

# **2010-2020**

## **Water Tender Rollover Analysis**



Est. 2002

**Wildland Fire Lessons Learned Center**

**September 2021**



*Figure 1 – [August Complex Water Tender Rollover 2020](#).*

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## 1. Background

This report is an independent effort of the Wildland Fire Lessons Learned Center (LLC). We have taken the initiative to conduct this analysis and compile this report based on the alarming frequency of water tender rollovers. This analysis includes only events in which we could find documentation. We are certain there have been numerous instances in which no written report of any kind was produced or shared with us. Even so, we have collected evidence of 27 events over 11 years – including seven fatalities.

Projecting forward based on the recent past, we can expect three fatalities every two years.

It is important for the reader to understand how the LLC operates. We do not investigate accidents or write individual accident reports. We rely on agencies, departments, and incident management teams to conduct reviews, compile reports, and share those reports with the LLC. We provide a single location for those reports to be housed and publicly accessed. All wildland fire related accident reports sent to the LLC are housed in our [Incident Review Database](#).

## 2. Introduction

The information in this report comes from documented water tender rollover accidents while assigned to or responding to wildland fires.

- Incident reports come from various agencies.
- These incidents occurred from 2010 through 2020.
- The dataset includes 27 incidents.

Twenty-three of these incident reports are available from the Wildland Fire Lessons Learned Center's [Incident Review Database](#).

The content of each accident report varies greatly. For some events we have only one sentence stating that a water tender rollover occurred with no additional details. Other reports are exceptionally thorough and provide much detail. This variation makes comparison difficult. This analysis extracted what information could be used to create useful comparisons. However, in doing so, not every element could be determined for every event. The two events listed only in NWCG Safety Grams did not provide enough detailed information to be included in the analysis. Therefore, in this analysis those two events were excluded from all percentage calculations.

## 3. Audience and Intent

The intended audience for this report is wildland fire program managers, fireline supervisors, contracting specialists, ground support personnel—anyone directly or indirectly involved with water tender operations. This report is NOT intended solely for water tender operators. Sound risk management is a culmination of insight and decision making at multiple levels. This report is therefore intended to inform personnel at all levels. The expectation is that the information provided here will aid anyone at any level to contribute to risk management via their particular sphere of influence.

***This report is NOT  
intended solely for  
water tender operators.***

The intent is for this report to provide context around the conditions present when water tenders assigned to wildland fires roll over. To the extent possible, we aim to identify focus areas for continued efforts related to

safer work practices. Included in this report are portions of previously published LLC efforts related to specific topics highlighted in this analysis. All of these efforts are intended to inform and improve existing and future efforts related to safer water tender operations.

## 4. Fatalities

This dataset included seven fatal water tender rollover incidents:

- [Equality VFD Initial Attack](#) 2019
- [New London VFD Initial Attack](#) 2018
- [Nuns Fire Water Tender Fatality](#) 2017
- [Canyon Fire Travel to Assignment](#) 2016
- [Ft. Shaw VFD Initial Attack](#) 2014
- [Big Windy Fire Return to ICP](#) 2013
- [Washington Township VFD Initial Attack](#) 2012

Some of the individuals who lost their lives.



We highlight the fatal events here because it illustrates the ultimate severity often encountered. At the same time, we also reiterate that every water tender rollover is cause for alarm.

## 5. Dataset

We chose to analyze all wildland fire related water tender rollovers (not just fatalities) because of the serious nature of each event, regardless of outcome. In multiple instances, while no injuries occurred, this does not diminish the gravity of the event. In multiple cases in this analysis, the survival of those involved is looked upon as a miracle.

## 6. Comparison of Rollover Reports

The following themes are identified and discussed in this section:

### A. The Mission

- Initial Attack
- Shuttle Water
- Water Roads
- Travel To and From
- The Contractor's Dilemma

### B. The Conditions

- The Road Surface
- Straightaway
- The Soft Shoulder

### A. The Mission

How are water tenders used on wildland fires? Most often water tenders shuttle water to fill portable tanks which are used to fill engines or feed pump operations. Water tenders are also used to water roads and parking areas to keep dust down (often referred to as dust abatement). In either case, these missions result in hours upon hours of driving, often up and down remote mountain roads, often for an entire shift. This is a large amount of exposure to the multiple hazards involved with moving big heavy machines around in unforgiving terrain.

The various missions water tenders carry out on wildfire assignments are neither simple nor without extreme risk. We point this out because water tenders are not always thought of as "frontline" responders such as hand crews or engine modules. Tenders are often thought of as support staff. This mental categorization may hinder our ability to fully appreciate the hazardous missions we ask tender operators to accept. We might adjust what or how often we ask tenders to perform if we consciously acknowledge how dangerous these missions can be.

As with all of our missions, we must constantly ask ourselves and others: ***Is this mission necessary?***

#### Who is Assigned to Drive the Tender?

In some instances, "rookies" are assigned to drive the tender, specifically because it is difficult to drive—akin to throwing someone in the water to learn how to swim. The thought process goes something like: "*If you can learn to handle that apparatus, you can handle anything else we have.*" This is a dangerous practice. If this is how your organization operates, it is worth reevaluating. Driving a water tender is a very specific skill . Drivers deserve very specific training before being asked to operate in high-consequence conditions.

## Excerpt from the 2015 Rollover Report

**How Critical is the Typical Water Tender Assignment?**

We roll Water Tenders on a regular basis—11 in the past five years, including three fatalities. Operating Water Tenders on steep, narrow, dusty roads is extremely dangerous. Knowing this, how *critical* is the typical Water Tender assignment? Whether you are an operator, overhead, or an additional resource watching a Tender work, always ask yourself and those around you:

*Is the assigned task worth the exposure and gravity of the consequences?*

**Questions Supervisors Can Ask Themselves**

*Am I using the appropriate resource for the tactic I've chosen?*

*Is my desire to complete the mission overriding my gut feeling?*

*Is there a safer alternative that will complete the same objective?*

*Can I give the driver an opportunity to size-up the road prior to engaging?*

*Is the driver comfortable with the task?*

**Water Tender Rollovers**

Year	Rollovers
2006	2
2007	2
2008	4
2009	0
2010	1
2011	0
2012	3
2013	3
2014	3
2015	1

**20 in Ten Years!**

Figure 2 – Excerpt from a 2015 Rollover Report.

## Initial Attack

**24% of the rollovers occurred during initial attack response – including four of the seven fatalities.**

Initial attack response was the mission in 57 percent of the fatality water tender incidents, all from local fire departments. These instances occurred primarily on paved surfaces and a mixture of straightaways, turns, and curves. The drivers' experience ranged from less than one year to more than 40 years.

We know that initial response involves a tank that is full (heavy) and a temptation to travel at higher speeds. Weight and speed complicate slowing, stopping, and turning. These conditions conspire to make initial response in a water tender an especially hazardous activity.



**Figure 3 – Initial attack water tender rollover in Oklahoma.**

Only one in-depth report is available for the Initial Attack related events, the [Washington Township FD Rollover Fatality](#). That report includes the following recommendations:

- *Fire departments should provide training to driver/operators, incorporating specifics on rollover prevention and maintaining vehicle control.*
- *Fire departments should develop emergency response deployment protocols to prevent resources from unnecessarily responding, unplanned or unknown, to an emergency scene.*

A related analysis (referenced on page 17 of this report) states: “Increasingly, fire agencies are realizing that there is little or no tactical advantage to driving tankers under emergency response conditions and procedures. In fact, many of them have reinforced that decision by not equipping their tankers with traditional red or blue warning lights and sirens.”

#### **Lessons Related to Initial Attack:**

- Evaluate the actual need for your organization’s water tenders to be part of initial response.
- Share this information with your cooperators and discuss the risk involved.

### ***Shuttling Water***

**28% of the rollovers occurred during shuttle missions.**

Well, of course. After all, shuttling water is what water tenders do. The primary function of a water tender is to move large amounts of water to where it is needed. In the case of wildland fire, this often involves traveling steep backcountry roads in dark, smoky, and dusty conditions.

The wildland fire community is typically quick to point out the dangers of driving. It is not uncommon to hear it stated that *“driving is the most dangerous thing we do.”* And yet we ask those operating some of the most vulnerable equipment to spend the most time behind the wheel.

Of note regarding the seven rollovers that occurred during these shuttle missions:

- 6 of 7 shuttle mission rollovers occurred on unpaved roads.
- 4 of 7 involved wheels sinking or slipping off a “soft shoulder.”
- 4 of 7 rollovers occurred on level sections of road.

#### Lessons Related to Shuttling Water:

- When developing operational plans that require shuttle missions, put very specific thought into how tenders will be utilized and what options exist to mitigate risk. Don’t allow tender operations to be merely an afterthought.
- Whenever possible, encourage and enable tender operators to scout missions in smaller vehicles ahead of time.

### *Watering Roads*

**24% of the rollovers occurred while watering roads.**

Watering roads and general dust abatement is another common task assigned to water tenders. This is often a very needed service. Dust is dangerous because it limits visibility. In several rollover incidents, poor visibility due to dust is listed as one of the complicating conditions present during the rollover.

While watering roads is a legitimate need, it can also become the default task assigned to “keep folks busy” or avoid “sitting around.” This is not unlike assigning hand crews to look for and cut down hazard trees—not because it is needed, but because it keeps them occupied. Assigning known high-danger tasks as a form of busy work is not good risk management.



*Figure 4*

*“I didn’t see any reason for watering. I was just trying to help in any way I could.”*

[First Creek Water Tender Rollover RLS](#)

Six of the rollover incidents reviewed took place during road watering operations:

- 3 occurred on curves or turns in the road.
- 2 incidents were initiated by a soft shoulder giving way.
- 3 of the reports specifically mention distractions. In one instance the operator was using a mobile phone when the rear duals slipped off the road, initiating the rollover.

**Lessons Related to Watering Roads:**

- Be very conscious of the exposure involved in our “bias for action”. Are you watering roads just to keep busy? Continue to ask: “*Is this mission necessary?*”
- When assigning or being assigned to road watering, consciously inject barriers to distraction such as:
  - Pre-scheduled breaks.
  - Disabling notifications on mobile devices.
  - Pre-determined point for reevaluation of the task’s necessity.

### *Travel To or From Assignment*

**16% of incidents occurred during travel to or from the assignment – including two fatalities.**

We all know that driving is dangerous. But with water tenders, driving is the primary danger. Just ordering a water tender exposes the operator to the primary risk involved in their line of work. Routes of travel are extremely important and should be selected with care. Deciding when and where a tender is needed is a weightier decision than it may appear.

Four of the incidents reviewed occurred during travel to/from the day's assignment.

- 2 occurred while heading from ICP to the day's assignment.
- 1 occurred while heading back to ICP from the day's assignment.
- 1 occurred while in travel status enroute to the fire assignment.



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*Figure 5 – Photo from the [Jolly Mountain Water Tender Rollover RLS](#).*

In one particularly tragic event, the tender was being driven back to ICP after night shift. The shift consisted of staging at a Drop Point all night. The tender was operated by 19-year-old Jesse Trader on his first fire assignment after gaining his commercial driver's license (CDL). [See details from this fatal incident below.]



*On August 5, E-220 reported to Drop Point (DP) 21 at 1800, completed the night shift period on August 6 at 0700, and was released shortly thereafter to travel back to the Incident Command Post (ICP). The return route, via Bear Camp Road 1 to the highway, is a narrow, winding, paved mountain road with a steep downhill grade (up to 10 percent).*

*As E-220 descended Bear Camp Road with the other water tenders and incident vehicles assigned to the night shift, he was observed gaining speed, traveling at speeds judged to be higher than the cautionary posted 15 mph and up to approximately 40 mph by witnesses on scene.*

*Toward the bottom of the downgrade, at approximately 0721, the operator lost control of E-220 which rolled over, landing on its cab. The E-220 operator sustained fatal injuries in the accident.*

**Figure 6 – Photo from the [Big Windy Fire Water Tender Fatality Accident Report](#).**

#### **Lessons Related to Travel to and From Assignment:**

- Have specific medical emergency plans for events that may occur during travel to or from the shift or assignment.
- Consider staggered departure times and alternative routes of travel that may help to eliminate driving hazards.

#### ***The Contractor's Dilemma***

**52% of the rollovers involved private (contract) water tenders, including two fatalities.**

Contractors happen to comprise a large portion of the workforce when it comes to water tenders. Contractors bring a wealth of knowledge and skill to the table. Yet, in addition to the variety of hazards they must face, they must also deal with the discernable power differential between themselves and their federal and state counterparts. Below is the link to a podcast that discusses this situation at length:



### The Contractor's Dilemma

October 7, 2016

In this episode we tackle the "Contractor's Dilemma" - the idea that contract fire resources face different pressures that make some conversations about assignment risk more difficult. Is this an issue? Is it not? Take a listen and share your experiences with us. Tune in to get dialed!

This excerpt (below) from the Wildland Fire Lessons Learned Center's [2014 Incident Review Summary](#) report also describes the "Contractor's Dilemma":

#### 4. Ten Years of Rollovers

During the past ten years, we have on record 62 different rollover accidents, including 7 fatalities. The vast majority (60%) consisted of Watertenders and Heavy Equipment, including 6 of the 7 fatalities.

Heavy Equipment bosses, Task Force Leaders, and Division Sups, are you as concerned as you should be to have this equipment under your supervision? Know the risk and the consequences of what you ask equipment operators to do.

##### The Contractor's Dilemma

We tell folks: "*If you see something say something.*" Is this realistic? Sure, in some instances. Like noticing a spot fire. We all welcome that type of information—no matter who is saying it: first-year seasonal, the weed wash operator, or salty old hotshot.

But when voicing concerns about the risk involved on any given assignment, not everyone is on a level playing field. Contractors, in particular, are at a disadvantage.

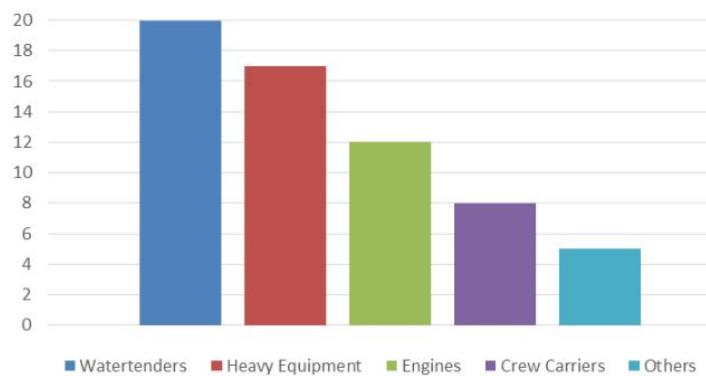
Contractors have to worry about their evaluation—which drives their ability to get work. If a contractor voices a concern over an assignment, some would use this as reason to give a poor evaluation.

This can lead to a decision to "*just do what's asked and hope for the best*" as a way to avoid misunderstanding or conflict.

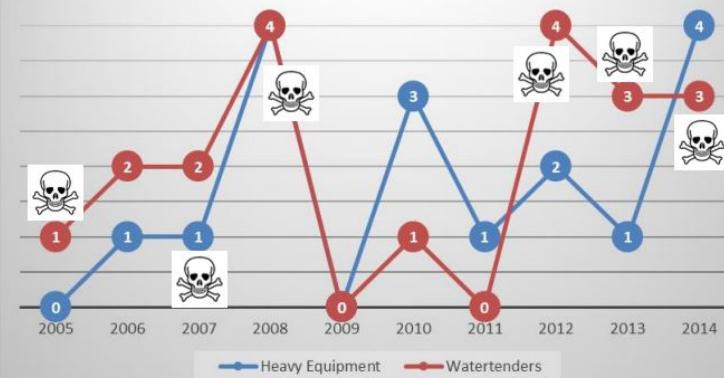
**Acknowledge that this dilemma exists.** Talk about it with overhead and other resources.

**Generate Solutions.**

Rollovers by Type 2005 - 2014



Heavy Equipment and Watertender Rollovers



### **Lessons Related to The Contractors Dilemma:**

- As an operator or a supervisor, bring up and openly discuss the potential power differential and its impact on risk management.
  - As an “Agency” supervisor (non-contract), consider ways to even-out the power differential. One tactic is to provide contractors the opportunity to evaluate **your** performance.
- 

## **B. The Conditions**

The conditions in which water tenders operate on wildland fires vary greatly. All assignments involve initial travel to the assignment, daily commute, actual assignment work, and travel home. During the course of one assignment a water tender will likely endure a wide range of conditions and significant time behind the wheel. This is great for experience, but it involves a significant amount of exposure as well.

### **Road Surface**

**60% of the rollovers occurred on unpaved surfaces.**

Again, this percentage is not surprising given the typical wildland fire assignment. The vast majority of our work involves travel on dirt roads. Driving any type of vehicle on dirt roads requires a specific skill set. Driving large equipment such as water tenders in these conditions requires an even more specialized skill—gained almost exclusively through experience. This illustrates another common paradox in our business. We blame mistakes on not having enough experience. But receiving the experience involves significant risk (navigating the hazards with fewer “slides” to rely on for decision making).

The water tender rollovers evaluated in this analysis included the full spectrum of operator experience:

*The Operator received his CDL learner’s permit on July 16, 2013. Approximately two weeks later, on July 30, he passed the required state testing and received his Class B CDL with Tanker endorsement.*

*The night shift on August 5 was the first documented wildland fire assignment for the Operator of E220, which began with ascending the Bear Camp Road to DP-21.*

### [Big Windy Water Tender Fatality](#)

*“The Water Tender’s driver is a 67-year-old male with 40 years of experience operating heavy equipment in the woods. He has a long history of driving for commercial logging operations and was the Safety Officer on a rock crushing operation for four years.”*

### [First Creek Rollover RLS](#)

### **Lessons Related to Experience and Capability:**

- As an **operator**, be very up front about your equipment's capability as well as your personal experience and comfort level. Actively engage in discussions and decisions about your assignment.
- As a **fireline supervisor**, ask specifically about the equipment and your operators' experience and comfort level with the road conditions and tasks. Do not ask operators to perform tasks outside their comfort, capability, or the limitations of their equipment.



*Figure 7 – Photo from the [Big Windy Water Tender Fatality](#).*

**40% of the rollovers occurred on paved surfaces—including all seven fatalities.**

It makes sense that fewer wildland fire rollover accidents occur on paved surfaces because the majority of assignments take place in rural areas with dirt roads. But ALL of the fatalities occurred on paved surfaces. That is striking. We don't presume to know what this indicates. It may simply be a matter of speed, which in turn influences the severity of the damage/trauma. We can't say. We can reiterate this is yet another chance to improve our decision-making regarding risk assessment.

### **Lesson Related to Paved Surfaces:**

- When making decisions about water tender assignments, do not focus solely on the hazards of the unpaved surfaces. Make a mental note of the fact that ALL fatal wildland water tender rollovers in recent years occurred on pavement.

## *Straightaways*

**63% of the rollovers occurred on straight sections of road (no curves or turns involved).**

Multiple reports include a description of the accident from the operator stating they are not sure how the rollover started.

*"The Water Tender operator's recollection was that he felt the vehicle leaving the road and didn't know why or what happened."* [Miles Water Tender Rollover RLS](#)

*"When asked him what happened, he recalled a bump, then waking up in the truck with oil dripping on him...it appears that he became distracted and the truck drove straight off the road."* [Ferguson Fire Water Tender Rollover](#)

Distraction and fatigue are often mentioned as possible contributions in these instances.

### **Lessons Related to Attentiveness and Fatigue:**

- As an **operator** – regularly evaluate your level of attentiveness and fatigue. Provide updates to your fireline supervisor and discuss mitigation options.
- As a **fireline supervisor** – regularly inquire about operator struggles and best practices regarding attentiveness and fatigue. Provide regular opportunities to reset and attend to potential distractions.

## *The Soft Shoulder*

**25% of the rollovers occurred when a soft shoulder gave way.**

This is a very specific road condition that can be looked for and identified. It is also important to note that this road condition is often created by the very act of improving the road by grading it. Grading a road may improve the overall condition of the road while simultaneously introducing additional hazards.

*"Freshly graded roads can be deceiving. The area that gave way was a natural drain area that had been filled in with dirt but not packed down. This gave the appearance of solid ground when it was not at all solid."*

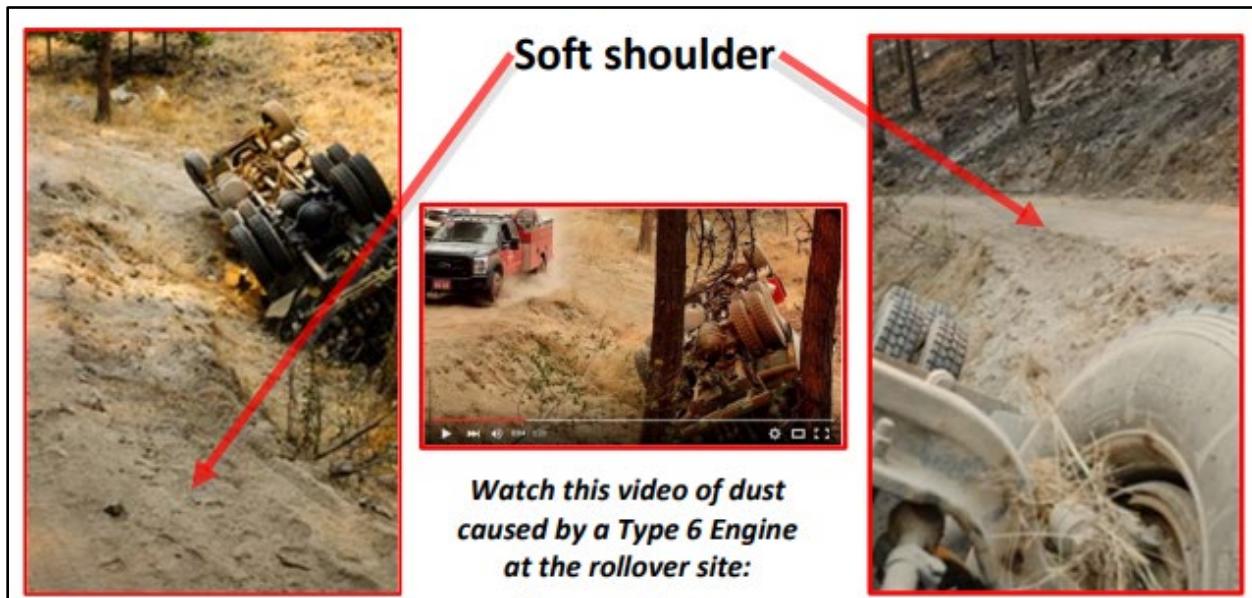
[Soberanes Tender Close Call](#)

*"The pre-existing roadbed was 11 feet wide. After Dozer improvement, it was 13 feet wide. Two feet of additional 'soft shoulder' had been introduced on the downhill side of the road by the Dozer. Furthermore, several large rocks had rolled out of the fire and landed on the road—narrowing it even more. This obstruction required the Water Tender driver to steer toward the false shoulder to avoid these large rocks."*

[First Creek Water Tender Rollover](#)



*Figure 8 – Two of the soft shoulders that gave way in water tender incidents.*



*Figure 9 – Image from the First Creek Rollover RLS.*

#### **Lessons Related to the Soft Shoulder:**

- Brief regularly on the dangers of the soft shoulder. We all need to be regularly reminded of this deceiving hazard.

## 7. Additional Items of Note

- Four of the reports indicate the operator was not wearing a seatbelt, including two of the fatality incidents.

- Only one of the reports identified problems with water tank baffles:

*"E-220's tank baffles did not meet the specifications required by the solicitation. Specifically, there was no longitudinal baffle—running the full length of the tank, front to rear. Transverse baffles did not meet the minimum requirements, and the existing baffling was severely rusted through in many locations. This finding magnified the energy of the crash."* [Big Windy Water Tender Rollover](#)

- Tank baffling is a crucial design element related to safe water tender operations. Inspecting equipment for contract specifications is carried out by a variety of people/positions on wildland fire incidents. Sometimes during initial attack, inspections do not even take place. Those tasked with inspecting equipment may not always take the time to ensure that baffles are indeed present and meet requirements. Based on the crucial nature of baffles, inspecting them is a high priority.

**If you are involved with water tender inspections in any way  
make sure tank baffling is discussed and inspected.**

- Contract specifications for non-tactical water tenders are often minimal on vehicle safety features, including driver ergonomics. Many water tenders that operate on wildland fires are old—in many cases retrofitted to meet minimum requirements. These conditions can lead to the vehicle being very uncomfortable to drive. Take this into account when making or taking assignments that involve long-duration driving.
- Only 13 of the reports included recommendations or lessons. Many of the recommendations focused on overall incident management topics (“Communications” and “Incident Within Incident” planning) rather than specific water tender operations. Of the recommendations specific to water tenders, the following three topics appeared in multiple reports:
  - Improve access to and consistency of operator/driver training.
  - Discuss and mitigate fatigue, distraction, complacency.
  - Improve equipment inspection and maintenance.

## **8. Similar Analysis/Reports**

Wildland fire is not the only group to be concerned about the regularity of water tender rollovers. The structure fire world has similar instances. Several entities have done basic analysis of water tender rollovers related to structure fire response. Excerpts and links to those reports:

### **Safe Operation of Fire Tankers**

<https://www.usfa.fema.gov/downloads/pdf/publications/fa-248.pdf>

This is an in-depth analysis of water tender accidents conducted by FEMA/U.S. Fire Administration (USFA) in 2002. An excerpt from its introduction:

“When reviewing the statistics regarding fire apparatus crashes, it becomes very apparent that a disproportionately high number of these crashes involve fire department tanker apparatus. The reasons for the disproportionate number of crashes involving fire department tankers will be detailed in the main body of this report.”

This report is the main source used by the following two efforts:

### **Safe Water Tanker Operation is Still a Cultural Issue**

<https://www.firehouse.com/home/article/12072167/fire-department-water-tanker-apparatus-safety>

This article highlights several points from the USFA report “Safe Operations of Fire Tankers” (cited above). This article is included here because it expands on a specific mitigation measure:

“Increasingly, fire agencies are realizing that there is little or no tactical advantage to driving tankers under emergency response conditions and procedures. In fact, many of them have reinforced that decision by not equipping their tankers with traditional red or blue warning lights and sirens.”

### **EVOc: Preventing Tanker/Tender Rollovers**

<https://www.firehouse.com/home/article/12310236/evoc-preventing-tankertender-rollovers>

“Tankers/tenders make up only three percent of the United States’ firefighting fleet, yet on any given year, they make up a majority of serious apparatus accidents.”

This analysis identifies the commonalities listed below. Follow the link (above) to access a short write-up on each of these topics:

- Limited Experience Operators
- Dangerous Environments
- Apparatus Advancements
- Older/Retrofitted Apparatus
- Seatbelt Use

## 9. Access to the 27 Rollover Incident Reports

This section provides a list of the 27 accident reports used in this analysis and their dates. Embedded hyperlinks are provided to the source of information.

- [Morton Fire Water Tender Rollover](#) 2010
- [Washington Township FD Rollover Fatality](#) 2012
- [Bagley Fire Water Tender Rollover](#) 2012
- [Lanes Fire Water Tender Rollover](#) 2012
- [Scotts Fire Water Tender Rollover](#) 2012
- [Corral Complex Water Tender Rollover](#) 2013
- [Big Windy Water Tender Fatality](#) 2013
- [Utah Water Tender Rollover](#) 2013
- [Duncan Fire Water Tender Rollover](#) 2014
- [Bailey Butte Fire Water Tender Rollover](#) 2014
- [Fort Shaw FD Water Tender Fatality](#) 2014
- [Waterman Complex Water Tender Rollover](#) 2014
- [First Creek Fire Water Tender Rollover](#) 2015
- [Canyon Fire Water Tender Fatality](#) 2016
- [Initial Attack Water Tender Rollover](#) 2016
- Sawmill Fire Water Tender Rollover 2016
- [Soberanes Water Tender Close Call](#) 2016
- Soberanes Water Tender Rollover 2016
- [Nuns Fire Water Tender Fatality](#) 2017
- [Jolly Mountain Fire Water Tender Accident](#) 2017
- [New London FD Rollover Fatality](#) 2018
- [Ferguson Fire Water Tender Rollover](#) 2018
- [South Umpqua Complex Tender Rollover](#) 2018
- [Cougar Creek Fire Water Tender Accident](#) 2018
- [Miles Fire Water Tender Rollover](#) 2018
- [Equality FD Rollover Fatality](#) 2019
- [August Complex Water Tender Accident](#) 2020