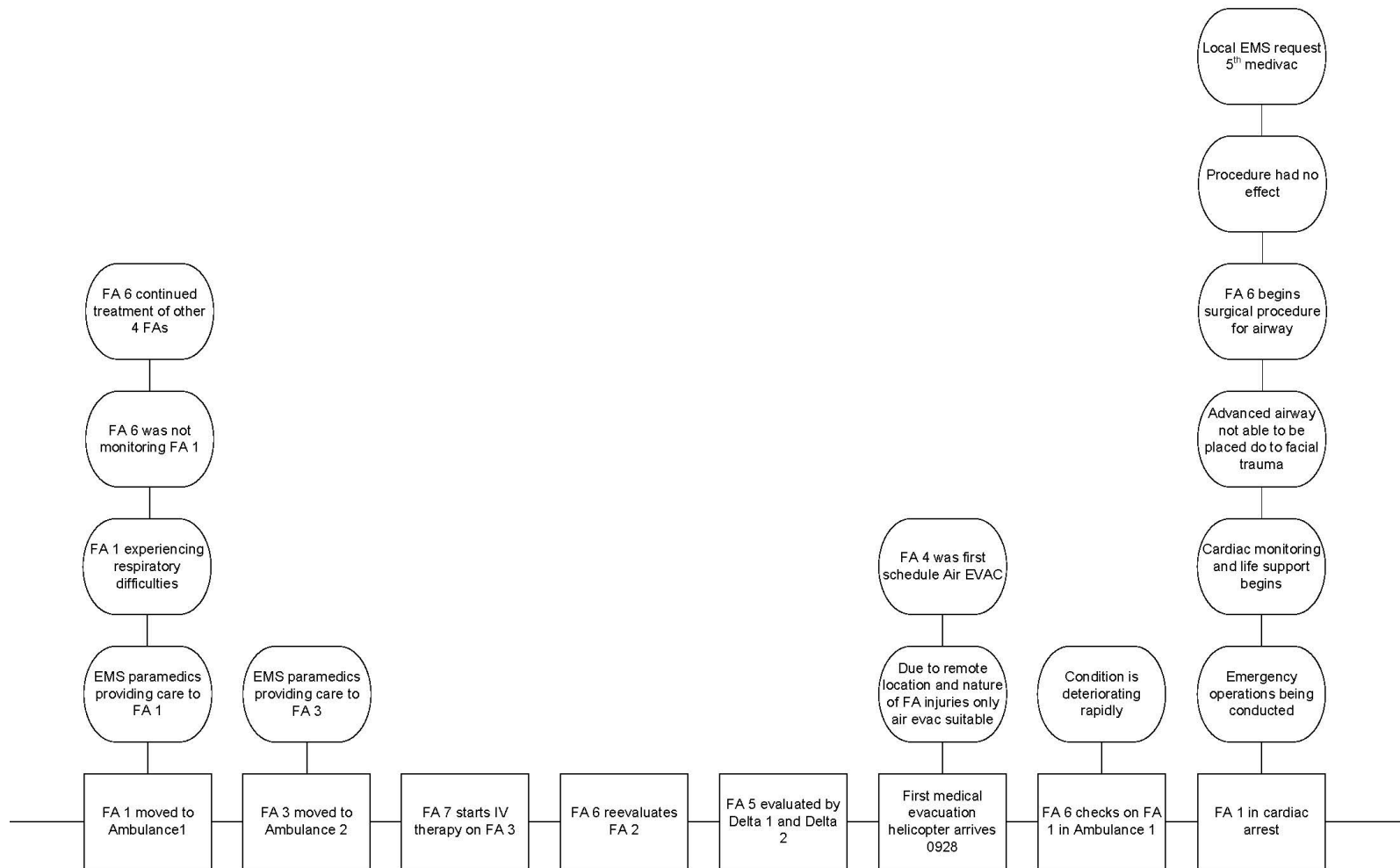


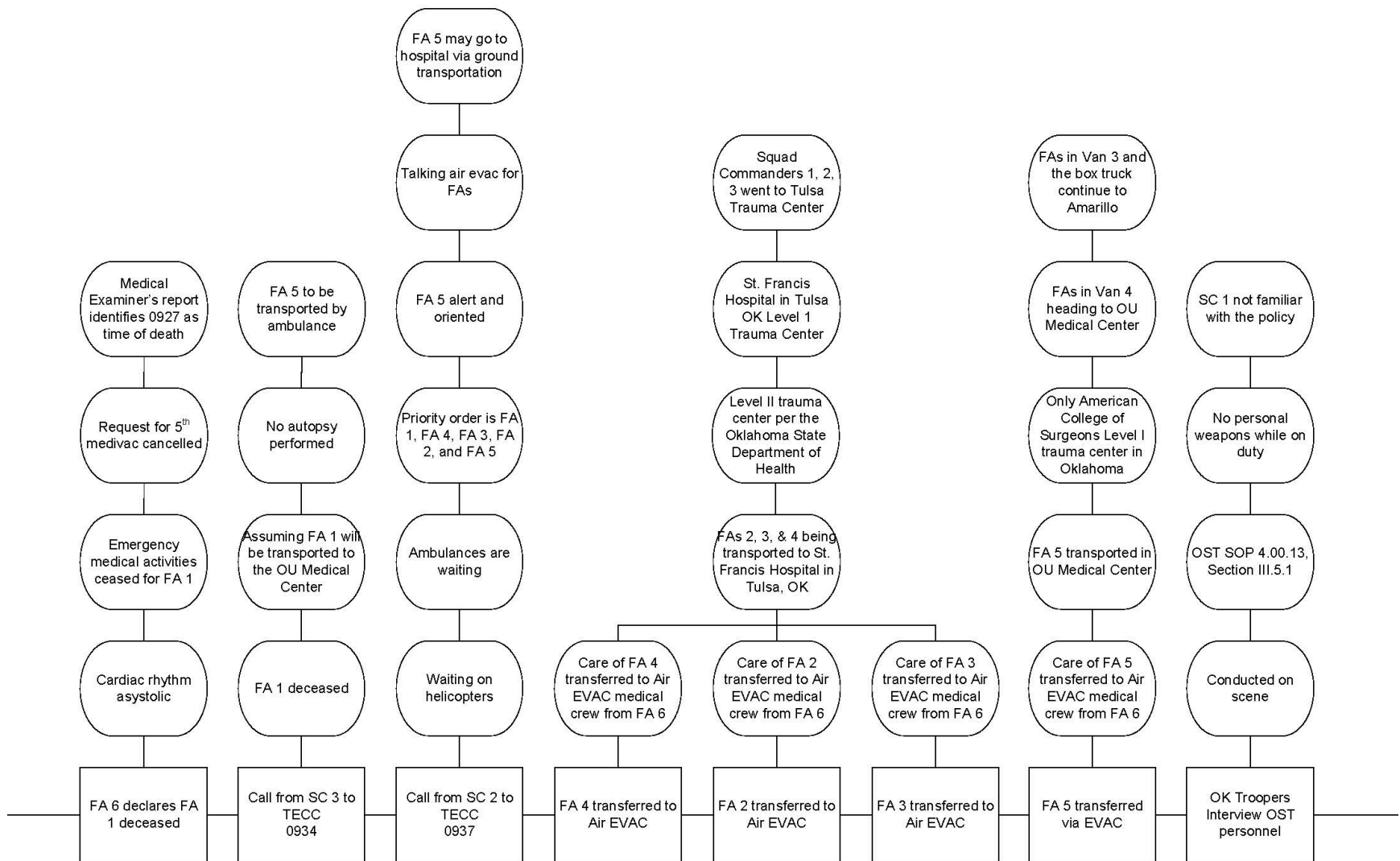


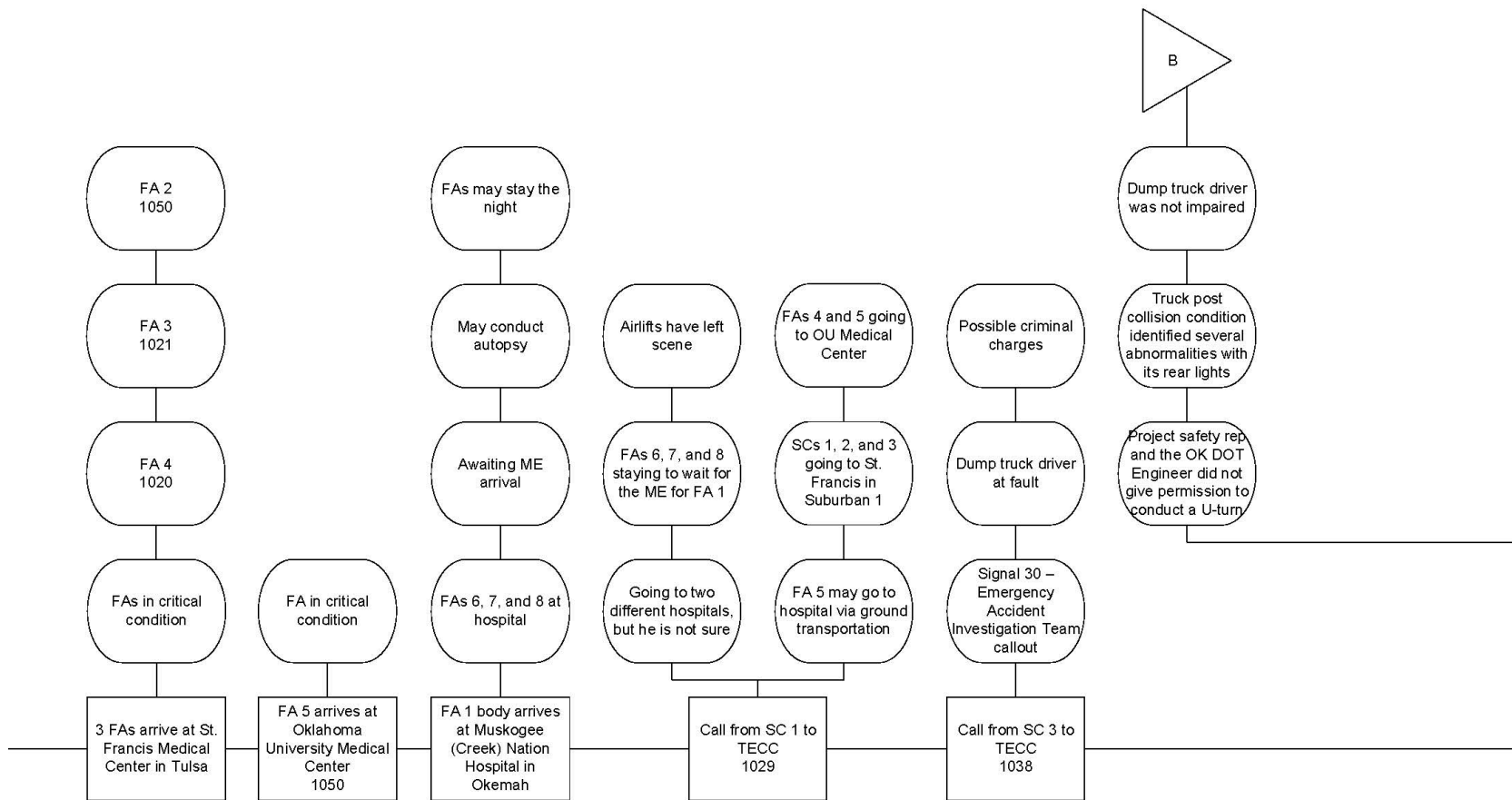


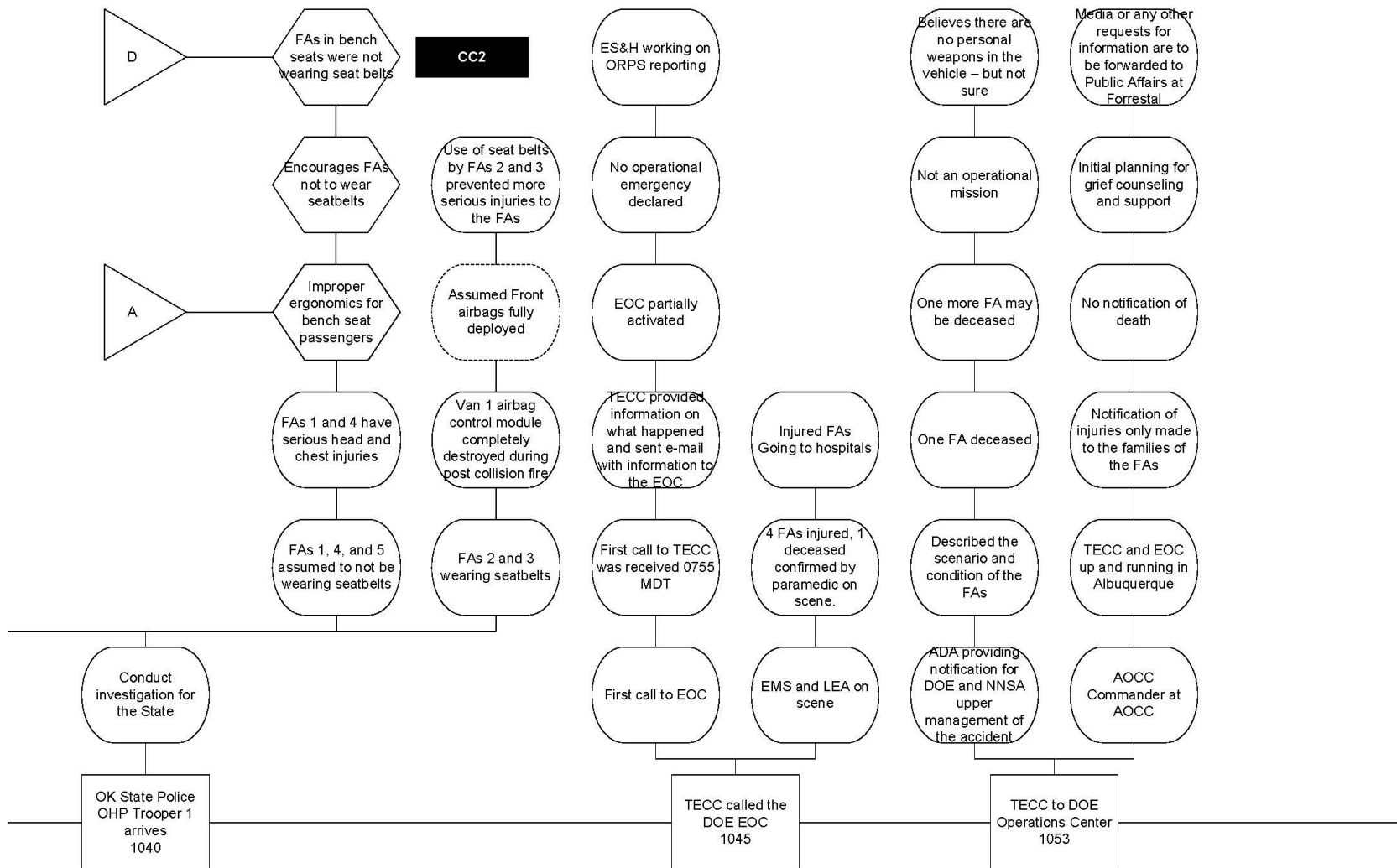


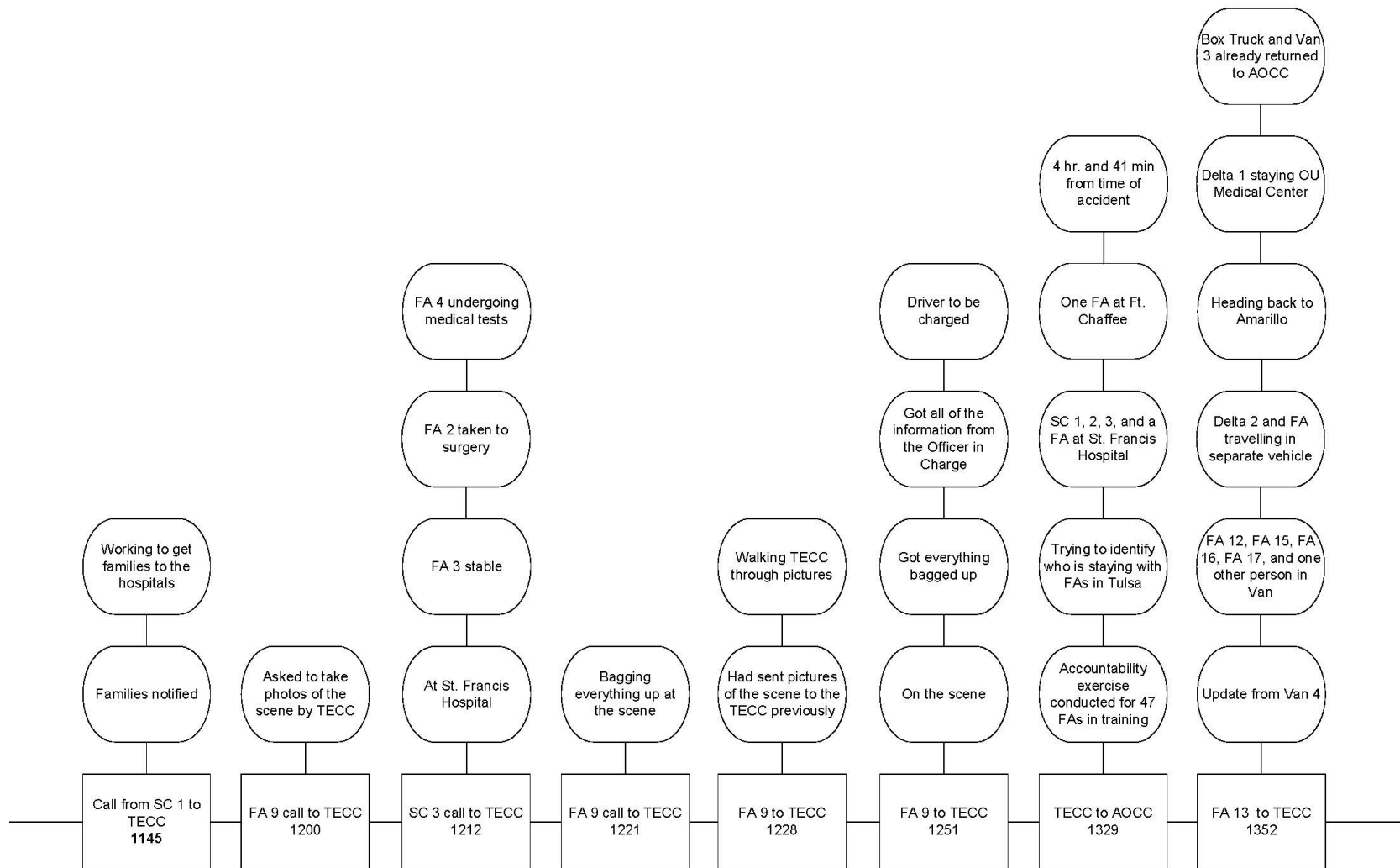


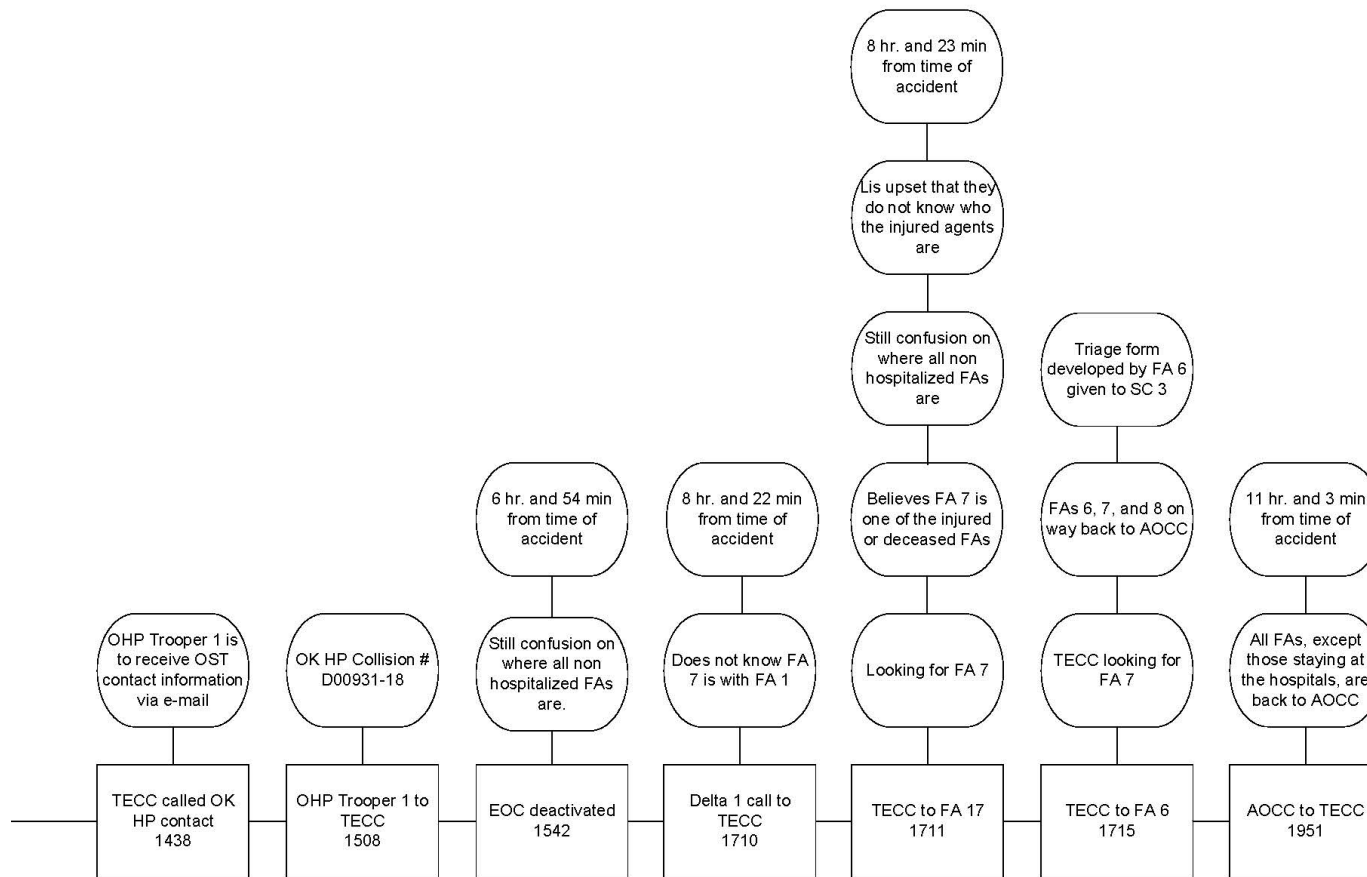












First individual with emergency medical training on the scene

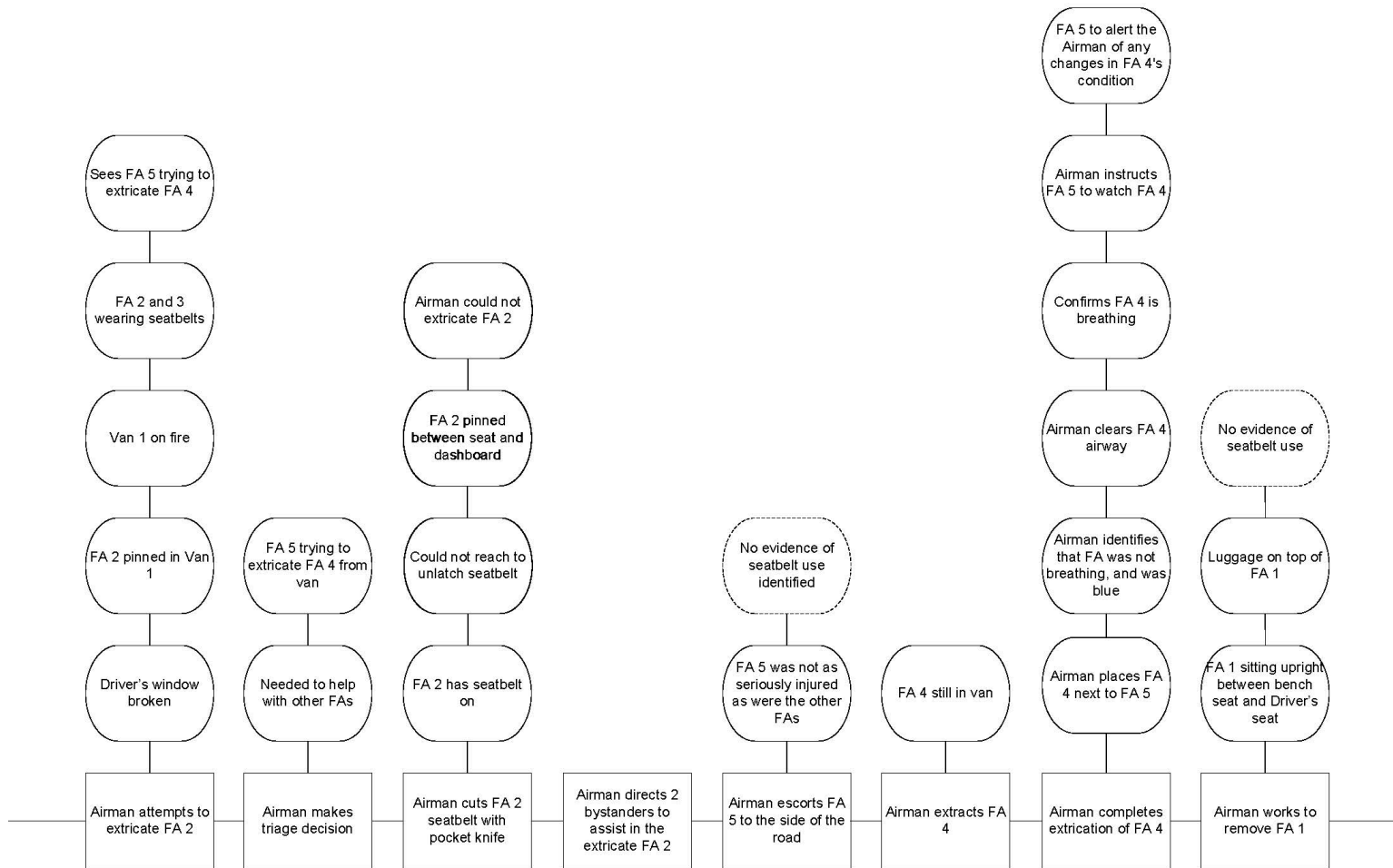
Assisted by other non-OST individuals

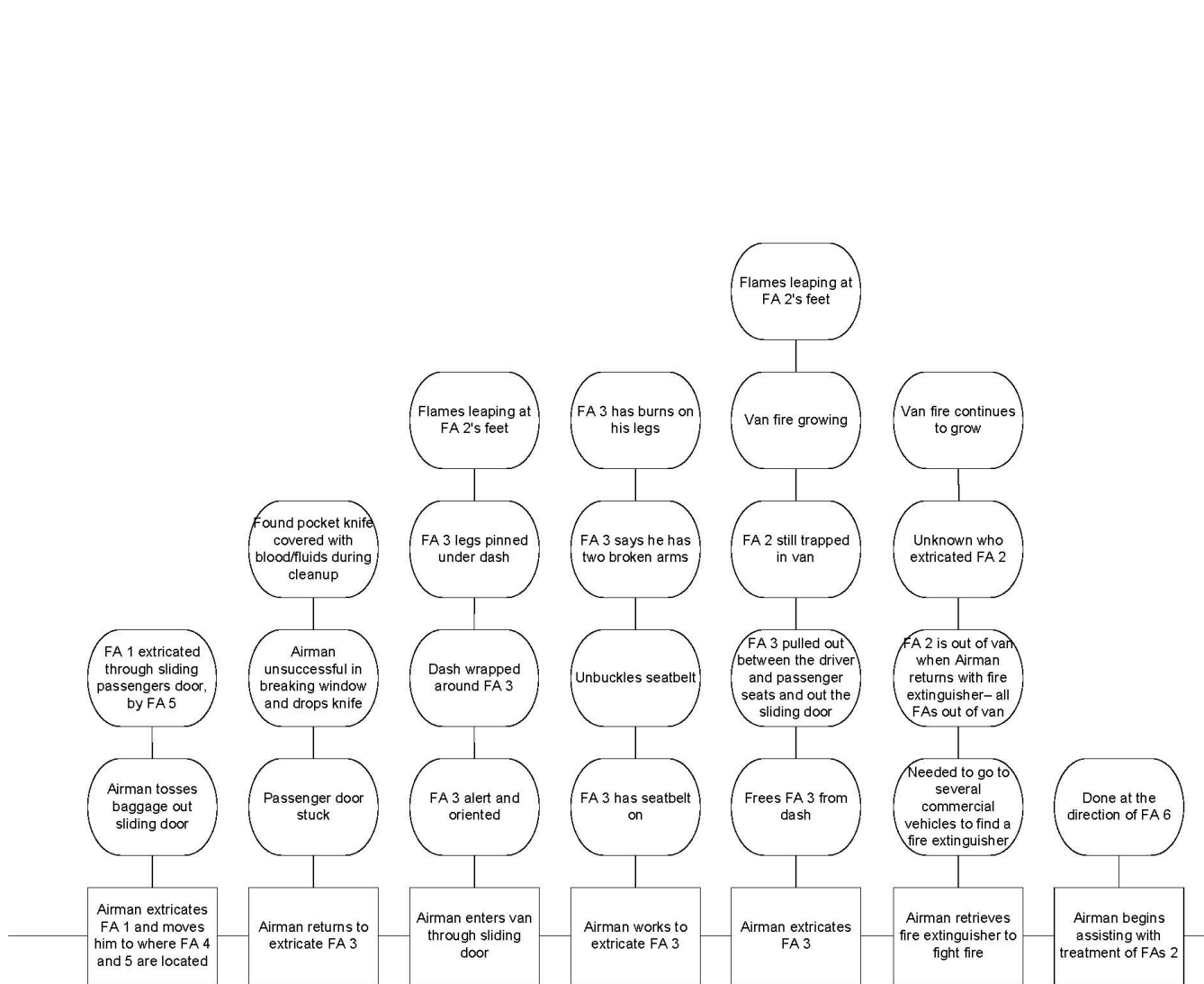
Van 1 smoldering

Did not see collision but did see Van 1 recoil off of the dump truck

Traveling East bound on I-40 with wife and children

Air Force SSgt (Airman) traveling east bound arrives and assists in extricating FAs ~0849





Appendix F. Legend and Acronyms

LEGEND

Dump Truck 1996 Construction Dump Truck hauling Concrete from Construction Site
The Airman Good Samaritan traveling eastbound on I-40 who stopped to render
assistance (U.S. Air Force Staff Sergeant)
Trooper 1 The lead Oklahoma Highway Patrol State Trooper who investigated the
accident

Van 1 Vehicle involved in accident

FA 1 Fatally Injured Agent, Bench Row 1
FA 2 Driver
FA 3 Front Passenger
FA 4 Severely Injured, Bench Row 2
FA 5 Bench Row 3

Van 2

FA 6 (Paramedic), FA 7 (EMT Basic), FA 8

Van 6

FA 9, FA 10, FA 11

Van 4

FA 12, FA 13, FA 14

Van 5

FA 15, FA 16, FA 17

Suburban 1

Squad Commander 1, Squad Commander 2 (Registered Nurse), Squad Commander 3

Suburban 2

Delta Squad 1, Delta Squad 2, Delta Squad 3

ACRONYMS

ABS	Anti-Lock Brake System
AOCC	Agent Operations Central Command
AR	Arkansas
ARC	Accident Review Committee
The Board	Department of Energy Accident Investigation Board
CAIRS	DOE Computerized Accident/Incident Reporting System
CDL	Commercial Driver License
CDT	Central Daylight Time
CFR	Code of Federal Regulations
CNS	Consolidated Nuclear Security, LLC
CON	Conclusion
CT	Computerized Tomography
DOE	Department of Energy
DRE	Drug Response Expert
EDCRASH	Engineering Dynamics Corporation HVE-2D 2018
EOC	Emergency Operations Center
ES	Executive Summary
ESHB	Environment, Safety, and Health Branch
F	Form
FA	Federal Agent
FEOSH	DOE Federal Employee Occupational Safety and Health
GPS	Global Positioning System
GSA	General Services Administration
HRP	Human Reliability Program
HQ	Headquarters
I-40	Interstate 40
ISM	Integrated Safety Management
JON	Judgment of Need
LFO	Los Alamos Field Office
LLNL	Lawrence Livermore National Laboratory
M	Manual

MILES	Multiple Integrated Laser Engagement System
MPH	Miles per Hour
NHTSA	U.S. Department of Transportation, National Highway Traffic Safety Administration
NMCB	Nuclear Materials Courier Basic
NNSA	National Nuclear Security Administration
NTSB	National Transportation Safety Board
O	Order
OCME	Oklahoma City Medical Examiner
OFD	Okemah Fire Department
OHP	Oklahoma Highway Patrol
OK	Oklahoma
ORM	Operational Risk Management
ORPS	Occurrence Reporting and Processing System
ORT	Operational Readiness Training
OST	NNSA Office of Secure Transportation
OU	University of Oklahoma
P	Policy
POV	Privately Owned Vehicle
SDA	Safe Driver Award
SOP	Standard Operating Procedure
SSEMD	Safety, Security, and Emergency Management Division
TECC	OST Transportation and Emergency Control Center
TQP	Technical Qualification Program
TRACOM	Fort Chaffee OST Training Command
TSS	Transportation Safeguards System
TX	Texas



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