Implementing an In-Vehicle Monitoring Program
A Guide for the Oil & Gas Extraction Industry
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Implementing an In-vehicle Monitoring System Program
A Guide for Improving Driver Performance in the Oil and Gas Extraction Industry
Disclaimer

This guidance document is not a standard or regulation, and it creates no new legal obligations. It contains recommendations that are advisory in nature, informational in content, and are intended to assist employers in providing a safe and healthful workplace.
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Executive Summary

Motor vehicle crashes are the most common cause of fatality for the oil and gas extraction worker, accounting for almost one out of every three fatalities. Workers from companies with fewer than 100 employees have the highest rates of motor vehicle fatality in this industry. Driving is both a critical and frequent task for workers in the oil and gas extraction industry. All sizes of trucks, from pick-up trucks to semi-trucks are driven long distances between well sites to deliver equipment, supplies, and personnel. Deaths to workers can be prevented by implementing comprehensive motor vehicle safety programs. One component of such a program is in-vehicle monitoring systems (IVMS). Oil and gas companies tell researchers that these systems are helping to reduce the rate of crashes and injuries for their workers.

This guidance is for oil and gas extraction safety and health professionals who are responsible for motor vehicle safety in their company. This publication was developed to assist these professionals in implementing in-vehicle monitoring system programs. The guidance highlights what is known about fatal motor vehicle crashes in this industry, the safety benefits of IVMS as reported by the oil and gas extraction industry and other literature, and things to consider when implementing an IVMS program.

Companies that implemented IVMS programs experienced:

- A reduction in motor vehicle crash rates of 49–93% (in conjunction with a motor vehicle safety program).
- A 60% reduction in speeding events.
- An 8-20% reduction in miles driven.
- Cost savings associated with reductions in crashes, fuel consumption, and maintenance costs as well as improved public perception.

Four practical steps that safety professionals can take to implement an IVMS program are described in this guide. These four steps are:

1) Select: choose an IVMS and conduct a pilot project.
2) Plan: determine which vehicles will receive monitors, establish staff roles, and develop a training and communications campaign for drivers.
3) Deploy: roll out the program.
4) Review: monitor performance and adjust the IVMS where necessary.
Introduction

Motor vehicle crashes kill more oil and gas extraction workers on the job than any other type of injury. Many factors contribute to this elevated risk, including driving on rural roads that may lack safety features, the movement of large trucks and equipment, and long work hours [Retzer and Hill 2011, CDC 2008]. To address this issue, many companies are turning to technology. Oil and gas extraction companies of all sizes and companies in other industries have found that monitoring their drivers’ behaviors is an effective way to reduce risk [Gale 2011, Hickman and Hanowski 2010, Matusalen 2006, Levick and Swanson 2005, Ballard 2004].

In-vehicle monitoring systems (IVMS), or driver behavior monitoring systems, refer to electronic devices that record data about a driver’s behavior and vehicle use, such as date, time, speed, acceleration, deceleration, and safety belt use. For the purposes of this guide, IVMS includes any device that can perform these functions (e.g., GPS, accelerometer-based, and video-based systems). Also, for the purposes of this guide, IVMS does not refer to in-vehicle technologies such as crash avoidance (e.g., lane-departure warning or other similar devices).

IVMS measures driver performance against a predetermined set of parameters. The monitor records the information electronically so information can be downloaded to a computer. Several types of monitors are available on the market, ranging from simple plug-and-go devices that record unsafe driving behaviors, to sophisticated systems that track the physical location of large fleets in real time. The time required to install the device varies widely as well, from less than one minute, to several hours. Although installing monitors is relatively simple, implementing an IVMS program is more complex and requires an investment of time and a commitment from all levels of the organization to be successful.

In-vehicle monitoring systems provide important information to support safe driving behaviors, but they should be only one component of a comprehensive motor vehicle safety program. In order for a company to have a sustained reduction in the risk of motor vehicle crashes, a comprehensive motor vehicle safety program needs to be in place.

A number of general guidelines have been developed to help employers implement motor vehicle safety programs. Two of these are Work-Related Roadway Crashes: Prevention Strategies for Employers [NIOSH 2004] and the Guidelines for Employers to Reduce Motor Vehicle Crashes [Occupational Safety and Health Administration 2006]. Motor vehicle safety guidance for U.S. employers is also provided by the American National Standards Institute (ANSI)/American Society of Safety Engineers (ASSE) Z15.1 standard, a national consensus standard, Safe Practices for Motor Vehicle Operations [ANSI/ASSE 2012].
The International Association of Oil and Gas Producers (OGP) released a *Land Transportation Safety Recommended Practice, Report #365*, for the oil and gas extraction industry specifically (2005). It is based on best practices for the industry and provides tools to support implementation. The OGP recommendations advise that oil and gas operators address motor vehicle crash risk for their employees on and off drilling sites. It also advises oil and gas operators to hold their contractors to the same high level of road safety performance. The OGP Recommended Practice recommends that all company vehicles (owned, leased, or contracted for greater than 3 months) have IVMS installed [OGP 2005].

More research is needed to evaluate the effects of IVMS on improving driver behaviors and reducing motor vehicle-related crashes and injuries in the workplace. However, the information collected during this research project from sources within the oil and gas extraction industry provides preliminary evidence that these systems can be an effective tool to improve motor vehicle safety when properly selected, installed, maintained, and managed. IVMS are uniquely able to provide quantifiable data that can identify high risk driving behavior.

**What this Guidance Document Covers**

This guide is a collection of information provided by motor vehicle safety experts in the oil and gas extraction industry who have implemented IVMS and reduced their motor vehicle crash rates. It provides motor vehicle fatality data for the oil and gas extraction industry, examples of benefits of using IVMS reported by experts and described in the literature, and four steps for deploying IVMS in a company. The appendices include a list of common IVMS features and other supplemental tools for an IVMS program.

This guide should help oil and gas extraction companies:

- Decide whether to install monitors in company vehicles.
- Select a system that is appropriate for their purposes.
- Successfully implement an IVMS.
- Utilize the data provided by monitors to improve motor vehicle safety.
- Effectively track the impact of the IVMS program on motor vehicle crash rates.

This guide does NOT cover all of the essential components of a motor vehicle safety program. Guidelines mentioned in the previous section should be used to design a comprehensive program before implementing an IVMS, including ways to reduce unnecessary miles driven. Because technology is advancing rapidly, this guide may not cover all features available in various IVMS products.
Motor Vehicle Fatalities in the Oil and Gas Extraction Industry

There were 716 oil and gas extraction workers (onshore and offshore) who died on the job in the U.S. during 2003–2009.\(^1\) The most common cause of fatality was motor vehicle crashes, accounting for 202 (28%) of fatalities [Retzer et al. in press]. As defined here, motor vehicle crashes include crashes on all public roads, but not in parking lots, on drilling sites, or on private lands.

Fatality rates by company size, type and other industries

During the 7-year period, the motor vehicle fatality rate for the oil and gas extraction industry was 7.6 deaths per 100,000 workers. Of all major industry groups, only transportation and warehousing had a higher motor vehicle fatality rate (9.3 per 100,000 workers, Figure 1).

Workers from small companies (fewer than 20 employees) were four times more likely to die in a motor vehicle crash than workers from larger companies (100 or more employees). Workers from medium sized companies (20-99 employees) were twice as likely to die in a crash.

Figure 1. Motor Vehicle Fatality Rate, Oil and Gas Extraction vs. Other Private Industries, 2003–2009

Data Source: Fatality rates were calculated by the National Institute for Occupational Safety and Health (NIOSH) Division of Safety Research, with restricted access to BLS CFOI microdata.

\(^1\)This research was conducted with restricted access to Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) data. The views expressed here do not necessarily reflect the views of the BLS. Reference: Retzer KD, Hill RD, Pratt SG [2013] Motor vehicle fatalities among oil and gas extraction workers. Accident Analysis and Prevention. 51:168-74.
Workers employed by well servicing companies and drilling contractors were about three times more likely to die in a motor vehicle crash than workers employed by operators (10.6 fatalities for well servicing companies and 9.4 fatalities for drilling contractors per 100,000 workers compared with 3.1 per 100,000 workers employed by operators.

**Contributing factors**

Factors reported included other drivers’ errors (worker died in a crash that was caused by another driver), excessive speed, overcorrecting and losing control, weather conditions, losing control on a curve, and falling asleep at the wheel.

**Safety belt use**

Even though safety belt use was not consistently reported, at least 38% of fatalities (77) occurred to workers who were not wearing a safety belt at the time of the crash. In 24 more fatalities, the worker killed was ejected from their vehicle, indicating that a safety belt was most likely not worn.

**Vehicle type, location, and crash type**

Of the 202 motor vehicle crash fatalities, more than half (51%) were occupants of a pick-up truck; another one-quarter (27%) were occupants of a large truck (semi, tractor-trailer, trailer truck).

The majority of fatal crashes (65%) occurred on rural state/U.S. highways rather than on interstates, freeways, or expressways.

Over one-third were single vehicle events where the vehicle jack-knifed or overturned. Single vehicle events were more common among large trucks.

**Conclusion**

Motor vehicle crashes are the leading cause of death in the oil and gas extraction industry. Motor vehicle fatality rates in the oil and gas extraction industry are among the highest of any private industry. NIOSH found that workers from companies with fewer than 100 employees are at greater risk than those from larger companies (more than 100 employees). Speeding and the lack of safety belt use are contributing factors in these crashes that can be addressed using IVMS. These data suggest the need for more efforts to be made to improve driver performance and reduce the risk of motor vehicle fatality in the oil and gas extraction industry.\(^1\)
How This Guide Was Developed

The authors conducted a comprehensive review of the Society of Petroleum Engineers (SPE) articles on motor vehicle safety programs in the oil and gas extraction industry. In-vehicle monitoring systems were identified as one of the tools used by several companies in the oil and gas extraction industry to improve motor vehicle safety.

In order to learn more about elements of successful IVMS programs, a questionnaire was developed to ask motor vehicle safety professionals in this industry about their experiences with IVMS. Nine experts were interviewed from seven different oil and gas companies (two operators and five well servicing companies). Interviews were conducted by phone or in person. Interviewees were asked questions about many different aspects of their IVMS program, such as steps of implementation, successes and challenges, IVMS selection criteria, driver buy-in, and management buy-in.

The information collected was categorized by themes. A workgroup was assembled to review the themes. The members included five of the interviewees, an insurance representative, and staff and consultants from NIOSH. The material was organized and enhanced as necessary. This resulting guide is intended as a reference for companies in this industry who are considering the implementation of IVMS.

Note: For the remainder of this document, the term “experts” is used to refer to the interviewees and workgroup members described above.
You Should Know:
IVMS, or In-vehicle monitoring systems, refers to any electronic device that can monitor driver/vehicle behaviors such as speed, acceleration, and deceleration. Many GPS devices are capable of in-vehicle monitoring.

Reported Benefits of IVMS

The oil and gas extraction industry needs to reduce motor vehicle fatalities. IVMS has been identified as a tool being used within this industry to reduce risk. The safety and other benefits of in-vehicle monitoring were collected through a review of government reports, scientific journals and articles published in SPE literature on the topic. Secondarily, oil and gas motor vehicle safety experts who were interviewed were asked about the benefits they experienced as a result of their company’s IVMS program. The following list summarizes the benefits reported in the literature and collected through interviews.

Safety Benefits

1) Reduces motor vehicle crash rates:
   - A review of articles submitted to the SPE revealed:
   - An independent evaluation funded by the Federal Motor Carrier Safety Administration (FMCSA) of a low-cost driving behavior management system was conducted within two commercial vehicle operations over 17 weeks. The on-board monitoring combined with behavioral coaching was responsible for a significant reduction in safety-related ‘events’ in both carriers. Carrier A reduced their events by 38% and Carrier B by 52% [Hickman and Hanowski 2010].
   - Three years of data were collected from a fleet of more than 2,000 vehicles that drove more than 50 million miles a year in the continental U.S.A. There was more than a 50% reduction in automotive incidents (per million miles driven) per year [Ballard 2004].

2) Reduces speeding:
   - SPE articles report a 60% reduction in speeding when IVMS is used [Twilhaar et al. 2000]. This is important because for every 1 mile per

“We have experienced a 55% decrease in motor vehicle incidents on highways and roads. There has been a reduction in the number of speeding events by several thousand and a steady reduction in harsh accelerations and decelerations.”
Col. Mark Trostel (ret.), driving safety advisor, Encana Oil and Gas (USA), 2011
hour decrease in speed, there is a corresponding 5% reduction in crash frequency. In addition, the consequences of collision are less serious when the impact speed is lower [Finch 1993, Taylor 2000].

- The group of experts report that monitoring systems provide a tool with which to evaluate driver performance and provide coaching to improve performance (e.g., speeding). Because driving is one of the few unsupervised activities workers engage in, drivers receive very little feedback on their performance.

3) Encourages safety belt use:

- A prospective study of 250 emergency vehicle drivers was conducted over a period of 18 months to determine if an onboard computer-monitoring device with real-time auditory feedback could improve driver behavior. Safety belt violations dropped from 13,500 to 4 per month (99.9% decrease). The number of over-speed violations decreased from 550,353 to 2,709 per month (99.5% decrease). There was also a 20% saving in vehicle maintenance costs within 6 months [Levick and Swanson 2005].

- When fitted with a safety belt sensor, IVMS allows safety professionals to monitor and coach drivers in their use. Using a safety belt is the single most effective measure for preventing motor-vehicle crash fatalities and serious injuries. Lap/shoulder belts, when used correctly by light-truck occupants, reduce the risk of fatal injury by 60% [NHTSA 2007].

4) Improves at-risk driver behavior:

- Following too closely, failing to look far enough ahead, distracted driving, “jackrabbit” starts, aggressive braking, over-revving—these are indications of at-risk driver behavior. The group of experts report that each can be identified with IVMS, and drivers can be coached for continuous improvement. Systems also provide remote driver safety benefits.

Other Benefits

1) Demonstrates corporate social responsibility:

- The group of experts report improved public perception stemming from a reduction in complaints of company drivers by residents and fewer citations from local law enforcement.

2) Reduces fuel costs and environmental impacts:

- According to SPE articles, systems have reduced miles driven from 8%–20%. It also can reduce idling time [Lopez 2006, Twilhaar 2000].
3) Reduces maintenance costs:
   • The group of experts report that reduced mileage and idling time combined with less aggressive driving styles reduces the frequency and extent of maintenance, and repair.

4) Provides other cost saving opportunities. The group of experts report that IVMS:
   • Identifies those drivers most at-risk and focuses resources on them.
   • Identifies and prevents risky driving behavior.
   • Can be used as a tool in providing regulatory agencies with verifiable proof of compliance, such as for hours of service.
   • More easily documents off-road mileage to apply for off-road fuel tax credits.
   • Extends vehicle life.
   • Gives the ability to be in constant communication with drivers who have HAZMAT or other important shipments.
   • Reduces insurance premiums, claims, citations, and workers compensation expenses.
   • Potentially decreases the number of at-fault crashes and associated litigation costs.

“In combination with personal accountability of drivers and strong safety culture, the IVMS program helped us to realize $500,000 in cost savings over a 1-year period as a result of reduced motor vehicle incidents alone. That does not include the savings resulting from more efficient driving behaviors and reduced idling and maintenance costs; not to mention a safer driving environment for our employees.”
Col. Mark Trostel (ret.), driving safety advisor, Encana Oil and Gas (USA), 2011
So is IVMS Right for Your Company?

Take the quiz. An answer of “yes” to any of these questions may indicate your company’s need for IVMS.

- Are you concerned about your drivers’ safety and welfare due to a high rate of motor vehicle incidents?
- Have you incurred significant costs due to motor vehicle fatalities, injuries, rollovers, and other incidents?
- Do your employees drive a large number of miles?
- Do you need to track hours of service, either for safety or regulation … or both?
- Are you concerned about liability costs, maintenance costs, and fuel costs?
- Do your employees drive company vehicles most work days, and sometimes drive alone?

Cost of IVMS

The cost of implementing IVMS varies widely. Apart from the cost of staff time to oversee the program, there are two main types of costs: 1) the monitors, and 2) monthly communication costs. As of 2012, monitors ranged from approximately $200 for a simple device to $2,000 for a device with the most advanced features. Communication fees varied widely as well, depending on the type of communication you use (see wi-fi, cellular, and satellite communications on Page 28 in Appendix A). As of 2012, the lower range of communication fees is approximately $35 per month per monitor.

In contrast, The National Highway Traffic Safety Administration [2003] has calculated the average costs of motor vehicle crashes to employers:

- Per fatality: $3.8 million
- Per injury: $128,000
- Per crash: $24,000
- Per million vehicle miles traveled: $236,000
Implementing an In-Vehicle Monitoring System Program

The implementation of an IVMS program is a complex process that involves a lot of careful planning. The group of experts recommend a structured approach, such as the following steps, to implement an IVMS program:

1) **Select** an IVMS, and conduct a pilot project.
2) **Plan** who will be monitored, establish staff roles, and develop training and communications campaign for drivers.
3) **Deploy** the program.
4) **Review** monitor performance and adjust the IVMS where necessary.

There may be less need for formal planning in a smaller company; however the overall process will be the same.
IVMS Models and Features
There are many IVMS systems. The right IVMS system will help a company to achieve their motor vehicle safety program goals and be consistent with company values. Common IVMS features are listed in Appendix A. Once a monitoring system is selected, include agreed-upon terms and conditions in a contract.

Basic considerations for selecting an IVMS include:

- Durability of the hardware to meet the needs of the operating environment (ruggedness, tamper-proof, mounting, sensors, etc.).
- Scalability for expanding or shrinking needs, objectives, and area(s) of activity.
- How much time and expertise is required for installation.
- The amount of maintenance required.
- Availability and timeliness of technical and customer support for the monitor and reporting system.
- The communication capabilities of the monitor. For example, accessibility to wireless internet, satellite coverage, ability to operate in environments requiring ‘radio silence’ or the need to be intrinsically safe.
- The reporting and mapping capabilities of the system.
- The experience of the IVMS vendor. Make sure the vendor understands your business and that their IVMS will work for your operations. Always request references with current and past customers, and follow up with direct calls. Reach out to other companies in the industry that are using IVMS.
- What information will realistically be used, how often, and by whom.

Pilot Test
Pilot test the monitors with a small group first to ensure data is accurate and consistent before implementing companywide. Test all aspects of system functions to see that they are collecting accurate data.

- Pick a test group of drivers that will be willing to provide constructive feedback in an area with supportive local management.
- Establish procedures for ensuring monitors are working properly, with thresholds set to local driving conditions.
Select for Growth
Select a system that will allow for continuous improvement and development of your IVMS program. You may have the need for only a basic system; however, make sure you don’t limit yourself for the future by purchasing a system that can’t grow with your company.

Watch the People, Not the Pickup
Ensure the system you select allows you to distinguish between each driver of a vehicle when vehicles are shared within your company.

- It may be desirable to begin with more liberal settings to allow drivers to become accustomed to devices, adjusting them as the program matures. However, they should not be too liberal and thus ineffective. Ensure that settings are also not so sensitive that drivers are forced into bad habits as they try to avoid setting off the alerts.
- Consider collecting baseline data for each driver for a short time before any performance improvement efforts occur in order to evaluate the effects of the program on driver performance.

Tracking Indicators
Indicators can vary from product to product.

These are the most important primary tracking indicators:

- **Speeding** is one of the contributing factors to motor vehicle fatalities among oil and gas extraction workers. With the reduction of speed, a crash may not always be prevented, but the severity of the resulting injuries frequently is.
- **Harsh braking** is an indicator of distracted or fatigued driving, the driver following too closely, or not looking far enough ahead.
- **Rapid acceleration** is an indicator of aggressive driving or being in a hurry.
- **Extended Hours of Service** can lead to fatigue, which is a serious problem for the oil and gas industry. Drivers of light- and heavy-duty vehicles become fatigued when they have not received proper rest.
- **Night time driving** can increase exposure to night time hazards, such as impaired drivers, fatigue and limited visibility.
- **Safety belt use** significantly reduces the risk of injury in the event of a crash.

Recommended settings for several of these indicators have been issued by OGP’s Land Transport Safety Taskforce and can be found at: [http://info.ogp.org.uk/LandTransport/](http://info.ogp.org.uk/LandTransport/). Keep in mind the need for the settings to be realistic and to reflect desired driver performance.
Plan

After selecting your IVMS, the group of experts recommend that companies take the time to plan certain elements of the IVMS program before deploying it to drivers. These elements include:

- Determine which vehicles and drivers will be monitored.
- Establish goals for driver performance.
- Develop a communication campaign to inform drivers of the plan to use IVMS.
- Develop training about the IVMS and what driving behaviors will be monitored.
- Educate leadership about the system.

For this planning process, a workgroup made up of individuals from operations; health, safety, and environment (HSE); maintenance; administration, and other business units needs to be involved. A group of drivers should also be part of the workgroup. These drivers will likely serve as champions of the program if they are involved in the planning process. IVMS experts may also be needed at the outset. All groups who will be affected by the IVMS program should be involved in its planning and implementation. Once the system is in place, each business unit takes ownership of the program and their drivers. Depending on the size of a company, it may take several months to several years for in-vehicle monitoring to become an integrated part of the company’s operations. A timeline for IVMS implementation should be developed in order to keep the process on track.

Whenever possible, those implementing an IVMS program should become familiar with the concepts of how to effectively manage change within a company, which includes communicating clearly why the change is needed, ensuring leadership commitment, and allowing for employee feedback.

Determine Which Vehicles and Drivers
Determine which vehicles, drivers, and locations will be monitored. The group of experts recommend installing monitoring systems in all vehicles and tracking all drivers in all locations. Some companies are also encouraging or incentivizing their contractors and sub-contractors to install monitors. When it is not possible to install monitors in all vehicles due to cost or other constraints, target the types of vehicles that have the highest crash rates based on established company-level or business unit-level metrics such as crashes per million miles (CPMM) or annual crashes per 100 vehicles. If these data are not yet available, consider initial implementation on the following vehicles:
- Vehicles driven by senior managers, to demonstrate commitment to the program at the highest levels within the company.
- Passenger vans or other vehicles that frequently carry a large number of people.
- Vehicles with the highest number of annual miles driven, or with greatest exposure to hazardous road conditions.
- Vehicles with particular risks, such as transporting hazardous materials.
- Vehicle types with a high center of gravity, such as water trucks.
- Single drivers who drive long distances and work long hours.

**Obtain Staff Support**

The group of experts report that IVMS systems increase administrative workload. During the planning process, staff should be identified to:

- **Coordinate** the IVMS program. This person reviews driver reports daily or weekly, works closely with the IVMS vendor as well as drivers whose behavior is identified by the system as being at-risk
- **Oversee** the installation of monitors if needed.
- **Train** drivers on how the monitors work and why they are being used.
- **Manage** drivers’ information in a database.
- **Coach** drivers using the IVMS data.
- **Train** administrative staff in their support functions.
- **Be present** and available to address issues in a timely manner.

**Establish Goals for Driving Performance**

Take the time to determine the goals and expectations for driving performance to be measured with the new IVMS. Identify the tracking indicators that will be used to determine if goals have been met. Make sure that your goals are specific, measurable, achievable, realistic and time-based. Goals for driving performance may vary between individuals or groups of individuals based on varying driving environments.

**Develop a Communication Campaign**

The group of experts report that it is important to develop a communication campaign to prepare workers for the change. Inform drivers about the role of IVMS as it relates to the company’s overall motor vehicle safety program and goals. Emphasize the positive safety and environmental impacts of IVMS. Provide industry crash statistics and compare with company data (if available) to show how your company performs. Explain to drivers that the monitors will serve as a tool to help identify and reduce risky driving behaviors, thus reducing crashes. There may be apprehension or resistance to installing the monitors. It will be necessary to communicate with workers and review the system with employees to help alleviate this. The campaign should emphasize
that the IVMS program is a safety initiative rather than a punitive program.

**Develop Training for Drivers**

Training on IVMS should explain how the technology works and what the monitor records. Explain to drivers what data will be collected and why, when it will be reviewed and what will be done with the information. Share this information in pre-implementation meetings. For example, explain that supervisors or fleet managers will review over-speed incidents on a weekly basis, and those drivers with a high number of over-speed incidents will be coached on their driving. Explain to drivers that they may encounter circumstances that trigger monitors from time to time and that is expected. Rather, it is consistently poor scores coming from monitors from multiple incidents that would be a cause for coaching. The objective is safe driving behavior.

**Educate Leadership**

An IVMS program must have strong leadership and management support throughout all levels of the organization. In order for senior management to be able to effectively support IVMS, they need to have an understanding of the system’s features, limitations, and reports. It may be detrimental to the program if a manager overreacts to data due to lack of understanding, fails to recognize or respond to a hazardous trend, or fails to recognize which resources are required for successful deployment. In addition, engage the unofficial leaders (“opinion leaders”) within the company to be on board with IVMS, to score well, and to advertise the benefits of it.

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**Frequently Asked Questions by Workers**

The group of experts noted that there will almost always be some resistance to IVMS by a handful of workers. Some of the concerns will be valid. For example, workers have a right to know the accuracy of the data and how the data will be used. In some cases, however, drivers will oppose the system because it will require them to change their driving habits and, quite possibly, how they do their jobs. The amount of effort placed on communicating the goal of reduced motor vehicle incidents at the outset will help to ease this transition. Be prepared for these common questions and respond with consistent and rationale explanations.

**In order to get my job done, I feel pressure to drive fast. What can I do about that?** IVMS may help to identify trends in unsafe driving that are a result of managerial and/or operational pressures. IVMS reports should be reviewed from this perspective. Opportunities to implement company policies and practices that eliminate the need to...
**Share the Road, Share Your Goals**

When operating in areas where other motorists may be frustrated by company vehicles that abide by posted speed limits, consider the use of a bumper sticker that could read something like: *For the safety of our employees and the communities we drive in, this vehicle is equipped with a speed monitor. Speed kills—please drive safely.*

drive unsafely should be identified.

**Does the monitor affect my vehicle’s operability?** In-vehicle monitors are read-only devices; they do not impact the way a vehicle drives in any way.

**Will I be constantly monitored when driving, including where I am driving?** The main purpose is not to track where the driver is going other than for possible logistical needs; it is to monitor driving behavior and therefore keep all drivers safer, saving money and liability. If the driver is concerned about being monitored because he knows there are areas for improvement, he can ask for support. He doesn’t have to wait for a crash or a poor driver performance report.

**Sometimes I have to brake hard on the highway because people drive crazy, will I be penalized?** A driver’s pattern of behavior is more important than isolated incidents. A frequent number of hard braking incidents would be an indicator that a driver is distracted, fatigued, follows too closely, fails to look far enough ahead, etc. A conversation with that driver, for example, may reveal that he is being distracted by having to eat while driving, a distraction that can be removed. Ask drivers to note isolated incidences for further explanation during reviews, if significant.

**The monitor is faulty and is providing inaccurate data. Will I be penalized in some way?** IVMS managers should be careful to ensure monitors are reporting accurately. If possible, review data from other drivers in the same vehicle to check if the pattern is similar. Once the monitor is inspected, report the results back to the driver.

**Everyone goes at least 5 miles over the speed limit on the highway I drive on; will I be penalized for going with the flow of traffic?** It is recommended that the monitor’s threshold include a reasonable buffer for slight variations in speed due to grades, traffic conditions, etc., and for the driver to respond in a reasonable time to variation in speed. It is also recommended that drivers select the appropriate lane in order to avoid congestion or acts of aggressive driving. IVMS managers should provide drivers with safe-driving tools and be careful not to unwittingly condone illegal or unsafe speed.

**I drive on icy/snowy/muddy roads and sometimes have to spin my tires to get my vehicle unstuck. Will these events be recorded and show up for my supervisor to see?** Supervisors should be aware that this is a possibility and take it into consideration. It is clearly not an indicator of aggressive driving like rapid acceleration on dry roadways may be. Again, what is important to track is a driver’s pattern of behavior. If a driver is repeatedly and aggressively spinning tires due to being stuck, coaching may be appropriate.
Once the planning process is complete, the IVMS program should be ready to deploy. Deployment includes the installation of the monitors, training of drivers, and implementing a recognition and accountability program.

The group of experts recommend that the deployment start from the “top-down,” with a commitment from senior leadership. Starting the program with leadership and supervisors will set an example. After leadership, continue with the company’s drivers engaged in the highest risk activities, such as transport of passengers, movement of hazardous materials, or those with the greatest number of miles driven.

**Installation and Training**
Create the least amount of disruption for drivers in order to get monitors installed, such as doing installations on drivers’ off duty hours. Ensure data is accurate so drivers have a positive experience with the IVMS.

All employees should receive IVMS training as soon as possible after being hired and preferably before driving unsupervised. This training should be done in conjunction with basic driver safety training. In the training, include information about your company’s unique operating environments (such as wildlife hazards, weather hazards, remote locations).

Consider having drivers sign a “driver commitment” form, which is an acknowledgement that the driver understands the purpose of the IVMS and other driver safety policies and procedures. This could be an effective tool for communicating both expectations of performance and accountability for non-compliance. An example of a driver commitment form is provided in Appendix B.

**Recognition and Accountability**
The group of experts strongly recommend an IVMS program include a policy addressing recognition (rewards) and accountability (penalties). This policy should provide an explanation to drivers of how the data collected from the monitors will be used, if at all, for rewards or penalties. It should be consistent with previously established goals and expectations for driver performance. A clear, well written policy will help to put at ease drivers whose driving skills are being monitored for the first time.
Recognition

Some companies offer rewards to drivers for either high scores or improved scores. Many companies have found that some type of recognition of top drivers for their respective units or for the company as a whole is very useful and motivating [World at Work 2011].

Rewards that may be appropriate include:

- Letters or certificates of appreciation, or recognition in company newsletters. Group and peer recognition can be very powerful—it often pays higher dividends than a financial or other type of reward.
- Gift certificates, personalized engraved plaques or awards, personalized embroidered jackets, vests, or coats, hardhat stickers and/or key chains.
- A driver of the month award.
- Newest vehicles in fleet- awarded to higher scoring drivers.

It may be more effective to target rewards to teams of drivers or business units, rather than individual drivers. This type of reward may provide some additional peer pressure to certain drivers who are consistently receiving lower scores. Companies report that if too many parameters are included, and especially those that aren't closely connected to driving safety, the rewards system loses value. The goal is to keep things simple.

In addition to using scores from monitors for rewards, other measures should be taken into consideration, such as the employee’s overall driving record, that is the absence of motor vehicle incidents where the employee was deemed at fault, moving violations, or violations of company policy.

The group of experts suggest being thorough and careful in the development of a driver recognition program. Recognition through monitors can be completely objective, based on drivers’ scores rather than subjectivity of the supervisor. However, be sure of the quality of the data. Rewarding an undeserving driver will undermine the IVMS program. For example, if you monitor speeding but don't compare speed driven and location, a driver may end up being rewarded for never exceeding 65 mph in a school zone!

Accountability

Periodic coaching is recommended for all drivers in order to provide positive as well as constructive feedback. It is also the first action taken with a driver who has poor scores reported from the IVMS system. To be most effective in providing quality feedback on driver behavior, it is recommended that the coach participates in a commentary drive (ride-along) with the driver and then review together the related IVMS report. When providing constructive feedback, the best approach is to have the driver identify any problems and develop a plan (with the coach) for future performance. This approach encourages ownership by the driver of what behaviors need improvement. A sample IVMS driver coaching form is provided in Appendix C.
The coach must be able to effectively:

- **Interpret** the IVMS report.
- **Recognize** the at-risk behavior.
- **Understand** the tendency for drivers to sometimes deny/rationalize risky behaviors.
- **Identify** the underlying opportunity for improvement.
- **Articulate** the possible outcomes.
- **Communicate** the expected future behavior.
- **Formulate** an action plan for improvement where required.
- **Determine** whether management or operational policies have contributed to the at-risk driving behaviors, and if so, formulate recommendations for policy change.

It is important when building a safe driving culture to ensure drivers and coaches know that IVMS is to be used primarily for ongoing improvement. However, the group of experts report the need for consistent accountability for blatant disregard of expected future behavior.

Coaches should give special consideration for a particular employee's driving environment. Those employees who are required to drive in congested city traffic *may* exhibit more frequent harsh braking than those who drive in a rural environment. In some rural areas, wildlife crossing roadways *may* be cause for some harsh braking events being reported for a particular week. Individual events certainly can warrant discussion and can be valuable for identifying specific examples, but it is essential to evaluate patterns of driving behavior rather than isolated incidents.

The group of experts report that penalties may be appropriate if a driver continues to receive poor driving scores after coaching. The use of penalties for drivers with poor driving scores varies widely among companies. In general, most companies focus on recognition for high-performing drivers and coaching for drivers with low scores (rather than penalties). Many companies, however, have a zero-tolerance policy for certain behaviors, such as tampering with the device, or lack of safety belt use. Each company will want to determine what is best for their business and clients while considering how it impacts the employees and company values.

Where penalties based on IVMS data are used, a number of things are suggested to be in place:

- The consequences for certain driver behaviors are clearly stated in company policy. For example, consider removing driving privileges if score is below a certain threshold for more than 2 months.
- The monitor’s data is assured to be accurate.
- The driver has been fully informed of the possible consequences of the risky driving behavior.
- The driver is given due process in any situation where a penalty is imposed, giving the driver an opportunity to explain his actions.

Be careful of unintended consequences that could arise, such as drivers swerving unsafely to avoid triggering a harsh braking event. When penalties for poor driving scores are a possibility, the risk of these unintended consequences may rise. In general, the group of experts suggest not using the IVMS system as a policing tool.
Reviewing the performance of the IVMS program is a crucial step and occurs on multiple levels. The four levels of review addressed here include individual driver performance, motor vehicle crash rates, the performance of management in implementing the program, and the performance of the IVMS system itself.

**Driver Performance Report**

The most effective monitoring systems create a driver performance report, which reports the calculated scores of drivers against the predetermined settings of the indicators being tracked. The report aids in identifying at-risk behavior, or conversely, expected behavior. The speed score is almost always the most heavily weighted measure, followed by harsh braking, and then by rapid acceleration. A “cutoff” is usually set to identify which drivers need attention—be it further coaching or recognition for good performance.

In companies where IVMS has been implemented, the fleet manager or IVMS coordinator usually monitors the data from the IVMS system daily. The system is sometimes set up to report driver scores to the drivers themselves (e.g., weekly). Drivers can use this feedback to make improvements where necessary. Behavioral changes are the key to success and lasting results.

The IVMS coordinators often send driver scores and trends to supervisors. Supervisors frequently review drivers’ performance monthly—sooner if there is a negative trend developing or high-risk events occurring. In some companies, senior management is also copied on these reports or at least receives a quarterly status and performance review.

At least one company surveyed attaches driving performance to overall performance evaluations and holds supervisors accountable for their drivers’ scores all the way up to the most senior executives.

Where possible, it is suggested to compare drivers’ scores to other drivers with similar numbers of miles and/or terrain in order to compare similar driving environments. It can also indicate at-risk behaviors by groups.

The group of experts report printing overall company or unit specific results monthly and posting on a bulletin board to publicly communicate progress, trends and opportunities for improvement.

**Tracking Changes in Motor Vehicle Crash Rates**

In order to determine if the IVMS is having a long-term impact on motor vehicle safety for a company, the company should maintain a database tracking motor vehicle crashes, the amount of damage, severity (see following table), injuries, root causes, and costs associated with lost productivity. All incidents involving a vehicle in motion with any amount of property damage should be
Communicate to drivers, supervisors, and leadership the successes and value of the IVMS program. Share with them any improvements in driving behavior, reduced motor vehicle crash rates, reduced costs, increased efficiency, etc.

**Motor Vehicle Crash Rate (MVCR) Calculation**

A common form of measurement should be used to determine the motor vehicle crash rate. Internationally, the oil and gas extraction industry has adopted metrics developed by OGP.

\[
\text{MVCR} = \frac{\text{CMS (Catastrophic, Major, Serious) crashes}}{\text{million kilometers driven}}
\]

<table>
<thead>
<tr>
<th>Crash Definitions</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C: Catastrophic</strong></td>
<td>Any company, contractor, or sub-contractor or third party fatality associated with a motor vehicle crash</td>
</tr>
<tr>
<td><strong>M: Major</strong></td>
<td>Any rollover or; Any motor vehicle crash where a company, contractor, or sub contractor has a Lost Work Day Case associated with a motor vehicle crash</td>
</tr>
<tr>
<td><strong>S: Serious</strong></td>
<td>Any motor vehicle crash where a company, contractor, or sub-contractor has a recordable injury (Medical Treatment Case and/or Restricted Work Day Case) associated with the motor vehicle crash or; Any motor vehicle crash where the vehicle cannot be driven away from the scene under its own power in a roadworthy state</td>
</tr>
<tr>
<td><strong>L: Light</strong></td>
<td>Any motor vehicle crash where a company, contractor or sub-contractor MVC resulting in either minor injury (first aid case) or no injury</td>
</tr>
</tbody>
</table>

Data Source: International Association of Oil and Gas Producers (OGP)—Land Transportation Safety Recommended Practice, Report #365-5 KPIs

Note: The MVCR does not include light crashes (defined in table). The reason for this is to encourage the reporting of all crashes regardless of severity. Light crashes include property-damage-only crashes.

**Management Performance**

As mentioned previously, to ensure the success of the program and to realize the greatest return on investment, management leadership and commitment is required. Consideration should be given for measuring the performance of management in implementing the IVMS and in ongoing support for and engagement in the program. Some metrics to consider would be: percentage of vehicles with working monitors installed; software and hardware revision dates; coaching records and records of the application of accountability for at-risk drivers; visibility of the program and related reports; installation of devices in management vehicles. For larger operations, consider such things as comparing operating locations, regions, business units.

**System Performance**

Metrics that measure IVMS performance and user satisfaction are recommended to be used. Meetings should be arranged with the IVMS vendor on a regular basis (e.g., every 3–6 months) to review these metrics to identify well-functioning components of the IVMS and those components that require attention. Some metrics that can be included are:
- Technical support—accessibility and response time, time to closure of outstanding items, availability of parts.
- Hardware reliability.
- Warranty—response, turn-around time.
- Communication—time successfully connected (up-time), costs.
- Internet interface and application up-time.
- System updates.
- Response to requests for system enhancements and/or improvement.

Making IVMS program changes
After reviewing the IVMS program on these levels, there will likely be some modifications that need to be made in order to make the program more effective. It is recommended that you identify these changes, return to the planning step to make the changes, and then deploy and review them. This cycle will continue as needed.
Conclusions

Motor vehicle fatality rates are high for the oil and gas extraction industry, and it is the leading cause of on-the-job death. Workers from small- and medium-sized companies are at the highest risk for fatality.

In-vehicle monitoring systems, along with a comprehensive motor vehicle safety program, have been shown to be a promising tool for improving driving behaviors and reducing motor vehicle crashes in this industry. We hope that companies will use this guide to implement successful in-vehicle monitoring system programs.

The authors acknowledge that more research to evaluate the impact of IVMS on reducing crash rates and improving driving behaviors in the workplace is still needed. Nonetheless, results thus far suggest that the implementation of IVMS programs (using this guide as a reference) will likely produce safer drivers and fewer injuries in the future for this industry.
Appendix A: IVMS Features and Functions

The following list describes common IVMS features and functions on the market now. It is not listed by priority or significance. This list is not exhaustive, and not all features are available on all products. These descriptions are generic and may vary depending on the IVMS product. Make certain you understand the specifications and capabilities of the system(s) you plan to use and discuss them with each vendor.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
</table>
| “Breadcrumming” | IVMS that have GPS functionality (Global Positioning System, or satellite positioning), commonly have a feature referred to as “bread-crumbing.” Such devices are usually configured to record the position of a vehicle at regular intervals to identify where that vehicle has traveled, and creates a series of “pin points” or “breadcrumbs” on a map displaying the vehicle’s travel history.  
  The frequency that breadcrumbs are “dropped” can be increased for more detailed mapping; and in some instances can (subject to installed and functional on board technology) be transmitted wirelessly to a remote address. If transmitted, the higher the number of breadcrumbs (i.e., the more detailed a report is), the higher the communication costs.  
  Many breadcrumbing-capable systems also record the time and speed at each logged GPS position. This feature allows a supervisor to monitor the path of travel and perform spot audits to determine whether the vehicle was speeding at any given point and if the vehicle and driver followed the defined route and journey management plan. This can help to identify at-risk driving.                                                                 |
| Crash Detection | The key indicator of a crash is usually an extreme deceleration, possibly followed by the vehicle coming to a stop for greater than a set time. Basic IVMS technology can ordinarily be configured to identify, capture and communicate such “events” without higher cost features such as gyroscopes and accelerometers. These units record such events as “high potential” and require further verification of an incident before determination of a crash. Some IVMS hardware may also have a gyroscope or similar device(s) to determine if a vehicle is off its wheels.  
  If a crash is detected, all captured data is typically recorded second-by-second from 20 seconds up to over 3 minutes (depending on technology) immediately prior to the crash.  
  Most IVMS units are capable of communicating the event’s occurrence by one or more methods (e.g., WiFi, GSM / GPRS, and Satellite). Data is usually stored for crash investigation purposes.                                                                 |
| **Driver alerts, or in-cab feedback** | IVMS units can be programmed to provide drivers with immediate feedback on the quality of their driving compared with programmed expectations. Monitors typically beep or give a voice alert to let the driver know that they are close to and/or exceeding speed thresholds, as well as alert them to other events.

If drivers understand the parameters of when and why an alert will be activated, they will be able to monitor their own activities and educate themselves to be safer drivers by adjusting their driving style as feedback is provided. |
| **Driver scores** | Typically, an overall driving score reflects the weighted average of several driving metrics. Examples include rapid acceleration, hard braking, overspeed, idling time, not using a safety belt. Companies can customize the weighting based on their strategic goals and values. The overall score is normalized to fall within a range of 0 (worst) to 100 (best), on a scale of 1 to 5, or some other range.

Some systems of IVMS driver scoring have added features to allow managers and supervisors of drivers to readily identify those who may require further attention via options such as color coding of driver scores according to risk level, such as red (high risk), amber (medium risk) and green (low risk) bands. |
| **Exception-based systems or Event-based systems** | Exception-based systems generally store and/or wirelessly transmit information to a configured remote destination (such as manager, supervisor, journey management center) for the configured “exception” or “event,” such as drivers or vehicles exceeding set conditions (rapid acceleration, over-speed).

Other IVMS technologies capture “exceptions” and other configured data from the vehicle depending on user defined settings for frequency (i.e., 1/sec; 1/min). This information is used to establish detailed driver behavior and vehicle usage reports. When so equipped, these systems are usually set up to only transmit critical information in real-time leaving the non-critical information to download in a “passive” manner, minimizing the costs associated with communication and data. |
| **Fuel consumption** | Most IVMS technologies can capture miles per gallon (mpg) information from the vehicle with each vehicle trip. An internal GPS modem may also determine the distance traveled between the vehicle starting/stopping or other events such as engaging/disengaging a power-take-off (PTO) so that mpg can be calculated for each specific trip segment.

Some IVMS units communicate directly with the vehicle’s engine management system to gather fuel consumption for any configured period of time, trip, etc. The ability to track fuel consumption traveling to and from specific locations can be used to apply for fuel tax exemptions (IFTA). This historically has helped to realize significant fuel cost recovery. |
| Geo-fencing | A geo-fence is a GPS-linked boundary that allows a user to apply different thresholds for that specified area with the ability to notify both the driver and a configured remote destination (such as the manager, supervisor, journey management center, etc.) if thresholds are exceeded.  
The bounded areas can act as exclusion zones by alerting when a vehicle enters; inclusion zones by alerting when a vehicle leaves; or speed zones by alerting when traffic speed zones are exceeded (e.g., off road, asphalt or gravel roads, at plants, in school/playground zones, urban or rural roads, rest stops).  
Some IVMS technologies are limited to system defined geo-fenced shapes and others permit the system user to define/draw the required shape and area to suit operations. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS tracking</td>
<td>GPS receivers in vehicles use signals from satellites to triangulate and calculate the user’s exact location. These can be used in real-time to track where a vehicle currently is (i.e., real-time) or used later for reporting (i.e., passive). See also “Breadcrumbing” and “Geo-fencing”.</td>
</tr>
</tbody>
</table>
| GPS velocity speed vs. hard-wired installation | There are two general types of installation when considering vehicle movement as the core element to managing safe land transportation—one that uses GPS for speed and distance and one that is hard-wired to the vehicle’s electronic speed pulse (either via the vehicle’s on-board computer [ECM] or via connection to the vehicle’s speedometer cable). There are strengths and limitations of each type of installation. There can be a difference in sensitivity for speed or distance traveled between device types when using GPS velocity speed as your input. Hard-wired technologies will require calibration to a vehicle’s actual road speed which may also differ to the speed shown on a vehicle’s speedometer gauge. It is for this reason that it is recommended that a hard-wired unit be calibrated to the speed shown on the vehicle’s speedometer gauge.  
You may be able to realize greater functionality by accessing more signals from more sensors when hard-wired; however, these benefits may be offset by the complexity, labor, and cost of installation. |
| Harsh acceleration | A harsh acceleration event is generated each time the monitor detects acceleration at or above a set number of mph/second. Monitors are often set to generate a harsh acceleration event at +6 mph/second. For example, driving at a speed of 20 mph, followed by acceleration to 26 mph or greater within 1 second will generate a harsh acceleration event. Continued acceleration at that same rate or greater will record subsequent harsh acceleration events each second until the acceleration is less than +6 mph/second. The harsh acceleration score is commonly calculated by dividing the total number of harsh acceleration events by the total travel hours or distance driven. |
| **Harsh braking** | A harsh-braking event is generated each time the monitor detects a deceleration at or above a set number of mph/second. Monitors are often set to generate a harsh-braking event at -6 mph/second. For example, driving at a speed of 40 mph, slowing to 34 mph or less within 1 second will generate a harsh braking event. Continued deceleration at the same rate (or greater) will record subsequent harsh braking events each second, until the speed reduction is less than -6 mph/second. The harsh-braking score is frequently calculated by dividing the total number of harsh-braking events by total travel hours or distance driven during the reporting period.

Ideally, the configuring of this parameter starts at a lenient value and over time is tightened to improve driver behavior and acceptance of set values. |
| **Idling** | An idling event is generated when the monitor detects a speed of 0 MPH with the engine on for a predetermined period of time. Three consecutive minutes is most typically the criterion, but this can be longer under extreme weather circumstances. Percent idling is calculated by dividing the total amount of time (HH:MM) a vehicle was idling by the total travel hours and multiplying by 100. IVMS technologies do not generally distinguish between idling associated with being stuck in traffic and other scenarios. |
| **Online tools (dashboards, etc.)** | Most systems provide online tools to either access reports or deliver reports to a selected e-mail address (typically via html format) or mobile phone (via SMS transmission—text message). Reports are traditionally based on preconfigured parameters of driver performance, vehicle location, and usage. This may be in the form of a “dashboard”—a visual or graphic display presenting important information in a user-friendly way. IVMS vendors may also provide detailed behavior and crash analyses as well as recommendations and tools for improvement. IVMS vendors may also offer management of specific data to ensure that set objectives of performance or event notifications occur without exception. |
| **Over-speed** | An over-speed event will be generated when the vehicle speed is in excess of the set threshold. The device may also be set to generate an event for every minute (or other configured time period) that the vehicle stays above the speed limit. For example, assuming the threshold is 65 mph, 5 minutes at 70 mph is equivalent to 5 over-speed events. The over-speed score is calculated by dividing the total number of over-speed events by total travel hours.

Some IVMS systems also contain “street by street” speed monitoring, which ensures that the speed at which a vehicle is driven is compared with the defined speed limit of that roadway, regardless of the vehicle’s maximum configured speed value. Over-speed by street can also be addressed using geo-fencing or breadcrumbing described above. |
<table>
<thead>
<tr>
<th>Safety belts</th>
<th>Some systems are able to identify whether safety belts are being worn. This may require additional sensor(s) to be installed. Be aware that, depending on the system, occupants may still connect the safety belt behind their back, overriding this feature.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamper events /plug-in events</td>
<td>For some IVMS technologies, a “plug-in” event is generated when the monitor that is connected to the vehicle becomes “disconnected” at any time. Other models may monitor power interruption. These events indicate that the unit was removed or disconnected and thus (temporarily) disabled or tampered with. From these events, alerts, and reports can usually be generated. In order for an IVMS technology to alert configured system users of such events, power is required. When power is disconnected from an IVMS unit, this functionality is likely to be disabled unless the unit contains its own internal power source. This feature could be seen to be critical for the success of a driver safety program. Besides disciplinary actions, one approach used to discourage tampering is to install the devices out of view and easy access for the driver or passengers.</td>
</tr>
<tr>
<td>Text or e-mail event notification</td>
<td>When equipped with wireless communication capabilities (e.g., RF DECT, WiFi modem, GSM/GPRS modem, satellite modem), the monitor can be set to alert configured destinations (e.g., supervisors, managers, journey management centers) to a speeding or other type of event in real time, assuming coverage is provided based on the vehicle’s position (see WiFi, cellular, and satellite communications).</td>
</tr>
<tr>
<td>Video capture</td>
<td>Certain event recorders capture video of a predefined event. Commonly, these devices have three accelerometers (y-, x- and z-axis). The device is always operational, and if a certain criterion is met or surpassed, an event is triggered and the device saves a predetermined amount of video from before, during, and after the event (commonly 8–12 seconds before to 4 seconds after). Subsequent review can then identify at-risk behavior (such as unbelted, cell phone in use, distraction) pertaining to the event.</td>
</tr>
</tbody>
</table>
| WiFi, cellular, and satellite communications | There are three common types of communication for those users who wish to have real-time and/or remote upload and/or download capabilities:  

1. WiFi—most commonly local systems; generally activated when entering or leaving a company facility; usually the least expensive.  

2. Cellular—using GSM, GPRS, CDMA, etc.; same coverage as handheld cell phones.  

3. Satellite—generally used for operations in more remote areas where cell coverage is inconsistent or non-existent and constant communication is required; usually the most expensive.  

Downloads from the device can occur frequently, depending on whether the vehicle is in WiFi, cell phone, or satellite range. Some of the devices have the ability to "roll-over" in areas of restricted communication, when they have more than one type of communication installed. In such instances, the IVMS technology attempts to use the least expensive mode of transmission before switching to a more expensive mode (WiFi, then cellular, then satellite) when transmitting priority messages (e.g., crashes, DOT Driver Hours of Service data).  

Vehicles without satellite access capability may not always be in communication, but data on monitors will be stored until vehicles enter cellular/WiFi range, and then data will be transferred. While a vehicle is in range, data from monitors can be downloaded regularly. |
| Working alone | Real-time monitoring of vehicle movement combined with the monitoring of vehicle location can be used to oversee employees working alone. Some IVMS technologies can be programmed to initiate an emergency alert if an employee is at a certain location for greater than an established period of time. Also, some IVMS can be used as a relay (cellular/satellite) for devices worn by workers to connect with a central working-alone monitoring system. |
Appendix B: Driver Commitment Form

Fully explaining the expectations of performance for drivers is critical. Here is an example of a commitment form that can be used to communicate these expectations.

**DRIVER'S COMMITMENT**

**NAME:**

**LOCATION:**

**VEHICLE(S) ASSIGNED:**

My signature on this commitment form indicates an understanding of my responsibilities as a vehicle driver for ________________________________.

Company Name

I have received and read a copy of the Fleet Safety Policy and agree to fulfill all my responsibilities as listed there in. These include, but are not limited to:

- Adhering to all policies and procedures governing the operation of my vehicle and operating within the bounds of all associated regulations, including abiding by the safety belt use policy for all vehicle occupants and the anti-technology policy.
- Driving only when I am alert and in full control of my assigned vehicle. If I am not, I will not drive, or I will stop driving, until such time as I am fully in control.
- Driving in a safe and responsible manner, with concern and respect for other users of the roadways and the communities I drive through.
- Ensuring all preventive maintenance is performed on my vehicle in accordance with the manufacturers' guidelines.
- Reporting all driving incidents and violations.
- Submitting a copy of my current driver's license as requested.
- Prohibiting use of company vehicles by anyone not authorized to do so, and only transporting authorized passengers.

I understand that failure to comply with the conditions listed above can result in disciplinary action including termination.

_________________________                                 __________________________
Employee Signature / Date                                               Manager's Signature / Date

(Modified from a version on www.toolboxtopics.com)
# Appendix C: Sample IVMS Driver Coaching Form


<table>
<thead>
<tr>
<th>Driver’s Name:</th>
<th>Driver Performance Report Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver Report ID</td>
<td>Interview Date</td>
</tr>
</tbody>
</table>

## Results Summary (from Driver Performance Report):

<table>
<thead>
<tr>
<th>Distance Driven</th>
<th>Acceleration Counts</th>
<th># of Accel’s per 100mi</th>
<th>Deceleration Counts</th>
<th># of Decel’s per 100mi</th>
<th>Highest Speed</th>
<th>Total Time over Speed in Minutes</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

## Analysis and Discussion:


## Improvement Recommendations:


## Management Review & Action Taken


<table>
<thead>
<tr>
<th>Reviewer’s Name &amp; Signature</th>
<th>Driver’s Name &amp; Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manager’s Name &amp; Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Appendix D: Motor Vehicle Safety Resources

**Government/Non-profit**

**International Association of Oil and Gas Producers (OGP)**


**Federal Motor Carrier Safety Administration (FMCSA)**

http://www.fmcsa.dot.gov/

**American Society of Safety Engineers (ASSE)**

http://www.asse.org/

**Centers for Disease Control and Prevention: National Institute for Occupational Safety and Health (CDC NIOSH)**

http://www.cdc.gov/niosh/

**National Center for Injury Prevention and Control (CDC NCIPC)**

http://www.cdc.gov/injury/

**National Highway Traffic Safety Administration (NHTSA)**

http://www.nhtsa.gov/

**National Safety Council (NSC)**

http://www.nsc.org/Pages/Home.aspx

**National Transportation Safety Board (NTSB)**

http://www.ntsb.gov/

**Network of Employers for Traffic Safety (NETS)**

http://trafficsafety.org/

**Transportation Research Board (TRB)**

http://www.trb.org/Main/Home.aspx

**Governors Highway Safety Association (GHSA)**

http://www.ghsa.org/

**Commercial Vehicle Safety Alliance (CVSA)**

http://www.cvsa.org/
Volpe National Transportation Systems Center
http://www.volpe.dot.gov

Insurance Industry
Public Risk Management Association (PRIMA)
http://www.primacentral.org/
Risk Insurance Management Society (RIMS)
http://www.rims.org/
Insurance Institute for Highway Safety (IIHS)
http://www.iihs.org/

Research Institutions
Montana State University – Western Transportation Institute
http://www.wti.montana.edu/
University of Iowa – National Advanced Driving Simulator
http://www.nads-sc.uiowa.edu/
University of Michigan Transportation Institute (UMTRI)
http://www.umtri.umich.edu/news.php
Virginia Tech Transportation Institute (VTTI)
http://www.vtti.vt.edu/
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