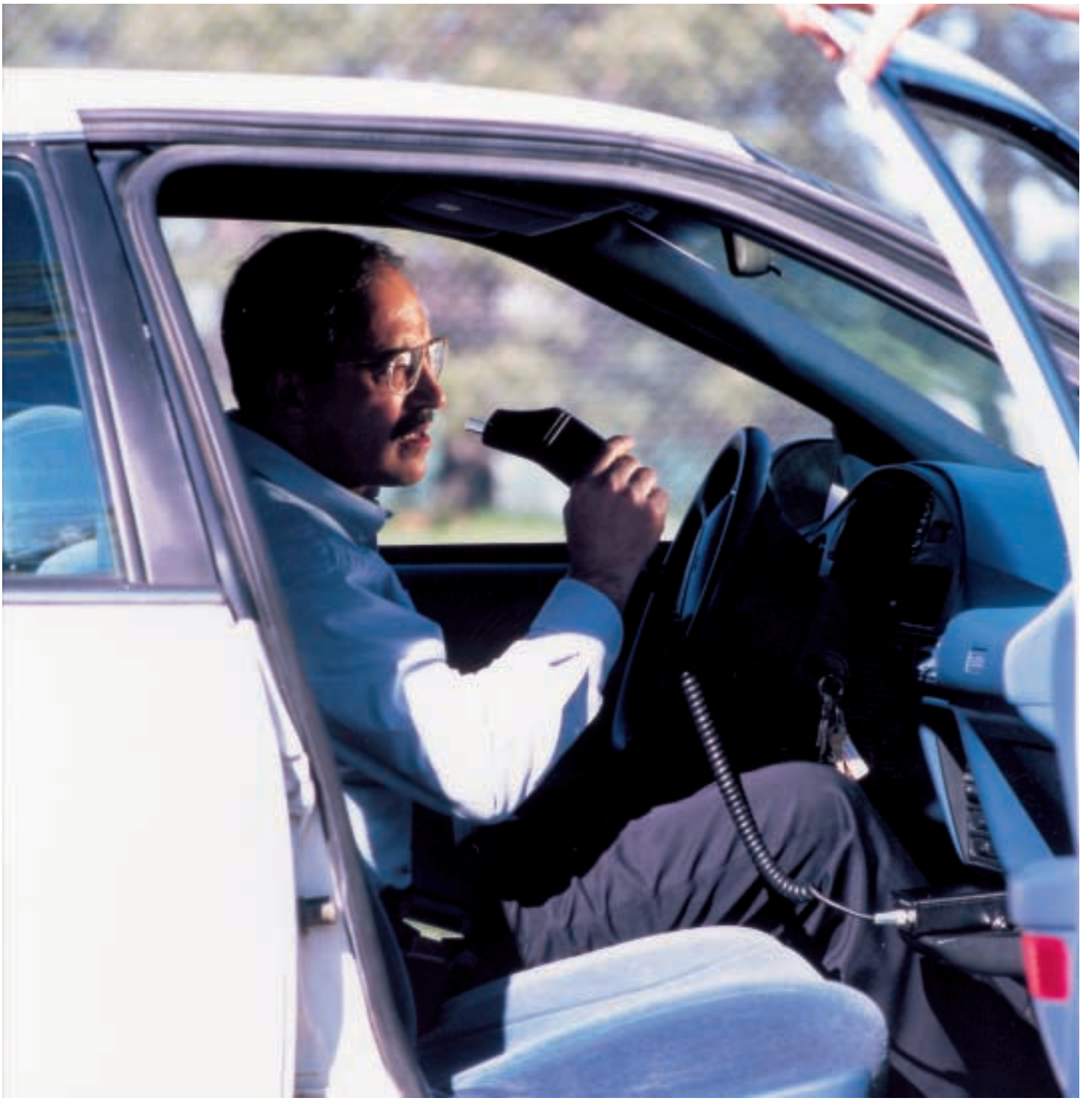


Best practices for alcohol interlock programs

A DRIVING FORCE FOR SAFETY

TRAFFIC INJURY RESEARCH FOUNDATION

The Traffic Injury Research Foundation

The mission of the Traffic Injury Research Foundation (TIRF) is to reduce traffic related deaths and injuries.

TIRF is a national, independent, charitable road safety institute. Since its inception in 1964, TIRF has become internationally recognized for its accomplishments in a wide range of subject areas related to identifying the causes of road crashes and developing programs and policies to address them effectively.

Traffic Injury Research Foundation
171 Nepean Street, Suite 200
Ottawa, Ontario K2P 0B4
Ph: (613) 238-5235
Fax: (613) 238-5292
Email: tirf@trafficinjuryresearch.com
Website: www.trafficinjuryresearch.com

April 2001

ISBN: 0-920071-14-7

Best Practices for Alcohol Interlock Programs

Douglas J. Beirness

Financial support provided by:

GUARDIAN INTERLOCK SYSTEMS CORP.

Guardian Interlock Systems Corp.

Transports Canada Transport Canada

Transport Canada

ROYAL & SUNALLIANCE
Forward thinking since 1710™

Royal & SunAlliance

Acknowledgements

The Montreal workshop and the production of this report were supported by Guardian Interlock Systems, Transport Canada, and Royal & SunAlliance.

The author acknowledges the contributions of all participants at the Montreal workshop, particularly Bob Voas, Paul Marques, Cliff Helander and Claude Dussault who made presentations and facilitated the discussion on various topics.

The author also wishes to thank Jean-Claude Mercure for generously providing the facilities for the workshop and Robyn Robertson for providing administrative support.

Table of Contents

Executive Summary

Background

- The alcohol interlock has been proven effective in reducing drinking and driving recidivism.
- As a consequence, many jurisdictions in North America have enacted legislation that has created interlock programs for DWI offenders.
- Recent legislation in both Canada and the United States has heightened interest in interlock programs.
- The purpose of this report is to provide a comprehensive source of information on alcohol interlock programs as well as guidelines on best practices for such programs.
- To identify best practices, a group of researchers, policy makers, service providers and manufacturers met in Montreal to discuss the current state of the art on interlock programs.

State of the Art

- Alcohol Interlock technology has advanced considerably over the past several years. Research and experience have contributed to the development of an interlock system that is able to reliably identify individuals who have consumed too much alcohol and prevent them from operating the vehicle.
- Evaluations of interlock programs consistently report that interlock participants have DWI recidivism rates that are as much as 90% lower than among non-participants, at least so long as the interlock is in the vehicle.
- Once removed, recidivism rates are comparable among interlock participants and non-participants.

- To reduce the likelihood of recidivism once the interlock has been removed, there is a need to enhance rehabilitation services and related programs available to interlock participants.

Best Practices for Interlock Programs

It is recommended that interlock programs incorporate the following key elements:

- a perspective that considers interlock programs as more than the device itself but rather as a coordinated set of activities designed to ensure that program participants do not drive after drinking;
- strong, clear legislation;
- an interlock device that has been certified to meet or exceed established performance specifications;
- a reliable service provider that understands, and is committed to dealing with, the DWI offender population;
- mandatory participation of all convicted DWI offenders with the option of voluntary early entry into the program by low risk offenders;
- authority for the program to reside within the driver licensing administration;
- regular monitoring of offenders, including a review of interlock data records;
- duration of program participation linked to the success of the individual in the program; and,
- integration of the interlock program with other DWI sanctions and programs, particularly rehabilitation.

Future Directions

- There remains considerable potential for the development of interlock programs that will increase their availability, acceptance, and effectiveness. Some possible areas for future development include:
  - an interlock system for all vehicles that is convenient and acceptable to all drivers;

- a universal interlock module in all new vehicles that would facilitate interlock installation;
- interlock programs for commercial fleet operators;
- a system to identify the individual providing the breath sample;
- an electronic driver's licence to help prevent interlock-restricted drivers from operating non-interlock equipped vehicles;
- flexible interlock programs that would provide varying levels of restrictions on vehicle use to match the degree of risk posed by the individual;
- pre-conviction participation in interlock programs.

1.0 Introduction

1.1 Background

In July 1999, the *Criminal Code of Canada* was amended to allow provinces to reduce the mandatory period of driving prohibition for a first DWI[1] offence from one year to three months provided the offender participates in an alcohol interlock program for the remainder of the one-year period. This legislation gave implicit federal approval to interlock programs and provided the impetus for provinces to renew interest in the development and/or expansion of such programs.

In the United States, the Transportation Equity Act for the 21st Century (TEA-21) contains a financial incentive for states to strengthen their programs to control repeat DWI offenders. Failure to comply will result in a portion of the state's highway construction funds being diverted to traffic safety programs. One of the alternatives that will assist states in their efforts to comply involves establishing an alcohol interlock program. This legislation has sparked tremendous interest in the development of interlock programs throughout the United States.

Since these laws were passed, the demand for information about interlock programs has escalated dramatically. Although considerable information exists about interlock programs, it tends to be scattered throughout scientific journals, technical reports and other documents. Those searching for the best available information on the operation and effectiveness of interlock programs must wade through an ever-expanding volume of literature containing the collective knowledge on the subject. In this context, there is a need for a document that provides legislators, policy makers and program administrators with the best possible information and advice concerning interlock programs. Such is the purpose of this report.

[1] The acronym "DWI" refers to "Driving While Impaired". In this report, DWI also includes driving with a blood alcohol concentration (BAC) in excess of the statutory limit and failing or refusing to provide a breath or blood sample for analysis.

To facilitate the development of such a document, a workshop was held in Montreal on September 18, 2000. In attendance were an international group of researchers, interlock manufacturers, policy makers, and program specialists[2]. The purpose of the workshop was to discuss the current state of knowledge on the effectiveness of interlock programs and to work towards a set of "best practices" for interlock programs. The workshop discussions were used extensively in the preparation of this document.

1.2 History

The idea of a vehicle that cannot be driven by someone whose ability to do so is impaired by alcohol has intrigued road safety professionals for over three decades (e.g., Voas, 1970). The development of such a system proved to be a considerable challenge. Performance-based interlock systems, which required the driver to perform a perceptual or motor task designed to detect impairment prior to driving, were sensitive to individual variations in performance and impairment but were incapable of discriminating between drivers with low to moderate blood alcohol concentrations (BACs). Hence, this type of device was not feasible.

The development of small, accurate breath testing devices changed the direction of interlock research. Alcohol interlock devices based on breath alcohol measurement proved considerably more reliable than performance-based devices in discriminating accurately between drivers above and below a specified threshold value. Although initially there was some concern about the possibility of circumventing the device, technological innovations introduced over the past several years have alleviated virtually all of these concerns. The result is a viable, practical and reliable device which, when installed in a vehicle, prevents its operation by a driver whose BAC exceeds the specified threshold value.

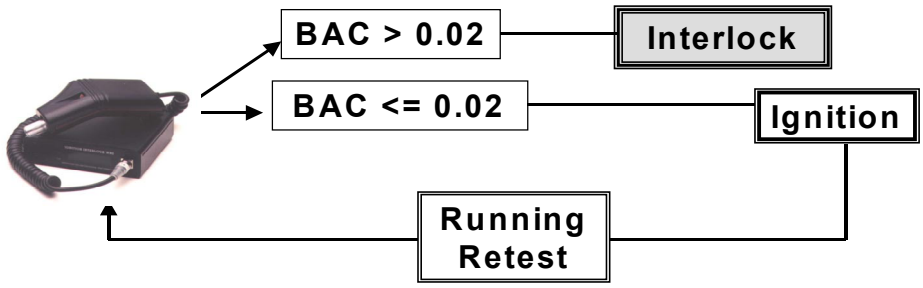
Present alcohol interlock systems consist of a small breathtesting device linked to the vehicle ignition system that require the driver to provide a breath sample every time an attempt is made to start the vehicle. A variety of devices are available and most

[2] A list of workshop participants is provided in Appendix A.

incorporate a number of anti-circumvention features such as temperature and pressure sensors, a running retest feature, and a data recorder.

Figure 1 illustrates the performance of the interlock system. To operate the vehicle the driver must first provide a valid breath sample into the device. In the event the breath test reveals a BAC in excess of the threshold value, the vehicle will not operate and the driver must wait a period of time before trying again. If the driver's BAC is less than or equal to the pre-set threshold value (in this case .02%), the vehicle is operational. (Some systems provide a warning if the driver's BAC is positive but below the threshold value.) Once the vehicle has been started, the interlock system requires periodic running retests to ensure the driver's BAC does not rise above the threshold value. A data recorder captures the results of all breath tests for later review.

Figure 1: Alcohol Interlock System



Alcohol interlock devices have become increasingly popular as a means to prevent persons convicted of a DWI offence from repeating the behaviour. They function as a form of incapacitation and serve as a bridge between full suspension and full licence reinstatement. Interlocks allow offenders to operate a vehicle legitimately within the driver licensing system while at the same time provide the public with the assurance that offenders will only be able to drive when their BAC is below a specified value.

Five Canadian jurisdictions and 42 American states have legislation that allows the installation of interlock devices in the vehicles of DWI offenders. However, not all jurisdictions with legislation are currently operating interlock programs. It is estimated that there are more than 40,000 interlock devices currently in use throughout North America. This is in contrast with an estimated 1.5 million DWI offenders in North America each year. Participation rates in most interlock programs are relatively low – typically less than 10% of offenders have an interlock installed.

There remains significant potential for the growth of interlock programs. More – and better – interlock programs will undoubtedly serve to increase the number of offenders who participate in these programs. The control and rehabilitation of DWI offenders will ultimately improve safety for all drivers.

1.3 Purpose of the report

The purpose of this document is to provide a comprehensive source of information on interlock programs. The intent is to summarize what is known about interlock programs, to identify the key features of an interlock program, and to provide a guide on best practices for interlock programs. It is expected that the information contained in this document will be beneficial to those investigating the feasibility of implementing a new interlock program or ways to improve an existing program.

1.4 Scope of the report

The remainder of this report is divided into four major sections, each of which addresses a series of key issues related to interlock programs.

The first of these sections, entitled *State of the Art*, outlines the current state of interlock technology and summarizes findings from research studies on the efficacy of interlock programs.

The next section, entitled *Current Issues,* examines a number of emerging issues that may have relevance for the success of interlock programs.

The key section of the report, *Best Practices for Interlock Programs*, outlines a series of recommended elements and practices to be included in successful interlock programs.

The final section of the report discusses what the future may hold for interlock programs.

A list of references is provided along with a more comprehensive bibliography.

2.0 State Of The Art

One of the most commonly asked questions about alcohol interlock programs is, “Do they work?” The question actually involves two separate but related issues -- one dealing with the technical aspects of the interlock device itself; the other addressing the efficacy of interlock programs to prevent impaired driving behaviour. This section summarizes the current state of knowledge on interlock technology and the effectiveness of interlock programs.

2.1 Does the technology work?

Historically, the major concerns about interlock devices have involved the accuracy and reliability of the technology and the ease with which the device could be circumvented, thereby allowing an intoxicated individual to operate the vehicle. For some early interlocks these concerns were legitimate. Unfortunately, the legacy of skepticism has lingered. Many of the stories of tampering with and/or misuse of alcohol interlocks have become sensationalized and have become the substance of “urban myths”. Experience with interlock programs over the past decade has served to help identify and resolve problem areas. Technological innovations over this period of time have successfully dealt with most of the concerns, resulting in a reliable and accurate device that does exactly what is intended – prevent persons impaired by alcohol from operating the vehicle.

There are several breath alcohol interlock devices available[3]. All instruments are similar in that they provide a physical barrier to prevent the operation of the vehicle by drivers who have a BAC above a specified preset threshold value[4]. A breath sample must be provided each time the driver attempts to start the vehicle. The vehicle

[3] A list of interlock manufacturers is provided in Appendix B.
[4] The preset threshold value varies according to jurisdiction but is typically in the range of .02% to .05%.

will not start unless the driver's BAC is below the preset threshold value. The instruments differ, however, in terms of the method used to detect and measure breath alcohol and the features incorporated to prevent tampering and circumvention of the device. The methods for alcohol detection as well as tampering and circumvention protection are discussed below.

2.1.1 Alcohol detection and accuracy

Ignition interlock devices employ one of two types of alcohol detection methods: semiconductor sensing; or electrochemical (fuel cell) sensing.

In the semiconductor device, the sensor (often referred to as a Taguchi sensor) is a small element whose electrical conductivity increases in proportion to the alcohol concentration in the breath sample (Dubowski, 1992). This technology has been used in a variety of breath test instruments including roadside screening devices used by police departments throughout North America. The major advantages of this method of alcohol detection are its accuracy, relatively low price, and durability.

There are *two primary disadvantages* of this method. First, it requires frequent calibration. This means that its stability of measurement over time may vary and, hence, it must be serviced at regular and frequent intervals.

Second, the semiconductor sensor is not specific to alcohol -- i.e., it responds to other combustible gases and vapors, most notably cigarette smoke and vehicle exhaust. As a consequence, it can, on occasion, give a positive reading even when the individual has not consumed alcohol. For the driver using an interlock with this type of sensor, a false positive reading can prevent legitimate use of the vehicle. For program administrators, this renders it impossible to determine whether low readings are the result of alcohol consumption by the driver or other volatile substances in the atmosphere.

The electrochemical (fuel cell) method of alcohol detection utilizes a small device to convert alcohol and oxygen into an electrical current. The current generated is proportional to the concentration of alcohol in the breath sample. This technology is

used in a variety of roadside screening devices, evidential breath test instruments, and passive sensors. Fuel cell-based devices are typically more expensive than semiconductor devices but *they have two major advantages.*

First, they are specific to alcohol. They do not respond to organic hydrocarbon solvents, so positive results can only occur if alcohol is in the sample. This eliminates the nuisance of unjustified (i.e., false positive) ignition lock-outs due to the presence of other volatile substances such as cigarette smoke and vehicle exhaust. This gives program administrators confidence that positive readings are the result of alcohol in the breath of drivers.

Fuel cell-based devices *also have greater stability in calibration*. This provides greater accuracy over the long term and eliminates the need for frequent calibration.

The ability of the interlock to perform its intended function does not necessarily depend on the accuracy with which it measures alcohol. The critical factor is that the device is able to distinguish accurately between persons who are above or below the preset threshold BAC. In this context, both types of alcohol sensors are capable of achieving a very high level of performance.

Ultimately, factors other than measurement accuracy will determine which type of device is selected for use in a particular program. Besides cost and stability of calibration, a key consideration is the specificity of the device to alcohol. Ignition lock-outs caused by substances other than alcohol in the breath (e.g., cigarette smoke) create frustration among users and may lower their confidence in the system, leading them to believe the device does not work properly. In an attempt to avoid false positive results (i.e., ignition lock-outs when the driver has *not* been drinking), participants may be tempted to find another vehicle to operate that does not have an interlock installed. In addition, program administrators must be able to dismiss claims by users that positive results are due to some other substance. With an alcohol specific device, all positive results can only be a consequence of the presence of alcohol.

2.1.2 Tampering and circumvention protection

Tampering and circumvention refer to any attempt to disable, disconnect or bypass the interlock to allow the intended driver to start the vehicle without providing a natural, unfiltered breath sample. A variety of features and systems have been incorporated into interlock devices to eliminate, or at least reduce substantially, the potential for the driver to bypass the system. Many of the common features are outlined in the following paragraphs[5].

Data recorder. A key feature for preventing tampering and circumvention is the inclusion of a data recorder as an integral part of the interlock device. The primary purpose of the data recorder is to provide program monitors (judicial or licensing authorities) with a record of all uses of the device, including attempts to tamper with, or circumvent, its function. Information about all attempts to start the vehicle (including the results of breath tests) and attempts to disconnect the interlock are recorded electronically.

In this context, the security of the data must be protected. Backup systems should be incorporated to ensure the information on the data logger is not lost if the power supply to the interlock is interrupted. It is also important that theft, loss, or disconnection of the sample head does not result in the loss of data. This requires that the data recorder be incorporated into a module that cannot be detached and/or the inclusion of a backup system that records vehicle starts even if the sample head has been disengaged. This also protects against unauthorized -- and unrecorded -- starts when the sample head has been removed.

Recording all attempts to tamper with or circumvent the interlock provides a general deterrent that will discourage most users from attempting to disengage or bypass the interlock system. In addition, the recording of these events provides program monitors with documentation of program violations so that appropriate action can be taken.

[5] Not all interlock devices include all features.

Sensors. Temperature and/or pressure sensors are incorporated as a means to detect and prevent the use of samples that have been stored (e.g., in a balloon), filtered, or introduced by a mechanical device. All breath samples that are rejected by these sensors are recorded on the data logger.

Running retests. Many alcohol interlock devices require repeated breath tests -- "running retests" -- on a random interval after the vehicle has been successfully started. The purpose of these "running retests" is actually threefold: (1) to prevent the possibility of a bystander providing an alcohol-free breath sample that would allow a driver with a high BAC to operate the vehicle; (2) to detect drivers whose BAC is still in the ascending phase and has risen beyond the setpoint after the vehicle was originally started; and (3) to prevent drivers from leaving the vehicle idling while they drink.

Failing to provide a running retest within the time allowed can result in a warning to the driver (either auditory or visual) or an alarm may be activated. After the warning, if a sample is not provided or if the vehicle is not stopped, the driver can be required to report immediately to the service centre or program manager. Any retest that registers a BAC in excess of the setpoint can lead to any of a number of consequences. For example, the interlock device can merely warn the driver of the failure and require the user to report to the program manager and service technician. Appropriate action would then be taken against the offender. Failure to report to the service centre within a specified period can result in the interlock preventing any further use of the vehicle. A failed retest might also activate an alarm – lights flashing, horn activated, or internal alarm – prompting the driver to discontinue driving. In no instance would the interlock device stop the engine so as to create a traffic hazard.

Driver recognition systems. As a means to prevent bystanders from providing an alcohol-free breath sample, some interlock systems have incorporated features such as “hum-tone” recognition and breath-pulse codes. “Hum-tone” recognition requires the driver to hum for a period of time while providing a breath sample. This requires some practice and repeated unsuccessful attempts by an inexperienced individual would result in a lockout situation. This system also prevents attempts to introduce a bogus (i.e., non-human) or filtered air sample.

Interlock systems that incorporate the breath-pulse code require the driver to provide a series of short and long breath pulses prior to a breath sample. To a large extent this prevents bogus and bystander samples and can be used to identify the driver in cases where other people operate the same vehicle.

Sealed wiring. Protection against tampering is generally provided by sealing the wiring and circuits in a manner that renders it easy to detect any attempt to alter it.

2.1.3 Specifications and certification

In 1992, the National Highway Traffic Safety Administration (NHTSA) issued a set of recommended guidelines and test protocols for States to use in order to help assess equipment and develop effective programs (Marques and Voas, 1993; NHTSA, 1992).

The guidelines indicate that the primary purpose of the ignition interlock is to prevent a person with an illegal BAC from operating a vehicle. There is no intention for the device to provide drivers with a precise measurement of their breath alcohol content. Hence, although the measurement of alcohol is an important consideration in distinguishing between drivers with BACs above or below the threshold value, the guidelines tend to emphasize prevention of circumvention and tampering rather than the precise measurement of alcohol.

The guidelines indicate that interlocks should allow legitimate use of the vehicle by drivers with zero or low BACs and should minimize problems of lawful use of the vehicle by other family members. Two aspects of the guidelines address this issue. First, it was recommended that the BAC at which the interlock should prevent ignition be set at .025%. This low but non-zero setpoint helps protect against the response of alcohol sensors to other types of alcohol or alcohol from non-beverage sources (e.g., mouthwash) while at the same time providing sufficient protection against the possibility of a person with a high BAC starting the vehicle.

Second, the specifications allow for some variability in the accuracy of BAC measurements that should help alleviate potential problems with legitimate users being prevented from starting the vehicle.

The NHTSA guidelines also acknowledge that the acceptability of interlocks depends on their ability to prevent a person with a high BAC from driving The specifications state that under normal conditions, interlocks must prevent ignition 90% of the time when the true BAC is .01% higher than the setpoint (i.e., the threshold BAC at which the interlock prevents ignition). Under extreme conditions (e.g., temperature, vibration), this standard is relaxed to within .02%. Even under extreme conditions, a person with a BAC of .065% would almost certainly be prevented from starting the vehicle 98% of the time.

The published guidelines also indicate the need for a system to record all use of the interlock as well as attempts to disconnect or otherwise circumvent the system. As a further means of protection from circumvention, the guidelines require interlock devices to include provisions for running retests. Periodic service of the device for calibration also allows program monitors to review data logger records and note any improper use of the device.

In summary, the NHTSA guidelines for alcohol ignition interlock devices attempt to balance the accurate and reliable measurement of alcohol with the need for a robust device that is difficult to circumvent.

Having issued guidelines for interlock devices, NHTSA chose not to take responsibility for the testing and certification of interlock devices as it does for preliminary and evidential breath test equipment. Certification of interlock devices provides assurance that the equipment performs as intended. The onus was thus placed on manufacturers to find a commercial laboratory to test their equipment and certify that it complies with the guidelines. In the absence of a central agency to certify interlock devices, there is no guarantee that the equipment being used is of comparable quality and performing to expectations. The only way to ensure that standards are being met is to authorize one central agency or a series of certified laboratories to test and approve interlock devices using the same testing methods and criteria.

The province of Alberta has also issued specifications for interlock devices to be used in their interlock program (Electronics Test Centre, 1992). The Alberta standards are similar to the NHTSA guidelines in that they attempt to balance the accurate and reliable measurement of alcohol with the need for a robust device that is difficult to circumvent. The Alberta standards are somewhat more stringent in the requirement for accuracy under extreme conditions and require that the device be specific to the measurement of alcohol. Testing and certification of equipment is done by an independent body, the Electronics Test Centre.

The Standards Australia Committee on Blood Alcohol Testing Devices also established a set of performance criteria for breath test devices installed in motor vehicles (Standards Australia, 1993). The specifications differ considerably from the NHTSA and Alberta standards on two dimensions. First, the Australian standards emphasize the accurate and reliable measurement of alcohol and impose very stringent criteria with little margin for error and no allowance for extreme environmental conditions. Second, the document indicates that the overall purpose of breath test instruments for personal use is to provide drivers access to blood alcohol meters to allow them to stay within statutory blood alcohol limits.

Specifications for interlock devices require a balance between safety (i.e., ensuring drivers with high BACs are unable to operate the vehicle) and mobility (i.e., allowing those with zero or low BACs to drive). The various agencies have approached the problem somewhat differently in their guidelines or specifications. Ultimately, the key to public acceptance of interlocks depends on the ability of the device to prevent an impaired individual from driving. It is unlikely that the public would support interlock programs if the device could be easily circumvented or if it was unable to reliably prevent impaired individuals from driving.

It is also important the device be accepted and supported by interlock users. Acceptance by users will be enhanced by a device that limits the number of times it incorrectly prevents legitimate use of the vehicle by a driver with a zero or low BAC. Such “false positives” may diminish confidence in the system and may increase the probability of users attempting to circumvent the system or driving another vehicle not equipped with an interlock.

2.2 The effectiveness of interlock programs

Evaluating the success of interlock programs involves two major issues. The first concerns the efficacy of interlock programs in preventing subsequent occurrences of impaired driving among program participants (i.e., outcome evaluation); the second involves the successful implementation of programs and the use of interlock devices under real-world conditions (i.e., process evaluation). These issues are examined separately.

2.2.1 Outcome evaluation

The objective of outcome evaluation studies is to determine the extent to which interlock programs reduce the incidence of subsequent DWI behaviour among participants. Although this would appear to be a relatively straightforward task, it is quite complex. In this context, evaluation studies are typically conducted within the existing judicial and/or licence administration systems. These systems are often unforgiving and impose constraints that render it difficult or impossible for researchers to exercise control over the factors which may influence the impact of the interlock program. For example, researchers are generally unable to determine which DWI offenders the courts assign to interlock programs. Judicial discretion plays an important role in sentencing but may result in only offenders deemed to be at highest risk of recidivism being assigned to interlock programs.

DWI offenders are typically subjected to a variety of sanctions and programs in addition to interlocks. This means that not all participants will necessarily have experienced the same length of suspension, jail time or rehabilitation programs prior to entering the interlock program. Although these factors may play a role in the success of individuals in the interlock program, researchers typically cannot control the sanctions imposed on interlock participants.

Every jurisdiction differs in its approach to dealing with DWI offenders; hence every interlock program will be unique in some way. This complicates not only the conduct of evaluation research but also compromises comparisons among evaluation studies conducted on different programs.

Table 1 summarizes the results of nine studies that have evaluated the impact of alcohol interlock programs. In reviewing these studies, it is important to recognize that they vary considerably in terms of the size and composition of the sample, the time period examined, the nature of the comparison group, and the study design. In addition, the interlock programs examined in the various studies were not the same. They differed in terms of the eligibility criteria for participation in the program, authority for the program (judicial or administrative), the equipment used, the period of interlock installation, and the requirements for monitoring and reporting.

Table 1: Summary of Interlock Evaluation Studies*

Jurisdiction	Authors/Year	Characteristics of population	Findings: Recidivism with interlock	Findings: Recidivism after interlock	Comparison Group
California	EMT Group (1990)	First and multiple	Interlock 3.9% Noninterlocks 5.9%	_____	Suspended
Cincinnati, Ohio	Elliot & Morse (1993)	First offenders over .20% BAC plus multiple offenders	Interlock 2.9% Noninterlocks 8.4%	Interlock 6.6% Noninterlocks 6.5%	Suspended
Oregon	Jones (1993)	Multiple offenders	Interlock 5% Noninterlocks 8%	Interlock 10.8% Noninterlocks 11.5%	Restricted
North Carolina	Popkin et al. (1993)	Second offenders	Interlock 2.7% Restricted 7.1% Suspended 9.8%	Interlock same or higher than noninterlock	Restricted license & suspended
California	Peck (1987)	Second offenders	Interlock 5.9% Noninterlocks 10.5%	_____	Suspended & restricted
Alberta	Weinrath (1997)	Multiple offenders	Interlock 10% Noninterlocks 25%	Interlock 7% Noninterlocks 11%	Suspended
West Virginia	Voas & Tippetts (1997)	First and second offenders	Interlock 1.6% Noninterlocks 6.4%	Interlock 10% Noninterlocks 10%	Licensed & suspended
Maryland (Random assignment)	Beck et al. (1999)	Second offenders	Interlock 2.4% Noninterlocks 6.7%	Interlock 3.5% Noninterlocks 2.6%	Licensed
Alberta	Voas et al. (1999)	First & second offenders	(12 months) Interlock 0.1% Suspended 2.23% Ineligible 4.61% (24 months) Interlock 0.85% Suspended 8.08% Ineligible 18.72%	Interlock 2.75% Reinstated 2.63% Still Suspended 2.48% Interlock 7.05% Reinstated 7.32% Still Suspended 3.94% Ineligible 10.52%	Suspended & ineligible

*Adapted from Voas (2000)

Despite the differences among studies and programs, the results are remarkably consistent. During the period of interlock installation (i.e., while the device is installed in the vehicle), the repeat offence rate among interlock program participants is 37% to 90% lower than among the comparison group. After the interlock is removed, there is no difference in the recidivism rate between the group that participated in the interlock program and the group that did not.

Results from the ongoing monitoring study of DWI offenders in California differ somewhat from those listed in Table 1. Although interlocks were mandatory for all repeat DWI offenders in California[6], in 1997 only 20.7% were assigned to the program. Follow-up of interlock participants revealed no significant reduction in recidivism over suspension and/or treatment (Tashima and Helander, 2000).

The predominant pattern of results across studies indicates that interlocks effectively prevent impaired driving while installed in the vehicle. It is equally apparent that there is no residual effect in preventing impaired driving after the device is removed from the vehicle. This latter finding has been somewhat disappointing to those who had expectations that the experience with an interlock device would provide a constant reminder of the problems associated with driving after drinking and/or reinforcement of sober driving, thereby creating a change in behaviour that would persist after the interlock was removed. The existing studies clearly indicate that the reduction in recidivism among interlock participants is limited to the period of interlock installation.

The exception is some recent preliminary evidence from the Quebec interlock program. In a paper presented at the International Conference on Alcohol, Drugs and Traffic Safety in Stockholm in May 2000, Dussault and Gendreau (2000) indicate that there was no increase in recidivism in the six-month period following removal of the interlock. The re-offence rate among participants after removal was no different than that during the interlock period. In addition, the results indicate that the 60% reduction in both casualty and property damage crashes evident during the interlock period was maintained after the interlock was removed. Although preliminary, these short-term findings are

[6] The California interlock program was changed in 1999. It is now only mandatory for repeat DWI offenders who drive while suspended. Offenders can also volunteer for the program in exchange for a reduction in the length of their suspension.

encouraging. The results also provide initial evidence of traffic safety benefits of interlocks over and above reductions in DWI recidivism.

The fact that most studies show that rearrest rates increase following removal of the interlock does not reflect on the efficacy of interlock programs, nor should it be used to discount or discredit the beneficial effects of interlock programs. First, it should be noted that even though the recidivism rate among interlock participants increases following the removal of the interlock device to match that of DWI offenders who did not participate in the program, the significant effect evident during the interlock period is not lost. For example, the three-year cumulative re-offence rate (minimum 2 years of the interlock program completion) for first-time offenders in the Alberta interlock program was 15.3 offences per 1,000 drivers compared to 43.8 for suspended drivers and 131.2 for drivers ineligible for the interlock program (Voas 2000). The five-year cumulative re-offence rate for repeat offenders who participated in the interlock program is about half that of non-participants.

Second, the interlock device can only prevent impaired driving when it is installed in the vehicle. If the factors that give rise to the drinking-driving behaviour do not change during the interlock period, it is likely that the behaviour will re-appear once the physical barrier (i.e., the interlock) preventing it is removed. A large number of DWI offenders who participate in interlock programs qualify for a clinical diagnosis of alcohol abuse or dependence. The installation of an alcohol interlock does not change this situation; it merely prevents the individual from operating the vehicle after drinking. Interlocks were never intended as a treatment for alcohol abuse; therefore, it should not be expected that installation and use of an interlock device will, by itself, prompt a change in the extent of alcohol consumption.

The period of interlock installation could, however, be used to greater advantage by encouraging or compelling simultaneous participation in a rehabilitation program to deal with the problem that results in the DWI offence – i.e., alcohol abuse. Marques et al. (1999) describe a study conducted in Alberta in which a group of interlock participants met with a case manager on a regular basis at the interlock service facility every time the offender came to have the device serviced. The intervention was designed to educate and raise awareness among participants of the need to plan and re-evaluate

their vehicle use whenever alcohol consumption was likely to occur, in an attempt to move offenders along a change-readiness dimension (Prochaska et al., 1992) toward greater problem recognition and action. The intent was to help prepare interlock participants to make permanent changes in their behaviour that would reduce the likelihood of subsequent problems after the interlock was removed.

An examination of data from the interlock recorder revealed that participants in the intervention program recorded fewer high BAC fails than other interlock users. Further data are required to determine if the behavioural changes associated with the intervention were maintained following removal of the interlock.

A criticism of evaluation studies concerns low participation rates and the problem of recruitment or selection into interlock programs. In general, only a small portion of eligible DWI offenders (generally less than 20%) choose to participate in an interlock program over remaining fully suspended (Voas et al., 1999). This suggests that those who participate in interlock programs might differ from those who elect to remain suspended on one or more critical dimensions (e.g., desire or need to drive, financial resources) that might affect re-offence rates. Whether participants volunteer for the interlock program or participate as a result of a judge's order, the process of selecting interlock participants may result in a bias that favours those with a lower likelihood of recidivism. Hence, it is possible that the lower rates of recidivism among interlock participants observed in evaluation studies may not be attributable to the program but rather to differences in the characteristics of those who do and those who do not participate in interlock programs.

Voas et al. (1999) suggested that the increase in recidivism rates among participants once the interlock is removed argues against the presence of an initial selection bias, at least in terms of the propensity to drive after drinking. Whatever differences may be created by the self-selection of offenders into the interlock program, these differences are not sufficient to account for the lower recidivism among interlock participants during the interlock period.

Only one study has been able to assign participants to an interlock program randomly (Beck et al., 1999). This design essentially ensured that DWI offenders assigned to the interlock program did not differ from those who were reinstated but with a zero alcohol restriction. The results were comparable to those of studies of programs in which participants were self-selected, or ordered by a justice to install an interlock device, adding further evidence that the differences in recidivism are attributable to the interlock program and not a consequence of differences in the characteristics of participants.

In summary, the evidence to date consistently shows a strong beneficial impact of interlock programs while the device is installed. Once the device is removed, the recidivism rate among interlock participants does not differ from that among DWI offenders who did not participate in an interlock program. If there remains an expectation that this beneficial effect of interlock programs should persist after the device is removed, then every effort must be made to change the individual's behaviour – particular drinking – during the interlock period.

2.2.2 Process evaluation

The purpose of process evaluation is to determine the factors and conditions that either facilitate or interfere with the successful operation of a program. It examines how a program functions and the operational characteristics of the program, including the responses and reactions of program staff and participants. This section outlines the experience with interlocks in everyday use.

- **Participation rates.** Perhaps the most significant problem noted in the early experience with interlocks in California was getting offenders to have the device installed. Approximately 25% of those ordered by the court to use an interlock never had the device placed in their vehicle (EMT Group, 1990). Most of these offenders were in violation of the conditions of probation. Because DWI probation was typically unsupervised in California, there was no reliable system in place to ensure compliance. The lack of supervision or monitoring of offenders who did have the interlock installed may have reduced the effectiveness of the system. In the county with the best results (San Diego), the manufacturer required regular calibration and maintenance of the

device. This regular contact between offender and "authorities" may have served to enhance compliance and increase the success rate.

Other studies also reported problems in getting offenders to have the device installed in the first place. Of the 455 offenders in Hamilton County, Ohio who were offered interlock, 40% chose not to have it installed (Morse and Elliott, 1990). In Hancock County, Indiana, DWI offenders are given the choice of participating in the interlock program, incarceration, or electronically monitored house arrest. Even under this system, where participation in the interlock program is the least restrictive and presumably the most desirable option, 12% of offenders assigned to the interlock program failed to comply with the requirement (Voas et al., in press).

♦ **Circumvention.** When interlocks were first introduced, one of the major concerns was whether these devices would live up to manufacturers' claims when used under real-world conditions by DWI offenders. Of particular concern was the extent to which users would attempt and succeed at circumventing the device. Indeed, circumvention of the system continues to be raised as a concern in just about any discussion of interlocks.

Early interlock devices were relatively easy to circumvent or bypass. For example, a sample of records from one of the initial counties to implement an interlock program revealed that almost half had been bypassed at some point (EMT Group, 1990). In the Hamilton County Ohio program, about 10% of participants reported attempts to circumvent the interlock; about 3% were successful (Morse and Elliott, 1990).

The newer generation of interlocks are much more difficult to circumvent. They include sensors and systems designed to prevent, detect, and record all attempts to bypass or circumvent the system. Nevertheless, with some effort and ingenuity, a determined and motivated individual will undoubtedly be able to circumvent the system, although not without being detected. For the most part, electronic recording of all events associated with the interlock combined with regular monitoring is the best way to deter attempts at circumvention.

♦ **False positives.** The most common problem reported by interlock participants is trouble starting the vehicle when they were “sober” (e.g., Morse and

Elliott, 1993). Some of these problems were undoubtedly true "false positives" as a result of the interlock device responding to other substances. The newer devices using fuel cell technology for alcohol detection virtually eliminate this problem.

The remainder of "sober" lock-outs are most likely attributable to unmetabolized alcohol that remains in the body many hours after consumption has ceased. In an analysis of records from interlock data recorders, Marques et al. (1999) found failed breath tests to be common on Saturday and Sunday mornings. An elevated BAC on Saturday or Sunday morning is often evidence of a heavy drinking episode the previous evening, which may be indicative of a pattern of excessive consumption. A skilled program monitor or case manager can use such incidents to illustrate the metabolism of alcohol and to focus on the extent of the individual's consumption and the need for rehabilitation.

- **Participant reactions.** As might be expected, interlock program participants are not always pleased with the system. Some of the problems reported include embarrassment and inconvenience of having to provide a breath sample, the cost of the system, and "malfunctions". But positive comments are common as well. Program participants often speak favourably about its beneficial aspects. For example, in a survey of fifteen offenders who had an interlock installed for at least two months (Baker, 1987), most were supportive of their use and reported the system was effective in preventing them from driving after drinking. The system had prevented ignition an average of 1.15 times since installation. Half of the respondents were aware of methods to bypass the system but none reported having done so. Offenders felt the system helped to "remind" them when they had consumed too much alcohol to drive. Moreover, the system forced them to take responsibility and make other plans *prior* to drinking to prevent them from driving afterwards.

Morse and Elliott (1990) reported that 82% of interlock participants believed the system was very successful in preventing them from driving after drinking and 68% indicated that it had been very successful in changing their drinking-driving habits.

- **Knowledge and communication.** Program administrators also report logistical concerns with the operation of interlock programs. Foremost is the apparent reluctance of judges and magistrates to assign DWI offenders to interlock programs.

This may be a consequence of inadequate knowledge of the existence of such programs and/or a personal belief that such programs are not effective.

Even when offenders are ordered to have an interlock installed, many fail to do so. This situation is often the result of poor communication between program administrators, providers and the courts. Where interlock participants are supervised by the probation department, it requires adequate training, good data linkages and timely reporting systems. It has also been noted that training for police officers would enhance their ability to identify interlock participants who are not in compliance with the interlock restriction.

2.3 Conclusion

Following years of research, development and field experience, alcohol interlock programs have come of age. State of the art technology has been employed to create a system that is able to reliably identify individuals who have consumed too much alcohol and prevent them from operating the vehicle. A variety of systems have been incorporated into the device to prevent virtually all attempts at circumventing it. Experience with interlocks over the past decade or so indicates that they perform exceptionally well and do the job for which they were intended – i.e., to prevent those with elevated BACs from operating the vehicle.

Evaluations of interlock programs consistently find reductions in recidivism among interlock participants of up to 90%. Once the interlock is removed from the vehicle, recidivism returns to a rate similar to that among DWI offenders who did not participate in an interlock program. In the absence of a simultaneous rehabilitation program to deal with participants' abuse of alcohol, it is unlikely that interlock programs alone will change the behaviour that underlies recurrence of the offence.

3.0 Current Issues

Experience with, and evaluation of, interlock programs over the past decade have provided a wealth of information concerning their use as an effective countermeasure for impaired driving. As interlock programs expand and mature, new issues emerge and questions arise as to how they can be made even more effective. This section examines some of the issues about interlocks that remain under discussion.

3.1 Circumvention

As described in the previous section, the new generation of interlocks has incorporated a variety of features to prevent and/or deter attempts at circumvention. Nevertheless, there remains one simple and easy way to bypass the interlock – drive a vehicle that is not equipped with an interlock device.

Although the laws in most jurisdictions forbid interlock participants from operating a vehicle without an interlock installed, the probability of being caught is extremely low. Even when violators are stopped by the police, unless the interlock restriction is noted on the driver's licence and the police officer is able to recognize a functional interlock installed in a vehicle, the probability of detection is low.

To a large extent, the onus is on participants to comply with the interlock restriction. In existing programs where the incentive for participation is a reduction in the length of their hard suspension, motivation among participants to comply is generally high. In a study of over 2,000 interlock participants, Voas et al. (2000) reported that among those who had access to another vehicle, there was no evidence to suggest that they were using a non-interlock equipped vehicle when drinking to avoid the interlock.

Programs that *require* all DWI offenders to participate in an interlock program may find offenders have lower motivation to comply with interlock program restrictions. Attempts to circumvent or tamper with the interlock may increase. As well, the operation of a non-interlock equipped vehicle may become more common.

3.2 Participation rates

Although research has demonstrated the value of interlocks as an effective means of preventing impaired driving, the number of interlocks in service remains relatively small in comparison to the number of DWI offenders. Many judges and magistrates are reluctant to order an offender to participate in an interlock program. This may be the result of a lack of adequate and accurate information about interlock programs and their effectiveness. Personal considerations introduced by the offender during trial or sentencing (e.g., financial circumstances, lack of vehicle ownership) may sway judicial opinion as to the appropriateness of ordering the offender to have an interlock installed.

Even among those ordered to participate in an interlock program, many fail to do so. Technically, those who violate a court order are subject to further sanctions. However, this requires communication among the interlock service provider, the probation department, and the courts. In the absence of an explicit reporting process, information transfer among these agencies may be inefficient and incomplete, allowing offenders to slip through the cracks.

Low participation rates also plague voluntary interlock programs. In these programs, offenders are generally offered a reduction in the length of their hard licence suspension in exchange for participation in an interlock program. Typically, less than 10% of DWI offenders elect the interlock option. This suggests that the benefits associated with the ability to drive legally sooner may not be sufficient to motivate interlock participation when weighed against the inconvenience of having to provide a breath sample to start the vehicle, the cost of the program, and the cost of insurance premiums following a DWI conviction.

Having a valid driver's licence may not be viewed by offenders as a sufficient incentive to participate in a interlock program. If the offender has already served a lengthy period of hard suspension and has experienced the ease, convenience and low risk of detection for driving while suspended, the "benefits" of participating in an interlock program may pale in comparison. In fact, licence reinstatement does not appear to be a priority among offenders. For example, a study in California reported that only 16.4% of

repeat DWI offenders applied for licence reinstatement within three years of having become eligible (Tashima and Helander, 1999).

In light of the demonstrated effectiveness of interlock programs, it is in society's best interests to find ways to encourage higher participation rates in these programs. Greater incentives for voluntary participation need to be explored.

3.3 Judicial or administrative authority

An issue that has arisen in the course of comparisons among various interlock programs concerns whether it is more appropriate and/or beneficial to have control over participation in interlock programs rest in the hands of judges and the courts or with driver licensing authorities.

In some jurisdictions, interlocks are ordered by the sentencing judge as a condition of probation. As noted previously, the primary liability of this approach is that many judges appear reluctant to impose interlocks and do so infrequently. In addition, a number of offenders never comply with the court order. The advantage of the judicial approach is that the courts have the authority to impose alternative or additional sanctions for non-compliance or misconduct. This, however, requires an efficient and effective reporting system between the program providers, probation officers and the courts.

Other jurisdictions place interlock programs under the authority of the driver licensing administration. Participation can be either voluntary, in exchange for a reduction in the terms of hard suspension, or mandatory, as a condition of licence reinstatement. Driver licensing agencies generally have existing systems for monitoring drivers and are in a better position than the courts to supervise participants and to issue swift and direct action against those who violate program requirements. Licensing authorities, however, have considerably less scope than the courts in terms of the types of additional sanctions for non-compliance or misconduct.

3.4 Duration of program participation

The duration of an interlock program varies considerably among jurisdictions. It can vary from three months to a year or more. In Sweden, the interlock program runs for two years. Some programs include an option for the term to be extended for repeated high BACs or violations (e.g., attempted circumvention). In consideration of the research evidence demonstrating that interlocks reduce DWI recidivism so long as they are installed in the vehicles of offenders, it would seem reasonable to suggest that the longer the interlock is in the vehicle the longer the beneficial effect would last.

Research and experience suggest that the ideal duration of participation in an interlock program may vary by the characteristics and performance of the individual. Marques et al. (2000) have demonstrated that a high rate of BAC fail readings from the interlock data recorder are predictive of the likelihood of recidivism. This suggests that the duration of the interlock period should be variable. For example, interlock participants who have repeated positive BACs when attempting to start the vehicle should be kept on the program longer, until such time as they demonstrate a consistently clean record (i.e., no interlock warns or fails). Those who have few, if any, fails during the first few months of their participation should be considered for release from the program as early as possible (i.e., after a minimum period of participation). Essentially, participants would have to demonstrate that they no longer need the interlock before having it removed. In addition to a solid record with no fails, completion of the program may also involve providing evidence of successful rehabilitation.

As an alternative to abrupt, complete removal from the interlock program, a system of gradual removal (graduated re-licensing) might be considered as a means to systematically wean participants from the control of the interlock device and reintroduce them to full, unrestricted driving privileges. This could involve de-activating the interlock and the requirement to provide a breath sample during specified low risk times (e.g., day time, weekdays), requiring breath tests at random intervals, and/or reducing the frequency of running retests. Participants would be restricted to a zero BAC limit (or a limit equivalent to the interlock threshold) at times when the interlock is not operational. This type of system requires participants to earn full reinstatement while ensuring that participants with the highest risk of committing a subsequent DWI offence remain on the interlock program until such time as they have demonstrated their ability to refrain from drinking and driving.

3.5. Eligibility

At present, interlock programs are almost exclusively restricted to persons who have been convicted of a DWI offence. Some programs include only repeat offenders; others allow first-time offenders to participate as well. Evaluation studies have demonstrated similar beneficial effects for both groups (see Table 1).

In North America, hard licence suspension has become a well-entrenched, stable element of sanctions for DWI offences. Interlock programs often require potential participants to complete a minimum period of hard suspension prior to being accepted into the program. Any offences committed during the period of hard suspension can render the offender ineligible for the interlock program. In the Alberta program, Voas et al. (1999) determined that these "ineligible" offenders had the highest re-offence rate during the period of time that the interlock would have been installed in their vehicles had they been accepted into the program. These high-risk offenders are most in need of the control provided by the interlock program to prevent repeated DWI occurrences, yet they are the very ones systematically excluded from participation.

In Sweden, hard licence suspension for DWI offenders is not as ingrained in the sanctioning system as it is in North America. Interlock programs are available as an alternative to full licence suspension and offenders can apply to participate in the program and have the interlock installed as soon as possible. Participants must undergo periodic medical assessment – including blood tests for biological markers of alcohol abuse – and provide proof of a sober lifestyle after one year. The interlock then remains in the vehicle for an additional year.

The evidence to date suggests that the sooner the offender enters the interlocks program the better. The highest risk offenders are more likely to drive and to drive after drinking during the period of hard suspension. This behaviour may render them ineligible for participation in the interlock program. Having the interlock installed as soon as possible after conviction would help prevent subsequent offences that might otherwise occur during the period of hard suspension.

3.6 Traffic safety benefits

Existing evaluation studies have used recidivism as the primary dependent measure to assess the efficacy of interlock programs. Although this is the measure most closely related to the stated purpose of interlocks – i.e., to prevent participants from driving after drinking – there are other measures that could be used to assess the overall safety benefits of interlocks.

For example, there remain concerns about overall crash rates among participants. In general, suspended drivers have extremely low crash rates compared to non-suspended drivers, particularly those with a prior DWI conviction. By allowing DWI offenders to drive (with an interlock), their exposure increases and there is concern that their crash rates would resemble those of reinstated DWI offenders. Should this be the case, the increased crash rates among interlock participants would discount the benefits of reduced DWI recidivism.

Preliminary data from the Quebec interlock program provide encouraging evidence to suggest that the crash rates of interlock participants are actually lower during the interlock period than before (Dussault and Gendreau, 2000). This effect is also maintained in the six-month period immediately following the removal of the interlock. Even though interlock participants are driving, they appear to be driving more safely and/or less often and without the impairing effects of alcohol. Further research is necessary to validate what appears to be a general traffic safety benefit associated with participation in an interlock program.

3.7 Cost

Virtually all interlock programs operate on a user-pay basis. Participants are responsible for the cost of installation (approximately $75 US) and a monthly program or service fee (approximately $65 US). This not only avoids government having to find considerable resources to fund the program, it provides participants with a constant reminder of the seriousness of their past behaviour as well as motivation to do well in the program.

In addition to the cost of participation in the interlock program, DWI offenders are often faced with having to pay fines, rehabilitation program fees, licence reinstatement fees, and insurance surcharges. These costs can be considerably more than the interlock program fees. As a means to encourage and facilitate participation in interlock programs, some judges will reduce or even waive fines for offenders. It is not an uncommon practice for rehabilitation programs to have a sliding scale fee structure based on the ability to pay. There are also a few insurance companies that recognize the value of interlock programs in preventing repeat occurrences of impaired driving and reduce or waive the usual surcharge for convicted DWI offenders who participate in an interlock program. More widespread use of these types of financial incentives could serve to enhance program participation.

Interlock programs should be available to all DWI offenders. Financial consideration should not necessarily exclude offenders with limited resources. Universal access to programs may require government, interlock providers, and insurance companies to work together to create a system to subsidize the cost of interlock programs for those who can demonstrate true financial need.

3.8 Conclusions

Although a great deal has been learned about interlock programs, some questions linger and new issues emerge concerning the operation and effectiveness of such programs. Some of these issues (e.g., eligibility, program duration, traffic safety benefits) can be addressed through research. Other issues (e.g., program authority)

can be more appropriately addressed through a review of experiences with various types of interlock programs. The lack of definitive answers to these questions should not, however, delay the implementation of new programs or expansion of existing programs. In most cases, sufficient evidence is available to guide the decision-making necessary to create an efficient and effective interlock program. The following section provides advice concerning the best practices for interlock programs.

4.0 Best Practices for Interlock Programs

As an increasing number of jurisdictions in Canada, the United States and other countries around the world move towards the implementation of interlock programs, they will undoubtedly rely heavily on the experience of existing programs to provide guidance. Comparative studies of interlock programs have not been conducted, so it is not possible to state definitively which types of programs or which features of programs produce the best results. Nevertheless, a review of the literature on interlock programs combined with discussions with program administrators, manufacturers, researchers and other experts provide valuable insights that can be used to help develop a set of "best practices" for interlock programs.

The Montreal symposium provided an opportunity for interlock experts to share their experiences and perspectives on the key elements of interlock programs. This section identifies those features deemed desirable in an interlock program and provides a set of recommended best practices for the implementation of an effective and efficient interlock program.

4.1 Perspective

A critical starting point for everyone involved in an interlock program, from legislators through to interlock participants and their families, is a clear understanding of what an interlock program is, as well as the purpose and objectives of the program. In this context, it is essential to recognize that an interlock program is more than simply having a device installed in a vehicle. It consists of a comprehensive and coordinated set of activities designed to ensure that convicted offenders do not drive after drinking while they progress along a path towards full, unrestricted driving privileges.

The interlock device itself is at the core of the program. Its purpose is to place a physical barrier between the drinker and the operation of the vehicle. However, the

support services surrounding the interlock device are critical to the success of the program. These support services include:

- the installation of the device;
- monitoring of participants;
- training of participants (and family members) in its use;
- communication among the service provider, rehabilitation services, probation officers, courts and/or motor vehicle administrators; and,
- continuing education and rehabilitation programs for participants. Interlock programs involve considerably more than simply placing the interlock device in the offender's vehicle.

The primary objective of the program is to allow participants mobility while providing the public assurance that participants will not drive under the influence of alcohol. Secondary objectives include monitoring of participants, education, and rehabilitation.

A comprehensive interlock program should emphasize the beneficial, rehabilitative aspects of the program over its punitive and deterrent aspects. Although it may be difficult for participants not to view the program as punitive, every effort should be made to help participants understand the goal of the program is to prevent subsequent drinking-driving problems and have them become fully reinstated licensed drivers with little risk of recidivism.

It is recommended that interlock programs be viewed as part of a comprehensive system for dealing with DWI offenders. Every effort should be made to ensure that participation in the interlock program be coordinated with other sanctions and rehabilitation programs to maximize beneficial effects.

4.2 Legislation

It is recommended that interlock programs be supported by strong, clear legislation that has the following characteristics:

- it specifies the administrative authority for the program and the eligibility criteria for participation;
- it must include supplementary provisions that prohibit: a driver from asking someone else to provide a breath sample; someone other than the driver providing a breath sample in an attempt to start the vehicle; and, renting or loaning a vehicle not equipped with an interlock device to an interlock-restricted driver;
- it must ensure that the interlock restriction is clearly marked on the driver's licence of all program participants; and
- it must specify the authority responsible for dealing with program violations and the sanctions for violations.

4.3 Equipment

The interlock device is at the centre of any interlock program. Therefore, it is essential that the device(s) selected for use in a program meet or exceed specifications and be certified by a reputable private or government laboratory.

The specifications may vary somewhat among jurisdictions. The NHTSA or Alberta specifications provide good examples of comprehensive specifications for interlock devices (Electronics Test Centre, 1992; NHTSA, 1992) that have been adopted in a number of jurisdictions.

It is recommended that specifications for interlock devices:

- include criteria for breath test accuracy, reliability and calibration stability under a variety of environmental conditions. They must also include protection from circumvention and tampering;

- require a data recorder to log all activities concerning the starting of the vehicle, particularly the BAC of the breath sample. These data are critical for monitoring the progress of participants over the course of the program, providing objective evidence of program violations that must be reported to authorities, and predicting future success after program completion;
- require the threshold BAC to lock the ignition or prevent vehicle operation be set sufficiently low to discourage driving after consuming any alcohol but high enough to prevent lockouts from most extraneous sources of alcohol; and
- require that the device be specific to alcohol. This prevents lockouts due to other volatile substances and assures program monitors and administrators that positive readings are the result of the consumption of alcohol.

4.4 Service provider

A related aspect of the interlock equipment selected for use is the selection of a reputable and committed service provider. It must be recognized that a service provider does more than simply install interlock devices in the participants' vehicles. The service provider:

- must be knowledgeable, competent and reliable;
- must maintain quality control, be able to provide service and support when required, and resolve problems efficiently and effectively;
- must have an appreciation for, and understanding of, their clientele and their needs; and,
- must be sensitive to the concerns of this population and be able to deal with difficult clients. This requires dedication and commitment.

The service provider is also the liaison between the participant and the program administrative authority – i.e., the courts, probation, or the motor vehicle department – providing information as required. The dedicated service provider values the relationship and trust established with clients and administrative authorities.

It is recommended that a consideration in the selection of a service provider be the extent to which the firm understands the clientele and is prepared to provide a level of service commensurate with the needs of this population.

4.5 Eligibility for program participation

Current use of interlocks is almost exclusively restricted to persons who have been convicted of an impaired driving offence. The primary objective of this approach is incapacitation – i.e., to prevent offenders from repeating the offence by placing a barrier between the drinker and the operation of the vehicle. For offenders, the cost and inconvenience is often viewed as a trade-off for the privilege of driving. In general, the public has little concern about the cost and inconvenience of the interlock for these individuals whose previous behaviour has placed the public at risk. It is the price offenders must pay for the privilege of driving.

Some interlock programs restrict participation to repeat DWI offenders; others allow first-time offenders to participate as well. Research has demonstrated comparable beneficial effects for both groups. Hence, there would not appear to be a reason to exclude either group from participating in an interlock program.

Voas et al. (1999) identified a group of DWI offenders in Alberta who were deemed ineligible for the interlock program as a result of a subsequent offence prior to the end of the mandatory hard suspension period. During the period the interlock would have been in place had they been eligible to participate, the reoffence rate of this group was considerably higher than that of any other group. These high risk offenders present a particularly difficult problem.

One approach is to impound the vehicles of these high-risk offenders immediately upon the occurrence of a subsequent offence. Alternatively, these offenders might be placed in the interlock program. The interlock could be installed in their vehicle even if they are not legally entitled to drive. This would allow family members to drive and provide some protection to the public that should the offender drive while suspended, it would not be under the influence of alcohol.

It is recommended that every effort be made to include as many DWI offenders as possible in the interlock program. Exclusions should be reserved for those rare cases in which the operation of a motor vehicle is not recommended under any circumstances.

4.6 Voluntary versus mandatory participation

There are mixed opinions as to whether participation in interlock programs should be mandatory for all DWI offenders, mandatory only for those deemed to be at high risk, or voluntary, left to the discretion of the individual offender. Many existing interlock programs are voluntary. In such programs, DWI offenders are typically offered a reduction in the length of their hard suspension in exchange for participating in the interlock program. In light of the typically low participation rates, it would appear that the incentive to participate – i.e., the privilege of driving legally – does not appear to outweigh the perceived disadvantages of participating in the interlock program – e.g., cost, inconvenience, embarrassment. In fact, Voas et al. (1999) have suggested that licence reinstatement is not a primary motivator for many DWI offenders, many of whom fail to apply for reinstatement when eligible. Driving while suspended may be perceived as a low risk, low cost alternative.

Mandatory interlock programs typically have higher participation rates. For example, in Hancock County, Indiana, where DWI offenders are required to participate in the interlock program or face incarceration or electronically monitored house arrest, over 60% of offenders enter the interlock program. Other programs are considered mandatory but participation remains at the discretion of the court. Some judges may routinely order offenders to participate in an interlock program; others rarely do so. Even when ordered to participate, some offenders manage to avoid it.

Beyond participation rates, a key issue in deciding between a mandatory or voluntary interlock program concerns effectiveness. Both types of programs appear to have beneficial effects on recidivism. A preliminary examination of recidivism among voluntary and mandatory interlock program participants in Alberta found no significant difference between the two types of clients (Beirness et al., 2000). However, data over a longer follow-up period on the same interlock participants presented at the Montreal

workshop by Bob Voas indicated that voluntary participants had somewhat lower recidivism rates over time.

It is recommended that interlock programs attempt to combine the best features of voluntary and mandatory programs into a single system that works best for everyone.

For example, participation in an interlock program may be compulsory for all DWI offenders as a condition of reinstatement following a period of hard suspension. This maximizes the number of offenders exposed to the interlock program and provides the greatest degree of protection to the public against repeat offences. However, low risk offenders may be allowed to enter the program early, immediately following conviction or after completing a portion of their hard suspension. This provides an incentive to participate and to participate as soon as possible after their DWI conviction. This approach facilitates early entry into the program and maximizes the opportunity for rehabilitation at the earliest possible time.

Consideration needs also be given to the duration of hard suspension that DWI offenders must serve prior to becoming eligible for the interlock program. The perceived punitive value of longer suspensions must be balanced against the risk of driving while suspended and the benefits of earlier participation in an interlock program.

4.7 Program authority

In many jurisdictions, participation in an interlock program is determined by a judge who issues an order for a DWI offender to participate as a condition of probation. An advantage of this approach is that the courts have the power to impose additional or alternative sanctions for failure to comply. The primary disadvantage is that not all judges are convinced of the benefits of interlock programs and many fail to order interlocks even when the law makes it mandatory (Tashima & Helander, 1999). The judicial approach also requires multiple lines of communication between the interlock service provider, the probation department, the motor vehicle department and the courts.

In other jurisdictions, the authority for interlock programs resides within the driver licensing administration. The licensing administration has generally been designed to deal with drivers and their problems. It has a large network of officers, staff, and service facilities to deal with large volumes of drivers. Because drivers participating in interlock programs are typically issued a conditional or restricted driver's licence, the licensing authorities generally have the authority to revoke the licence for program violations or non-compliance with program requirements. In this type of program, the licensing authorities and the service provider are the only agencies involved, eliminating the need for multiple lines of communication among a multitude of agencies. This also allows for closer supervision and direct monitoring of participants.

It is recommended that wherever possible, interlock programs should be administered by the driver licensing authorities. Whether the program is mandatory or voluntary, the driver licensing department can be most readily adapted to administer the program efficiently. Administrative authority does not preclude a judge from ordering a DWI offender to participate in the interlock program and having that person supervised by probation services. This option can be made available to judges for cases they deem to require a high level of supervision.

4.8 Monitoring

A key component of interlock programs involves periodic monitoring of participants. Monitoring serves several functions. On the practical side, periodic reporting ensures that the interlock device receives regular maintenance and calibration. Monitoring also provides an opportunity to review participants' use of the device through the data downloaded from the internal recorder. This allows program monitors to review progress, to address questions and concerns, and to correct any difficulties/problems. Program violations or an excessive number of high BACs noted on the data record must be reported to the appropriate authority. From the perspective of program participants, regular reporting serves notice that their driving is being continuously monitored, providing motivation to fulfill program obligations and expectations.

Regular monitoring also allows program staff to talk with participants about their experiences in the program and any problems and difficulties they may be having within

and/or outside of the programs. These discussions, possibly supplemented with objective assessments, provide the opportunity to learn more about individual participants. This information can be used to help determine participants' risk of recidivism and the extent to which they might benefit from additional counseling, rehabilitation, or treatment. Program monitors can then coach, counsel, encourage and facilitate entry into the appropriate program.

It is recommended that contact with participants should occur at least monthly, with more frequent contact in the early stages of the program. Interactions with participants can be scheduled to coincide with the regular service/maintenance of the interlock device.

4.9 Program duration

Most existing interlock programs specify a fixed period of time for participation. Some allow the program to be extended for violations. Generally, completion of the program is determined by the passage of a set amount of time.

In light of the research evidence showing that recidivism rates increase once the interlock device is removed, it has been suggested that the duration of the interlock program be made considerably longer. There is, however, no guarantee that a longer interlock period would prevent recidivism following program completion, or merely delay it.

An alternative approach is to link program completion with objective indicators of success within the program. Recent evidence indicates that participants with a record of repeated interlock fails (i.e., high BACs) are at higher risk of recidivism than those with few or no fails. Participants with frequent fails should remain on the interlock program until they have demonstrated a "clean" record for a specified period of time. Lower risk participants could be allowed to exit the program after a minimum period of participation (not less than six months).

The observed increase in recidivism following program completion may also be related to the complete, abrupt removal of participants from the control over drinking-driving provided by the interlock device. In this context, it might be beneficial to implement a

system of graduated re-licensing whereby interlock participants are systematically moved through a series of progressively less restrictive steps in the process of regaining a full unrestricted driver's licence. This might involve: reducing the number and frequency of rolling re-tests; only requiring breath tests at high-risk times of day or days of the week; or, requiring breath tests on a random schedule. The final stage might involve removing the interlock device but restricting the driver to a zero BAC. Successful completion of these less restrictive phases would lead to full unrestricted driving privileges.

The rationale for the process is to gradually reduce the offender's reliance on the interlock to prevent driving after drinking while reintroducing the driver to unrestricted driving privileges. The goal is to reduce the likelihood of recidivism associated with the abrupt withdrawal from the control provided by the interlock device.

It is recommended that the duration of the interlock be dependent upon the success of the individual in the program. Objective measures of performance in the program might include: the number of breath tests resulting in an interlock "warn" and "fail" reading; completion of a rehabilitation program; no DWI or other serious driving offences during the interlock period; and medical certification of successful treatment for alcohol abuse/treatment. Consideration should also be given to the gradual removal of the interlock restriction.

4.10 Integration of programs

Interlock programs should not be viewed as independent and separate from the other sanctions and programs typically associated with a DWI conviction. Every effort should be made to integrate the interlock program with other complementary programs so as to maximize efficiency and effectiveness. For example, in those jurisdictions that provide "hardship" licences or "work" permits, participation in an interlock program could be a condition for obtaining such a licence. Texas currently requires interlock program participation as a condition of an occupational licence.

More importantly, there is a growing trend towards rehabilitation of the DWI offender. Successful rehabilitation of alcohol problems requires time and may be interspersed by

one or more relapse. A relapse to drinking can have devastating consequences, particularly if the individual happens to drive. Integrating rehabilitation and interlock programs not only provides the individual with a means of transportation to attend rehabilitation, it can prevent tragic consequences while the individual tackles his or her problems with alcohol.

It is recommended that every effort be made to integrate the interlock program with other sanctions and programs associated with a DWI conviction.

4.11 Summary

On the basis of the research literature on interlock programs and the collected wisdom, expertise and experience of program administrators, service providers, and interlock manufacturers, the following "best practices" for interlock programs are recommended:

- interlock programs must be viewed as a coordinated set of activities to prevent impaired driving among participants and not just as a device installed in a vehicle;
- the program needs to be supported by strong, clear legislation;
- the selected interlock device must be alcohol-specific and meets or exceeds established performance standards;
- the program must be offered by a dedicated and committed interlock service provider;
- the program should set participation criteria that include as many DWI offenders as possible;
- participation in the program by all eligible offenders should be mandatory, with provisions that allow early voluntary entry into the program;
- administrative authority for the program should reside with the agency responsible for driver licensing and control;
- participants should be monitored regularly, including a review of data from the interlock data recorder;
- the length of the program should be linked to participants' success in it; and,

- the program should be integrated with other DWI countermeasure programs and sanctions, particularly rehabilitation.

It is recognized that it may not be feasible to incorporate all of these features into the interlock program in some jurisdictions but efforts should be made to include as many as possible.

5.0 Future of Interlocks

The recent legislation in Canada and the United States will undoubtedly prompt the introduction of new interlock programs as well as the expansion and improvement of existing ones. The information contained in the preceding sections of this document will be of assistance in the development and evolution of interlock programs.

In reviewing what is known about interlock programs, it is evident that they have progressed substantially since the mid-1980s when programs were first implemented. The technology has undergone considerable advancements. In addition, our understanding of how programs operate and what offenders require in order for the programs to be successful has improved considerably. But there remains considerable potential for interlock programs to become more effective in preventing impaired driving. This section examines what the future may hold for interlock programs.

5.1 Interlocks in all vehicles

Many have questioned the selective use of interlocks for convicted DWI offenders. As a universal preventive measure, interlocks would virtually eliminate the alcohol crash problem if they were installed in every vehicle. No one would be able to operate a vehicle if they had a BAC in excess of the pre-set threshold.

Objections to the installation of an interlock in every vehicle are raised by the 75-80% of the population who either do not drink or claim to never drive after drinking. Drivers at low risk neither need, nor want, the expense and inconvenience associated with an interlock. It is possible that with time, interlocks could become an accepted part of operating a motor vehicle as much as buckling a seat belt has. More likely, the inconvenience of having to provide a breath sample every time the vehicle is started and periodically while driving may limit widespread acceptance.
As a means to limit the inconvenience, it may be possible to develop an in-vehicle passive alcohol sensor that is able to detect alcohol in the immediate vicinity of the

driver. The driver would only be required to provide a breath sample if the passive system detected the presence of alcohol. The breath sample would then be used to determine if the driver was fit to drive. This type of system would limit the inconvenience and might be more acceptable to the general population of drivers.

5.2 Universal vehicle interlock modules

The initial cost of installing the interlock device is sometimes perceived as a deterrent to offenders entering the interlock program. Part of the cost of installation is the time required to tap into the electronic circuits of the vehicle. This is complicated by the multitude of vehicle makes and models available on the market. The task could be simplified by having motor vehicle manufacturers install a universal module in all vehicles at the time of manufacture that would allow the interlock device to be "plugged-in" when necessary. The cost of the module would be negligible in relation to the overall price of a vehicle. Such a module would also facilitate voluntary installation of interlocks (e.g., parents wishing to have one for their teenage children who drive).

5.3 Commercial use of interlocks

Although widespread acceptance of interlocks in all vehicles may be several years away, their use by commercial vehicle operators may be considerably closer. The public has an expectation that the operators of commercial vehicles will not drive under the influence of alcohol. Employers may already demand that their employees not drive after drinking. In the United States, commercial operators are subject to a .04% alcohol limit and Quebec has recently introduced legislation to restrict commercial operators to a BAC limit of zero.

Interlock devices installed in commercial vehicles provide a means to enforce low BAC limits. The data recorder also provides employers with a means to monitor their employees. In addition, by installing interlocks in all their vehicles, businesses demonstrate their commitment to safety, ensuring the public that their employees do not drive after drinking.

A pilot project involving the installation of interlocks in commercial vehicles is currently underway in Sweden. The project is an answer to consumers' demands for sober commercial traffic and is supported by different parties such as the Swedish Road Administration, the Swedish Road Haulage Association, and the Swedish Transport Workers' Union. Several businesses have volunteered to equip their vehicles with interlock devices. Authorities are currently targeting taxis, buses, school buses, vehicles used for driver training, and recently trains for participation in this program. Public interest is strong and the project will be discussed in a high level meeting in the European Union this spring. The results of this study may facilitate expansion of the concept.

5.4 Driver identification

In most interlock programs, family members of the participant must also be trained to use the interlock. In many programs, the device does not distinguish between users and the participant is deemed responsible for all positive breath test results even if other people have occasion to operate the vehicle. Breath pulse codes have been used to help identify the driver but such codes can be copied by others and, therefore, do not provide definitive proof of the identity of the driver.

Should it become necessary to identify the driver with absolute certainty, it may be possible to incorporate a personal recognition system (e.g., using fingerprints, pupil scans or digital photography) into the system. The added expense of such a system would have to be weighed against the extent to which concerns about driver identity are compromising the efficacy of the program.

5.5 Electronic driver's licence

With the anti-circumvention features built into the present generation of interlock devices, the most likely way for a program participant to drive after drinking is to operate a vehicle not equipped with an interlock device. Although it is illegal for the participant to drive such a vehicle and for someone to knowingly rent or loan such a vehicle to an interlock program participant, it can happen.

The electronic driver's licence might fill this gap (Goldberg, 1995). This licence is electronically coded with critical information about the driver, including the restriction to interlock-equipped vehicles. Prior to starting the vehicle, the licence must be inserted into a card reader in the dashboard. The reader determines the eligibility of the driver to operate the vehicle. If the vehicle does not have an interlock, the vehicle will not start. Such a system would require the entire vehicle fleet to be equipped with readers. Should this occur, the system may provide an additional barrier to help prevent interlock participants from operating other vehicles.

5.6 Tailored programs

Current interlock programs are generally the same for all participants. Driving is restricted to those occasions when their BAC is below the preset threshold value and the duration of the program is generally pre-determined at a fixed number of months.

It may be possible and desirable, however, to tailor the interlock program to match the characteristics of the participant. For example, high risk offenders might initially be restricted to driving on certain days or at certain times. The interlock device could be programmed to allow the operation of the vehicle (provided the BAC criterion is met) at certain times and to disable the vehicle at other times. As the participant demonstrates success, the restrictions can be gradually relaxed to allow driving at other times/days. As the offender continues to demonstrate success in the program, the interlock restrictions can be systematically eased as part of a process of graduated re-licensing as described in section 4.9.

This type of system would provide for greater flexibility in interlock programs, creating programs tailored to the specific circumstances of participants.

5.7 Pre-conviction program participation

At present, the use of interlock programs is typically restricted to persons convicted of a DWI offence. Even then, there is often a period of hard licence suspension that must be served before an offender is eligible for the interlock program. The period of time between the DWI offence and entry into the interlock program can be two years or

longer. During this time, the offender may engage in drinking-driving behaviour on numerous occasions.

In an attempt to restrict the driving of DWI offenders between the occurrence of the offence and their appearance in court, administrative licence suspension (ALS) was introduced. ALS is an administrative procedure whereby the licence of a driver who has a BAC over the limit or who refuses to provide a breath sample is suspended immediately for a period of (usually) 90 days. Some jurisdictions provide the opportunity for those subjected to ALS to apply for a restricted driving permit that allows them to drive for such things as work, school, medical appointments. It would seem reasonable that as a condition of receiving such a permit, offenders agree to participate in an ignition interlock program until such time as the case is resolved by the courts. At that point, continuation in the program would be the decision of the judge or licensing authority. This targets the behaviour that precipitated ALS and serves to get the individual into the interlock program at the earliest possible time following the offence.

A comparable approach is already used in Texas. DWI offenders can be ordered to have an interlock installed as a condition of bond. This approach also serves to get DWI offenders into a interlock program at the earliest opportunity. No evaluation of this program has been conducted.

5.8 Conclusions

There remains considerable potential for expanding and enhancing interlock programs. Technological innovations will undoubtedly assist in the continual improvement of programs. The greatest opportunities, however, may lie in the application of interlock programs in novel ways and in non-traditional areas.

6.0 References and Bibliography

Bailey, J.P.M. and Winkel, L.E. (1981). *Recidivist Drinking Drivers*. Report No. CD 2316, Chemistry Division, Department of Scientific and Industrial Research, New Zealand.

Baker, E.A. (1987). *In-Car Alcohol Breath Analyzers - A Pilot Study*. College Park, Maryland: Safety Education Centre, University of Maryland.

Bard, A.E., Mozham, A. and Ryon, P.A. (1990). *Summary of Research Finding to Date Involving Guardian Interlock System (GIS) Participants*. Detroit, MI: State of Michigan.

Beirness, D.J. (1996). *Alcohol Ignition Interlocks: A Link Between Punishing and Helping Systems*. Paper presented at the Transportation Research Board Human Factors Workshop on new strategies for dealing with the persistent drinking driver. Washington: January, 1996.

Beirness, D.J., Marques, P.M., Voas, R.B. and Tippetts, A.S. (2000) The impact of mandated versus voluntary participation in the Alberta ignition interlock program. In: *Proceedings of the Fifteenth International Conference on Alcohol, Drugs, and Traffic Safety* (CD Paper 902), Stockholm, May, 2000.

Bodi, A., O'Connor, R.E., and King, M.J. (1985). Evaluation of a drunk driving warning system. In: S. Kaye and G.W. Meier (Eds). *Alcohol, Drugs and Traffic Safety. Proceedings of the Ninth International Conference on Alcohol, Drugs, and Traffic Safety*. San Juan, Puerto Rico, 1983. Washington: National Highway Traffic Safety Administration.

Cobden, J.H. and Larkin, G.L. (1999) Effectiveness of ignition interlock devices in reducing drunk driving recidivism. *American Journal of Preventive Medicine* 16: 81-87.

Collier, D.W. (1990). Field test experience with breath analyzed ignition interlocks - How well do they work? Paper presented at the Lifesavers conference, April, 1990.

Compton, R.P. (1988). Potential for Application of Ignition Interlock Devices to Prohibit Operation of Motor Vehicles By Intoxicated Individuals. Washington, D.C.: National Highway Traffic Safety Administration.

Dubowski, K.M. (1991). *The Technology of Breath-Alcohol Analysis*. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism.

Dussault, C. and Gendreau, M. (2000) Alcohol ignition interlock: One-year's experience in Quebec. *Proceedings of the Fifteenth International Conference on Alcohol, Drugs, and Traffic Safety* (CD Paper 905), Stockholm, May, 2000.

Electronics Test Centre (1992). *Qualification Test Specification for Breath Alcohol Ignition Interlock Devices (BAIID) for use in the Province of Alberta*. Edmonton: Alberta Research Council.

Elliott, D.E. (1987). *The Hamilton County-Guardian Interlock Evaluation Study.* Washington: National Highway Traffic Safety Administration.

EMT Group (1990). *Evaluation of the California Ignition Interlock Pilot Program for DUI Offenders. Final Report*. Sacramento, CA: EMT Group.

Foley, J.P. and Fricker, J.D. (1987). Penalizing recidivist drunk drivers in Indiana: Impediments to implementation. *Accident Analysis and Prevention* 19: 479-486.

Frank, J.F. (1988). *Further Laboratory Testing of In-Vehicle Alcohol Test Devices.* Report No. DOT HS 807 333. Washington, DC: National Highway Traffic Safety Administration.

Gjerde, H., Bjorneboe, A., Bjorneboe, G.E.A.A., Bugge, A., Drevon, C.A. and Morland, J. (1988). A three-year prospective study of rearrests for driving under influence of alcohol or drugs. *Accident Analysis and Prevention* 20: 53-57.

Goldberg, F. (1995) Electronic driving licences: Key to a new traffic safety system. In: C.N. Kloeden and A.J. McLean (Eds.). *Alcohol, Drugs and Traffic Safety. Proceedings of the 13th International Conference*, pp 683-687. Adelaide, Australia: NHMRC Road Accident Research Unit.

Grant, B.A. and Buck, L. (1986). Development of the Tracometer as an In-Vehicle Impairment Warning Device. Paper presented at the Impairment Warning Devices Workshop, Washington, 1986.

Hagen, R.E. (1978). The efficacy of licensing controls as a countermeasure for multiple DUI offenders. *Journal of Safety Research* 10: 115-122.

Hagen, R.E., Williams, R.L. and McConnell, E.J. (1979). The traffic safety impact of alcohol abuse treatment as an alternative to mandated licensing controls. *Accident Analysis and Prevention* 11: 275-292.

Hagen, R.E., McConnell, E.J., and Williams, R.L. (1980). *Suspension and Revocation Effects on the DUI Offender*. Sacramento: California Department of Motor Vehicles.

Haight, F.A. (1983). Impediments to effective drinking-driving countermeasures with a proposal for a driver's license interlock. In: S. Kaye and G.W. Meier (Eds). *Alcohol, Drugs and Traffic Safety. Proceedings of the Ninth International Conference on Alcohol, Drugs, and Traffic Safety*. San Juan, Puerto Rico, 1983. Washington: National Highway Traffic Safety Administration.

Harmony Institute (1990). Survey of attorneys representing drunk drivers. *Harmony Institute Newsletter* 1 (1) 1-2.

Homel, R. 1988. *Policing and Punishing the Drinking Driver: A Study of General and Specific Deterrence*. New York: Springer Verlag.

Jones, B. (1993). The effectiveness of Oregon's ignition interlock program. In: H.D. Utzelmann, G. Berghaus and G. Kroj (Eds.) *Alcohol, Drugs and Traffic Safety - T92.*

Proceedings of the 12th International Conference on Alcohol, Drugs and Traffic Safety. Cologne: Verlag TUV Rhineland.

Jones, B. and Wood, N. (1989). *Traffic Safety Impact of the 1988 Ignition Interlock Pilot Program*. Oregon Motor Vehicles Division.

Landrum, J.W. and Windham, G.O. (1981). A comparison of DWI repeaters and non-repeaters who attend a level I rehabilitation program. *Journal of Alcohol and Drug Education* 26: 11-23.

Lindbohm, R., Kataja, M., Maki, M. Penttila, A. and Pikkarainen, J. (1980). Drunken driving in Finland. I. The profile of all arrested drunken drivers in 1977-1978. In: L. Goldberg (Ed.). *Alcohol, Drugs, and Traffic Safety. Proceedings of the Eighth International Conference of Alcohol, Drugs and Traffic Safety*. pp 218-238. Stockholm: Almqvist and Wiksell.

Linnell, R.H. and Mook, S. (1991). *Ignition Interlock Devices: An Assessment of their Application to Reduce DUI*. Washington, DC: AAA Foundation for Traffic Safety.

Mann, R.E., Leigh, G., Vingilis, E.R. and de Genova, K. 1983. A critical review on the effectiveness of drinking-driving rehabilitation programs. *Accident Analysis and Prevention* 17: 239-250.

Mann, R.E., Vingilis, E.R., Anglin, L., Suurvali, H., Poudrier, L.M. and Vaga, K. (1987). Long-term follow-up of convicted drinking drivers. In: P.C.Noordzij and R. Roszbach (Eds.). *Alcohol, Drugs, and Traffic Safety. Proceedings of the 11th Conference on Alcohol, Drugs, and Traffic Safety*. Amsterdam 1986. Amsterdam: Elsevier.

Marques, P.R. and Voas, R.B. (1993). Setting performance priorities for breath alcohol ignition interlock devices. *Journal of Traffic Medicine* 21: 127-132.

Marques, P.R., Voas, R.B., and Taylor, E. (1995). Health and social service coordination adjuncts to the Alberta alcohol ignition interlock program: Research in progress. In: C.N. Kloeden and A.J. McLean (Eds.). *Alcohol, Drugs and Traffic Safety. Proceedings of the 13th International Conference*. Adelaide, Australia: NHMRC Road Accident Research Unit.

Marques, P.R., Voas, R.B., Tippetts, A.S. and Beirness, D.J. (1999) Behavioral monitoring of DUI offenders with the Alcohol Ignition Interlock Recorder. *Addiction 94*: 1861-1870.

Marques, P.R., Voas, R.B., Tippetts, A.S. and Beirness, D.J. (2000) Predictors of failed interlock BAC tests and using failed BAC tests to predict post-interlock repeat DUIs. In: *Proceedings of the Fifteenth International Conference on Alcohol, Drugs, and Traffic Safety* (CD Paper 907), Stockholm, May, 2000.

Mercer, G.W. Personal communication. September 14, 2000.

Morse, B.J. and Elliott, D.S. (1990). *Hamilton County Drinking and Driving Study: 30 Month Report*. Boulder, Colorado: University of Colorado.

National Highway Traffic Safety Administration (1988). *Second Workshop on In-vehicle Alcohol Test Devices.* Report DOT HS 807 299. Washington, D.C.: National Highway Traffic Safety Administration, U.S. Department of Transportation.

National Highway Traffic Safety Administration (1988). *Potential for Application of Ignition Interlock Devices to Prohibit Operation of Motor Vehicles by Intoxicated Individuals. A Report to Congress.* Prepared in response to Section 203: Public Law 100-17, April 1987, The Highway Safety Act of 1987. Washington: NHTSA.

National Highway Traffic Safety Administration (1992). *Model specifications for breath alcohol ignition interlock devices (BAIIDs)*. Federal Register 57: 11772-11787.

National Highway Traffic Safety Administration (1996). *Digest of State Alcohol-Highway Safety Related Legislation*. Washington: US Department of Transportation.

National Transportation Safety Board (1984). *Safety Study - Deficiencies in Enforcement, Judicial, and Treatment Programs Related to Repeat Offender Drunk Drivers.* Washington, D.C.: National Transportation Safety Board.

Nichols, J.L. and Ross, H.L. (1990). The effectiveness of legal sanctions in dealing with drinking drivers. *Alcohol, Drugs and Driving* 6: 33-60.

Nichols, J.L., Ellingstad, V.S., and Reis, R.E. (1980). The effectiveness of education and treatment programs for drinking drivers: A decade of evaluation. In L. Goldberg (Ed.). Alcohol, Drugs and Traffic Safety. *Proceedings of the 8th International Conference on Alcohol, Drugs and Traffic Safety*. Stockholm: Almqvist and Wiksell.

Peck, R.C. (1987). *An Evaluation of California's Drunk driving Countermeasure System: An Overview of Study Findings and Policy Implications*. Sacramento, CA: Department of Motor Vehicles.

Peck, R.C. Sadler, D.D., and Perrine, M.W. (1985). The comparative effectiveness of alcohol rehabilitation and licensing control actions for drunk driving offenses: A review of the literature. *Alcohol, Drugs and Driving: Abstracts and Reviews* 1(4): 15-40.

Perrine, M.W. and Sadler, D.D. (1987). Alcohol treatment program versus license suspension for drunken drivers: The four-year traffic safety impact. In: P.C. Noordzij and R. Roszbach (Eds.). *Alcohol, Drugs, and Traffic Safety. Proceedings of the 11th International Conference on Alcohol, Drugs and Traffic Safety*, pp 555-560. Amsterdam: Elsevier.

Popkin, C.L., Steward, J.R., Beckmeyer, C., and Martell, C. (1993). An evaluation of the effectiveness of interlock systems in preventing DWI recidivism among second-time DWI offenders. In: H.D. Utzelmann, G. Berghaus and G. Kroj (Eds.) *Alcohol, Drugs and Traffic Safety - T92. Proceedings of the 12th International Conference on Alcohol, Drugs and Traffic Safety*. Cologne: Verlag TUV Rhineland.

Preusser, D., Blomberg, R. and Ulmer, R. (1988). *Follow-Up Evaluation of Wisconsin's 1982 Drunk Drivers. Final Report. Comprehensive Driving Under the Influence of Alcohol Offender Treatment Demonstration Program*. Sacramento, CA: National Highway Traffic Safety Administration.

Road Traffic Authority (1987a). Submission to the Inquiry into the Management of Drivers Apprehended with High Blood Alcohol Levels (The Social Development Committee of the Victoria Parliament). Hawthorne, Victoria: Road Traffic Authority of Victoria.

Road Traffic Authority (1987b). Second Submission to the Inquiry into the Management of Drivers Apprehended with High Blood Alcohol Levels Regarding the Use of In-vehicle Interlocks (The Social Development Committee of the Victoria Parliament). Hawthorne, Victoria: Road Traffic Authority of Victoria.

Sadler, D. and Perrine, M. (1984). *An Evaluation of the California Drunk Driving Countermeasure System. Volume 2. The Long-Term Traffic Safety Impact of a Pilot Alcohol Abuse Treatment as An Alternative to License Suspension*. Sacramento, CA: Department of Motor Vehicles.

Salzberg, P.M., Hauser, R. and Klingberg, C.L. (1982). License revocation and alcoholism treatment programs for habitual traffic offenders. *The Quarterly/Journal* 4(2): 30-37.

Standards Australia (1993). *Breath Alcohol Testing Devices for Personal Use.* Homebush NSW: Standards Association of Australia.

Sweedler, B.M. and Smith, L. (1984). The repeat offender drunk driver: Where has the system failed? *Proceedings of the International Workshop on Punishment and/or Treatment for Driving Under the Influence of Alcohol and Other Drugs*, Stockholm.

Tashima, H.N. and Helander, C.J. (1999). *1999 Annual Report of the California DUI Management Information System*. Report Number CAL-DMV-RSS-99-179. Sacramento: California Department of Motor Vehicles.

Tashima, H.N. and Helander, C.J. (2000). *2000 Annual Report of the California DUI Management Information System*. Report Number CAL-DMV-RSS-00-185. Sacramento: California Department of Motor Vehicles.

Temer, R.G., Peck, R.C., Perrine, M.W. and Borok, L.S. (1987). Study of the relative effectiveness of disulfiram vs. alcoholics anonymous participants in the treatment of drinking driver offenders. In: P.C. Noordzij and R. Roszbach (Eds.). *Alcohol, Drugs, and Traffic Safety. Proceedings of the 11th International Conference on Alcohol, Drugs and Traffic Safety*, pp 571-575. Amsterdam: Elsevier.

U.S. Department of Transportation (1968). *Alcohol and Highway Safety: A Report to Congress for the Secretary of Transportation.* Washington DC: Department of Transportation.

Voas, R.B. (1970). Cars that drunks can't drive. Paper presented at the annual meeting of the Human Factors Society, San Francisco.

Voas, R.B. (1986). Evaluation of jail as a penalty for drunk driving. *Alcohol, Drugs and Driving: Abstracts and Reviews* 2(2): 47-70.

Voas, R.B. (2000) The Evidence for Program Effectiveness. Presentation at the Montreal Workshop on Alcohol Interlocks, Montreal, September, 2000.

Voas, R.B., Blackman, K.O., Tippetts, A.S. and Marques, P.R. (in press) Motivating DUI offenders to install interlocks: Avoiding jail as an incentive. *Accident Analysis and Prevention.*

Voas, R.B., Marques, P.R., Tippetts, A.S., and Beirness, D.J. (1999) The Alberta interlock program: The evaluation of a province-wide program on DUI recidivism. *Addiction* 94: 1849-1859..

Voas, R.B., Marques, P.R., Tippetts, A.S., and Beirness, D.J. (2000) Circumventing the alcohol safety interlock: The effect of the availability of a non-interlock vehicle. In: *Proceedings of the Fifteenth International Conference on Alcohol, Drugs, and Traffic Safety* (CD Paper 909), Stockholm, May, 2000.

Weeber, S. (1981). DWI repeaters and non-repeaters: A comparison. *Journal of Alcohol and Drug Education* 26: 1-9.

Wells-Parker, E.; Cosby, P.J.; and Landrum, J.W. (1986). A typology for drinking-driving offenders: Methods for classification and policy implications. *Accident Analysis and Prevention* 18(6): 443-454.

Wells-Parker, E., Anderson, B.J., Landrum, J.W. and Snow, R.W. (1988). Long-term effectiveness of probation, short-term intervention and LAI administration for reducing DUI recidivism. *British Journal of Addiction* 83: 415-421.

Wilson, C.B. and Stoke, C.B. (1990). *Motor Vehicle Ignition Interlocks: In-Vehicle Devices that Monitor Alcohol Levels of Motor Vehicle Operators*. Richmond, VA: Virginia Transportation Research Council.

Appendix A

List of Participants at the Montreal Workshop on Alcohol Interlock Programs

Ignition Interlock Conference

Montreal, QC – September 18th, 2000

List of Participants

Bengt Allo
Title: President
Company: Alkolås I Skandinavien AB
Address: Lärjungevägen 6
S-136 69 Haninge, Sweden
Tel. (468) 776-1805
Fax: (468) 776-1890
Email: mailbox@alkolas.se
Website: www.alkolas.se

Mike Balgord
Title: President
Company: National Interlock Systems, Inc
Address: 1660 Jasper St, Suite 1
Aurora, CO 80011
Tel: (888) 769-6080
Fax: (888) 262-6044
Email: mrbalgord@nationalinterlock.com
Website: www.nationalinterlock.com

Jim Ballard
Title: CEO
Company: Smart Start, Inc.
Address: 4850 Plaza Drive
Irving, TX 75063
Tel: (972) 621-0252
Fax: (972) 929-6638
Email: Jballard@smartstartinc.com
Website: www.smartstartinc.com

Doug Beirness
Title: Vice President of Research
Company: Traffic Injury Research Foundation
Address: 171 Nepean St., Suite 200
Ottawa, ON K2P 0B4
Tel: (877) 238-5235
Fax: (613) 238-5292
Email: dougb@trafficinjuryresearch.com
Website: www.trafficinjuryresearch.com

Paul Boase
Title: Chief, Road Users
Company: Transport Canada
Address: 330 Sparks Street
Ottawa, ON
Tel: (613) 993-4463
Fax: (613) 990-2912
Email: boasep@tc.gc.ca
Website: www.tc.gc.ca/roadsafety

Christiane Brosseau
Title: Coordinator
Company: Guardian Interlock Systems, Inc.
Address: 5940 Papineau, 2nd Floor
Montreal, QC
Tel: (514) 273-1098
Fax: (514) 273-0122
Email: cbrosseau@guardianinterlock.ca

Bill Burger
Title: Director, Product Development
Company: Alcohol Countermeasure Systems, Corp.
Address: 14- 975 Midway Blvd.
Mississauga, ON L5T 2C6
Tel: (905) 670-2288
Fax: (905) 670-8211
Email: wjburger@acs-corp.com
Website: www.acs-corp.com

Patricia Charles
Title: Coordinator
Company: GIS Quebec
Address: 5940 Papineau, 2nd Floor
Montreal, QC H2G 2W8
Tel: (514) 273-2451
Fax: (514) 273-0122
Email: pacharles@guardianinterlock.com

Ronald Chartrand
Title: President
Company: Alcotest Quebec
Address: 2135A Des Laurentides
Laval, QC
Tel: (450) 666-2500
Fax: (450) 666-2500
Email: adro@videotron.ca
Website:

Felix Comeau
Title: President
Company: Alcohol Counter Measure Systems, Corp.
Address: 14-975 Midway Blvd.
Mississauga, ON L5T 2C6
Tel: (905) 670-2288
Fax: (905) 670-8211
Email: mailbox@acs-corp.com
Website: www.acs-corp.com

Kathie Darroch-Dehenne
Title: Safety Policy Advisor
Company: Ministry of Transportation, ON
Address: 1201 Wilson Ave, Bldg. A
Downsview, ON
Tel: (416) 235-3716
Fax: (416) 235-3633
Email: Kathie.darroch-dehenne@mto.gov.on.ca
Website: www.mto.gov.on.ca

Claude Dussault
Title: Chief- Highway Safety Research
Company: SAAQ
Address: 333 Jean Lesage
C.P. 19600
Quebec, QC G1K 8J6
Tel: (418) 528-4095
Fax: (418) 646-1003
Email: claude.dussault@saaq.gonv.qc.ca
Website: www.saaq.gonv.qc.ca

Geoff Ewing
Title: Deputy Registrar (Acting)
Company: Gov't of Nfld and Labrador
Address: P.O. Box 8710
St. John's NF A1B 4J5
Tel: (709) 729-2520
Fax: (709) 729-6955
Email: gewing@mail.gov.nf.ca
Website: www.gov.nf.ca

Richard Freund
Title: President
Company: Lifesafer Interlock, Inc.
Address: 512 Reading Road
Cincinnati, OH 45202
Tel: (513) 651-9560
Fax: (915) 651-9563
Email: freund@lifesafer.com
Website: www.lifesafer.com

David Greening
Title: Policy Analyst
Company: Manitoba Dept. of Justice
Address: 1210-405 Broadway
Winnipeg, MB R3C 3L6
Tel: (204) 945-1700
Fax: (204) 945-0433
Email: dgreening@jus.gov.mb.ca

Cliff Helander
Title: Acting Chief
Company: CA DMV Research
Address: 2415 First Ave, F-126
Sacramento, CA 95818
Tel: (916) 657-7039
Fax: (916) 657-8589
Email: chleander@dmv.ca.gov
Website:

Bo Lonegren
Title: Senior Project Director
Company: Vägverket
Address: S-781 87 Borlange, Sweden
Tel: *46 24375496
Fax: *46 24375733
Email: bo.lonegren@vv.se
Website: www.vv.se

Darrel Longest
Title: CEO
Company: Ignition Interlock of MD
Address: 315-A E. Diamond Ave.
Gaithersburg, MD 20879
Tel: (301) 252-3498
Fax: (301) 926-9113
Email: longest@worldnet.att.net
Website: www.ignitioninterlock.com

Louis Malenfant
Title: President
Company: Centre for Education Research and Safety
Address: P.O. Box 5221
Shediac, NB E4P 8T9
Tel: (506) 532-2501
Fax: (506) 532-1453
Email: JELM@cers-Safety.com
Website: www.cers-Safety.com

Pierre Malouin
Title: Resp.
Company: Lebeau Vitres D'Autos
Address:
Montreal, QC
Tel: (514) 593-3796
Fax: (514) 329-5708
Email: pmalouin@belroncanada.com

Ian Marples
Title: President
Company: Guardian Interlock Systems Corp.
Address: 14-975 Midway Blvd.
Mississauga, ON L5T 2C6
Tel: (905) 670-2288
Fax: (905) 670-8211
Email: irmarples@guardianinterlock.ca
Website: www.guardianinterlock.ca

Paul Marques
Title: Senior Research Scientist
Company: Pacific Institute for Research and Evaluation
Address: 8201 Corporate Dr., Suite 220
Landover, MD 20785
Tel: (301) 731-9891 x102
Fax: (301) 731-6649
Email: marques@pire.org
Website: www.pire.org

Jean-Claude Mercure
Title: President
Company: Alcocheck Inc.
Address: 3400 Rolland
Ste-Adele, QC J8B 1C6
Tel: (450) 229-5152
Fax: (450) 229-3868
Email: mercure2@cgocable.ca

Hal Pruden
Title: Legal Counsel
Company: Department of Justice
Address: Room 5029 East Memorial Bldg.
Ottawa, ON K2B 7H3
Tel: (613) 941-4138
Fax: (613) 941-4122
Email: hal.pruden@justice.gc.ca

Robyn Robertson
Title: Research Assistant
Company: Traffic Injury Research Foundation
Address: 171 Nepean St., Suite 200
Ottawa, ON K2P 0B4
Tel: (877) 238-5235
Fax: (613) 238-5292
Email: robynr@trafficinjuryresearch.com
Website: www.trafficinjuryresearch.com

Jay D. Rodgers
Title: Chairman
Company: Smart Start Inc.
Address: 7350 Hawk Rd.
Flower Mound, TX 75022
Tel: (817) 430-8793
Fax: (817) 430-3441
Email: jdr@pst@aol.com
Website: www.smartstartinc.com

Appendix B

List of Interlock Manufacturers

Interlock Manufacturers

1. Alcohol Countermeasure Systems Corp.
   14 – 975 Midway Blvd.
   Mississauga, ON L5T 2C6
   Canada

   Tel. 905 670 2288

2. Alcohol Sensors International, Ltd.
   1111 Broadhollow Rd., 3rd Floor
   East Farmingdale, NY 11735

   Tel. 516 470 0792

3. Autosense International
   683 East Brokaw Rd.
   San Jose, CA 95112

   Tel. 408 453 1700

4. Consumer Safety Technology, Inc.
   10520 Hickman Rd., Suite "F"
   Des Moines, IA 50325

   Tel. 515 331 7643

5. Draeger Safety, Inc.
   Breathalyzer Division
   185 Suttle St., Suite 105
   Durango, CO 81301
   Tel. 970 385 5555

6. Guardian Interlock Systems, Inc.
   13 A West Park Sq.
   Marietta, GA 30060

   Tel. 770 499 0499

7. LifeSafer Interlock, Inc.
   512 Reading Rd.
   Cincinnati, OH 45202.

   Tel. 513 651 9560

8. Smart Start, Inc.
   4850 Plaza Dr.
   Irving, TX 75063.

   Tel. 972 621 0252