Emergency Services Foundation
Scholarship Project 2012

Improving pre-hospital care in remote and wilderness environments of Victoria, Australia

North American Study Tour Report

Alpine Search and Rescue Victoria Exercise, Mt Bogong, Victoria, Australia, 2007.

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North American Study Tour Report

“That others may live”

The motto of Search and Rescue Technicians (SARTECHs) of the Canadian Forces

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Executive Summary

Ambulance Victoria (AV) has established itself as a world class provider of prehospital emergency care.[1,2] In wilderness and remote areas AV has a range of resources in place to provide a response capacity. However this capacity currently has limitations in areas with poor or no direct vehicular access.[3] Responding to remote and wilderness environments presents a range of specific challenges that create difficulties for patient access, management and extrication. International best practice in these settings incorporates the ability to rapidly and safely access patients in a wide range of environments including alpine, high angle and swift water. Safely accessing these settings necessitates specialist four wheel drive, safety, survival, navigation, and communication skills and equipment. **Establishing a specialist ambulance response to these environments with a small group of highly skilled individuals is a cost effective way of addressing the limitations of the current system.**

Internationally there are a range of wilderness response models in place. As AV seeks to establish a wilderness response capacity it is sensible to tap into the knowledge and experience already gained by other services as they have developed their own specialist response systems. The USA and Canada have significant experience in providing prehospital emergency care in wilderness and remote environments due to the large population base in close proximity to wilderness areas and the wide range of wilderness activities undertaken there.[4,5,6] From the military based search and rescue technicians (SARTECHs) of the Canadian Forces to the park medic and climbing ranger systems in Grand Teton National Park to voluntary SAR teams in Wyoming, Colorado and Utah and ambulance based response teams in Oregon and North Carolina. The opportunity to visit this wide range of systems has given a valuable insight into the possibilities for the establishment of an ambulance based wilderness response capacity in Victoria, Australia.

This report recommends the establishment of specialised paramedic wilderness response teams in areas of identified need throughout Victoria. It would be sensible to establish these teams under the proposed regional Hazardous Area Response Team (HART) framework.[7,8] This would provide the opportunity to expand the skill set of responders in the future and develop a regional “all hazard” response capacity. It is important these teams are co-ordinated across the state to ensure consistency of response. It is also sensible and appropriate that the various response agencies work together closely to avoid duplication of resources and ensure effective use of limited funding.

Establishing a specialised wilderness response team, made up of a small group of highly trained and motivated individuals, helps to address a number of issues AV has experienced regarding provision of service to hazardous environments. These include availability of trained staff, skills maintenance, depletion of available staff as well as ongoing equipment familiarity and maintenance.[7,8] It is also a cost effective means of assisting AV to meet its obligations under the Occupational Health and Safety Act 2004.[9]

An effective wilderness response team will generally employ a “get in / get out” philosophy, with emphasis on moving efficiently and effectively with the goal of stabilising and moving the patient to definitive care as quickly as possible.[4] This means carrying the minimum of equipment to be safe and effective. **It is important to note that this report does not propose the establishment of a rescue team, but a paramedical team with the ability to**

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safely enter a remote or wilderness environment for the purpose of providing clinical care to the patient and other responders and clinical advice to the control agency.

As there are a range of models that could be considered in the establishment of a wilderness response team it is important to identify the "critical elements" of an achievable and effective wilderness response capacity. The model utilised throughout this report is the "Systems Model of Accident Causation and Risk Control" (SMACRC) (refer appendix 1).[10] The critical elements outlined in this model as they relate to an ambulance based wilderness response team in Victoria include the following recommendations.

Recommendations:

1 Suitable organisational environment and management approach
- Statewide co-ordination that promotes_**interagency operability** and provides a consistent ambulance response capacity
- Regional ownership and management with a focus on interagency operability at the regional level
- Clinical governance provided by a doctor specialising in wilderness medicine

2 Competent and knowledgeable workers
- A **robust selection procedure** which identifies applicants with the motivation, skill set, background and personality required for the expected task.
- A **comprehensive initial training** program
- A **comprehensive skills maintenance and re-accreditation** program
- Educational integration across response agencies as far as practicable

3 Well designed physical environment
- An **effective base of operations** to include secure, practical and accessible storage of vehicles and equipment
- A well designed, appropriate and **effective response vehicle** for the expected environment

4 Fit for purpose equipment
- A **well designed, robust, comfortable response pack** with flexibility in the deployment of survival and medical modules
- Appropriate and **effective PPE** for the expected response environment
- Appropriate, **reliable communications and navigation** equipment

5 Suitable rules and procedures
- **Robust dispatch procedures** that identify the need for and dispatch the specialist resource in an appropriate timeframe for the specific case.
- Appropriate clinical practice guidelines for the response environment

AV currently utilises a range of strategies to provide a response capacity to remote and wilderness environments, however current systems lack some key components. Further development, expansion and integration of current wilderness response systems will streamline AV's response capacity while assisting in meeting its strategic objectives. These objectives include providing a higher level of care to patients and increasing the safety of responding paramedics.[11] Meeting worlds best practice in wilderness response is achievable in Victoria and will complement AV's current high standards of clinical excellence.

Acknowledgements

This study tour was made possible by the generous support of the Emergency Services Foundation and Paramedics Australasia.

I would like to acknowledge the following for their assistance and support in this project. Without the co-operation and support of those named this project would not have been possible.

Anthony Vail:	Master Corporal, SARTECH, 442 Transport and Rescue Squadron, Canadian Forces, Comox, British Columbia
Trevor Reid:	Capt, Public Affairs Officer, 442 Transport and Rescue Squadron, Canadian Forces, Comox, British Columbia
John David ("JD") Storn:	Paramedic, American Medical Response, Portland Reach and Treat Team, Oregon
Dr Marion McDevitt:	Associate Director Wilderness Medicine / EMS Fellowship, University of Utah, Salt Lake City, Utah
Dr Will Smith:	Medical Director, Grand Teton National Park, Teton County SAR, Jackson Hole Fire/EMS, Jackson Hole, Wyoming
Dr Seth Hawkins:	Medical Director, Burke County EMS Special Operations, Morganton, North Carolina
Dr Greg Stiller:	Medical Director, Douglas County SAR, Denver, Colorado
Bindi Bowman:	OHS Advisor, Gippsland, Ambulance Victoria
Paul James:	Group Manager, Wellington, Ambulance Victoria
Michael Stephenson:	Regional Manager, Gippsland, Ambulance Victoria
Kirsty England	ALS Paramedic, Morwell, Ambulance Victoria
Justin Dunlop:	Manager, Emergency Management, Ambulance Victoria
Ross Salathiel:	MICA Paramedic, Morwell MICA Unit, Ambulance Victoria
Dave Jones:	Team Manager, Lakes Entrance, Ambulance Victoria
Andy Oates:	ALS Paramedic, Bairnsdale, Ambulance Victoria
Mick Bajada:	ALS Paramedic, Geelong, Ambulance Victoria
Brett Grundy:	Team Manager, Mt Beauty, Ambulance Victoria

Paul Kent:	Team Manager, Corryong, Ambulance Victoria
Karl Morrison:	Geospatial Information Services Officer, Ambulance Victoria
Rohan Martin:	VACIS Manager, Ambulance Victoria
Ian Hunt:	Group Manager, Hume, Ambulance Victoria
Dave Booth:	Four Wheel Drive Specialist, Ambulance Victoria
Dr Paul Jennings:	Director of Research, Monash University Department of Community Emergency Health and Paramedic Practice. Chairman of Paramedics Australasia (Victorian Chapter)
Peter Campbell:	Convener, Bush Search and Rescue Victoria
Linda Beilharz:	President, Alpine Search and Rescue Victoria
Rik Head:	Past President, Alpine Search and Rescue Victoria
Duncan Maughan:	Acting President, Alpine Search and Rescue Victoria
Ian Veitch:	Leading Senior Constable, Search and Rescue Squad, Victoria Police
Ben Fisk	MICA Paramedic, Ambulance Victoria PhD candidate, Deakin University, Centre for Rural Emergency Medicine,
Dr Edi Albert	Emergency physician with extensive wilderness medicine experience in Tasmania, Antarctica and Perisher Valley
Sam Dodds	Dispatcher, Emergency Service Telecommunication Authority

Introduction

There are a range of ambulance based wilderness response models employed across Australia and the world. These models generally equip responders with specialised skills and equipment to enhance their safety and effectiveness in wilderness environments.[4] While Ambulance Victoria (AV) provides a world class prehospital emergency medical response within the State of Victoria, this capacity has limitations in remote environments with difficult or no direct vehicular access.[3] This report will convey the lessons learnt from a five week study tour of North America which investigated wilderness response systems that incorporate high level medical practitioners as front line responders. The author suggests that these lessons can be applied to the development of a wilderness response model within AV.

AV's current wilderness response arrangements include the utilisation of the Helicopter Emergency Medical Service (HEMS), four wheel drive retrieval vehicles and Wilderness Response Packs (WRPs). However at times HEMS are inappropriate or unavailable and the distribution of specialist ground resources such as four wheel drives and WRPs is restricted. The specialist wilderness training of ground based paramedics is minimal and there is no specific staff selection process for these dynamic and challenging environments.[4] By incorporating a comprehensive selection, training and skills maintenance regime along with increasing the availability and effectiveness of response vehicles and equipment, current wilderness response arrangements can be reinforced to provide resilience and robustness to AV's wilderness response capacity. This in turn will deliver world class services that protect paramedic health and safety while enhancing patient outcomes in remote and wilderness settings.

Over 12 months, (2011/12) AV had 20 reported instances of attendance in wilderness settings, 16 reports of inadequate vehicles and/or equipment for terrain and weather conditions and 11 instances of no communication signal or radio breakdown.[12] This data indicates a total of 47 wilderness or remote area related incidents in 2012.[12] Anecdotally these figures reflect significant underreporting of wilderness and remote area attendances by AV. Comparatively Ambulance Service of New South Wales (ASNSW) Special Operations Unit paramedics have attended 98 cases in wilderness or remote settings and a further 60 cases requiring the use of a four wheel drive in the 2012/13 financial year over the 8 months to March 2013.[13] This equates to approximately 205 wilderness cases attended by ASNSW annually, over 4 times the number reported by AV.

In 2012 there were 1250 emergency service worker (ESW - police/fire/ambulance) injuries reported to Worksafe Victoria, of these 297 were injuries to paramedics.[14] 79% (234) of the paramedic injuries were muscular skeletal and 12% (37) were stress related.[14] Further to this there have been 7 reported deaths of emergency service workers in bush fires in Victoria over the last 10 years.[15] This data demonstrates a significant burden of injury, stress and mortality within the emergency service industry. It is well understood within ambulance and other emergency service organisations that there are significant risks in the manual handling of patients and equipment in urban environments.. These risks are magnified in remote and wilderness settings due to the physically demanding, dynamic and challenging nature of the environment.[16,17,18,19] It is also understood that operating outside of your comfort zone, particularly in an unfamiliar operational environment increases stress and promotes poor decision-making.[18,19,20]

By integrating specialist paramedics into AVs response matrix, particularly in support of specialist tasks such as fire fighting and search and rescue, the burden of injury and stress to both AV paramedics and combating agencies can be reduced. Having specialist paramedics located to quickly access hazardous environments such as an active fire ground, may also help reduce the mortality of ESWs.

Wilderness and remote areas of Victoria attract large numbers of visitors for a wide range of recreational, educational and industrial activities.[21,22] Wilderness activities incorporate a level of risk and the possibility of injury, illness or death.[16,17,23,24] Even if these ailments are minor in nature, the logistics of accessing, managing and extricating a patient in a remote or wilderness environment are significant and often require a specialised skill set and close working relationships with co-responding agencies.[5,25,26,27] International best practice in these settings includes the ability to rapidly and safely access patients in a wide range of environments to deliver a specialist wilderness medicine skill set. This often incorporates specialised four wheel drive, alpine, survival, navigation, communication, high angle and swift water skills. **Establishing a specialist ambulance response, tailored to meet the unique challenges of these environments by utilising a small group of highly skilled individuals, is a cost effective way of addressing the limitations of the current system.**

As AV seeks to establish a wilderness response capacity, the ability to review international prehospital wilderness care services has provided a valuable insight. The use of a framework to compare existing models provided a robust, comprehensive and consistent evaluation on every model encountered. The framework utilised for the analysis of international models was the Systems Model of Accident Causation and Risk Control (SMACRC) developed by Dr David Borys of the University of Ballarat (appendix 1).[10]

AV employs a number of strategies to provide service to remote and wilderness environments, however the current model lacks key components. Further development, expansion and integration of current wilderness response systems will streamline AV's response . This will assist in meeting AV's strategic objectives by providing a higher level of care to patients and increasing the safety of responding paramedics.[11] Meeting world's best practice in wilderness response is achievable in Victoria and will complement and enhance AV's current high standards of clinical excellence.

Figure 1: American Medical Respond Portland Reach and Treat (RAT) team members training in Portland, Oregon, July 2012.

Study Tour Overview

9 - 13 July 2012 *Remote Medicine for the Advanced Practitioner (RMAP)*
Remote Medicine International
Lake Diablo, North Cascades, Washington, USA

This is a five day course focusing on advanced medical practice in remote and wilderness settings. This course was facilitated by two experienced paramedics who regularly operate in remote and wilderness locations. A wide range of skills and procedures were covered. Notable procedures included:

- Extended wound care including suturing and stapling
- Relocation of dislocations
- Administration of nerve blocks

Of particular interest was the diverse range of medical practitioners who attended the course. Having practitioners from diverse backgrounds made for interesting conversations and a plethora of learning opportunities. Attendees included:

- Paramedics from many parts of the United States and Canada
- A Special Weapons and Tactics (SWAT) medic
- Physicians' Assistants with both civilian and military backgrounds
- Special Forces medics
- A General Practitioner

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13 - 17 July 2012 *Wilderness Medicine Society (WMS)*
6th World Congress of Wilderness Medicine
Whistler, British Columbia, Canada

Advanced Wilderness Life Support

This two day course was attended as a pre-conference workshop associated with the WMS congress. The course included a range of theoretical lectures and practical exercises. Of particular note were:

- The wide variety of uses of a SAM® splint
- The many different techniques for patient extrication from wilderness settings when a traditional stretcher or basket is not available

Wilderness Medicine Conference

Running over four days, the conference itself was stimulating and informative with a wide range of authoritative speakers. Of specific interest was:

- A lecture by Jennifer Dow, Medical Director, Denali National Park, reviewing search and rescue (SAR) procedures in Alaska
- A lecture by "Professor Popsicle" Dr Gordon Giesbrecht on the latest thoughts regarding hypothermia management
- A review of European SAR systems by Dr Bruno Durrer
- A display by Blackcomb Aviation of the helicopter long line short haul insertion and rescue technique used widely throughout the United States

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19 - 20 July 2012 *Canadian Forces 442 Transport and Rescue Squadron. Comox, Vancouver Island, Canada*

I was fortunate enough to be able to meet with Search and Rescue Technician (SARTECH) Anthony Vail. Anthony took considerable time to explain the training, equipment capabilities and procedures of 442 Squadron. 442 Transport and Rescue Squadron operates CC-115 Buffalo fixed wing aircraft and Ch-149 Cormorant rotary wing aircraft. This squadron are the Joint Rescue Co-ordination Centres (JRCC) primary SAR resource for aviation and maritime emergencies, but can be tasked for LandSAR when provincial authorities agree and cannot respond effectively themselves. I was fortunate to witness a display of the Cormorant helicopters capabilities including insertion and extrication of two SARTECHs and a rescue basket as well as a visit to the JRCC in Victoria.

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21 July 2012 *American Medical Response (AMR) EMS Reach and Treat (RAT) Team. Portland, Oregon, USA*

I spent a day training with the AMR Portland Reach and Treat (RAT) team. The RAT team is available 24/7 to respond to medical emergencies, special rescue situations and search and rescue missions. They respond to "general duties" as required until there is a need for a specialist wilderness resource within their call area. RAT team members have an extended scope of practise in wilderness settings and are equipped to access and support a patient in remote environments until resources can be called to safely extricate and evacuate the patient to hospital.

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23 July 2012 *Intermountain Life Flight.*
Saltlake City, Utah, USA

Bill Butts, Life Flights Director of Aviation Operations took the time to introduce me to Life Flight and a number of its dedicated staff including paramedic Paris Napoli. Life Flight have a wide range of aero medical capabilities including the only private winch equipped rescue helicopter in the United States as well as paediatric, neonatal and adult specialty medical teams. They operate 8 aircraft out of 6 bases across Utah, including 3 Beechcraft King Air B200's, 2 Bell 407 helicopters, 2 Augusta 109K2 helicopters and 1 Agusta Grand Helicopter. Life Flight also maintain a 24 hour call centre to co-ordinate every aspect of their operation. They are well equipped to support SAR operations in wilderness environments having access to an avalanche beacon locator as well as night vision and technical alpine equipment.

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25 - 29 July 2012 *Jackson Hole Fire/EMS : Teton County SAR : Grand Teton NP Park Medics : Jenny Lake Rangers.*
Jackson Hole, Wyoming, USA

I was welcomed to Jackson Hole by Dr Will Smith and Dr AJ Wheeler. Here I was able to:

- Attend training and ride along with Jackson Hole Fire/EMS at Station 1
- View the extensive Teton County SAR cache
- Tour a range of the Park Medic facilities in Grand Teton National Park
- Visit the base of the Jenny Lake Rangers

I was privileged to speak with Mike Moyer who shared his courageous story of survival following the crash of a helicopter he was responding in during a SAR call. His story is extremely valuable and one we can use to inform the development of a wilderness response capacity here in Victoria.

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30 July - 2 August 2012 *Burke County EMS Special Operations:*
Burke County SAR. Morganton, North Carolina, USA

Dr Seth Hawkins kindly co-ordinated my time in Morganton NC visiting the Burke County EMS Special Operations team. Special Operations paramedics are based at Station 5 and service Linville Gorge and the surrounding area. These paramedics utilise a modified four wheel drive ambulance with wilderness response and technical rescue equipment. Special operations paramedics are equipped to respond to steep and vertical environments and have an extended scope of practise in wilderness settings.

6 - 10 August 2012

Alpine Rescue Team ; Douglas County SAR ;
Rocky Mountain Rescue.
Denver, Colorado, USA

My visit to Denver was kindly co-ordinated by Dr Greg Stiller. Greg volunteers with the Alpine Rescue Team and is the medical director for Douglas County SAR. I was fortunate to observe the Alpine Rescue Team during a response to Mt Evans. The dedicated and highly skilled volunteers responded quickly and under the guidance of the local sheriff efficiently located and transported the patient to a waiting ambulance. The sheriff took active charge of the rescue and consulted closely with the SAR team and ambulance resources as they arrived. The swiftness of the response and the efficiency with which the various agencies worked together was very impressive.

Figure 2: A SARTECH from 442 Squadron Comox, explains the rescue equipment carried by the CH 149 Cormorant helicopter. WMS conference, Whistler, BC, Canada. 2012.

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Outline of Objectives

The objectives of this project are to:

1 **Identify how Ambulance Victoria currently responds to patients in wilderness alpine, subalpine and forested areas of Victoria.**

2 **Identify appropriate key performance indicators that reflect the effectiveness of responding to patients in wilderness alpine, subalpine and forested areas of Victoria.**

3 **Analyse the effectiveness of the current model through application of key performance indicators and comparison with international models.**

4 **Identify the occupational health and safety considerations of operating in wilderness alpine, subalpine and forested areas of Victoria.**

5 **Identify ways of managing the occupational health and safety considerations of operating in wilderness alpine, subalpine and forested areas of Victoria.**

6 **Liaise with other emergency service agencies and identify strategies that would improve prehospital care of patients in wilderness alpine, subalpine and forested areas of Victoria.**

7 **Identify practical and cost effective ways of improving the current model.**

Figure 3: Rescue personnel from Blackcomb helicopters explain the equipment utilised for the short haul long line insertion and extraction technique widely used throughout North America.

Objective One

Identify how Ambulance Victoria currently responds to patients in wilderness alpine, subalpine and forested areas of Victoria.

Introduction

Ambulance Victoria (AV) has a well developed prehospital emergency medical response capacity across the state of Victoria. However this capacity has limitations in areas without direct vehicular access, particularly when a Helicopter Emergency Medical Service (HEMS) response is unsafe, impractical or not available. Current systems lack state-wide co-ordination and redundancy. **Further development, expansion and integration of current wilderness response systems will assist AV to meet its strategic objectives principally through providing a higher level of care to patients and improving the safety of responding paramedics.**[11]

Ambulance Victoria's response capacity in remote or rural areas is delivered through a network of professional Basic Life Support (BLS), Advanced Life Support (ALS) and Mobile Intensive Care (MICA) paramedics who are assisted by Remote Area Nurses (RAN), volunteer Community Emergency Response Teams (CERT) and casual Ambulance Community Officers (ACO). These resources are heavily reliant on direct vehicular access to patients to provide prehospital medical care. Options become limited in those environments where there are no or poor formed road access, particularly in adverse weather conditions. There are however a range of resources, equipment options and systems that currently assist in responding to remote and wilderness areas including HEMS, four wheel drives and wilderness response packs.

Helicopter Emergency Medical Service (HEMS)

In Victoria ambulance access to remote, wilderness, steep or vertical environments is generally facilitated by Air Ambulance Victoria through the utilisation of the Helicopter Emergency Medical Service (HEMS). In most situations utilising helicopters as a rescue platform is very effective.[28,29] The high level of skill and ability displayed by HEMS crew's means the majority of patients are successfully located, managed and evacuated to safety. However, there are times when utilisation of the rotary wing platform is unsafe or impractical.[25,28,29,30] These restrictions include the presence of fog, cloud, cross winds, storms, lightening, excessive heat and poor light conditions.[28,29,30] The risks associated with operating helicopters in a rescue capacity have been sadly demonstrated with the death of a paramedic in New South Wales and serious injury of a Queensland paramedic during winching operations.[31,32] There are also limited HEMS resources in Victoria and this can at times cause delays in responding to patients in remote or wilderness environments.

Four Wheel Drive Resources

Ambulance Victoria has a range of four-wheel drive vehicles positioned in outer metropolitan and rural locations that can be utilised when responding to areas with challenging road access.[33] These vehicles include the Mercedes four wheel drive Sprinter and Toyota Landcruiser.[33] Four wheel drive vehicles serve an important function in ensuring effective emergency response and a well developed course teaches paramedics how to operate the

four wheel drive vehicle safely and effectively. Whilst Ambulance Victoria has some systems in place to manage paramedic safety while responding to remote and wilderness environments in a four wheel drive vehicle, there remains considerable potential to further develop and introduce more robust wilderness and remote area response systems of work. For example paramedics operating four wheel drive vehicles are not formally trained in wilderness or remote area survival techniques should it become necessary for them to remain in an isolated area for an extended period of time (hours to days). There are varying levels of recovery and survival equipment carried by the four wheel drive fleet across Victoria and local strategies are in place to trigger their deployment. It would be useful to co-ordinate this equipment to ensure all four wheel drives are of standard configuration and ensure the equipment that is in place is fit for purpose. Survival skills and equipment are particularly important when the patient is not directly accessible by road and paramedics are required to leave the vehicle to access the patient.[16,34] It is evident that four wheel drive resources are an imperative part of successful wilderness and remote area response. However without resilient systems to ensure both efficient deployment methods and appropriate staff education the current four wheel drive fleet cannot be utilised to it's full potential and this may affect the quality of response and the safety of paramedics.[23,24,35]

Wilderness Response Pack

Paramedics in the both Hume and Gippsland regions of Victoria have previously recognised the hazardous and specialist nature of responding to remote and wilderness environments. A significant amount of work has gone into developing Wilderness Response Packs (WRP) and an associated work instruction (refer appendices 11, 12, 13 and 16). Elsensohn et al state "medical backpacks should be equipped in accordance with... the medical emergencies in a given region, and take into account the climate, geography, (and) medical training of rescuers".[36] Further to this Worley suggests "The 3 primary signalling devices everyone should carry are a whistle, a signal mirror, and a reliable method of starting a fire".[16.] As such, the WRPs currently provide a valuable resource in the areas where they operate. While the existing WRP provides an excellent foundation for a wilderness response model, there remains room for further development and expansion of this system to increase its effectiveness.

The WRP is currently restricted to Hume (Bright, Corryong, Mansfield and Mount Beauty branches). The activation of the WRP clinical work instruction (CWI) relays heavily on the local paramedic recognising the need for the specialist resource at the time of dispatch (Appendix 16). While normally this does not cause a problem, if a relieving paramedic not familiar with the local environment and procedures is on duty at the time of dispatch, they may not initially recognise the need for this specialist resource. This can lead to delays in accessing and managing this cohort of patients and reduction of compliance with the WRP CWI.

Even if the need for the WRP is recognised, its utilisation requires prior training and familiarisation.[36] Currently only a restricted number of staff (approximately 15) are familiar with the packs and associated CWI. If on any given day the staff on duty in the area are not familiar with its use, it cannot be deployed until one of these paramedics' can be recalled to duty.

Selection and Training of Personnel

The current wilderness response framework in Victoria does not include a formal process relating to selection of suitable ground based personnel to deploy to remote or wilderness settings. It is critical that responding personal are appropriate for the role.[16,34] Johnson states "Alpine search and rescue teams must perform each incident response safely. To do so requires experience, organisational skills, technical training, and ability".[36] Adding to this is the wide recognition that operating in a wilderness environment, particularly in a rescue capacity can be hazardous, stressful and physically demanding.[16,17,18,19] It is clear that increasing and maintaining fitness improves the health and safety of emergency service workers operating in challenging environments.[33] Maintaining an appropriate level of fitness and experience also assists in moving efficiently through challenging terrain while carrying the survival and medical equipment necessary to operate effectively in these environments.[16]

Ambulance Victoria has systems in place to manage employee health and safety while responding to remote and wilderness environments by foot, however there remains significant potential to introduce more resilient systems. For example there is not currently a standard course utilised by Ambulance Victoria to equip ground based paramedics with the basic survival and self preservation skills to support safe and effective operation in alpine, subalpine and forested remote and wilderness environments. HEMS paramedics do receive training in personal preservation in remote, wilderness, alpine and vertical environments and it would be useful to expand the existing programme to encompass paramedics operating in areas likely to require a ground based response.

Ground based paramedics responding to these environments are also unlikely to have received any formal training in the techniques necessary to keep themselves safe in steep or vertical terrain. One possible exception to this is the current pool of Urban Search and Rescue (USAR) paramedics. However the USAR paramedic skill set is focused on an urban environment and as Smith states "Wilderness emergencies present unique problems in rescuer access and medical evacuation". This is particularly true in a steep snow and ice environment where the perceived risk and real risk are often unbalanced.[38,39]

Lack of specific selection, ongoing training and maintenance of fitness can lead to paramedics being put into situations outside of their physical and psychological comfort zone.[16] Operating outside of your comfort zone, particularly in an unfamiliar operational environment increases stress, and it is clear that stress affects human decision making.[18,19,,40] Paramedics operating in these environments need to be able to make clear clinical decisions, often under considerable pressure. Kowalski-Trakofler et al and Useem et al in their respective papers regarding decision making in stressful environments agree that stress can be minimised through adequate preparation and pre-event training.[18,19]

Wilderness Medicine

The current wilderness response model could better recognise the specific clinical challenges of operating in remote or wilderness environments. Although the principles of patient care are the same whether in an urban or wilderness environment, wilderness medicine is recognised internationally as a specialty in its own right.[5,27,40,41,42] Tomazin et al state "Even in the mountainous environment, the patient should be reached as quickly as possible and provided with on-site and en-route medical treatment according to international standards".[42]

It is important that international evidence based guidelines such as those produced by the International Liaison Committee on Resuscitation (ILCOR) and International Commission of Alpine Rescue (ICAR) are followed to ensure patient care is of the highest possible quality.[30,32,41,44] In their paper of recommendations to the International Commission for Mountain Emergency Medicine (ICAR MEDCOM)", Tomazin et al state "in the severely injured or ill patient, survival depends on approach time and quality of medical treatment by high-level providers".[30] Therefore, to align with worlds best practise, paramedics responding to remote and wilderness environments should receive specific wilderness medicine training to ensure they delivery the highest possible care according to international best practise.[,26,45,46] Hurst puts it as "it is not what we did or didn't do.... but what we could have done if we had a strong base of knowledge"[42].

Interagency Relationships

It is widely acknowledged in the emergency response community that it is fundamental to have well established relationships and clear boundaries of responsibility when working with other agencies.[48,49] Johnson states "alpine search and rescue teams should interface with.... control advisors who are familiar with local terrain, mountain rescue operations, and the evacuation techniques employed".[26] Ground based access to and rescue of patients in steep or vertical environments of Victoria is undertaken by agencies external to Ambulance Victoria (including Victoria Police Search and Rescue, Country Fire Authority and the State Emergency Service). In Victoria the Police are the control agency for incidents requiring land Search and Rescue (SAR) while the Department of Sustainability and Environment (DSE) and Parks Victoria play a role in operations on public estate.[48] Although ground based paramedics are not expected to execute patient rescues in these environments, it is important paramedics are able to keep themselves safe, provide appropriate clinical care to the patient and operate effectively alongside other agencies.[16,26]

Conclusion

Ambulance Victoria maintains an extensive network of ambulance response resources throughout Victoria and is recognised internationally as a leader in pre-hospital service delivery. However wilderness and remote area response capabilities could be improved. There is a heavy reliance on HEMS resources and little built in redundancy to account for times when HEMS resources are inappropriate or unavailable. There is only isolated specialist training and equipment and no process of selection to ensure fitness for duty of paramedics responding to remote and wilderness environments.[16,34] Consequently paramedics may be exposed to unnecessary or controllable risk and may not be able to provide optimal care to the patients they attend in remote and wilderness environments.[18,19,20]

While current systems provide an excellent base on which to build a state-wide model, they require further development and expansion to adequately manage all the hazards of responding to remote and wilderness environments and provide optimal care to patients.[39,43] Venticinque & Grathwohl put it well when they state "the fundamentals of successful critical care practice in unusual settings include proper planning with an emphasis on attention to detail, the careful management of all resources, using the proper equipment, leveraging aeromedical evacuation assets, and employing the right people with the right skills".[50]

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Objective Two

Identify appropriate key performance indicators that reflect the effectiveness of responding to patients in wilderness alpine, subalpine and forested areas of Victoria.

Measuring quality in prehospital care systems is acknowledged as challenging.[51,52,53] This is particularly apparent in specialist response environments such as wilderness response because of the relatively low call volume and wide variety of variables encountered. Measuring quality is however important to ensure high standards of care are being meet, particularly when introducing new or updated systems of response.[52,53,54,55] Increasing the scope of prehospital care providers has traditionally been paralleled with increased scrutiny to ensure "value and effectiveness of services".[51]

Traditionally there are three fundamental terms when evaluating system performance quality: key performance indicators (KPI's), quality measurements and benchmarking.[54] Establishment of KPI's is therefore a critical element in measuring system performance. When developing KPI's for any system there are some basic principles that should be followed. KPI's must have "face value", that is, they should both represent and be seen to represent the important qualities of the system in question. KPI's need to be measurable, meaningful, understood and accepted by all stakeholders.[56] Sayed suggests performance indicators need to be "specific, measurable, action orientated, relevant and timely".[51] **In essence it is important to measure the right system components.**

What is wilderness response?

An essential part of measuring quality as it relates to wilderness and remote area response is defining what exactly "wilderness" and "remote" settings are. The New Oxford American Dictionary defines *wilderness* as "an uncultivated, uninhabited, and inhospitable region and *remote* as "situated far from the main centers of population; distant".[57] The Oxford American Writers Thesaurus identifies the words "isolated" and "inaccessible" as being comparable to remote.[58] In terms of relating this to ambulance services, Millins et al define wilderness as "any geographic area were the typical urban resources are not adequate for the management of an injured or sick patient.[5]

A remote setting therefore does not only apply to wilderness areas far from habitation, as you may traditionally imagine, but also to any patient who becomes isolated or inaccessible, for example by falling or driving down an embankment, gorge or cliff, by rising flood waters, a beach, a confined space, a tactical environment and by chemical or biological barriers. When put in the context of prehospital EMS response, patients in these remote, isolated or inaccessible settings require a specialised ambulance response.

Key performance indicators applicable to wilderness response

With some understanding of the meaning of "remote" and "wilderness", we now need to identify specific cases that key performance indicators can be applied to. Ambulance Victoria maintains an electronic means of recording patient care records via the Victorian Ambulance Clinic Information System (VACIS). This data is stored in a VACIS "clinical data warehouse" and is electronically searchable.

Remote or wilderness area case's can be identified in VACIS by a number of means:

- Latitude / Longitude co-ordinates within defined wilderness area
- Specific post codes, town names or intersections of known wilderness area recorded under "scene"
- Case type eg 22A1 Inaccessible incid/Other Entrap
  22D06 Inaccessible incident/other entrapments N/V Avalanche
  572 AFPR EME-SAR Rescue Trapped/threatened
- Case dates, case times and the employee numbers of those attending if an employee can identify these from memory or notes

Once the specific case group of wilderness or remote area responses are identified the key performance indicators can be applied.

In consideration of this information and utilising examples from the USA's National Highway Traffic Administration's list of 25 most valuable KPIs and Ambulance Victoria's existing KPIs, some examples of key performance indicators to consider in the context of wilderness response include:[59,60]

1. Resource Dispatch

   - Percentage of wilderness or remote area cases a specialist resource (4wd and/or Wilderness Response Pack) is dispatched to.

   This is aimed at testing the dispatch systems ability to identify the need for and dispatch specialist response resources in wilderness environments.

   - Percentage of occasions when Advanced Life Support (ALS) or greater level of care makes patient contact in a wilderness or remote area incident (ALS/Mobile Intensive Care Ambulance (MICA)/MICA Flight).

   Designed to measure the level of care that is able to make patient contact in remote settings.

2. Time

   - Time from call received to identification of need for specialist response.

   Designed to measure the ability of the call taking and resource allocation procedure to identify the need for a specialist resource.

   - Time from call received to arrival of ALS or greater crew at patient (at patient as opposed to at scene) in remote settings (ALS/MICA/MICA Flight).

   Designed to measure the effectiveness of the entire system (call taking / dispatch / reflex / response).

   - Time from dispatch to enroute of specialist resources (4wd / WRP)

   Designed to measure the efficiency of dispatch and at branch systems in deploying specialist resources.

3. Pain
   - Mean reduction in pain score for adults (>14 years) in remote or wilderness settings
   - Percentage of adults with initial severe pain (= or > 8) who have a significant reduction in pain (reduction of pain to 3 or more) in remote or wilderness settings
   - Time from first patient contact to first analgesia for adults in wilderness settings
   - Time from first patient contact ("at patient") to significant reduction (=/> 3 points in patients with =/> 8) in severe pain

4. Mortality
   - Mortality (appropriately adjusted) for patients assessed by the ambulance service in remote or wilderness settings

5. Clinical Interventions
   - Number and percentage of patients who meet Rapid Sequence Intubation (RSI) criteria who receive prehospital RSI in remote or wilderness settings
   - Number and percentage of patients showing clinical signs of tension pneumothorax who receive prehospital chest decompression in remote or wilderness settings
   - Number and percentage of patients with ischemic chest pain who receive prehospital aspirin while in remote or wilderness settings
   - Number and percentage of patients presenting with hypo or hyperthermia in a remote or wilderness setting where patient temperature is stabilised or improved prior to arrival at hospital
   - Number and percentage of patients suffering a limb threatening injury (fracture / dislocation with neuro-vascular abnormalities) who have limb perfusion maintained or restored prior to arrival at hospital (measured by improvement in neuro-vascular status)

6. Destination
   - Number and percentage of patients meeting actual or emergent time critical guidelines who are transported directly to a trauma centre from a remote or wilderness setting (patient is not transported to a rural or regional hospital or clinic prior to air medical transfer to trauma centre)

7. Patient Satisfaction
   - Number and percentage of patients satisfied or very satisfied with services in remote or wilderness settings

The above KPI's are suggestions only and would require further development prior to implementation according to what data is practical and achievable to capture and measure.

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MICA Paramedic
Ambulance Victoria

Objective Three

Analyse the effectiveness of the current model through application of key performance indicators and comparison with international models.

While the development and comparison of the previously discussed key performance indicators is ongoing the comparison of international models can be explored in some depth.

In order to provide structure and integrity to the comparison of international models I have adopted the "Systems Model for Accident Causation and Risk Control" (SMACRC) as a framework for comparison (refer appendix 1).[10] The SMACRC has been developed by Dr David Borys of the University of Ballarat. It provides a systems model of risk control and is designed to be a "framework against which (organisations) can evaluate their existing paradigms and mental models and select an approach... to risk control that best suits their needs".[10] Utilising this model provided a robust and consistent structure for comparison.

This framework outlines five key areas of consideration in developing a system of this type:

- Suitable organisational environment and management approach
- Competent and knowledgeable workers
- Well designed physical environment
- Fit for purpose equipment
- Suitable rules and procedures

Suitable organisational environment and management approach

The successful establishment of a specialist response capacity such as this requires support from all levels of management within the organisation. This is important for a number of reasons. The system is more likely to be sustainable and effective in the long term if it provides a consistent response to wilderness areas throughout Victoria. The system also needs integration with other response organisations at all levels of management as well as oversight from the Emergency Management Department to ensure adherence to State and Federal emergency management arrangements.

There is also a clear need for regional ownership and management. A single point of contact in the region where the team is based would provide many benefits to the system. They would be responsible for the day to day running of the team, ensuring team members maintain their competencies and championing the needs of the team with higher level management and kindred organisations. They would facilitate intra and interagency relationships and develop and administer training opportunities at the regional level.

Wilderness medicine is developing as a subspecialty within prehospital care.[5] Therefore there is a need for clinical governance of a professional wilderness response team by a medical practitioner with interest and expertise in wilderness medicine. This would provide a connection with the wilderness medicine community and clinical oversight to ensure the team was adhering to "best practice" wilderness medicine principles and procedures.[5] The choice of the individual physician is vital and their role in clinical oversight needs to be clearly defined.

Competent and knowledgeable workers

Introduction

It is clear that adequately trained and competent personnel are central to the effective operation of any specialised emergency response team.[61,62,64,64,65] All the agencies visited in North America have well developed and integrated selection and training requirements to support their specialist operations. This allows the specialist responders to operate safely and effectively in challenging operational environments. Ambulance Victoria has recognised the need for prehospital specialist response capabilities through the bicycle response unit (BRU),as well as chemical/biological/radiological (CBR), urban search and rescue (USAR), Australian medical assistance team (AusMAT) and motorbike response unit (MRU) programs. **However specifically selected and trained staff are a critical element that is missing from Ambulance Victoria's current wilderness response capabilities.**

The process of incorporating competent and knowledgeable workers into a program such as this includes three key stages:

- **Selection**
- **Training**
- **Skills Maintenance**

Selection

Having competent and knowledgable personnel begins with selecting the right individuals. It can be challenging to establish a selection process that is both efficient and relevant to the needs of the specialist response team. However comparison with existing systems can provide a useful benchmark.

SARTECHS at 442 Transport and Rescue Squadron in Canada undertake an arduous two week selection process followed by a challenging 11 month training period and a very high level of ongoing training and proficiency testing. This includes an annual 5 day wilderness exercise (SAREX) to maintain their currency as a SARTECH. Similarly Burke County EMS Special Operations paramedics, North Carolina Helicopter Aquatic Rescue Team (NCHART) paramedics and American Medical Response Portland Reach and Treat (RAT) paramedics must meet specific experience, knowledge, physical and medical benchmarks prior to acceptance onto the team (see appendices 2-4**)** Hazardous Area Response Team (HART) paramedics in the UK also go through a comprehensive selection process.[7,8]

These different programs include similar themes in their selection criteria. These are:

- Physical Fitness
- Medical Fitness
- Psychological appropriateness
- Clinical exposure and experience
- Wilderness and survival exposure and experience
- Interpersonal, communication and leadership attributes

The process of assessing each of these components is variable, but often consists of an application including self and peer assessment of clinical and wilderness experience, a physical fitness test targeting the requirements of the operational environment, a medical examination by a doctor and an interview with senior staff. The physical fitness component often includes carrying a specified weight over a certain distance within a certain time.

This process could be undertaken in the style of the SARTECH pre-selection course where candidates are put into challenging wilderness and survival situations over an extended period and their ability to operate effectively is assessed or in the style of RAT or Special Operations paramedics where these components are broken up and addressed individually.

Wilderness response paramedics need to be able to operate autonomously and be accomplished at making clinical decisions in the knowledge that clinical backup could be a long time coming or not coming at all. In the context of Ambulance Victoria, individuals accredited as Single Responder Paramedics would be a specific group that meet this criteria.

In the selection of appropriate individuals there needs to be recognition that participants would benefit significantly from being active in wilderness settings in their own time. This gives the participant a depth of background and ongoing experience that is very difficult and expensive to accomplish through a structured training process. This could be achieved through encouraging participants to undertake a lead-in program prior to applying for the wilderness response team. This is similar to the informal preparation many participants undertake when applying for MICA or MICA Flight positions. This would produce a higher quality applicant, not only from the experience they would obtain through the program, but because of the clear commitment and drive associated with obtaining this experience. The acquisition of this experience could be facilitated through voluntary agencies such as Alpine Search and Rescue Victoria or the State Emergency Service (SES) who already have wilderness response competency procedures in place. This could be supported by a mentoring program run by experienced practitioners from within the response team.

This structure suggests a number of levels of response team member. The RAT team have four “levels of participation”. These are:

- **Recruit**

A recruit is not a member of the RAT team but a potential candidate.

- **Trainee**

A trainee is a probationary member who is working through the RAT training course material. Trainee members do not respond to any RAT missions.

- **Support**

A support member has successfully completed the initial course and is going through a process of mentoring and skill development in their first 12 months of being active.

- **Rescue**

A rescue member is a fully qualified RAT member having successfully completed at least 12 months exposure to RAT missions post training.

Training and Skills Maintenance

Once appropriate staff have been selected they need to be equipped with the appropriate skill sets for the environment they are expected to operate in.[64,65] The organisations visited have a combination of intensive training of a specific time period (ie SARTECH 5 day wilderness SAREX) and ongoing training throughout a 12 month cycle (eg RAT team academy).

Components of training and skills maintenance programs often include:

- Building relationships with co-responding agencies
- Team building
- Risk management
- Search and Rescue
- Ongoing physical and medical fitness
- Wilderness survival (shelters/navigation/firelighting/signaling/psychological factors)
- Wilderness medicine / extended care in wilderness settings
- Steep angle and vertical rescue
- Operating in the alpine environment
- Litter attending in steep and vertical environments
- Helicopter operations (preparing an landing/winch zone, tag line management)
- Water rescue (inland/swift/marine)
- Equipment familarisation
- Four wheel drive training / recovery
- State and federal emergency management procedures

Every agency visited had a significant level of training incorporated in their skill development and maintenance program. A typical example would be the Portland RAT team. This team undergo a 12 - 24 day training academy every 12 months adding up to approximately 168 hours of training annually (refer table 1). This program needs to be attended and passed yearly to remain on the team. The training academy is skill and competency based, with only 22 of the 168 hours spent in the classroom. This training is complemented by a workbook which is worked through on an annual basis and completed in the members own time or downtime while operational.

Figure 4: Jackson Fire/EMS - Wilderness response training in a wilderness environment

Table 1. Breakdown of initial training of Reach and Treat team members, This has since been modified to add 22 hours more training (168 instead of 148.5 hours). American Medical Response, Portland, Oregan. reproduced with permission from Schmidti T. et al Advanced life support in the wilderness: 5-year experience of the Reach and Treat Team. Wilderness and Environmental Medicine. 3,208-215 (1996)

Topic	Hours
SAR fundamentals	10
ALS in SAR environment	10
Equipment and navigation	9
Basic vertical rope work	9.5
Glacier travel and ice climbing	14.5
Basic rock climbing	13
Adverse terrain, water ops, night ops, shelter, fire	12
Basic mountaineering and shelters	14
ALS skills and litter attendance	10.5
Avalanche evacuation and rescue	16
Alpine rescue and scenarios (overnight)	30

The literature demonstrates that training in specialised skills needs to be regular and as realistic as possible.[66,67,68,69,70] For example the Jackson Fire/EMS hold regular training nights in specific wilderness environments that they may be called to operate in (refer figure 4). There appears to be a higher quality learning experience during the Remote Medicine for the Advanced Practitioner course due to the regular use of simple moulage to indicate patient injuries (refer figure 5). Bredmose et al describe this as “the zone” or the psychological state of the trainee when they perceive the training environment as real.[66]

Skills maintenance is a critical and often undervalued aspect of specialist response team operational effectiveness. Maintaining a high level of proficiency in a wide range of skills which may only be occasionally utilised is difficult and requires many hours to be dedicated to training.[66,71,72] There is clear evidence that rarely utilised skills decay quickly if not regularly practised.[71,72] HART team members in the UK have a seven week training cycle. This includes one week in every seven where the team are not available for deployment for the purpose of meeting their minimum training and recertification standards (37.5 hours training/ rotation).[7,8] Having a comprehensive ongoing skills maintenance program similar to the HART model is an essential element to maintaining the operational effectiveness of an ambulance based wilderness response team.[7,8]

Many volunteer search and rescue teams undertake a weekly or fortnightly training rotation in the evenings. The Alpine Rescue Team based in Evergreen Colorado recommends it members allow for 300 hours of skills maintenance annually (refer appendix 8). Alpine

Search and Rescue Victoria maintains a competency based assessment of all its active members. Specific competencies must be achieved within specific time frames to remain in "active" status.

There are a range of options for the implementation of an appropriate and cost effective training program for Ambulance Victoria. A personal preservation course has been developed for HEMS paramedics in Victoria. The expansion of this program would have a number of benefits when comparing the various options. This program is already in place so a program would not need to be built from scratch. As it is run internally it is also a particularly cost effective option. Other state ambulance services also run training programs orientated to wilderness response including Tasmania, New South Wales and South Australia. These programs warrant further investigation to identify aspects that could be adapted to meet the needs of Ambulance Victoria's wilderness response program. A model could be developed to facilitate the attendance of Ambulance Victoria representatives at an appropriate course with the intention of building the necessary intellectual base to expand the existing personal preservation program.

Ambulance Victoria already has four wheel drive and aquatic response courses in place. When combined with an expanded personal preservation program candidates would receive a well rounded introduction to a wide range of wilderness response skills.

As a substantial portion of wilderness response will be completed alongside other emergency response agencies it is sensible and cost effective to train together. The Police SAR squad in Victoria have developed basic snow skills and map reading courses which Ambulance Victoria may be able to utilise to train staff much like the Bike Response Unit training. Staff may also wish to join a volunteer organisation such as Alpine Search and Rescue Victoria to assist with their personal skill development and increase interagency operability.

There are also a number of privately run wilderness response orientated medicine and survival skills courses which may contribute to the body of knowledge required to educate wilderness response paramedics.

A number of those visited in North America also offered their services in the setting up of a wilderness response system in Victoria. Many of these people have a significant depth of knowledge and understanding of wilderness response models internationally and would provide a valuable source of information throughout the process of establishment.

Figure 5: Simple but effective moulage. RMAP course, Lake Diablo, WA July 2012.

It is clear that education and training can be a significant and ongoing financial burden to agencies that maintain a specialist skill base. Responding to remote and wilderness environments necessitates proficiency in a wide variety of skills that may not be regularly utilised, but which need to be well practiced for the times that they are required. Therefore innovative ways of developing and maintaining this specialist skills base need to be considered. **A comprehensive selection, initial training and skills maintenance program will need to be implemented for safe and effective operation of an ambulance based wilderness response team.**

Well Designed Physical Environment

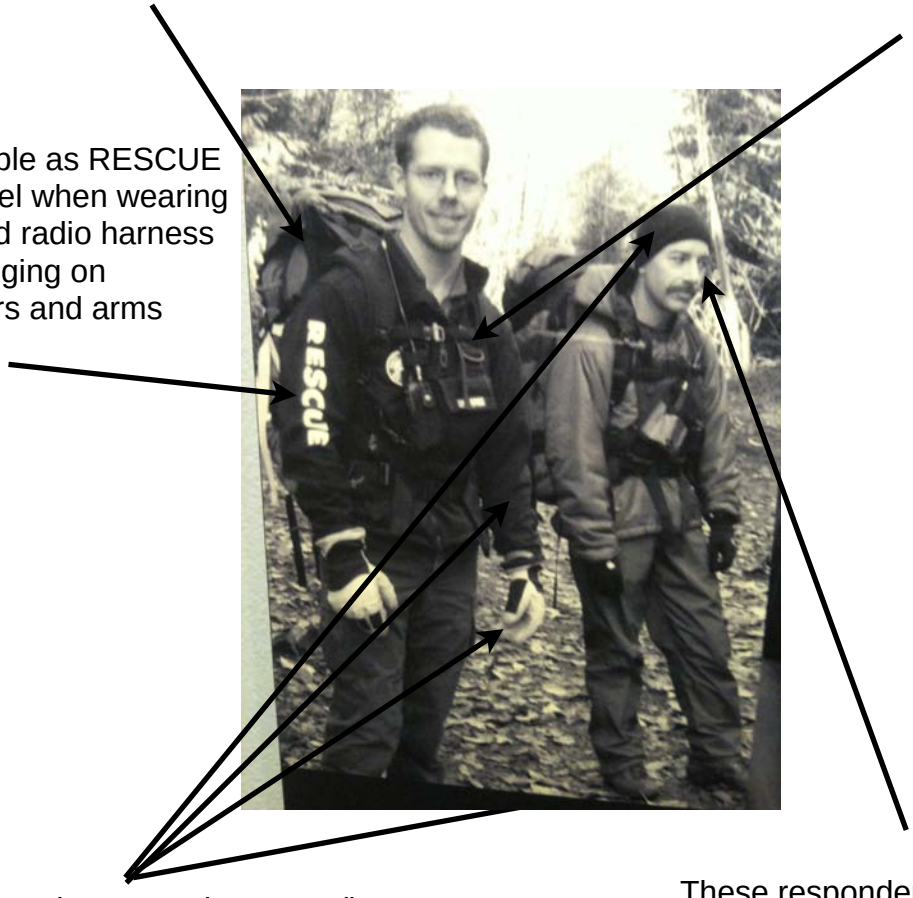
The main physical environments that wilderness response agencies operate within is by definition wild and inhospitable, so very difficult to control by introducing physical management strategies. However there are a number of physical environments within the sphere of wilderness response that can be controlled. These include:

- the physical environment on **the responder** including their Personal Protection Equipment
- **the vehicle** the responder travels in to access the scene and
- **the base of operations** where equipment and supplies are stored.

Physical Environment One - The Responder

Appropriate pack for the environment. Size and weight not restricting operational effectiveness.

Radio Harness - Provides easy access to communication equipment, navigational aids, notepad, whistle and other survival aids.



Identifiable as RESCUE personnel when wearing pack and radio harness with badging on shoulders and arms

PPE appropriate to environment (hat, gloves, trousers, long sleeve top, boots) for warmth and physical protection from abrasion

These responders are not wearing eye protection. If moving through thick vegetation eye protection is important.

Figure 6: It is important to have control over whatever aspects of the environment you can during wilderness response activities. Here members of a SAR team in Colorado demonstrate appropriate personal set up and PPE utilisation.

Physical Environment 2 - The Vehicle

The set up of wilderness response vehicles vary greatly from region to region and is based on the specific needs of the team utilising them. Whatever their specific use, it is important the vehicle is designed to operate effectively.

Two specific vehicle layouts encountered during the study tour were ambulances modified to operate in wilderness settings and specific search and rescue (SAR) operations vehicles. The ambulance vehicles are primarily designed around patient care and transport while the SAR operations vehicles are primarily utilised to deliver SAR personnel and equipment and support the management of SAR operations.

Patient Care Wilderness Response Vehicle

The ambulance vehicles encountered generally had minor modifications and are utilised as dual role vehicles. Both the Portland RAT team and the Burke County Special Operations team operate out of general duties ambulances which has been modified with heavy suspension and four wheel drive to operate in wilderness environments (refer figures 7 and 8 and appendix 10).

Figure 7: Burke County Special Operations vehicle. A RAM 4500 four wheel drive (centre). Patient compartment configuration is standard (right), while wilderness and vertical rescue equipment is stowed in a side locker (left).

Figure 8: American Medical Response Portland Reach and Treat (RAT) team vehicle. A four wheel drive ambulance (right) with wilderness and vertical rescue equipment stowed in side lockers (left and centre).

While this layout gives significant benefit in terms of supplying a platform for patient care and transport, the wilderness areas these vehicles can penetrate is restricted. To overcome this problem these vehicles are supported by all terrain vehicles such as four wheel drive quad bikes and over snow vehicles for more specialised and challenging environments.

The equivalent vehicle in operation with Ambulance Victoria is the Mercedes Sprinter AWD. This incorporates a standard internal ambulance layout on an AWD chassis. While appropriate for more challenging conditions (ice/snow/sand), on beaches and well formed roads, this platform is not considered appropriate for standard use in the back country of the Victorian Alps, particularly in steep or muddy conditions.

In the Victorian context the more appropriate wilderness response vehicle would be a vehicle similar to the Toyota Landcruiser already in operational use across Victoria (refer figure 9). This vehicle has proven capability in the challenging wilderness environments of the Victorian backcountry. Some modification would be required to the internal and roof space configuration to accommodate specialist wilderness response packs and equipment. It may be possible to accommodate specialised wilderness response packs and recovery equipment in a roof box. This could be supplemented by modifying the amount of medical equipment carried internally.

Figure 9: Ambulance Victoria's existing 4wd Toyota Land cruiser configuration - A dedicated 4wd retrieval vehicle suitable for wilderness environments

Another or complimentary possibility would be the modification of the existing rural Single Response Paramedic (SRU) fleet of ford territories to accommodate a wilderness response pack and personal protection equipment (PPE). This may offer an option of rapid response to wilderness settings when operating as part of an interagency response team. In this case the SRU officer could be backed by another wilderness accredited paramedic in a 4WD or equivalent resources from other agencies could be utilised for transport over more challenging terrain. It must be noted that other agency's vehicles generally do not have the facility to secure medical equipment or supine patients. This can create significant health and safety issues for Ambulance Victoria staff.

Search and Rescue Wilderness Response Vehicle

The specific SAR operations vehicles encountered in North America are configured to deliver larger volumes of equipment for a team of responders.These vehicles generally carried (refer figure 11 and appendices 7 and 9):

- Medical equipment (bumbags, small packs, large packs)
- Patient extrication equipment (litter, litter wheel, hypothermia wrap, SKED)
- Communications with ability to recharge (Satellite phone, SPOT, PLB, UHF, HF, VHF)
- Navigation (GPS, Maps, Compasses)
- Command and Control (Audio visual equipment, Computer with SAR management software)
- Alpine equipment (ice axe, crampons, snow shoes, snow shovel, avalanche probe, avalanche transceiver
- Survival Equipment (shelter, food, water, signaling, navigation)
- Technical Rescue equipment (ropes, carabiners, pulleys, prussic)

Access to maps of the response area is commonly a difficult problem to solve. Most teams visited in North America have a file of printed maps of their response area at their base of operations. Many also have access to digital maps that they can print as required. The Teton County SAR team have printed maps filed within their response vehicle and accessible externally, as well as digital maps in the on board computer that can be viewed via a screen on the side of the response vehicle or printed by the onboard colour printer (refer figure 11).

442 Squadron have a dedicated physical environment within their response aircraft that has been refined over a long period of time. The interior of their aircraft are carefully set out for ease of use. All equipment is labeled, racked and secured, while still being accessible for use whenever required (refer appendix 5).

A dedicated response vehicle of this type, such as that used by Ambulance Service New South Wales (ASNSW) Special Operations Team (SOT) paramedics could provide a valuable single response clinical resource as well as a specialist wilderness resources when required (refer figure 10). This would be particularly useful if the response capacity of the team expanded to include other specialist response environments (aquatic, marine, inland water, CBR, USAR, industrial, fire ground support) such as a Hazardous Area Response Team (HART).

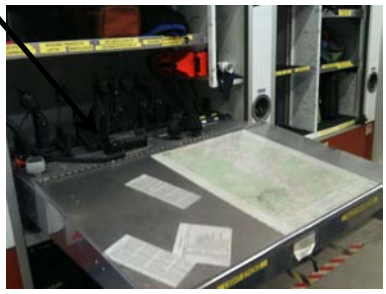
Another vehicle consideration may include the ability to shelter and accommodate two wilderness response paramedics at a forward operating base or base of operations during a prolonged event or in support of policeSAR during a SAR operation. This may include an awning on the primary response vehicle or a camper trailer.

Figure 10: Ambulance Service New South Wales (ASNSW) Special Operations Team (SOT) response vehicle with response equipment on display. The ASNSW SOT model provides an excellent example of a wilderness and remote area response system that is currently operating in an environment with many parallels to Victoria.

Figure 11: Outline of Teton County SAR (Wyoming) and Alpine Rescue Team (Colorado) response vehicles. Both have similar elements: Roll out shelves for heavy equipment, mapping and planning facilities and compartments for litters and litter wheels.

Teton County SAR

Alpine Rescue Team, Evergreen, Colorado



Teton County SAR have a computer based mapping system incorporated into their vehicle computer which is displayed on the side of their SAR response vehicle to assist with SAR management and mapping needs, while the Alpine Rescue Team have an integrated map table.

Both Teton County SAR and Alpine Rescue Team response vehicles with “slides” housing equipment for easy access and limited lifting.

Teton County SAR and Alpine Rescue Team vehicles both house a litter frame and wheel. They are housed for easy access and in themselves reduce the need for lifting during patient extrication.

Vehicle based recovery and safety equipment

In Australian conditions it is pertinent for four wheel drive response vehicles to be equipped with the necessary safety and recovery equipment to ensure occupants are able to recover the vehicle should it become bogged or have difficulty negotiating steep terrain.[73,74,75,76] Having this equipment is widely recommended by government, educational and industry based organisations who operate four wheel drives in remote areas of Australia.[73,74,75,76]

This equipment includes:

- Towbar / winch points
- Driving lights
- Bullbar
- Winch
- Dual Batteries
- Hi-lift Jack
- Snatch Strap
- Chain
- Tree Protector
- Jumper Leads
- Tool Kit
- Fire Extinguisher
- Water Tank / Container
- 1 or 2 spare tires

Physical Environment 3 - Base of Operations (BoP)

It is essential for the effective operation of a wilderness response program to have a well designed base of operations (BoP). There is a large amount of equipment needed to effectively respond to remote and wilderness environments. This equipment needs to be stored securely and be well set out for easy identification and maintenance while being easily accessible when preparing for a response.

442 Transport and Rescue Squadron maintain a large facility that meets their needs for secure and appropriate storage of the wide variety of equipment they require in their day to day response activities. Examples include large lockers to accommodate equipment, a large bench space to allow sorting of equipment and a locked room for technical vertical and steep angle rescue equipment. Maps are filed logically, with smaller scale being available in filing cabinets while larger scale maps for navigation during flight are accessed digitally.

The Jenny Lake Rangers, who operate in Grand Teton National Park providing ranger, SAR and Park Medic services, have a well designed BoP. The layout of this environment allows individual pieces of equipment to be identified and accessed easily when preparing to

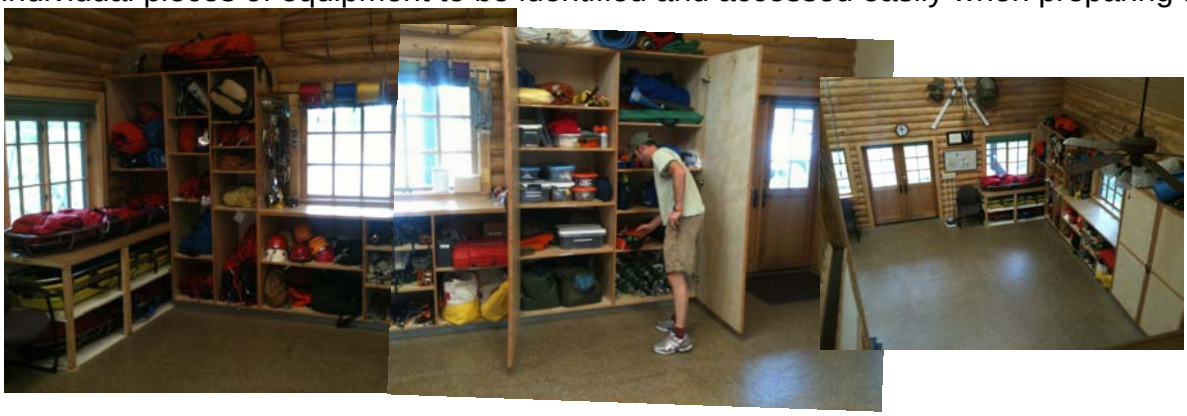


FIgure 12: Jenny Lake Rangers, Grand Teton NP, Wyoming, have their equipment well set out for easy access and a fast response. This response facility also has plenty of space for laying out equipment while packing and unpacking (far right)

respond to the wide variety of wilderness locations throughout the park. The specific equipment required for a particular response will change, so a wide variety of equipment needs to be immediately available (refer figure 12 and appendix 6).

Colorado's Rocky Mountain Rescue also maintain a well organised and appropriate BoP with their equipment stored securely and in order for easy access. Rocky Mountain Rescue maintain a manual compacter to utilise space efficiently (refer figure 13).

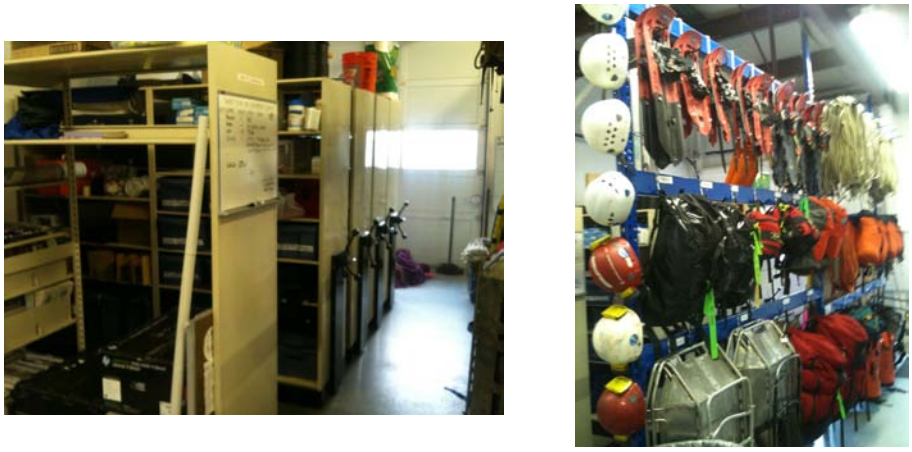


Figure 13: Rocky Mountain Rescue in Denver, Colorado maintain a high volume of technical rescue equipment that needs to be accessed efficiently when preparing for a response. This is achieved by utilising a compacter (left) and racking systems (right).

Other examples include Life Flight in Salt Lake City and Teton County SAR who both maintain well organised racking systems as part of their BoPs.

Apart from equipment storage there are other important features of well designed BoPs. These include appropriate vehicle garaging, briefing areas and access to maps of the immediate response area (refer figure 14).

Figure 14: The Jenny Lake Rangers (left) and Rocky Mountain Rescue (centre) and Teton County SAR (right) all maintain a briefing / meeting room with easy access to a large scale maps and audio visual equipment for planning and debriefing response and training activities.

Ambulance Victoria currently maintains a large number of response locations throughout Victoria. The development of existing buildings has generally not included provision for a specific wilderness response capability. The examples viewed during the study tour all had

dedicated facilities to garage wilderness response vehicles and store equipment appropriately.

While dedicated facilities would be preferable, this may not be immediately possible within Ambulance Victoria. Each location identified as requiring a wilderness response capability would need to be individually assessed to identify the most efficient and cost effective way of appropriately storing wilderness response vehicles and equipment. The best means of providing appropriate space for equipment maintenance, pre response briefing, post response debriefing and training would also need to be identified at each location.

Figure 15: American Medical Response, Portland Reach and Treat (RAT) Team members performing a rope assisted lower down a slippery slope for increased patient and responder safety.

Fit for Purpose Equipment

As with other aspects of wilderness response, it is important the response and personal protection equipment (PPE) is appropriately designed for the intended purpose.[77] In the context of an ambulance based wilderness response capability, the necessary equipment includes:

- **Wilderness Response Packs**
  Housing medical, survival, navigation and communication needs and facilitating the transport of this equipment into a wilderness environment.

- **Personal Protection Equipment**
  Clothing, vertical / steep angle, swift water and alpine specific equipment to facilitate the safe movement of personnel through various wilderness environments.

- **Patient Extrication Equipment**
  Various patient extrication equipment suitable to the environment, climate and topography of the area. With consideration for patient toileting during extended extrications.

- **Communication and navigation equipment**
  A robust and effective two way communications system that promotes clear communication for responder safety throughout the response area. Navigation equipment for identifying your current location and assisting efficient movement to a predefined destination.

Wilderness Response Packs

The availability and contents of wilderness response packs vary's widely depending on many factors including the environment being responded to, information regarding the patient's injuries, time of year and skill set of the responder.

Critical elements of a wilderness response pack includes:

- Appropriate weight and bulk for circumstances
- Efficient - provides fast and efficient access to equipment and is flexible in its application
- Comfortable - appropriate and adjustable harness system
- Robust - Is strong and able to survive "abuse" in challenging wilderness environments

Weight / Bulk

A bulky, heavy pack impedes efficient movement through a wilderness environment and provides significant manual handling risks for the responding paramedic. It is important to keep equipment restricted to the minimum that is required to operate effectively in that environment. Generally pack weight should be in the vicinity of 20kg to both promote efficient movement and allow sufficient equipment to operate effectively.

Efficiency
The layout of the pack is important. While in general simplicity promotes longevity, adding features such as removable hoods and external pockets adds versatility and provides structure and the ability to compartmentalise equipment into modules which aids accessibility.

Comfort
It is important the packs harness system is appropriately engineered to support the intended weight of the pack and provide comfort to the operator. This necessitates some level of adjustment to fit different sized users.

Robustness
Operating in remote and wilderness environments can be tough on equipment, not to mention the reputation paramedics have regarding caring for their tools. Therefore it is important paramedic wilderness response equipment is constructed with the appropriate materials and workmanship to deal with these challenging environmental conditions.

Pack Contents
While many of the teams visited maintained specialised equipment pack configurations (Burke county special operations, Teton County SAR, 442 Squadron) it would be more appropriate in the context of Ambulance Victoria to develop packs containing both survival and medical components. It is important each pack contains both of these components so each responder has continuous and immediate access to essential survival equipment and at least some medical supplies while responding on foot. While it may be impractical for a single responder to carry all the necessary medical supplies, it needs to be recognised that spreading this equipment out amongst non-medical responders needs to be managed carefully to ensure this equipment is available when and where it is required.

Medical Equipment
Medical equipment needs to be formed into modules for access, versatility and ease of packing. This concept has already been recognised within AV with the development of the Hume Wilderness Response Packs (WRPs) (refer appendices 11,12 and 13). Examples of modular response kits seen in North America include Dr Will Smith's wilderness response kit (refer appendix 15) and the response kit of Portland's Reach and Treat (RAT) Team. The RAT team normally deploy two paramedics who together carry four medical modules (refer figure 17**)**

- Drug / Assessment Kit
- Airway Kit Intubation Roll
- Intravenous Kit
- Trauma Kit

The exact components of each kit are listed below:

Figure 16: One option for suction in a wilderness environment - a nasopharyngeal airway and a 60 ml syringe.

American Medical Response Portland Reach and Treat Team Medical Kit Content

1. Intravenous Kit

1000ml Normal Saline
Regular Extension set
IV Catheters (2 x 16g - 22g)
Gloves (3 x Med and Large)
IV Tubing
Quarter Inch non sterile 4x4
Tourniquet
Sharps Shuttle
ETOH Preps
Iodine Preps
Pressure Bag
1” Tape
Bioclusive
Controla flow extension

2. Airway Kit

Bag Valve Mask
Tongue Depressor
Colour Metric CO_2
Tension Pneumothorax Kit
Quick Tracheotomy Kit
King Air
Large Stylet
OPAs 80mm and 100mm
NPA 24mm and 30mm
Small and Large Blade Lites
4 AA Batteries
Adult Tube Holder
10cc and 60cc Syringe
Suction Device
Lubricating Gel
Laryngoscope Handle
Mac 3 and Miller 3
ETTs (5.5 - 8.5)

3. Trauma Kit

10x30 Trauma Dressing
8x10 ABD Pads
5x9 ABD Pads
4x4 Sterile Gauze
4” Cling Wrap
Sam Splints
Triple Antibiotic ointment
1” non sterile 4x4
Tactile Tourniquet
2” Tape
Trauma Shears
Triangular Bandages
1” Tape
5x9 Petrolatum Dressing
Kendrick Traction Device

4. Medication / Assessment Kit

Adenosine
Ibrofen
Atropine
Amiodarone
Albuterol
Atomidate
Aspirin
Acetazolmide
Benedryl
Calcium
Cefazolin
Dextrose
Decadron
Epinephrine
Flumazenil
Glucagon
Hypertonic Saline 500cc
Inapsine
Narcan
Nitro Tabs
Oral Glucose
Solu Medrol
Sodium Bicarbonate
Vasopressin
Vecuronium
Zofran
Suxamethonium
Syringes (2 x 1, 3, 5, 10, 20cc)
Needles (2 x 23 and 25 g)
Filter Straw
Twin Pak
Glucometer
Magnesium
Lasix
Ipratropium
Lidocane
Normal Saline 10ml
BP Cuff / Stethoscope
Thermometer

Figure 17: Reach and Treat Team Medical Equipment

Drug / Assessment Kit

The majority of drugs are set out in see through, divided pouches on a Velcro board.

Drugs and assessment equipment are housed in a mid sized, zippered pouch.

Airway Kit

Airway equipment is housed in an airway roll, inside a similar pouch to the drug kit. The pouch could be substituted for a lighter, waterproof, see through dry bag.

Restricted drugs are transported in a sealed container.

Intravenous Kit

IV equipment is housed in a small pouch. This could be substituted for an IV roll and transported in a lightweight, clear, dry bag for easy access and protection from the elements.

Trauma Kit

The trauma kit is housed in a small pouch similar to the IV kit. A clear pouch with internal dividers for organisation would assist with easy identification and access to specific pieces of equipment.

A comparison of the RAT team ALS response kit with the existing Wilderness Response Pack contents utilised by specific locations in Hume region show many similarities (refer appendices 11 - 13). It may be possible to utilise the best ideas from each of these systems to develop a set of wilderness response medical equipment that provides a very efficient and effective system for wilderness response in Victoria. A recommendation would include six medical modules.

- Assessment Module
- Resuscitation Module
- Intravenous Module
- Drug Module
- Trauma Module
- Airway Module

Assessment Module
Sphygmometer
Stethoscope
Blood Sugar Monitor
Thermometer (lightweight)
Sp02 finger probe (lightweight)

Resuscitation Module
Bag Valve Mask
(eg Pocket BVM by Persysmedical)
KY Gel
Suction Device (eg squid suction)
Nasopharyngeal Airways
Oropharyngeal Airways
Y Sucker 12 - 14
Gloves / Eye protection
Shears

Intravenous Module (eg Conterra Ad Wrap)
Tournique
Alcohol Swabs
IV catheters (16 - 22 gauge x 1 each)
3 Way extension tubing
Reflux Valves
Tegaderm
Tape
Small sharps container
1 x giving set
1000ml normal saline (NS)
Thermal bag for NS
(eg Conterra IV Bag)
Pressure infuser
Intraosseous device

Drug Module
Set of drugs to suit skill set of provider
Spring Infuser

Trauma Module
Crepe Bandages (S,M,L)
Combine (S,M,L)
Coban
Gauze
Plasters
Tape
Sleek
Moldable Splint
Normal Saline 20ml
Kendrick Traction Device
Cervical Collar
Triangular Bandages

Airway Module
Endotracheal tubes (5.5 - 8.5)
LMAs (3, 4, 5)
Adult bougie
Colour metric CO_2 detector
Adult laryngoscope handle / blades
Endotracheal tape
Large Stylet
NAR Chest decompression needles x 2
Tracheotomy kit
50ml Syringe (for LMAs)
10ml Syringe (ETT)
Consider lightweight capnograph

Each of these modules could be housed in a lightweight organiser as appropriate and placed in a dry bag for transport. **These modules could be available externally on a purpose designed pack. With the pack containing survival and other equipment internally.**
There are a number of components that could be added to this kit depending on the operational environment and information known prior to response. These include:

- a portable automated external defibrillator (eg the 490g Schiller Fred Easyport)
- a lightweight oxygen delivery system (eg carbon fibre)
- a hypothermia prevention and management kit

The ability to provide defibrillation is an essential element of any ambulance response unit. Therefore the addition of a light weight and portable AED is worthwhile. Another kit worthy of consideration is a lightweight oxygen delivery system. Many wilderness response teams visited utilised lightweight carbon fibre oxygen bottles as part of their response kit. Carbon fibre offers an extremely strong lightweight alternative to aluminium, while providing increased capacity within the same sized cylinder. 442 Squadron also utilise SCOTT solid state oxygen which SARTECHs deploy from the aircraft when required.

There is significant evidence that there is both a high risk of hypothermia when injured or ill in a wilderness environment and that this has an adverse affect on outcome, specifically in the trauma patient.[45,46,78,79,80,81,82,83] There is also evidence that even urban based trauma patients regularly arrive at hospital hypothermic.[82,84,85] It would therefore be advantageous for an ambulance based wilderness response team to carry specific equipment to address hypothermia.

It is common practice for medical teams to carry lightweight silver reflective patient wraps, however their efficacy, particular in patients who are already hypothermic is highly questionable.[83,86] Patients who are already hypothermic in a cold environment require gentle and consistent rewarming.[79,83,87,88,89] This can be achieved with the use of an external heat source such as a ready heat blanket.[83,89]

The basic mechanisms of hypothermia are:

- conduction
- convection
- radiation
- evaporation

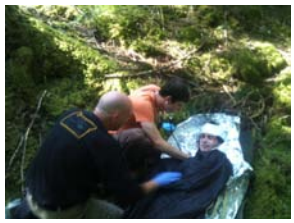


Figure 18: The author and other RMAP participants demonstrate the use of a "Hypothermia wrap"during a trauma scenario using the Blizzard Survival blanket and right in the classroom using tarpaulin

Put more simply these mechanisms can be described as "wet, wind, cold". Therefore to manage a hypothermic patient we must manage each of these mechanisms.

The concept of a "hypothermia wrap" is taught widely in North America. This concept utilises ground and air insulation layers and a waterproof/ windproof layer to encapsulate a hypothermic patient and facilitate passive rewarming (refer figure 18).[81,83] There are a number of lightweight technologies utilised principally by military organisations internationally that have proven to be very effective at preventing and managing hypothermia.[83] These include Ready-Heat™ blankets, Blizzard survival blanket,

and the North American Rescue Heat Reflective Shell (HRS). Based on the available literature effective components of a hypothermia kit could include:

Figure 19: Ready-Heat blanket in Colorado's Alpine Rescue Team response kit.

Ready-Heat™ blankets (refer figure 19)
Light weight (single panel = 280g) blanket that heats up when exposed to air. In wide use internationally in military and prehospital response teams. Currently being trialled by HEMS throughout Victoria.

Blizzard Survival Blanket (refer figure 20)
Compact, light weight thermal blanket (525grams / 1 litre). A large, baffled version of the traditional "space blanket" having a significantly increased ability to trap warm air.

North American Rescue (NAR) Heat Reflective Shell (HRS)
Compact, light weight patient shell (822 grams / 200cm x 110cm). Provides environmental protection while maintaining patient access.

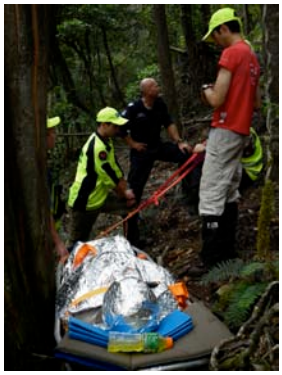


Figure 20: Blizzard survival blanket utilised to passively rewarm an exposure patient following a multi day bush search. 2010 Gippsland, Victoria,

Thermarest ridgerest or similar
Lightweight, robust ground matt to provide ground insulation.

Integral Designs bothy bag (refer figure 21)
Lightweight, fast emergency shelter.

Thermal base layer
A set of thermal clothing (wool or polypropylene) to put on patient if their clothes are wet.

Hot, sweet drink
Ability to produce a hot, sugary drink if patient condition allows them to safely consume this.

Toileting
Consideration for patient toileting during prolonged extrication is necessary and important. Inclusion of an adult nappy in a hypothermia kit can be useful. Alternately patient clothing can be utilised.

Intravenous fluid and humidified warm air in hypothermia
Numerous studies have demonstrated benefit in administering normothermic fluids in hypothermia.[80,82,84,85,87,88] A number of agencies maintain the ability to warm intravenous fluids in the field including SARTECHS of 442 Squadron. This provides an ability to infuse IV fluids to trauma patients without promoting further hypothermia. An effective means of achieving this is utilising the HEBL invehicle fluid warmer and carrying warm fluid into the wilderness environment. This method of warming fluid has been extensively investigated by MICA paramedic David-Bedford Lee and is currently utilised at MICA 14 in Melbourne, Victoria. The previously mentioned Ready-Heat™ blankets may also assist in warming IV fluids prior to patient administration, although the safety and efficacy of this method is yet to be established.

Figure 21: Bothy shelter in use by Alpine Search and Rescue Victoria. The bothy provides a warm, sheltered environment to manage a patient or just to have lunch.

Survival Equipment

Providing a range of survival necessities is important for both responder and patient safety. As with medical equipment, the exact configuration of survival equipment may change with the particular environment being entered, expected weather conditions, the time of year, the length of time expected to be in the wilderness and the preferences of the particular responder. However a basic configuration can be suggested and modified as required.

A survival kit should include components that combat the "seven enemies of survival":[75,90] These are:

- Pain
- Cold
- Thirst
- Hunger
- Fatigue
- Boredom
- Loneliness

The most comprehensive survival kit encountered in North America was used by SARTECH Anthony Vail. As SARTECHs spend a lot of time in wilderness environments I would suggest this is a useful basis on which to build a survival kit for Victorian conditions (refer figure 23)

FIgure 22: Orange smoke flare in use to guide HEMS 2 to a patient at the conclusion of a multi day bush search in Eastern Gippsland, 2010.

Figure 23: SARTECH Anthony Vail's operational survival kit.
442 Transport and Rescue Squadron, Comox, British Columbia, Canada.

External:	Strobe Whistle Knife	
Internal:	Sunscreen Chapstick Bug Repellent Head Net (bugs)	Environmental Protection - Pain
	Synthetic Jacket (warm) Hydralite Jacket (waterproof) Protective Gloves (leather) Balaclava (warm) Space Blankets	Shelter - Fatigue / Cold
	Spare Whistle (on cord) Mirror Flare Radio / GPS (Garmin RINO) Glow sticks x 2 Pelican Mitylite 1900 Torch	Signaling / Communication - Loneliness
	Wire Saw 50 feet cord	General
	Fire Paste Lighter Magnesium Flint (strike with knife) Blast Match (spare flint) Wet fire (chemical tinder) Candles	Fire - Cold / Hunger
	Water Purification Tablets (Chlorine Dioxide/Phosphoric Acid - Pristine Sealed Water (packets)	Water -Thirst
	Fishing kit Survival Candy (500 calories / day)	Food - Hunger
	Basic Trauma Kit	First Aid - Pain
	Cards	Psychological Health - Boredom / Loneliness

Accessibility

One practice that is widely employed by regular responders to wilderness areas was keeping essential survival equipment on their person during operational duty. This was witnessed at 442 Transport and Rescue Squadron, British Columbia, Life Flight, Utah and at Jackson, Wyoming. Mike Moyer, a paramedic in Jackson, Wyoming, told a significant story of survival following a helicopter crash he was involved in. He listed having immediate access to survival equipment as a key component of his survival.

Navigation

While some navigation aides are listed within the survival kit above, it is important to also have access to up-to-date printed maps of the area being responded to, a compass and sufficient knowledge to utilise these tools effectively. The Garmin Rino radio/GPS utilised by Anthony Vail in his role as a SARTECH is a combination UHF radio / GPS that incorporates weight savings and the ability to track other responders who are also using the same device. There are a wide variety of GPS's available and the current handheld GPS unit utilised by Bush Search and Rescue Victoria is the Garmin Etrex Vista Hcx.

Lighting

Having a range of light sources available is critical when needing to operate in remote and wilderness environments at night or in low light conditions. A headlight is particularly useful so the responder can continue with their tasks without having to occupy their hands with a torch.

Helicopter Landing Zone Identification

Working in wilderness environments is likely to include working closely with HEMS and other helicopter assets in Victoria for patient or self evacuation. Therefore it is important a ground based wilderness response team is capable of communicating clearly with HEMS and other helicopter crews. Strobes, flares and smoke signaling devices can be utilised to mark landing and winch zones for easy identification from the air (refer figure 22). Mike Moyer, in his survival story mentioned earlier, also emphasised the importance of being seen from the air when requiring rescue. Following the accident he was involved in, air crews could not pinpoint his location despite an accurate grid reference. This resulted in a five hour wait for ground resources to access the crash site.

Food and Water

Responders will need to have access to food and water throughout their response activities.[72,73,74,89] This is likely to include carrying water (possibly in a hydration bladder) as well as water purification equipment within the survival kit. Food needs to be easily accessible, easy to prepare and enjoyable. There are a wide range of "instant" meals available that simply require the addition of hot water. Having to boil water for a meal would necessitate carrying a fuel stove. There are alternatives including carrying a variety of energy snack foods or meals with the ability to heat themselves.

Extended Care

There may be times when it is anticipated or likely that response teams will be required to spend extended periods in the field (>24hrs), or it is appropriate to camp at a road end. In these cases the team will require access to more substantial camping equipment including:

- tent
- sleeping bag
- personal ground insulation
- fuel stove / cooking equipment / food

Communications

Clear communication is both absolutely essential and tremendously difficult in wilderness settings. **Establishing a reliable method of two way communication with paramedics who respond to wilderness environments is essential**. This contributes to both safe systems of work for paramedics and best practice patient care and extrication. [73,74,75,76,92] There are numerous ways this could be achieved and it is likely any communications plan would require a number of alternatives to be available to build redundancy into the communications system.[92] Options include:

- Working with other agencies to utilise established radio networks
- Satellite Phone
- Personal satellite communications (SPOT / InReach)
- Personal / Vehicle based UHF radio
- Vehicle based HF radio
- Personal VHF (SMR) radio
- GSM Mobile phones
- Personal locator beacons
- EAS Pager network

Please refer to appendix 15 for a complete comparison of communications options.

Working with other agencies

Numerous other government agencies operate in wilderness environments on a regular basis and require reliable communications with their staff (Police, CFA, DSE, Parks, SES) (refer figure 24). Identifying the methods other agencies use for operational communications has the potential to both maximise the cost effectiveness of establishing a reliable communications network and increase the likelihood of interagency operability, both of which are important considerations.

Figure 24 Radio communications available in Victoria Police's Swifts Creek based four wheel drive response vehicle, including VHF, HF and UHF options.

Satellite Phone

Iridium offers the most reliable satellite network available. Iridium consists of a constellation of 66 Low Earth Orbiting Satellites (LEOS). They provide full global coverage and the best available coverage compared to other networks which use geostationary satellites where coverage is affected by gullies, mountains and foliage.

PROS

- 2 way communication via satellite to landline, mobile and satellite networks
- SOS button to request help (non verbal – Iridium 9575 Extreme)
- GPS enabled – (Iridium 9575 Extreme)
- Global coverage outdoors (but depends on satellite position)

CONS

- Initial purchase cost (RRP $1499 inc GST - Iridium 9575 Extreme)
- Call drop outs due to satellite orbiting positions
- Ongoing subscription – starting at $45 per month

Personal Satellite Communicators (PSC)

SPOT Satellite GPS Messenger and Delorme inReach are two devices used by many government and corporate companies as safety devices for lone and remote workers. They are also widely used by recreation users in the areas of reduced or no mobile phone coverage.

SPOT Satellite GPS Messenger

SPOT Satellite GPS Messengers are utilised widely throughout Victoria by the Police, including the Police Search & Rescue squad and many police in alpine, remote and regional areas. SPOT utilises the Globalstar Satellite constellation of LEOS satellites to communicate. It offers one way messaging. These SPOT messages are currently monitored by the Emergency Services Telecommunications Authority (ESTA)

Other government users of this product include:
State Emergency Service
Parks Victoria
Department of Sustainability & Environment

PROS

- Lightweight (147 grams)
- Easy to use
- Low purchase price
- SOS button
- Existing ability to have messages relayed to ESTA
- Easily carried when out of vehicle
- Pre programmed messages possible (eg arrived, loaded, delayed)
- Use off-the-shelf batteries to operate

CONS

- One way communications only
- No confirmation of message sent successfully
- Requires ongoing subscription (starting at $19.95 inc GST per month)

Delorme inReach

The Delorme inReach is a new product utilising the Iridium Satellite network. It has all the features of a SPOT satellite GPS Messenger with the added ability to receive messages via satellite (2 way messaging) and confirmation of messages sent (refer figure 25).

PROS

All features of the SPOT plus:

- Provides 2 way communications when paired with a phone, iPod or tablet
- Confirmation of message sent successfully
- Iridium satellite network more reliable

CONS

- Not currently monitored by ESTA
- Requires ongoing subscription (starting at $19.95 inc GST per month)

Figure 25: Close up of InReach personal satellite communicator (Left) and InReach in use by the Kerryn Wratt and Linda Beilharz on a crossing of the South Patagonian Icecap (Dec 2012) (Photo by Rob Rigato).

UHF handheld radio

Utilisation of “line of sight” UHF radios is useful when operating in close proximity to one another (within line of sight). This method is commonly used in SAR teams in North America and in Victoria by Alpine Search and Rescue Victoria. Lightweight UHF 5 watt radios provide a cost effective solution for local communications. Some UHF radios also have the ability to display GPS location to assist in navigation (Garmin Rino).

PROS

- Easy to use
- Low purchase price
- Lightweight
- Easily carried when out of vehicle

CONS

- Short Range – Up to approximately 5 - 10km in good conditions
- Line of sight communication
- Require charging

VHF - Handheld SMR (StateNet Mobile)

SMR radios have traditionally been used by a range of emergency services to provide communications. RAVnet currently utilises the SMR network. SMR provides a range of facilities including dialing into the phone network while remote from the vehicle.

PROS

- Infrastructure already in place
- Utilised by multiple agencies
- Ability to access phone network
- Can be utilised for both short range and long range communications

CONS

- Relatively expensive to buy hardware and upgrade existing network

HF Radio - Codan NGT

HF radio has a long history of use in wilderness areas of Australia, particularly in the vast deserts of central Australia. Victoria Police utilise HF radio extensively in wilderness areas, including East Gippsland, making shared use of HF facilities a possibility as well as facilitating interagency communications (refer figure 26). This technology has advanced significantly and is now much easier to operate than when first introduced, reducing training costs associated with its use.

PROS

- Utilised by multiple agencies and throughout four wheel drive community
- Long range and reliable
- Ability to access phone network

CONS

- Some expense in buying hardware initially

Figure 26: Victoria Police Codan NGT HF system as currently utilised throughout rural Victoria by police for remote area communications. This unit is based at Mallacoota in far East Gippsland (Photo by Ross Salathiel).

GSM Mobile Phones

GSM Mobile phone coverage is widespread throughout the world. In the emergency response context the emergency services are most likely to have been initially alerted by mobile phone. It is therefore possible there may be some level of coverage in the response area, although this may not be at the actual scene of the incident / injury.

In areas with minimal coverage, text messaging (SMS) has proven to be a reliable method of communicating that uses very little battery life. While mobile phones are often an effective means of communication they cannot be relied upon solely in remote or wilderness settings. Many areas in Victoria provide no GSM phone coverage

PROS

- Low purchase cost
- Easy to use

CONS

- Will not work outside of coverage areas
- May require travel from injured person / scene to get communications
- Requires ongoing network plan

Personal Locator Beacons (PLBs)

PLBs are renowned for being reliable, but there remain a percentage of occasions when they fail for various reasons. The major drawback of the PLB is the lack of detail when calling for assistance. They can only indicate that assistance is required and do not have any mechanism to detail the level or type of assistance. This can lead to a full scale rescue being organised when only more minor assistance is required.

PROS

- Easy to use
- Lightweight
- No subscription required

CONS

- One way device to Australian Maritime Safety Authority (AMSA) Canberra
- Single “emergency response required” message
- Expensive to buy – (Approx $500 - $800)
- Single use only (then requires expensive battery change through manufacturer)
- Cannot be directly monitored by ESTA

EAS Pager Network

The pager network covers 97% of Victoria and provides an important link for one way data transmission from the communications centre to the paramedic. There is no allowance to send a message from the paramedic and it is the remote areas that have the poorest coverage.

Global Positioning System (GPS)

While the above communication devices are a great way of contacting the outside world it is vital to be able to relay your exact location. A patient extrication from a wilderness or remote environment is likely to require the assistance of HEMS or an outside agency. To accurately provide the position of the scene a GPS would be required. The Garmin Rino UHF radio/GPS combine a GPS / street navigator and a hand held UHF radio into the one device.

Communication Discussion

It is recommended that a range of these systems be introduced to ensure efficiency of operation in a range of conditions while remaining cost-effective. Options could include:

- Providing **regional group managers** with **satellite phones** to allow them to communicate effectively during specialist events in wilderness or remote settings outside of cell phone coverage.

- **Providing HF** (possibly Codan NGT) **and UHF in vehicle** radio systems would give responders robust, reliable communications with ability to send a duress alarm, make phone calls and talk directly with other agencies and infield paramedics while in their vehicle.

- When **remote from the vehicle** responding crews could carry a personal satellite communicator **(InReach or SPOT)** and compatible **smartphone** for ongoing satellite based communications while outside of normal radio or cell phone range and a **UHF radio** for communicate between themselves if they become separated or for interagency communications when appropriate.

Figure 27: Ambulance Victoria's Lakes Entrance based four wheel drive and Victoria Police's Swift Creek based unit, Dinner Plain, 2013. (Photo by Dave Jones)

Personal Protection Equipment (PPE)

The purpose of PPE is to protect the operator from hazards in the external environment. Fit for purpose PPE is a critical component in providing safe systems of work to increase responder safety in wilderness settings.[93,94,95,96] Functions of wilderness PPE include ensuring the responder is highly visible, while providing protection from hypothermia (including cold/wet/wind) and abrasion, arresting falls in steep or vertical environments, and specifically protecting the responder in alpine and swift water environments.[93,94,95] The exact nature of the items will vary depending on the season, topography, current weather conditions and personal preference of the responder. However a basic set of PPE utilised in wilderness settings is well established (refer appendix 8).

Basic Wilderness Response PPE

(Refer figure 28 and 29 and appendix 8)

- Warm Hat (wool)
- Sun Hat (full brim)
- Balaclava (wool/ polypropylene)
- Upper and lower thermal base layer (wool/polypropylene)
- Mid weight upper layer (wool/ fleece/primaloft)
- Outer thermal layer (down/ primaloft)
- Upper shell layer (goretex)
- Lower shell layer (goretex or canvas)
- Glove system - (base layer / mid layer / shell layer)
- Socks (wool/combination)
- Boots (leather/laceup/ appropriate fit/appropriate stiffness in sole for environment)
- Gaiters
- Sunglasses
- Radio harness

Figure 28: Members of the Alpine Rescue Team in Colorado extricating a patient. Note the personal setup including PPE utilised in the alpine environment in summer - long pants, thermal top, helmet with torch, radio harness, supportive walking boots.

Figure 29: Appropriately attired members of Alpine Search and Rescue Victoria during a summer search for a missing person at Lake Mountain, Victoria, Australia. Note the high visibility caps, jackets and shirts.

Vertical or Steep Environments
(Refer figures 1 and 30 and appendix 8)

- Helmet
- Sit harness
- Carabiners
- Prussic's (2 x short, 1 x long)
- Slings
- Belay device / descender
- Pulleys
- Rope

Figure 30: Alpine Search and Rescue Victoria members during winter training at Mt Stirling, Victoria, Australia in 2011. Note PPE appropriate for a winter alpine steep snow environment.

Alpine Environment
(Refer figure 30 and appendix 8)

- Helmet
- Goggles
- Face shield (eg Buff)
- Avalanche transceiver
- Avalanche probe
- Snow shovel
- Ice axe
- Crampons
- Snow shoes
- Walking poles
- Well insulated boots (consider plastic)
- Rope

Figure 31: Alpine Search and Rescue Victoria members during team building exercises in a river environment at night. Note glow sticks on helmet for identification and visibility.

Swift Water Environment
(Refer figure 31 and appendix 8)

- Helmet
- Personal buoyancy device
- Wetsuit
- Throw bag
- Knife
- Rope

This equipment is often kept in a duffle bag for transportation. Immediately prior to deployment the necessary equipment for the specific response can be worn or packed into the response pack for movement into the field.

Patient Extrication Equipment

As with other areas of equipment for wilderness response there is significant variability in the type of patient extrication device required for different environments and circumstances. Options include lightweight, stokes wire, thompson plastic and titanium litters (refer appendix 8).

Figure 32: A foxtrot litter being discussed by students at the Remote Medicine for the Advanced Practitioner course at Lake Diablo, WA, USA in July 2012. This litter is in common usage by US special forces.

Lightweight Litters

There are a number of lightweight patient extrication devices available. These litters offer the benefit of lightweight, compactness and ease of use, making it possible to carry them as part of a standard wilderness response configuration. These litters are robust and offer the option of dragging the patient when limited resources or terrain mean a carry is not feasible. They are also small enough to fit into tight spaces when deployed. However they are restricted in their functionality as they are not rated to support the patients weight in steep or vertical environments, cannot accept a wheel and do not provide cervical stabilisation. One example in wide use in the military in North America is the Foxtrot™ litter which weighs 2kg (refer figure 32)

Figure 33: A wheeled litter in use by Alpine Search and Rescue Victoria members during a winter training exercise on Mt Bogong, Victoria, Australia.

Wheeled Litter

Wheeled litters are in common usage in SAR agencies worldwide. The concept normally encompasses the use of a standard litter, such as a stokes basket, with the attachment of a frame and wheel to its base. This substantially decreases the load on responders by removing the need to carry the weight of the patient and stretcher. Instead, rescuers only need to balance and guide the stretcher over the terrain. Considered an essential element in wilderness medical extrication devices (refer figure 33).

Figure 34 Vertical extrication training by the AMR Portland Reach and Treat (RAT) team.

Vertical Extrication Litter

Similarly there are a wide variety of vertical or steep angle extrication litters available. The Alpine Rescue Team in Colorado prefers to use a titanium litter that splits into two parts for vertical extrication and carry outs. Some lightweight litters have a mesh base which is not ideal in a wet or snowy environment. In these conditions a heavier solid base litter is preferred (refer figure 34).

Figure 35: A SKED rescue stretcher. Widely utilised throughout North America as a robust, lightweight, compact patient extrication device. It weighs in at 8kg.

SKED Rescue Litter

The SKED rescue litter is widely utilised by rescue organisations internationally. It provides the benefit of lightweight compactness as it can be rolled up and carried in a purpose made carry pack. The SKED is also rated for steep angle and vertical extrication and is made of tough plastic so can be dragged if necessary. It is not rigid and cannot be used as a wheeled litter (refer figure 35).

Suitable rules and procedures

Overview

There are a wide variety of rules and procedures that would need to be implemented for a wilderness response system within Ambulance Victoria to operate most effectively. These include an appropriate deployment procedure, clear interagency arrangements, wilderness specific clinical practice guidelines and equipment maintenance procedures.

Deployment Procedure

A very important procedure in any emergency response system is that related to dispatching of resources. A range of communication centres were visited in North America including the Joint Rescue Communication Centre (JRCC) in Victoria, British Columbia, the Life Flight dispatch centre in Salt Lake City, Utah and the emergency services dispatch centre in Jackson, Wyoming.

One outstanding difference that was evident when comparing the United States EMS dispatch model with Victoria's, was that generally counties in the USA have their own EMS service and associated dispatch centre. In contrast, Victoria has two ambulance dispatch centres for the State. In the USA, often one controller dispatches all emergency services (police/fire/ambulance/SAR). In contrast in Victoria, each service dispatches its own resources. One advantage of the US model, having dispatchers control multiple agencies, is the increased co-ordination between agencies. This is only possible because of the relatively small geographical area covered by each dispatch centre.

One question asked of EMS dispatchers at the locations visited was “how do you identify the need for a specialist wilderness response resource?” The overwhelming answer was, “we ask”. Having the opportunity to ask the caller exactly where they are and what resources they think they will need can assist in the dispatch process. Questions such as “is your location accessible by 2wd vehicle or 4wd or by foot?” is not currently part of Emergency Services Telecommunication Authority’s (ESTA) standard call taking process and it is often left up to responding paramedics to ask these questions of the dispatcher and duty manager after they have been dispatched. This can lead to delays in responding the appropriate resource and put paramedics at risk by dispatching them into a hazardous environment without the appropriate knowledge, skills or equipment.

In the context of wilderness response, it is important to identify the need for a wilderness response resource early in the progression of the case. The earlier this can be achieved the more efficient the use of resources. Currently in Victoria there is no specific system to identify or flag possible remote or wilderness area responses in the ESTA call taking or dispatch procedure. What generally occurs is that the closest available ambulance is dispatched to any particular case. Dispatchers are required to meet their key performance indicator of dispatching code one cases within 150 seconds of the call-taker receiving the call. The case is then dispatched to a crew who also have a KPI to meet for response time (15 minutes 90% of the time for code 1 cases). The system then puts pressure on call-takers, dispatchers and paramedics to respond as quickly as possible. There is little opportunity to gather details regarding the specific access requirements of the patient’s location and any specialist resources that may be required to safely access them. This model suits urban environments, where the vast majority of locations are accessible by two

wheel drive vehicle, but is less suitable in rural or regional areas where many locations require specialised tools for safe access.

In an urban setting, where a danger has been identified such as violence at the scene, the ambulance is asked to wait until police have made the scene safe before entering or wait to meet with police and enter the scene together. Similarly it would seem appropriate to identify wilderness response cases, with the range of hazards they present and send an appropriate resource, such as a wilderness response team and/or meet with other agencies prior to entering the wilderness or remote environment.

In view of the above discussion, it would be useful to be able to identify possible wilderness response cases within the Computer Aided Dispatch (CAD) system, prior to dispatch. Through discussions with Karl Morrison, Ambulance Victoria's Geospatial Information Services Officer, it appears possible to establish Locations of Interest (LOI's) that are triggered within the computer aided dispatch system currently utilised by ESTA to dispatch ambulances. These LOI's would be triggered by a defined area or polygon in similar fashion to the current address point match LOI's. This would compliment the existing ESTA emergency markers program which has been established at various remote and wilderness locations throughout Victoria. **Establishing a system of LOI polygons for wilderness or remote areas would be a significant process but one that would provide substantial benefit to the organisation** through reduction in hazard exposure of paramedics and more efficient utilisation of resources.

When cases are currently identified in potential remote or wilderness areas the Helicopter Emergency Medical Service (HEMS) is predominately relied upon to access the scene. While the high levels of skill and proficiency of HEMS crews means this is effective most of the time, there are are range of settings where a HEMS response is impractical, unsafe or unachievable due to mechanical, weather or availability problems. There are also times when a HEMS resource is able to drop a MICA flight paramedic into a scene but is unable to retrieve the paramedic immediately. In these settings the wilderness response team can be deployed alongside the HEMS resource to build redundancy into the wilderness response system and ensure the HEMS paramedic can be supported and retrieved by a ground team if required.

Duty Managers are charged with the responsibility of altering the system when required to dispatch non-standard resources. They also pass on specific case types to the Ambulance Emergency Operations Centre (AEOC) in Port Melbourne. Group Managers, particularly in regional areas, have a particular depth of knowledge about the staff and resources available in their region. Given this, it would seem appropriate that Group Managers have involvement in allocating resources to specialist events such as wilderness and remote area responses in regional areas. A suggested dispatch procedure could include:

- Identification of possible wilderness response by LOI polygon/ESTA/crew
- Notification of Duty Manager
- Emergency response plan implementation
- Notification of Regional Duty Manager (Group Manager) and/or
- Notification of Ambulance Emergency Operations Centre (AEOC)
- Dispatch of wilderness response resource

This procedure should align with the procedure in place in Hume for activation of the Wilderness Response Pack (see appendix 16).

Interagency Operability

Wilderness and remote area cases are often prolonged and require a multi-agency response.[5] It is therefore important for responders to be familiar with State and Federal interagency response arrangements and protocols as well as the capabilities of co-responding agencies. These are set out in the Ambulance Victoria emergency response plan, the emergency management manual Victoria, the State Health Emergency Response Plan (SHERP) and Federal response plans formulated under Emergency Management Australia (EMA).[7,8,77,97]

There are a number of established interagency courses that can be taken to become familiar with these arrangements including:

- Introduction to emergency management
- the Australasian inter-service incident management system
- the major incident medical management and support course

There is also an internal health commander course that would further build on the wilderness responders knowledge of interagency roles and procedures.

It is important the operation of the wilderness response team is overseen by Ambulance Victoria's Emergency Management department to ensure its activities integrate appropriately into State arrangements and to provide advocacy for the team at higher levels of management.

At a regional level it would be of significant benefit to establish regular interagency training activities so individual responders can build relationships and an understanding of interagency capabilities.[72]

Establishing a regional wilderness or specialist response Team Manager or appropriate portfolio would assist in the day to day co-ordination of training, response and equipment maintenance procedures as well as providing advocacy at the regional level. This Team Manager could also be responsible for ensuring other agencies understand AV's wilderness response capacity as it develops at the regional level.

Clinical Practice Guidelines

Wilderness areas are by definition a long way from urban centres and therefore a long way from definitive medical care. The implementation of an extended skill set for specialist paramedics responding into these areas has the potential to reduce patient morbidity and mortality.[4,98,99,100,101] Millins et al state that "Wilderness EMS is emerging as a subspecialty in EMS that requires different approaches, protocols and medical oversight".[5] It is therefore common for ambulance based wilderness response teams in North America to have an extended scope of practice (refer appendices 17 and 18).[4,98,99,100,101] However it must be clearly defined when the clinician is in this setting and so able to practice their extended skill set. Introducing an extended scope of practice necessitates the introduction of a medical

director with specific wilderness medicine interest and expertise.[5] This ensures there is appropriate physician oversight in the application of wilderness medicine.[5]

Common examples of extended skill sets include (refer appendices 17 and 18):[42]

- Reduction of simple dislocations (digit / shoulder / patella)
- Modified wound care
- Antibiotic therapy
- Selective spine immobilisation
- Arterial tourniquet application and removal
- Increased pain relief options
- Wilderness resuscitation without cardiac monitoring
- Hypothermia management

Equipment monitoring procedures

Wilderness response activities necessitate the introduction of a range of specialist equipment and supplies. The equipment and supplies would require robust systems of maintenance and tracking to ensure continuous operational readiness.

In order to maintain specialist equipment in good order, the equipment would need to be stored correctly, with regular inspection to ensure it continues to be fit for purpose. Every use of technical equipment must be logged with equipment replaced when certain benchmarks of wear, use or time are reached.

These processes could be introduced as necessary by the manager of the wilderness response team. Storage procedures relating to the Wilderness Response Pack are already in place under WIN/OPS/160 (refer appendix 16).

Figure 36: Canadian Forces Dehavilland CC-115 Buffalo aircraft of 442 Transport and Rescue Squadron, Comox, BC, Canada.

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Ambulance Victoria

Objective Four

Identify the occupational health and safety considerations of operating in wilderness alpine, subalpine and forested areas of Victoria.

Operating in wilderness environments incorporates a wide array of risks.[77,102,103,104,**105**] It is **important for responder and patient safety that these risks are identified and managed as far as practical while still providing an appropriate level of service to the community.** Specific risks relating to wilderness and remote area response can be identified through review of the literature, identification of relevant incident reports and completing a formal risk assessment process.

The National Institute for Occupational Health and Safety in the US lists a wide range of hazards associated with working in outdoor environments.[102] These include heat and cold exposure, exposure to UV light and exposure to poisonous plants and insects.[77,102,103] In the United States around 100 fire fighters are killed annually in the line of duty, many related to physical exertion while operating in an outdoor environment.[102]

In 2012 there were 1250 emergency service worker (ESW - police/fire/ambulance) injuries reported to Worksafe Victoria, of these 297 were injuries to paramedics.[14] 79% (234) of the paramedic injuries were muscular skeletal and 12% (37) were stress related.[14] Further to this there have been 7 reported deaths of emergency service workers in bush fires in Victoria over the last 10 years.[15] This data demonstrates a significant burden of injury, stress and mortality within the emergency service industry. It is well understood that there are significant risks in the manual handling of patients and equipment in urban environments. These risks are magnified in remote and wilderness settings due to the physically demanding, uncontrolled and challenging nature of the environment.[16,17,18,19] It is also understood that operating outside of your comfort zone, particularly in an unfamiliar operational environment increases stress and promotes poor decision-making.[18,19,20]

As a result of a number of remote and wilderness response related incidents reported through Ambulance Victoria health and safety reporting systems, four comprehensive risk assessments have been undertaken. These risk assessments are designed to identify the risks faced by paramedic responders in remote and wilderness environments. The framework used to undertake the risk assessments was the Systems Model of Accident Causation and Risk Control (SMACRC) (refer appendix 1).[10] The SMACRC provides a systems model of risk control and a robust framework with which to consider the risks present in a wilderness environment.

The risk assessments were titled:

- Organisational environment and management approach
- Competent and knowledgable workers
- Environmental factors
- Equipment factors
- Rules and procedures

The Ambulance Victoria wilderness response risk assessment pro forma was utilised to

complete the risk assessments (refer appendix 19). Undertaking these risk assessments not only assists to directly identify the risk but includes a procedure to identify the appropriate control measures through the application of the hierarchy of risk controls.

A summary of the risk assessments follows:

1 Organisational environment and management approach

It is clear that without a suitable organisational environment and supportive management approach responders can be put at risk.[106] Reason states “Management decisions regarding..... training, the allocation of resources, cost-cutting, reduced man hours and the like can increase error likelihood by creating error-enforcing and violation-promoting conditions at the sharp end (poor provision of tools and equipment, high workloads, time pressure, inappropriate or unavailable procedures, lack of knowledge and experience, fatigue-enhancing shift-work pattern)”.[106] The risk assessment associated with wilderness response with Ambulance Victoria identified risks associated with:

- The need for support at all levels of management
- The need for appropriate funding allocation
- The need for appropriate regional management
- The need for appropriate clinical governance

2 Competent and knowledgeable Workers

Having competent responders with appropriate skill sets and knowledge of both the response environment and response equipment as well as competence in the utilisation of specialist tools and procedures is essential. The risks identified relating to competent and knowledgeable workers included:

- Physical fitness to operate safely in a wilderness environment
- Medical fitness to operate safely in a wilderness environment
- Experience and ability to operate in difficult conditions (cold/wet/wind/terrain)
- Knowledge of wilderness environments
- Familiarity with specialist tools and equipment
- Ability to manage activities of daily living in a wilderness setting (managing thirst/ hunger/hygiene)
- Responder competency at wilderness specific tasks such as operating a four wheel drive or self arresting in a snow environment
- Psychological factors such as clinical fears of particular situations such as confined spaces / appropriate confidence in own ability / ability to persevere in difficult conditions
- Ability and personality to operate effectively alongside other services in wilderness environments
- Ability and personality to facilitate clear and effective communication with other paramedics and members of other services in wilderness settings

3 Well designed physical environment

The physical environment in the context of remote and wilderness settings cannot be directly

controlled and so presents a wide range of risks. Environmental risks identified within the risk assessment include:

- Cold/Heat/Wind/Rain/Wet
- Water bodies (marine/inland water/swift water)
- UV Exposure
- Ground Coverage (mud/rock/snow/ice/slippery/uneven/abrasive/sharp)
- Surface Slope (vertical/steep)
- Vegetation (dense/sharp/poisonous)
- Animals/Insects (poisonous/stinging/biting)
- Isolation
- Confined spaces
- Fire
- Darkness

4 Fit for purpose equipment

As previously described, there is a wide variety of equipment required to operate an effective ambulance based wilderness response team. This equipment needs to be well designed and technologically advanced to ensure it is fit for purpose to operate effectively over a long period of time in wilderness environments.

- Pack and contents (weight/bulk/accessibility/usability)
- Personal protective equipment (clothing/boots/helmet/technical)
- Adjuncts for manual handling of patients in wilderness settings (snow/ice/mud/ rocks/uneven ground/steep or vertical slopes)
- Communications in wilderness environments
- Adjuncts for navigation in wilderness settings

5 Suitable rules and procedures

Developing and instituting an appropriate set of rules and procedures can make a significant contribution to paramedic safety. Key issues identified during the study tour of North American wilderness response systems included:

- Dispatch procedure
- Interagency procedure
- Clinical practice guidelines
- Skills maintenance procedure
- Equipment maintenance procedure

Figure 37: Ambulance Service New South Wales (ASNSW) Special Operations Team (SOT) paramedics undertaking swift water response training. This provides paramedics with the skills to remain safe in a swift water environment. February 2013.

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Objective Five

Identify ways of managing the occupational health and safety considerations of operating in wilderness alpine, subalpine and forested areas of Victoria.

The risk assessments described previously provided a systematic assessment of the risks faced by paramedic responders to remote and wilderness environments in Victoria. Organisations such as Ambulance Victoria are obligated to provide a safe work environment and safe systems of work under the Occupational Health and Safety Act 2004. By applying a hierarchy of risk controls these risks can be effectively managed. The hierarchy of risk controls includes:

- Eliminate
- Substitute
- Isolate
- Engineer
- Administrative

Risk assessment outcomes

1 Suitable organisational environment and management approach

Borys describes the hierarchy of risk control as “top down” from safe organisation to safe place to safe person.[10] This is illustrated by the inverted triangle in the SMACRC model (refer appendix 1).[10] Therefore the most important place for risk management strategies to be introduced is upper level management, followed by mid and lower level management and finally at an operational level.

Support of management in the development of a specialist response capacity such as this begins with an acknowledgement of the particular problem and an engagement in finding a workable solution. There appears to be a level of recognition of the issues surrounding wilderness response in Victoria due to the widespread support for this project from the Emergency Services Foundation and Ambulance Victoria.

Management do not only control factors such as training, resourcing, expenditure and rostering. The engagement and support of management also facilitates connection with other agencies at higher levels of management to support integration and close co-operation as well as giving the team a single focus point for the State. This facilities consistency of approach throughout the State and close working relationships with other agencies.

Access to appropriate levels of funding for ambulance response is difficult in the current climate. Many emergency service organisations and others are actively finding ways to reduce their expenditure. It is therefore important to highlight the improvement in paramedic safety and patient outcomes that may be possible with the introduction of a specialist wilderness response unit. Training and equipping a smaller group of paramedics for specialist tasks is a cost effective solution for managing risk in wilderness environments. There is a need to find innovative solutions regarding finance for a wilderness response model to be established and maintained in the long term.

Engaging regional management is equally important. The development of a regional wilderness or specialist response Team Manager position or portfolio would greatly assist in this regard. Having a manager with allocated function hours to manage the specialist unit will assist with training development, implementation and maintenance, equipment testing, storage and maintenance, development of interagency relationships and advocacy of the group with regional management and other agencies.

It is also important to ensure adequate and ongoing clinical governance. This can be achieved by the engagement of a medical director with expertise and interest in wilderness and austere environment medicine. This connects the team with the wilderness medicine community and helps to establish robust clinical practise guidelines and clinical governance procedures appropriate to the environment.

2 Competent and knowledgeable workers - managing human error

The most important element of a specialist response team, such as that proposed here is the people. There are a wide range of highly skilled, capable paramedics employed by Ambulance Victoria who are quite capable of operating in hazardous environments such as the wilderness. However, there is not currently a selection process to identify these individuals so they can be responded when required. Incorporating a robust selection procedure which identifies applicants with the motivation, skill set, background and personality required for the expected task is an important element in managing risk in wilderness environments. A selection process would seek to **substitute** inappropriate responders with appropriate ones and thereby reduce the risk of injury.

Once selected, it is important the paramedics are supported with the specific skill sets required for wilderness response. To this end, there is already a self preservation course in place to educate MICA flight paramedics about operating in remote and wilderness environments, however this course is not available to paramedics outside of Air Ambulance Victoria. Expanding the scope of this course and making it available to selected ground based paramedics would greatly assist in managing the risks associated with responding to wilderness areas. Other courses already provided by Ambulance Victoria include four wheel driving and aquatic response. Integrating these courses into a wilderness response training program will assist in providing a well rounded education to wilderness response paramedics. It is also important to note that a commitment to a skills maintenance program is equally as important as the initial training course. It is clear that rarely practiced skills decay rapidly, and therefore important to regularly practice these skills to remain competent.[71,72] A comprehensive training and skills maintenance program is a **administrative** risk control strategy.

3 Well designed physical environment

Controlling risks associated with the physical environment is of particular importance in wilderness settings. There is a range of risk management strategies already in place within Ambulance Victoria to support a safe paramedic response into wilderness environments. These include wilderness response packs at specific locations in Hume and a range of four wheel drive vehicles throughout the state. By developing and expanding these existing risk control strategies, risk exposure of responding paramedics can be further lessened.

Further risk control strategies include:

- Selection of appropriate staff for wilderness settings
- A comprehensive training and skills maintenance program
- Regular time dedicated to skill and competency maintenance
- Expansion of facilities to create an effective training environment
- Appropriate facilities to support physical fitness requirements
- Introduction of fit for purpose personal protective equipment (PPE) for wilderness environments
- Appropriate, secure storage of PPE
- Increased availability of appropriate, safe and effective response vehicles modified to accommodate wilderness response equipment
- Appropriate vehicle recovery and safety equipment for the response environment
- Appropriate, secure garaging of vehicles

These risk control strategies include elements of **substitution** (staff selection), **engineering** risks out of the system (appropriate vehicle and modification of vehicle to accommodate equipment, modification of facilities for appropriate storage of equipment) and **administrative** (training and PPE) risk control strategies.

4 Fit for purpose equipment

Fit for purpose equipment is an important element in developing a safe and effective wilderness response capacity. The wilderness response pack system in Hume has been developed to provide this specific capacity. This pack design can be further developed and the system expanded to increase the effectiveness and availability of WRPs to reduce risk exposure of responding paramedics. Ambulance Victoria also currently provide a range of personal protective equipment to paramedics operating in alpine environments. This PPE could be evaluated and modified to ensure it is appropriately designed and fit-for-purpose for wilderness operations. Other risk reduction strategies include:

- Providing appropriate adjuncts for manual handling of patients in wilderness settings (snow/ice/mud/rocks/uneven ground/steep or vertical slopes)
- Establishing reliable communications in wilderness environments
- Ensuring adjuncts to assist with navigation in wilderness settings

These strategies include elements of **engineering** and **administration**.

5 Suitable rules and procedures

Developing and instituting an appropriate set of rules and procedures can make a significant contribution to paramedic safety. Ambulance Victoria have in place a range of operating procedures and work instructions that contribute to providing a safe work environment. In the wilderness context these include the remote/wilderness response work instruction (refer appendix 16 - win/ops/160) and fire ground safety and procedures (B2006-0215) including OWI 5002-02 personal issue protective items. By expanding the range of wilderness specific procedures paramedic safety can be enhanced. These risk control strategies are all **administrative.** Procedures to consider include:

- Dispatch procedure

Identifying the need for specialised resources such as WRPs and four wheel drives early in the progression of a case in a wilderness or remote environment assists with early dispatch of these resources. This avoids paramedics without the necessary training and equipment being exposed to the hazards described in wilderness settings. This is a key risk management strategy as it sits high in the hierarchy of controls. This procedure **eliminates** hazard exposure to the paramedics without the extra layer of skills and equipment, and **substitutes** instead the more appropriate responders.

- Interagency procedure

State and Federal multi-agency emergency response procedures are well developed. They provide an important framework for responding to specialised incidents such as the wilderness environment. It is important however that these procedures are well known amongst the responders at the coalface to ensure clear role allocation and communication within and between response agencies. This requires an increased investment in interagency training to ensure the procedures are well known and well practiced at a regional level.

- Clinical practice guidelines

Wilderness medicine is developing internationally as a subspecialty of emergency medicine.[5] As such, the safe and competent practice of wilderness medicine requires medical oversight from a medical director with specific wilderness medicine interest, experience and qualifications.[5] Providing an extended scope of practice to paramedics operating in wilderness environments provides a higher level of care to the patient as well as providing a safer workplace for paramedics. For example, introducing selective spinal immobilisation protocols based on physician protocols for ordering cervical radiologic studies reduces the need for spinal immobilisation and the significant logistical and manual handling consequences this imposes in remote areas. There can be similar reduction in manual handling and increase in patient comfort from the introduction of simple joint reduction techniques.

- Skills and competency maintenance procedure

Specialised skills such as those utilised in wilderness response are known to decay rapidly if not utilised regularly. In the setting of a paramedic wilderness response team it is important these skills are maintained at a high level to ensure safe and effective operation. This necessitates a commitment to a comprehensive and ongoing training and skills maintenance program.

- Equipment maintenance procedure

Specialised wilderness response equipment will require maintenance to ensure it remains in a state of operational readiness. This necessitates rigorous equipment maintenance procedures to be in place.

Objective Six

Liaise with other emergency service agencies and identify strategies that would improve pre-hospital care of patients in wilderness alpine, subalpine and forested areas of Victoria.

A range of formal and informal discussions have been undertaken with many of the agencies and organisations that routinely operate in or respond to remote and wilderness areas in Victoria, including:

- Police Search and Rescue
- State Emergency Service
- Central Gippsland Essential Industries Group including:

Victoria Police / Country Fire Authority / Ambulance Victoria / Energy Australia (Yallourn) / Australian Energy (Hazelwood) / Loy Yang Power / Australian Paper / Gippsland Water / Department of Human Services and others

- Bush Search and Rescue Victoria
- Alpine Search and Rescue Victoria
- Country Fire Authority
- Parks Victoria
- Department of Sustainability and the Environment (DSE)

There is wide support amongst these groups for Ambulance Victoria to widen its response capacity to include specialist ground response to wilderness and remote areas.

It is important that these groups are kept informed of the development of Ambulance Victoria's wilderness response capability. It is particularly important to work closely with police as they are the control authority during land search and rescue events.[95] Other agencies with significant wilderness response capabilities include the State Emergency Service, and Bush Search and Rescue Victoria.

Figure 38: Maffra State Emergency Service (SES) response vehicles. Tracked argo (left) and land cruiser (right). It is important for co-responding agencies to understanding each others response capabilities. Maffra, Victoria, March 2013.

Objective Seven

Identify practical and cost effective ways of improving the current model

Recommendations:

1. It is recommended that Ambulance Victoria establishes a regional wilderness and remote area response team capability in regions with identifiable need. Consideration should be given to the future expansion of these teams to form a regional Hazardous Area Response Team (HART).

2. It is recommended that a regional wilderness/remote team manager position or portfolio be created to ensure the proposed system has dedicated regional management.

3. It is recommended that regional wilderness team members should meet specific minimum criteria to be considered for selection to include:

    - Physical fitness
    - Medical fitness
    - Psychological fitness
    - Established experience in wilderness environments
    - Clinical competence (experienced ALS or MICA officer)
    - Leadership and interpersonal skills
    - Able to operate autonomously (eg Single Response Accreditation)

Initial selection criteria should take account of the possibility of future skill expansion to meet HART team status (eg sufficient MICA staff for USAR response, acceptance of staff to undertake USAR/Confined Space/CBR/Aquatic/Swift water/Fire ground/Tactical training and response if required)

4. Selection process is recommended to include:

    - Expression of interest
    - Team Manager and Clinical Support Officer endorsement
    - Behavioral interview
    - Physical fitness test
    - Psychological examination
    - Medical fitness examination
    - Clinical scenario in a wilderness setting

Selection would preferably take the form of a two day overnight wilderness exercise which tests the participants physical and psychological ability in wilderness environments.

5. Selected staff recommended to enter an initial training program which includes approximately 168 hours of training covering:

    - Team building
    - Wilderness survival (shelters/navigation/firelighting/signaling/psychological factors)
    - Wilderness medicine / extended care protocols
    - Clinical access in high angle and vertical environments
    - Operating in the alpine environment
    - Litter attending in steep or vertical environments
    - Helicopter operations
    - Equipment familiarisation
    - Interagency operations

For consideration at appropriate locations:

    - Clinical access in swift water environments
    - Clinical access in cave and confined space environments

It is recommended that initial training be supplemented with existing internal and external training courses over the first 12 - 24 months of membership:

    - Four wheel drive course
    - Aquatic response course
    - Health Commander course
    - Australian interagency incident management system
    - Introduction to emergency management
    - Major incident medical management and support

Alternatively these modules could be delivered as part of the initial training package.

6. Skills maintenance modules revising and expanding skills taught in the initial training phase could be spread over a 12 month cycle of reaccreditation.

It would be preferable for teams to regularly exercise their skills with the Police, SES and Bush Search and Rescue. This could take the form of an annual interagency exercise or more regular short exercises. There is significant scope to participate in other agencies existing training programs which would provide a cost effective means of skills maintenance and interagency capacity building.

7. It is recommended regional wilderness response team members be accredited at specific “levels of participation”:
    - **Recruit:** A recruit is not a member but a potential candidate.
    - **Trainee:** A trainee is a probationary member who is working through the training course. Trainee members do not respond to any missions.
    - **Support ;** A support member has successfully completed the initial course and is going through a process of mentoring and skill development in their first 12 months of being active.
    - **Rescue:** A rescue member is a fully qualified member having successfully completed at least 12 months exposure to missions post training.

8. As a minimum it is recommended each regional wilderness response team is equipped with:

   - An appropriate four wheel drive response vehicle with allowance made for carrying wilderness response and four wheel drive recovery equipment
   - Appropriate garaging for the vehicle
   - A wilderness response pack per responder
   - Modular medical kits to suit environment and response pack
   - Fit for purpose survival equipment to suit response pack
   - Fit for purpose personal protection equipment
   - Appropriate, secure, practical storage of equipment
   - An appropriate and reliable two way communication system (both in vehicle and remote from vehicle)
   - Four wheel drive recovery equipment
   - Fit for purpose patient extrication equipment
   - Alpine safety equipment

   Other equipment to be considered includes:

   - Aquatic safety equipment
   - Swift water safety equipment
   - Vertical / high angle safety equipment
   - Cave and confined space safety equipment

9. Regional wilderness response teams should be strategically placed to enable
   - the most efficient and timely response to wilderness areas
   - adequate crewing by accredited staff

10. It is recommended that team activation and equipment maintenance procedures align with the existing wilderness / remote area respond work instruction in operation in Hume region (appendix 16 win/ops/160). The proposed wilderness response system could be initiated by:
    - the ESTA Duty Manager or
    - the Regional Duty Manager or
    - the Ambulance Emergency Operations Centre

11. It is recommended that Ambulance Victoria provides wilderness environment familiarisation training to all operational staff as part of the continuing professional education (CPE) program. This would increase paramedic awareness of the hazards associated with remote and wilderness environments and assist in the appropriate dispatch of specialised wilderness response resources.

12. It is recommended that Ambulance Victoria investigate the integration of Location Of Interest (LOI) polygons within the existing computer aided dispatch (CAD) system operated by the Emergency Services Telecommunications Authority (ESTA) in order to identify cases in wilderness or remote areas prior to dispatch. This would increase the effectiveness of specialist response resources and decrease risk exposure of responding paramedics.

13. It is recommended that Ambulance Victoria's medical standards committee give consideration to an extended scope of practice for accredited wilderness response paramedics who are operating in remote or wilderness settings. Considerations could include:
    - Simple dislocation reduction (Shoulder, Patella, Digits)
    - Sedation for dislocation reduction
    - Extended wound care and management of impaled objects
    - Antibiotic therapy for high risk wound and body system infections
    - Tourniquet use in life threatening limb haemorrhage
    - CPR termination without available monitoring
    - Selective spinal immobilisation protocols
    - Crush injury / Crush syndrome / Compartment syndrome management

Further research and investigation:

1. There is a need to quantify the exposure of paramedics in Victoria to remote and wilderness environments. This will assist in the identification of the most appropriate locations for a wilderness response capacity and inform the development of an appropriate model of response. This process could include:

    - Education of paramedics regarding the health and safety considerations of responding to remote and wilderness environments and encouragement to record and report all cases in these environments.
    - Development of the "access" input area on VACIS to include specific options for remote and wilderness environments.
    - Active investigation of case load to identify remote and wilderness cases and follow up with responding crews via survey and personal conversation.

2. There is a need to develop an appropriate model of response. There are a number of models that may be effective in providing a wilderness response capacity to regional Victoria. Alternatives to consider include:

    A. Semi-Centralised Model
    Specialist wilderness resources centralised to larger centres within the regions.

    B. Centralised Model
    Specialist wilderness resources centralised to one large center within each region.

Kerryn Wratt
MICA Paramedic
Ambulance Victoria

Conclusion

Extensive areas of Victoria lie in remote or wilderness terrain, these areas attract a large volume of visitors for recreational, educational, industrial and land management activities. Activities in remote areas include an element of risk and the potential of injury or illness. Access, clinical management and extrication of patients in these environments is difficult and often requires specialist skills, equipment and close co-operation amongst responding agencies. The implementation of a wilderness response model will assist Ambulance Victoria (AV) to meet its current strategic objectives by effectively reducing the risk exposure of paramedics while improving clinical outcomes for patients.

There are currently systems in place to facilitate an ambulance response to remote and wilderness environments in Victoria. The present wilderness response arrangements include the utilisation of the Helicopter Emergency Medical Service (HEMS), four wheel drive retrieval vehicles and wilderness response packs (WRPs). However there are times when a HEMS response is unsuitable or unavailable and the accessibility of specialist ground resources such as four wheel drives and WRPs is restricted. There is no specific process for selection of staff appropriate for these varied and demanding environments and the specialist wilderness training and skills maintenance of ground based paramedics is negligible.

By utilising the System Model of Accident Causation and Risk Control (SMACRC) as a framework for comparison of various international models of wilderness response, it is possible to make a number of recommendations to guide the future development of the wilderness and remote area response capacity of Ambulance Victoria. By incorporating a comprehensive selection, training and skills maintenance regime along with increasing the availability and effectiveness of response vehicles and equipment, current wilderness response arrangements can be reinforced to provide resilience and robustness to AV's wilderness response capacity. **Establishing a specialist ambulance response to remote and wilderness environments with a small group of specifically equipped and highly skilled individuals is a cost effective way of addressing the gaps in the current model.**

Specific recommendations include:

1 Suitable organisational environment and management approach
- Statewide co-ordination that promotes **interagency operability** and provides a consistent ambulance response capacity
- Regional ownership and management with a focus on interagency operability at the regional level
- Clinical governance provided by a doctor specialising in wilderness medicine

2 Competent and knowledgeable workers
- A **robust selection procedure** which identifies applicants with the motivation, skill set, background and personality required for the expected task
- A **comprehensive initial training** program
- A **comprehensive skills maintenance and re-accreditation** program
- Educational integration across response agencies as far as practicable

3 Well designed physical environment
- An **effective base of operations** to include secure, practical and accessible storage of vehicles and equipment

- A well designed, appropriate and **effective response vehicle** for the expected environment

4 Fit for purpose equipment
- A **well designed, robust, comfortable response pack** with flexibility in the deployment of survival and medical modules
- Appropriate and **effective PPE** for the expected response environment
- Appropriate, **reliable communications** and navigation equipment

5 Suitable rules and procedures
- **Dispatch procedures** that identify the need for and dispatch the specialist response in an appropriate timeframe for the specific case
- Appropriate clinical practice guidelines for the response environment

Further work needs to be completed to reveal the remote and wilderness response case profile across Victoria to ensure the specific skill set and placement of specialist resources is optimised for the expected response environment. Anecdotally, this data is currently difficult to access due to significant underreporting of wilderness and remote responses by paramedics. Particular those cases where paramedics are required to work remotely from their vehicle in difficult environments outside areas defined as wilderness, such as in a muddy paddock or down a steep embankment. This information is required to inform the development of specific models of response that best suit the operational needs of AV in remote and wilderness areas. The process of identifying this case load is currently being undertaken and it is hoped a clearer picture of AV's response profile will emerge over the next 12 months.

The intention of this report is to provide an overview of current best practice in wilderness response internationally, review the current capabilities for wilderness response in Victoria, and to offer a framework for the establishment of a wilderness response mode within Ambulance Victoria. This has been achieved through investigating a number of preeminent North American wilderness response systems that incorporate high level medical practitioners as front line responders. Establishing a formal wilderness response model within Ambulance Victoria that meets worlds best practise is achievable and will augment AV's current high standards of clinical excellence in prehospital emergency care.

Figure 39: Keith Williams (Ambulance Service New South Wales (ASNSW) Manager Rescue/ SCAT/SOT) and Kerryn Wratt with the ASNSW SOT response vehicle during a recent visit to share ideas to assist in the development of an effective wilderness response model for Ambulance Victoria. February 2013.

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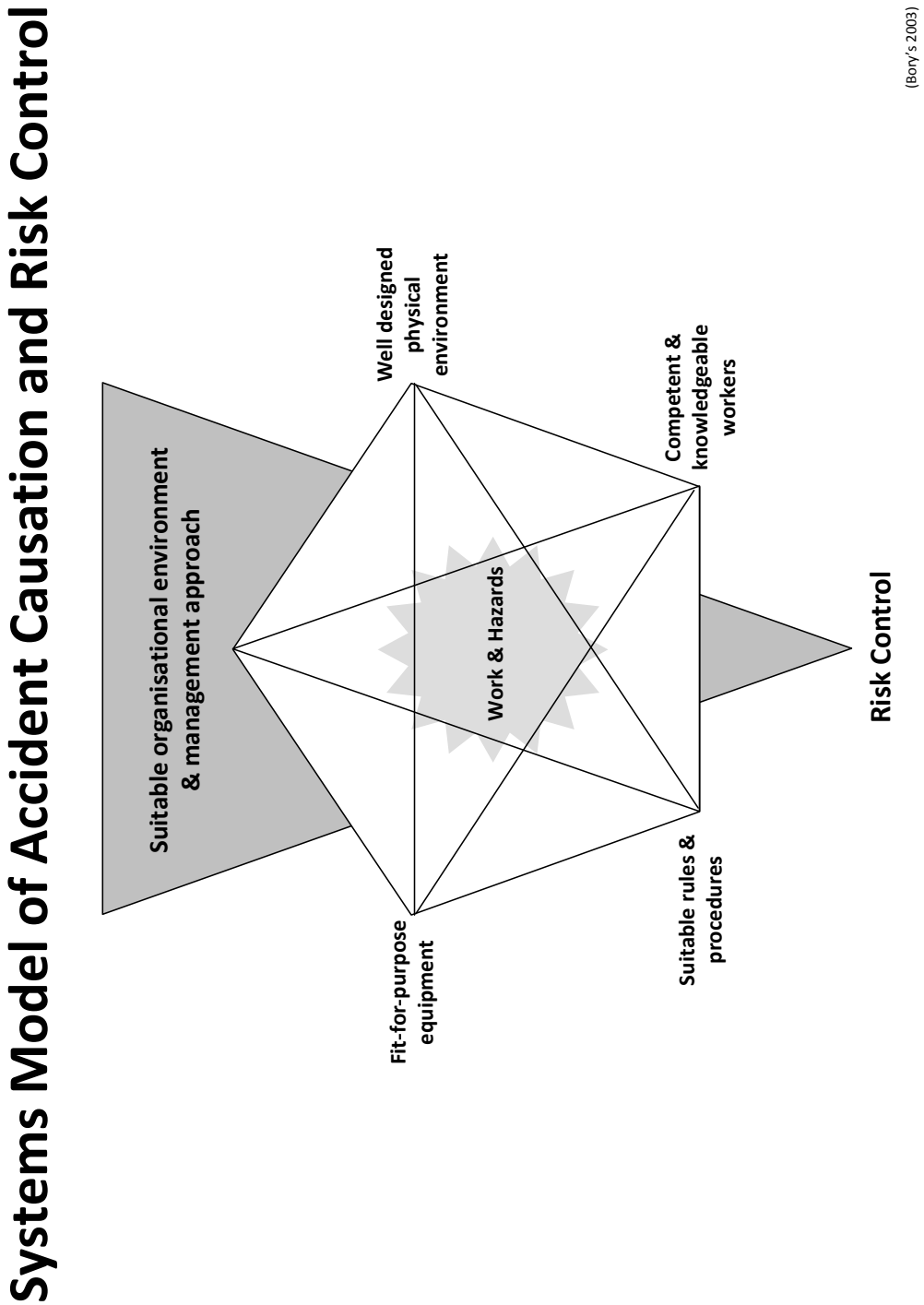
Figure 40: The author with a SAR response vehicle, British Columbia, Canada, 2012.

Appendix One: System Model of Accident Causation and Risk Control



Kerryn Wratt
MICA Paramedic
Ambulance Victoria

Appendix Two Burke County EMS Special Operations Team Requirements and Assignments

Application Process

Paramedics interested in serving on the Special Operations team must express their interest to EMS Administration.
Prerequisites:

- Current EMT-P certification
- Two (2) years clinical experience as Burke EMS paramedic. (Documented clinical experience of 2 years as EMT-P with another service, or documented clinical experience of 2 years as EMT-I with frequent Burke EMS Special Operations assistance, are also acceptable for this prerequisite.)
- Acceptable medical screening
- Approval from EMS Administration, Medical Director, and Assistant Medical Director for Special Operations
- Oral examination on Special Operations protocols administered by Medical Director and/or Assistant Medical Director
- Successful completion of physical fitness test
- Completion of the following courses or training:
  - Fundamentals of SAR
  - Basic ropes and knots (ERT courses accepted)
  - Basic rigging/rappelling (ERT courses accepted)
  - High Angle Rescue (ERT courses accepted)
  - Low Angle Rescue (ERT courses accepted)
  - BAT Trailer Operations
  - Basic Map & Compass
  - Basic Swiftwater Rescue or SRT 1 & 2
  - Incident Command IS-700, IS-800, I-100 and I-200E
  - ATV Operation
  - Basic Boat Operation
  - Hazardous Materials Operations
  - Decontamination/PPE

Appendix Two Burke County EMS Special Operations Team Requirements and Assignments (continued..)

Requirements for Continuing Membership on Special Operations Team

- Completion of WMD for EMS course (within 2 years of membership)
- Successful completion of physical fitness test every 2 years
- Acceptable medical screening every 5 years
- Attendance at two (2) Special Operations Exercises or Workshops yearly
- On-call signup a minimum of six (6) times per year

Special Operations Assignments

- Extended/wilderness rescues and medical care
- Search and Rescue medical responses
- Special Events coverage
- WMD/Hazardous Materials medical support
- Storm activations (state)
- Large fire responses
- Disaster response (excluding SMAT activities)
- Situations approved by the Medical Director, Assistant Medical Director for Special Operations, and EMS Administration

Appendix Three North Carolina Aquatic Rescue Team Physical Selection Criteria

All NCHART team members will pass a physical fitness evaluation at a minimum of every two years. Passing score is 45 points. For consideration into the program a score of 50 or greater is desired.

NCEM Helicopter Aquatic Rescue Team
Candidate Evaluation

☐ Total Points Candidate # _____

Candidate Name
Agency

Documentation
- ☐ Hold harmless agreement
- ☐ Drug Free form
- ☐ Agency Commitment Letter

Confirmation of requisite training
- ☐ Current EMT-B or above
- ☐ NFPA 1006/1670 Water Rescue Technician
- ☐ NFPA 1006/1670 Rope Rescue Operations
- ☐ NIMS ICS 100
- ☐ NIMS ICS 200
- ☐ NIMS ICS 700

POINTS ☐

training bonus-1 point for each certification
- ☐ NASAR FUNSAR or equivalent (OSFM Land SAR not eligible)
- ☐ NASAR SAR Tech II
- ☐ NIMS ICS 300
- ☐ NIMS ICS 400

Station 1 Swimming Skills

Evaluation 1- 300 meter swim

☐ Time ☐

time	points
<8 minutes	10
8-10 minutes	8
10-12 minutes	6
12-14 minutes	4
14-16 minutes	2
>16 minutes	0

If the candidate stops or stands up at any point they are to be disqualified from the evaluation

Evaluation 2- 400 meter snorkel swim

☐ Time ☐

time	points
<7.5 minutes	10
7.5-8.5 minutes	8
8.5-9.5 minutes	6
9.5-10.5 minutes	4
> 10.5 minutes	2
Stopped	0

Evaluation 3- 100 meter rescue tow

☐ Time ☐

time	points
< 2 minutes	10
2-3 minutes	8
3-4 minutes	6
4-5 minutes	4
> 5 minutes	2
Stopped	0

Evaluation 4- Dunker Escape

☐ Pass/Fail ☐

	points
pass	5
fail	0

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.Appendix Three North Carolina Helicopter Aquatic Rescue Team Selection Criteria - Continued

NCEM Helicopter Aquatic Rescue Team
Candidate Evaluation

Candidate # _____

Candidate:

Station 2 Physical Fitness

Evaluation 1- 1 mile run

Time

time	points
< 7 minutes	10
7-8 minutes	9
8-9 minutes	8
9-10 minutes	7
10-11 minutes	5
11-12 minutes	4
12-13 minutes	1
> 13 minutes	0

Station 3 Rope Rescue Rigging and Skills

Evaluation 1- knots

Points

.5 points per knot

- Figure Eight with a bight
- Figure Eigth with a double bight
- Directional Figure Eight with bight pointing towards anchor
- Directional Figure Eight with bight pointing away from anchor
- Bowline with a bight on an object
- Double Fisherman's Bend

Evaluation 2- rigging and descending on a fixed rope

Time

time	points
< 5 minutes	5
5-6 minutes	4
6-8 minutes	3
8-9 minutes	2
9-10 minutes	1
> 10 minutes	0

Station 4 Helicopter Operations

Evaluation 1- Helicopter Operations

Pass/Fail

	points
pass	5
fail	0

Comments:

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Appendix Four SARTECH (BC, Canada), RAT (Oregan, USA) and AlpineSAR (Victoria, Australia) Fitness Testing

SARTECH Fitness Test (completed annually)

A 2.4km run in ten minutes

B 31 pushups
33 situps
8 chin ups
450m shuttle run
All in 16 minutes

C 6 metre rope climb x 2

D 675m swim in 20 minutes

Portland Reach And Treat (RAT) Team Fitness Test (reaccredited annually as below)

Original Test
4.82 km (3 miles) run
Every 400 metres applicants must ascend and descend one flight of stairs over the first 1.6km
Every 400 metres between 1.6km and 3.2km applicants must ascend and descend 2 flights of stairs
Every 400 metres between 3.2km ad 4.8km applicants must ascend and descend 3 flights of stairs
All wearing a 20.4kg (45 pound) weight vest and in 1 hour.

Annual reaccreditation
The physical agility and fitness evaluation will consist of a standardised 5.3km (3.28 mile) varied terrain hike. The hike must be completed in less than sixty minutes while carrying a backpack or weight vest loaded with 20.4kg (45 pounds).

Alpine Search and Rescue Victoria Fitness Test (completed triannually)

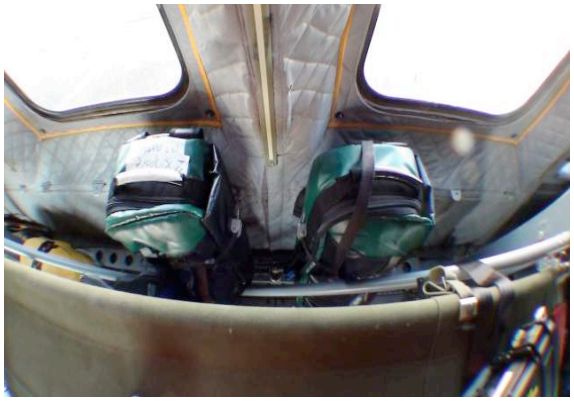
This self assessed competency requires the member to walk 4.83km on a level track carrying a weight of 20.4kg in less than 45 minutes (average 6.44kph)
Prior to the walk take a photograph of your 20.4kg pack on a set of scales
Record your walk on a GPS
After the conclusion of your walk submit you photograph and track log file to the secretary who will confirm your result and ensure your training record is updated accordingly
Participants 68kg or less can carry a weight of 15.4kg

Appendix Five CH149 Cormorant Cabin Configuration 442 Transport and Rescue Squadron, Comox

Wall Pouch contains:

- 2 Rescue Collars;
- 2 PLBs;
- 2 Radios;
- 1 Carabiner;
- 1 Hoist Transfer Assembly; and
- 1 Static Discharge Probe (with rapid link).
- T-Bars to be hung on outside of rack

Rescue Basket
(Ensure 2 guide lines are available)



Spare Oxygen Cylinders
(Behind stretcher and dive gear)

Dive Gear & Dive Cylinders
Camp Kit & Snowshoes

Appendix Five CH149 Cormorant Cabin Configuration 442 Transport and Rescue Squadron, Comox (continued)

Sked, Force Extraction Tool, Reel Splint and Sawzall

AED, and two Body bags on Shelflet

Enhanced Belay Kit, Alpine Kit and Blanket Kit

Sup Kit, Casualty Bag, and two Pen Kits

Anthron

SAT Phone, Propaq, Goodie Bag, Backrest

Appendix Six Jenny Lake Rangers Response Equipment

Headlights

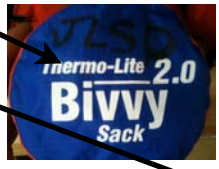
Lightweight head rolls

Ready heat blankets

Kendrick extraction device

SAM pelvic splint / kendrick traction devices / IV roll

Radio mics / headsets



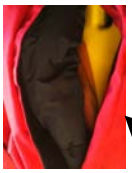
Lightweight Bivy

Smoke and flagging (Helicopter LZ marking)

Radio harnesses

Titanium oxygen bottle

AED + small medical packs



Velcro opening down sides for patient access

Litter shield - for patient protection

SKED rescue stretcher

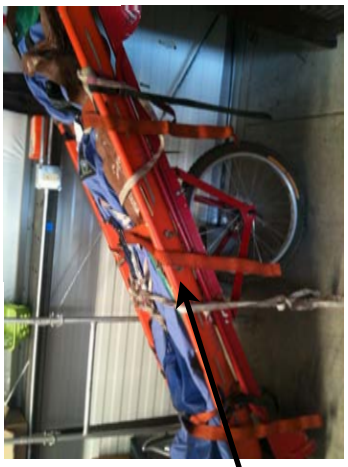
Rescue litter and hypothermia wrap

Draw cord for insulation around patient's face

Ropes and technical rescue equipment

Kerryn Wratt
MICA Paramedic
Ambulance Victoria

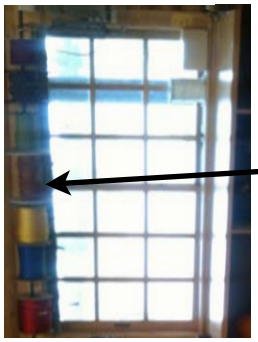
Appendix Six Jenny Lake Rangers Response Equipment

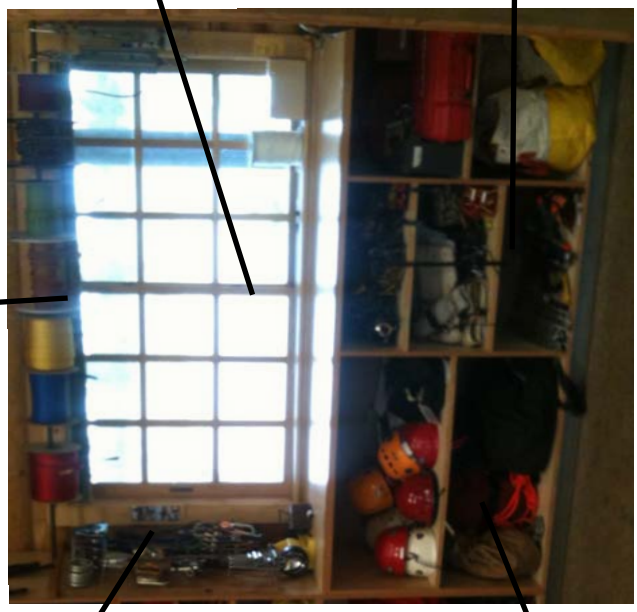


Wheeled Litter (Stored outside)

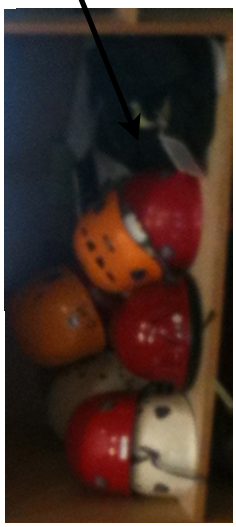
Alpine response equipment (snow stacks, ice axe, ice screws)

Prussic and webbing available on rolls. WIth a bench area for preparation





Technical rescue equipment (carabiners, belay devices, pulleys)



Helmets

Appendix Six Jenny Lake Rangers Response Equipment

General
SAM Splint
Biohazard Bag
Space Blanket
PCRs
Notepad and Pen
2-2x2 gauze

Assessment
Latex Gloves
B/P Cuff
Stethescope
Pulse Oximeter
Glucometer Kit

Airway
Pocket Mask
Oropharyngeal Airways (small/med/large)
Nasopharyngeal Airways
Surgitube Packets
Squid Suction
14 ga Needles

Wound Care
Adrenaline Kit Adrenaline (1:1000)
1 cc Syringe with needle
4 x 4 Gauze pads
Benadryl packet
Alcohol swabs
Trauma Shears
Tape 1”
4” Coban
4x4 Gauze
5x9 Combi
Gauze
Band Aids
Triangular Bandage
Kerlex
Alcohol Swabs
Iodine Swabs
Vionex Wipes

Lightweight IV Kit (Roll)

Normal Saline 1000cc
IV Drip Set
Hand Warmer
Normal Saline preloaded syringes

2-Bandaids
2-Pair latex gloves
1-Small bio bag
1-Sharps container
4-Alcohol swabs
4-Iodine swabs
2-Vionex pad antimicrobial towelette
1-1” tape
1-IO catheter
2-14/16/18/20/22 IV catheters
1-IV start kit
2-Veni-guard (tegaderm)
1-Tourniquet

Drug Kit
Ibubrofen
Benadryl
Epinephrine
Aspirin

Backcountry First AId
6-Ziplock Bags
Latex gloves
Oral glucose
Non-stick Gauze
Band Aids
Steri-strips
3” coban
Tweezers
2 x Safety Pins
12cc irrigation syringe
Triple antibiotic ointment
Alcohol swabs
Shears
3” bandage
10” tape
Vionex wipes
5x9 combine
Pen / pencil
Note pad
SAM Splint
Ibuprofen / Aspirin

Appendix Seven Alpine Rescue Response Equipment

Third man pack (first response rope access)

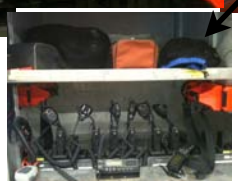
High line pack / Technical Equipment

Litter Wheel

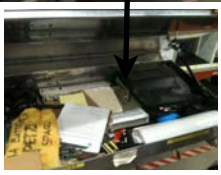
ICS vests / SKED / Edge Rollers

Vehicle anchors

RECCO, Transceivers, GPS, Helmets



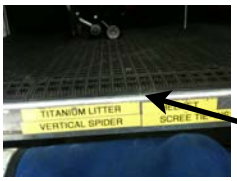
Food and Water



Radio harnesses / Laptop / Binoculars / Radios on Charge /

Mapping table / storage for inverter / printer / light sticks

Maps / Spotting scope



Titanium litter / scree tie ins / patient helmet / spider straps

Cascade litter with scree tie ins / sleeping

Vacuum mattress / foam matting

Ropes

Patient “hypothermia wrap” with full body access via zips and velcro openings

Appendix Eight Alpine Rescue Team - Equipment Outline

Personal Equipment

All Alpine members accumulate a fairly extensive amount of personal equipment during the time they are active in mountain rescue. This does not mean, however, that a new member has to buy hundreds of dollars of equipment before becoming involved in missions and team activities. Initially, only basic mountaineering equipment, much of which most people already own, is needed. This includes: the ten essentials, good mountain boots, appropriate clothing, and a medium size backpack. This inventory can be expanded as personal funds permit and new skills are mastered.

Whether your pager goes off for a rescue at 02:00 a.m. or in the middle of a busy workday, it is hard to know exactly what to pack. Here is a checklist to help you avoid forgetting something essential. It is not necessarily a complete list; everyone's equipment is very personalized. But, it is a good start for developing your own list. Before you go out and buy a lot of new equipment, talk to other team members and see what works for them. Getting the right equipment takes years. Buy the necessities and things you can use for your own recreation first. Look for sales, choose well and you will have equipment that will be good for years. Also, once you are on the team, there are many manufacturers that will offer team members discounted equipment and clothing.

Each piece of equipment should be chosen carefully to suit personal preference and needs. A great deal of valuable information concerning product quality and prices can be gained by talking to other team members, many of whom have had experience with many products. In general, the higher quality (higher priced) equipment is recommended due to the demanding nature of mountain rescue work.

Important Things to Remember:

- Know yourself! Know your personal needs for water, food and staying warm.
- If you do not have the proper equipment to go out, do not put yourself at risk by being unprepared.
- Dry, recheck and repack your equipment and vehicle after each mission. Don't wait until the pager goes off to assemble your equipment.

Below is a list of possible equipment a rescuer should own; again, work on getting basic mountaineering or basic survival gear before the more advanced (and less frequently used) equipment. Please refer to the current Field Procedures for a listing of required personal equipment and clothing.

Appendix Eight Alpine Rescue Team - Equipment Outline

Ten Essentials

1. **Map&Compass:** A simple liquid-filled compass with declination adjustment and sighting device is best. Personal maps can be limited to Clear Creek County 7.5 minute quad maps, and an Arapahoe Forest Service map. The Trails Illustrated Topo Map #104 (Idaho Springs / Georgetown / Loveland Pass) is also highly recommended.

2. **Headlamp & Spare Batteries:** A headlamp provides hands free operation. Extra batteries and a spare bulb are also necessary (batteries can be either alkaline or Lithium, the bulb should be low wattage for maximum battery life).

3. **Emergency Shelter:** Bivouac sack, plastic tube tent, tarp, space blanket, or two large trash bags.

4. **Appropriate Clothing:** Personal clothing should include insulating layers, outerwear, warm hat, gloves, and extra socks. See additional information later in this document.

5. **Sun Protection:** Sun protection for primarily eyes and skin; Sunglasses or dark goggles and sun block are recommended.

6. **Extra Food & Water:** Each member should have food and water to last 48 hrs. Plan to have water, not ice in your pack in winter! (a 1 qt, wide-mouthed water bottle is recommended).

7. **Waterproof Matches:** Waterproof matches are best, but a waterproof container may suffice.

8. **Firestarter:** A candle, fire starter paste, or "canned heat" will provide a means for getting a fire started when conditions are less than optimal.

9. **Pocket Knife:** A Leather man or Swiss Army type knife is recommended. No Alpine member should ever have the need for a Bowie-style knife.

10. **Personal First-Aid Kit:** Recommended contents include: Aspirin or non-Aspirin pain reliever, antacid, band aids, heavy absorbent pad, moleskin, needle, tweezers, razor blade, gauze, triangular bandage, tape, latex gloves, and safety pins.

Appropriate Clothing

Alpine Rescue Team prides itself on being a professional mountain rescue unit. This not only includes being prepared but also looking like a professional. Field active team members are issued a team jacket if available and are expected to look the part of a professional rescuer.

One of the ten essentials listed is appropriate clothing. This includes the clothes you wear into the field and extra clothes. Clothing protects you from wind and rain, insulates you from cold temperatures, shields the hot sun, wicks moisture away from your body, and protects you from minor abrasions and cuts.

Appendix Eight Alpine Rescue Team - Equipment Outline

Recommended General Clothing

- Quality Boots
- Gaiters
- Quality Socks (like Smart Wool) or liners and insulation layer Shorts
- Long Underwear (polypro, capilene)
- Warm Weather Shirt
- Long pants
- Insulation layer (sweater, pile, wool shirt -tops and bottoms) Waterproof/windproof layer (pants and parka)
- Hats (wool, rain, sun)
- Balaclava
- Mittens / Gloves / Liners

Layering

A common method used to dress is called layering. This method allows you to adjust very easily to changing weather conditions. Layering is your best defense against heat loss due to convection, conduction, radiation, and evaporation.

Dressing for the mountains is about creating a system. Layering is a way to dress to regulate your body temperature so that you are comfortable standing around mission base for hours or hauling a litter up a steep slope. It takes practice and, most important, each person has his or her own personal temperature comfort range. You must develop your own personal layering system.

Layering techniques may be applied to each part of the body. Layering techniques involve three basic layers of clothes.

1. The Wicking Layer: This inner layer acts to wick the moisture away from you to keep you dry. This is the long underwear layer. The weight of underwear may vary dependent on weather conditions and activity.

2. The Insulation Layer: This layer is the layer that insulates you from the cold. The number of garments you wear in this layer will vary. Generally, several lightweight insulating layers provide more opportunities for controlling temperature then one heavy one but thickness is what insulates.

3. The Windproof/Waterproof Layer: This layer breaks the wind and rain to keep you dry and reduce convective and evaporative heat loss. Sometimes this layer over light clothing is sufficient when you are doing strenuous activities, or if the weather is mild.

Appendix Eight Alpine Rescue Team - Equipment Outline

Used correctly, layering is very effective. For varying weather conditions, the type and number of layers may be adjusted. As an example, for cold temperatures you will need to add more insulation or increase the thickness of the insulation layer. The trick is to vary these layers depending on the temperature and your level of activity. Your goal is to stay slightly cool and dry. Good Luck!

Clothing should be kept as clean and dry as possible. Avoid wet willows and mud bogs even though you are wearing waterproof pants and have freshly sealed boots. Do not allow yourself to get sweaty. Vent, or stop and strip off a layer. Wet clothing decreases insulation value and may increase evaporative cooling.

Clothing, the Name Game

Confused by all the different names for the new materials you find in outdoor gear? These materials can be categorized as waterproof/breathable, or liners.

- Undergarments: Coolmax, Thermax, Polypropylene, Capilene .
- Insulated Liners: There are many synthetic liners. Most of them absorb very little moisture. In many cases less than 1%. Some of the popular names for these materials include; Dryline, Drylite, Polyester Pile, Prima Loft, Polar Max, Synchilla, Polar Plus, Polar Fleece and Polar Max.
- Liners: A wide variety of liners has been developed to reduce perspiration build up and radiated body heat.
- Waterproof Coatings: Also used in outerwear to make a garment waterproof. These coatings are applied to the material and often need to be re-applied. Examples are K-Kote, Zepel.
- Waterproof/Breathable: Used for outerwear to keep you dry, break the wind and allow body moisture to pass outward. Often a lining hung in the garment or attached to the material. Gore-tex, Entrant, Sympatex, Ultrex are just some examples.

The type of material varies by manufacturer. This part of the industry is changing quickly and each season there are new materials on the market.

Old Fabrics That Still Work

- Wool: Is a great insulator and has good wicking qualities.
- Silk: Has both insulation and wicking qualities.
- Cotton: Is not recommended for the field because it holds moisture.

Appendix Eight Alpine Rescue Team - Equipment Outline

Applying the Layering Technique to each part of the Body

Feet:

Two layers of socks are recommended. The first is the wicking layer, the second is the main insulation, and the gap between them decreases the chance of getting a blister. The first layer is a thin sock, usually made of polypropylene or similar wicking material. The second layer is a thick pair of wool, wool blend or neoprene socks. Boots qualify as the third layer. The boots should be of a sturdy ankle-high mountaineering type with single piece split leather uppers. Gaiters are also a part of the third layer. These protect your legs against abrasion, and keep snow and pebbles out of your boots.

Legs and Torso:

Again the layering is applied with a wicking layer closest to the skin. Good materials here are silk, polypropylene, capilene or other wicking synthetics. For the insulation layer the most common materials are polar plus, wool, pile, and down. Wool or a synthetic is the best for the summer also because it is the most durable (needed for willow bashing and rock climbing). The shell layer usually is made of a breathable weatherproof material such as Gore-Tex. Full zip pants, both for the insulation and shell layers, are very desirable. Pit zips for your torso insulation and shell layers are very useful for venting. Full front zips are the best for torso layers. Sweaters and anoraks are less desirable as they are less adjustable when conditions change.

Hands:

Here the layering system consists of thin glove liners usually made of polypropylene or silk, and polar plus, down, or wool for the insulation layer. The shell layer usually is made of breathable weatherproof material such as Gore-Tex. Both the insulation and shell layers can be found in mitten and glove style.

Head:

A thin balaclava is a good wicking layer (fits under the helmet). This layer is usually made of silk or polypropylene. A wool or synthetic material hat that covers the ears works best for an insulation layer. The hood from your shell parka completes this layering system.

Other Basic Equipment

Boots

Foot comfort and durability are of prime concern to the mountain rescuers who spend most of their time in rugged terrain and adverse conditions. Like clothing, boots have gone one step beyond the hob-nailed and kletter shoes of the past. However, rescuers are still looking for boots that protect their feet and provide ankle support. Lightweight boots are great for personal use but not appropriate for rescue type work.

- Boots that hold up the best in the rugged terrain that we find ourselves in are of three types: Rough Trail boots, Off Trail boots, and Mountaineering boots.

Appendix Eight Alpine Rescue Team - Equipment Outline

- Rough Trail Boots: These boots are good for rough trails and carrying moderately heavy loads. These boots cover the ankle and are made of split or full leather. Some have a Gore-tex and leather upper. They also have a quarter to half-length shank.

- Off Trail Boots: These boots are made for off trail hiking and carrying heavy loads. They have a heavy-duty sole, come ankle high or above and are of full grain leather. They are very abrasion resistant and are easily waterproofed.

- Mountaineering Boots: Full shank boots in either plastic or leather. These boots tend to be particularly stiff and heavy. However, some of the newer lightweight plastic boots work well for year round rescue work.

Correct fit is very important in boots. Boots that fit correctly will bring you miles of pleasure. Here are a few tips.

1. Bring the socks you are going to wear to the store.

2. Plan to spend some time shopping for boots. Don't settle for the first pair your size without trying them on. Be patient!

3. Listen to your feet. Buy boots that feel good. Not too tight in the toes and snug in the heels, so they won't slip when traveling up and down hills. If you feel rubbing, pain or hot spots while you' re in the store, odds are it won't go away.

4. Check to see what the policy of the store is regarding boots. Many have an unconditional guarantee on fit and will trade them in after as much as a year towards a different pair.

5. You may also want to consider upgraded foot beds, custom foot beds or orthotics.

Packs

Like boots, a good pack is an essential piece of gear for the mountain rescuer. The proper pack for rescue work is between 3000 and 4000 cubic inches. This size will give you enough room to carry your personal gear and some team equipment. It should be of rugged material, such as pack cloth or cordura. Some type of frame is recommended because of the weight you will have to carry. When fitting a pack, even with a day-to-day and half size pack, it is advisable to put weight in it. For testing, your personal gear will weigh from 15 to 30 pounds and a team rope will add another 20 plus pounds. Wearing your pack with the added weight will help you determine the fit and determine whether it will carry what you need it to carry. A detachable/expandable hood/pocket will allow you to increase the pack's volume. Internal frame packs give you more ease of movement in rugged terrain. A larger pack often carries better than a smaller pack and gives you extra room to carry team gear.

For your first pack, it is better to buy a larger one (perhaps with compression straps) that you could use both in the summer and the winter (winter usually requires more equipment). Later, you can buy another smaller pack for summer. When buying your smaller pack, beware of those without some sort of internal frame. Without an internal frame, 20 - 40 plus pounds will end up on your shoulders, and that gets tiring after a couple hours.

Appendix Eight Alpine Rescue Team - Equipment Outline

Winter Travel Gear

No member is required to own winter travel gear such as snowshoes, skis, crampons, or ice axes. However, in order to be qualified to go into the field in winter conditions, each member must show his/her capability with at least some of this equipment. Additionally, no team member is allowed in the field during winter operations without the following equipment.

- Shovel
- Probe Pole
- Avalanche Beacon

This equipment is available through the team, although you may want to eventually purchase your own. The team has a limited supply of snowshoes and ice axes, however new members should not count on using this equipment as more experienced members will likely be given priority usage of this gear. Since proficiency comes with usage, all members are encouraged to purchase and practice with their own equipment. New members are advised to first equip themselves for spring, summer, and fall missions. Later, as personal finances permit, and as advice from experienced members is obtained, the new member should obtain equipment for safe winter travel.

Team Uniform

(Optional) If available a team jacket will be issued to field active members. Members are also encouraged to often wear a bright, orange shirt with the team member name and team patches. These shirts distinguish us from "civilians" in the mission area and indicate a level of professionalism. Team members can also purchase team hats and shirts from the team store and patches to apply to regularly worn clothing. The team also has several logos available for embroidering on clothing.

Appendix Eight Alpine Rescue Team - Equipment Outline

Other Equipment

Following is a partial list of other equipment that you may want to have. These items are not always carried on missions. (Although some of these items are small and light enough that you may choose to keep them in your pack at all times.) However, they are useful to carry in your response vehicle for special conditions/missions and for out-of-county missions.

Whistle - Plastic to attract attention from a lost subject or other field teams.
Paper and Pencil - These are very useful for recording information about your subject and to make notes during a mission.

Toilet paper (often known as the eleventh essential)

Parachute cord

Insect repellent

Flagging tape
Camera and film
Handkerchief/Bandana
Binoculars
Water purification chemicals
Down Jacket
Extra socks
Waterproof clothing (outerwear)
Advanced First Aid Kit, including moleskin or second skin Snow Travel Equipment (skis and / or snowshoes); Avalanche Beacon
Bivy Sack
Plastic Mountaineering Boots
Probe Ski Pole
Probe Poles
Stove and Fuel
Candle lantern
Ice Saw
Down Booties
Lip balm
Extra prescription glasses
Signaling mirror
Sleeping Bag
Tent
Cooking Gear
70’ – 100’ of 8mm rope

Transportation, and Organization of Gear

Your gear must be kept in a ready state, preferably in your car. Don't wait for the pager to go off to organize your gear. There are many ways which team members organize their gear in their cars from just throwing it into one big pile to having all of the equipment in color coded stuff sacks. Some

members only have the basic gear in their packs, then once they find out their assignment they finish packing the additional gear required. It is a good idea to have all your gear organized in the car, packed in a couple of large duffel type bags so you can quickly change cars and ride with someone else.

When you are called out of county on a mission, a sleeping bag and pad should be taken along. When you fly out of county, a maximum of two bags is prudent. One of these bags is your standard pack. The other, a duffel-type bag, with extra clothes, food, sleeping bag, tent, stove and other equipment you feel necessary for the particular mission. Team members should try to minimize gear taken out of county. A tent and a stove are not needed for each member and can be shared. Bear in mind when taking this extra gear that a helicopter might take you in and not bring you out. You might have to carry this extra gear out. Usually a helicopter ride takes you to a "mission base area" where you may leave your extra gear. Your extra gear bag should be waterproof or wrapped in trash bags (the gear may end up outside in a big pile).

Recreating with your gear is very important. Just because you own it does not mean you know how to use it. When you do play with your gear, clean, repair and reorganize it as soon as you are done to be mission ready again.

Personal Equipment

Required Personal Clothing And Equipment

The 10 essentials:

- Map and Compass
- Headlamp & Spare Batteries - Emergency Shelter
- Appropriate Clothing
- Sun Protection
- Extra Food and Water
- Waterproof Matches
- Fire starter
- Pocket Knife
- Personal First Aid Kit

Additional Clothing and Equipment

- Adequate Hiking Boots
- Adequate Backpack
- Weatherproof Parka and Pants
- Insulating Layer
- Gloves or mittens for cold protection - Insulated head and ear protection
- Long Underwear

Appendix Eight Alpine Rescue Team - Equipment Outline

Technical Equipment

- Team Approved Helmet (UIAA or other appropriate)
- Team Approved Harness (UIAA or other appropriate)
- Leather or approved synthetic gloves (used only with Alpine) - Rescue Eight w/ Ears
- (2) Large Locking "D" Caribiners
- (4) Regular Locking Caribiners

Other Recommended Technical Equipment

1 - Belaying Device (ATC, Tube, Etc.)

2 - (2) Additional Large Locking "D" Caribiners

3 - (2) Additional Regular Locking Carabiners

4 - Runners (used for diaper slings, chest harness, etc.)
These can either be 1" tubular webbing or 5/8" Sewn Spectra Runners Factory runners are normally 24"or 48"
Additional Prusik Loops - different color than above Prusiks – Based on your height, prusiks loops used for litter tie-ins may be longer or shorter than those listed below

(2) Personal Pulleys

5/8" Personal Anchor System (PAS)

Team Equipment - Overview

Team equipment refers to those items most basic to the performance of field training and missions, with the emphasis on the technical. Items not included would be those covered under another category, such as communications or medical.

The team equipment is only used for search and rescue operations and for scheduled trainings. Exceptions to this may be granted by the on-call Mission Leader. This includes other activities that may remove significant items from service or delay their availability for a mission. Any equipment to be checked out must first be cleared through the on-call Mission Leader. The on-call Mission Leader must also be notified when the equipment is returned and mission ready. Any equipment that is damaged or needs repairs should immediately be brought to the attention of the Mission Leader and the Equipment Director.

Each team member should know the operation, uses, weaknesses and limitations of all equipment which might be used in the course of a mission or training. The proper use of all team equipment will be taught during trainings.

Additional mission ready equipment is stored on the walls in the vehicle bays. Equipment in the equipment room is not considered mission ready.

Appendix Eight Alpine Rescue Team - Equipment Outline

There are specific locations within the individual vehicles for the various pieces of equipment, and sometimes, even within an individual compartment or pack. Every team member should be familiar with all the team equipment and where it is located.

Alpine also has a litter, sleeping bag, litter wheel, radio and helmet cached at the Mt Evans Ranch in the event an evacuation is necessary from that location.

Team Vehicles

Team vehicles are to be driven only by members who have completed specific training requirements and are approved by the Vehicle Director. Each truck has a mobile radio and cellular telephone.

Rescue 1

Rescue 1 is the primary response vehicle containing the greatest variety of equipment. It is equipped with 4-wheel drive, a front mounted winch, and customized compartments for all of Alpine's rescue gear. This vehicle was custom-built for the team in 1998. This vehicle is not designed for off road use.

Rescue 2

Rescue 2 is the secondary response vehicle and is commonly used as our "out of county" vehicle. This vehicle was custom built for the team in 2002 and contains approximately 50% of the equipment as Rescue 1. It is also equipped with 4-wheel drive and a front mounted winch. This vehicle is appropriate for off road use.

Comm 4

Comm 4 is the command and communications vehicle. This vehicle was custom built for the team in 2002 and contains a computer networking system along with radio and phone systems used in the course of running a mission. This vehicle is usually called into service during a search after a primary vehicle has already been dispatched. Comm 4 is primarily used as the team' s Command Post from which the mission leader can run a mission. It is also equipped with 4-wheel drive and a front mounted winch. This vehicle is not designed for off road use.

Snowmobiles and Trailers

The snowmobile trailers contain the team's snowmobiles, a rescue sled and other related winter gear. Only trained, designated drivers are permitted to operate the snowmobiles. Each of Alpine's snow machines has their own unique capabilities.

Some are fast, powerful machines typically used to rapidly insert gear and personnel into the field. Others are used for hauling heavy loads. It is the responsibility of each driver to know the proper use of each machine. The use of personal protective equipment (Helmet, Gloves, Eye protection, etc.) is required.

Appendix Eight Alpine Rescue Team - Equipment Outline

ATV's and Trailer

ATV's are used in a manner similar to that of the snowmobiles, but usually during the summer season. Drivers of the ATV's must be properly trained. The use of personal protective equipment (Helmet, Gloves, Eye protection, etc.) is required.

Technical Equipment

Rope

Rope is Alpine's primary tool for technical rescues. Our team members' and subjects' lives depend on its proper care and use.

On both Rescue 1 and Rescue 2 there are 200' and 300' static ropes. Rescue 1 should carry nine 200' ropes, three of each color as well as two 300' ropes. Rescue 2 should carry six 200' ropes, two of each color as well as two 300' ropes. Rescue 1 has an additional 600' spool of static rope. Each vehicle also has a Third Man Pack that has a dynamic lead climbing rope.

Service-life of ropes is monitored closely. The date that a rope is placed into service is noted on a shrink-wrapped tag at the end of the rope. **Any rope older than five (5) years is to be retired, regardless of condition.** Each time a member of Alpine bags a rope; it should be inspected physically and visually for damage or excessive wear.

**If a rope is taken out of service for any reason, it must be replaced on the truck immediately and notification should be made to the Mission Leader and Equipment Director.*

Bash Pack

Each bash pack contains prepackaged technical rescue equipment used to rig our basic technical rope systems. The equipment in each bash kit is stored in properly marked red rope bags. Standard equipment in each kit will include; an anchor rope, webbing slings, carabiners, pulleys, prusik loops, brake tube, rigging plate and edge protection. Rescue 1 and Rescue 2 have two bash packs each, and two additional bash packs are hanging on the wall in the first bay. It is only to be used as a temporary replacement in the event a bash pack needs to be taken out of service.

Each bash pack contains a card in a side pouch that lists the contents and explains the proper order in which the equipment should be stored.

**Each bash pack should be visually and physically inspected each time it is used, and the Mission Leader and the Equipment Director should be notified if any piece of gear is found to be missing, damaged or unsafe. When a member repackages the Bash Pack, a J-Tag should be signed and attached to the pack by that member prior to placing the Bash Pack in service.*

Litter Wheel

The litter wheel is a large single wheel on an aluminum frame that mounts under the litter. The wheel takes the bulk of the weight of the litter and patient during a trail evacuation. Rescue 1 has a litter wheel on board and there are two spare litter wheels on the Comm 4 bay wall.

Appendix Eight Alpine Rescue Team - Equipment Outline

Litters

1. Titanium Litter – Alpine's litter of choice for vertical evacuations or long carry outs. These lightweight litters come in two sections and can be mounted to the litter wheel for easier and faster trail evacuations. There is one of these Titanium litters in each rescue vehicle. There are two spare Titanium litters stored on the wall at the shack.

2. TitaniuMAX Composite Shell Litter – Manufactured by Cascade Toboggan, this is primarily a winter evacuation litter. These lightweight litters come in two sections. There is one of these TitaniuMAX litters in each rescue vehicle.

3. SKED Litter- An orange plastic litter rolled up and stored in an orange bag. When the sides, head and foot flaps are folded around a patient, the plastic becomes semi-rigid. The SKED, by itself, does not provide adequate C-spine stability. Its primary advantages are its lightweight and small size. It is typically used in our high altitude missions prior to getting one of the other litters into the field. It will slide over snow, and can be X-rayed through, but tends to pinch the shoulders and can be uncomfortable if the patient is in it for long periods of time.

Winter Equipment

Snowshoes, Avalanche Beacons, Avalungs, Recco Avalanche Rescue System, Collapsible Probe Poles, 10' Probe Poles, Shovels, Flags, Ice Axes, Ice Screws, Avalanche Guide-on Cords, Wands, Snow Flukes, Pickets.

Water Rescue Equipment

Life Jackets, Throw Ropes, River Probe Poles

Equipment Readiness Program (J-Tags)

In order to insure the readiness of the team's equipment and vehicles, in 2006 the team instituted the "Equipment Readiness Program". Each time a vehicle or any equipment is used for a training or mission, they are inspected prior to being placed back in service.

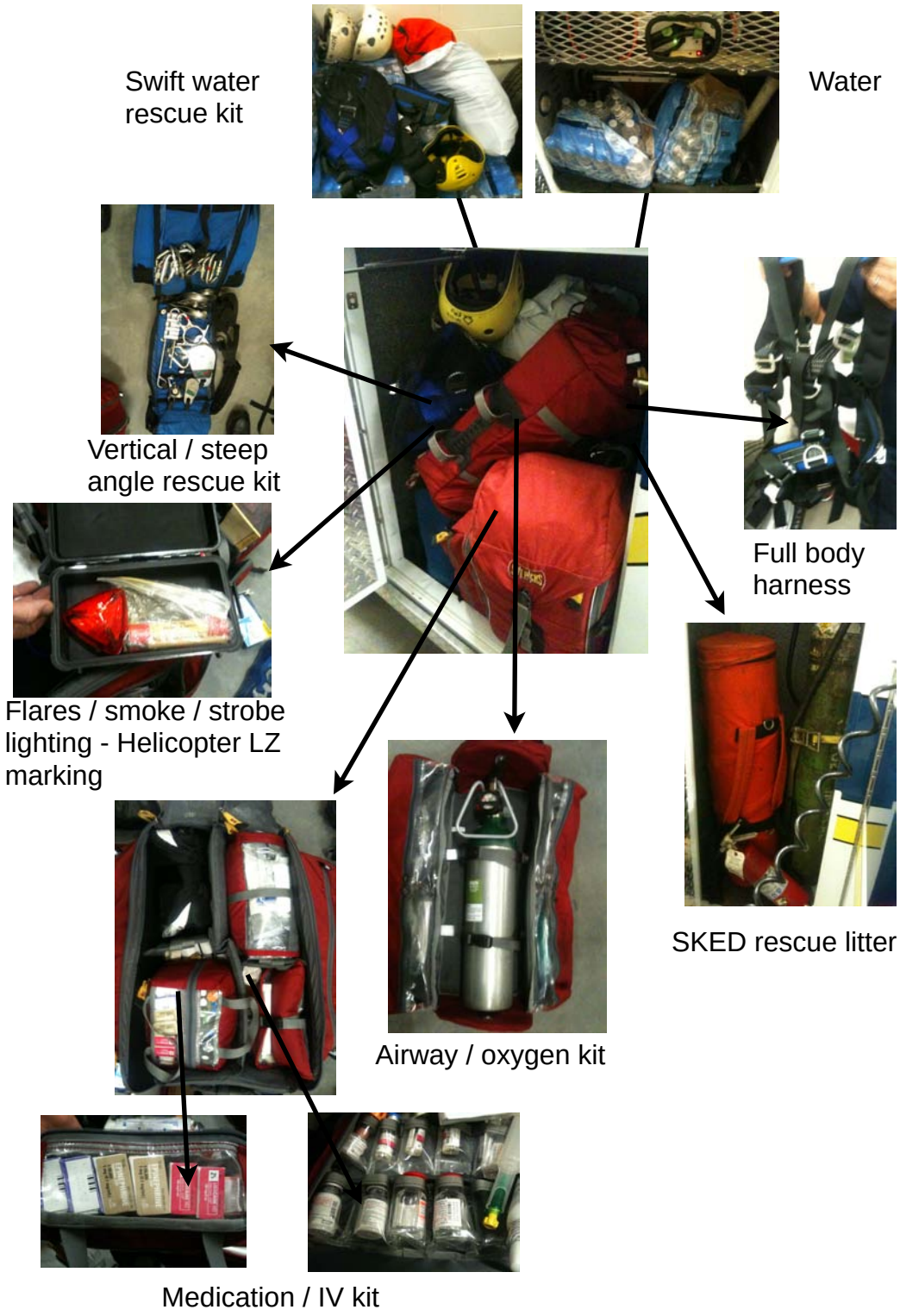
For each vehicle there is a long form and a short form. A sample of the long form is located in the appendix section of the Blue Book.

The long form for each vehicle is to be filled out during the bi-monthly inspection. Members are assigned to small groups that are responsible for the complete inspection of each vehicle and all the equipment located on it. A J-tag is placed on specific equipment packs to confirm that the contents have been inspected and the pack is mission ready. A J-Tag is a piece of flagging that has the name of the pack, the date inspected and the initials of the inspecting member. Each time the pack is used, the current J-tag is removed to signify that the pack now needs to be inspected prior to being placed back in service. The long form for each vehicle lists the packs that require J-Tags.

Appendix Nine Teton County SAR Response Equipment

Appendix Ten

Burke County Special Operations Equipment



Appendix Eleven

Ambulance Victoria, Hume Region
Modular First Aid Kit Contents

Pack 1: Survival Equipment

Snack food

Tent

Down sleeping bag

Foam ground mat

Pack

Air mattress

Butane gas cooker and cooking set

Pack 2: Modular Medical Equipment

Pack

Trauma

Resuscitation

Paramedic

Airway

Fluid

Splints

Appendix Twelve Ambulance Victoria, Hume Region Modular First Aid Kit Contents List

PARAMEDIC

- BP Cuff
- Stethoscope
- Thermometer
- BSL
- Drugs (selected by Paramedic prior to deployment)
- IV Equipment

RESUSCITATION

- Bag Valve Mask (adult)
- Various Size Face Masks (adult and child)
- Hand Suction Unit
- Suckers; Yanker(1), Y Sucker
- (1 X 6g, 8g, 10g, 12g, 14g)

AIRWAY

- Airway NP; 8.5, 7.5, 6.5, + Lube
- Airway OP; 10, 9, 8, 6, 5.5, 5,
- LMA Size; 5, 4, 3, + Lube
- Tube Holder; Adult
- Magills; Small and Large
- Laryngoscope; Handle
- Laryngoscope Blades; infant, adult and child
- MISC; safety glasses, gloves, tape, scissors

FLUIDS 1

- 2 X Bags NaCl (1000 ml.)
- 2 X Giving Sets

TRAUMA

- Bandages; triangular(4), 15cm(3), 10cm(2), 7.5cm(1), 5cm(1), Coban(1),
- Combine(3), Eye Patch(2), Melanin(2), BurnAid Large(1), Aero Plast(1)
- Eye stream(2)
- Misc; tape(3), Scissors (lge. & sml.), Artery Forceps, Tweezers, ThermalBlankets(2), Handrub

SPLINTS

- Air Splints
- Sam Splint
- Pliable foam splint
- Thermal Blankets X 4

FLUIDS 2

- 2 X Bags NaCl (1000 ml.)
- 2 X Giving Sets

Appendix Thirteen: Ambulance Victoria, Hume Region Wilderness Response Pack Contents List

- Pack – One Planet Strezlecki x 2 (WRP; 1 Modular First Aid kit)
- STS packliner - large
- Tent – Peak
- 75d polyester tarp & pegs
- Snow tent pegs
- Mattress trail Pro (womens)
- Closed cell mat
- Sleeping bag – One Planet Bush Light x 2
- Sleeping bag liner – silk
- Stove - MSR Pocket Rocket
- Fuel – Propane canisters x 2
- Camel Back Source Spinner Pro
- Lexan non toxic bottle (narrow mouth)
- Water purifying tablets
- Cutlery – plastic
- Princeton Tech Quad head torch
- Small torch - Extream
- Silvia Field 26 compass
- Gerber Suspension multitool
- Maps – area specific
- Map bag A4
- Matches – weatherproof
- Gaiters
- Cooking/eating bowls
- Food – assorted meals, snacks etc
- Black Diamond Transfer 7 shovel
- Microfibre towel
- Cyalume sticks x 3
- Strobe light – ACRC strobe
- Trekking poles – Black Diamond Alpine CF
- Snowshoes – MSR Denali Ascent
- Snow goggles
- EPIRB GPS enabled
- 20m 4mm static cord & carabiner
- Winter Pig grain glove – Thinsulate lined
- Ruler, pencil, rubber, sharpener, fluro string & notepad
- Batteries – AA/AAA
- Sunscreen, insect repellent
- Protective glasses
- Riggers gloves
- Nitrile gloves – assorted sizes
- Hazardous waste bags

Appendix Fourteen Will Smith's (MD, EMT-P) Medical Kit

Technical Rescue Medical Kit

This kit, used by Will Smith, MD, EMT-P, Medical Director/Team Leader, Teton County Search and Rescue, Jackson, WY, USA, one of the authors of this chapter, is presented as an example of a technical rescue medical kit. The contents of a medical kit are a matter of personal or institutional preference. No single set of contents can be appropriate for all providers in all practice settings.

This kit is modular. The various components can be quickly sorted and assembled making an appropriate kit for the anticipated rescue situation. The kit is designed to be carried in a rescue pack. The entire kit may be utilized on a helicopter insertion. A long walk-in or technical insertion will limit the amount of medical gear that can be carried in addition to personal and technical gear.

Technical Rescue Medical Kit (15 kg)

Medication Bag:

- 2 - Epinephrine 1:1,000 (1 mg/ml) ampule
- 1 - Epinephrine 30 mg/30 ml vial
- 3 - Prednisone 20 mg tablets
- 1 - Diphenhydramine 50 mg/ml vial
- 2 - Etomidate 20 mg/10 ml vials IV
- 1 - Ketamine 500 mg/5 ml vial
- 1 - Midazolam 50 mg/10 ml vial
- 1 - Succinylcholine 200 mg/ 10 ml vial (stored in refrigerator)
- 1 - Rocuronium 50 mg/5 ml vial (stored in refrigerator)
- 2 - Vecuronium 10 mg vial
- 1 - Dexamethasone 20 mg / 4 ml vial
- 2 - Cefazolin 1 gram
- 2 - Ketorolac 30 mg/ml vial
- 4 - Chewable Aspirin 81 mg tablets
- 2 - Hydromorphone 2 mg / ml vial
- 2 - Fentanyl 100 mcg/ml ampoule
- 1 - Narcan 4 mg / 10 ml vial
- 1 - Metoclopramide 10 mg / 2 ml vial
- 1 - Promethazine 25 mg / 1 ml vial
- 1 - Ondansetron 4 mg / 2 ml vial
- 2 - Ondansetron 4 mg sublingual dissolving tablets
- 2 - Albuterol 3 mg/Ipratropium 0.5mg/3 ml for nebulizer
- 5 - 10 ml saline flushes

Appendix Fourteen Will Smith's (MD, EMT-P) Medical Kit (continued)

- 10 - Alcohol prep pads
- Assorted Syringes (3-1 ml (with needle), 4-3 ml (with needle), 1-10 ml, 1-20 ml)
- 2 - Nasal Mucosal Atomizer Device (MAD)
- 10 - 18 gauge needles
- 10 - Syringe caps

IV Bag:

- 1 -1000 ml normal saline IV solution
- 1 - 10 drip IV drip tubing
- 2 - IV catheters (14 gu, 16 gu, 18 gu, 20 gu – 2 each size)
- 1 - EZ-IO handheld driver and adult needles (15 gauge x 25 mm)
- 2 - Saline lock tubing
- 2 - 10 ml normal saline flushes
- 1 - Sharp Shuttle
- 2 - Non-latex IV tourniquets
- 4 - Band-Aids
- 10 - Alcohol prep pads
- 1 - Tape roll 1"
- 1 - Occlusive dressing for IV site
- 1 - IV pressure bag

Miscellaneous Bag:

- 1 - Lidocaine 2% – 30 ml vial
- 1 - Lidocaine 2% w/ epi 1:100,000 – 30 ml vial
- 1 - Bupivacaine 0.5% – 50 ml vial
- 1 - scalpel #11 blade
- 2 - tape 1"
- 2 - Coban – non-stick bandage – 1 "
- 1 - Cavit tube 7 g (dental)
- 1 - dental cement kit
- 2 - Steristrips (1 ea, ¼" and ½")
- 1 - stapler (#5 staples)
- 1 - burn gel package
- 1 - Rhino Rocket ® 7.5 cm for expistaxis
- 2 - 18 gu IV catheters
- 2 - OpSite™ occlusive adhesive bandage
- 1 - tetracaine eye anesthetic drops
- 3 - 10 ml normal saline flushes
- 5 - 18 gauge needles
- 5 - 27 gauge needles
- syringes: 10 ml (3), 1 ml (3), 20 ml (2)
- Front and Top Pockets
- 1 - note pad and pencils/pens/sharpies
- 1- head lamp

Appendix Fourteen Will Smith's (MD, EMT-P) Medical Kit (continued)

- 1 - Ibuprofen 200 mg tablets (bottle #100)
- 1 - tape 1"
- 5 - charcoal hand warmers
- 2 -alcohol hand sanitizer bottles
- 10 pr - non-sterile gloves (non-latex)
- 3 - benzoin swabs
- 10 - triple antibiotic packets
- 4 - small clear zip-lock bags
- 4 - wooden tongue blades
- 2 - emesis bags
- 2 - trauma shear/scissors
- 1 - pocket mask (Nu Mask ®)
- 1 - pack of 20 Triage tags
- 1 - pack of Wet Ones™ sanitary wipes
-

Bandaging Side Pocket:

- 2 - 4" ace bandages
- 2 - 4" Kerlix™ bandages
- 2 - 10 pack 4x4 guaze
- 2 - 5x9 absorbable pads
- 1 - triangle bandage
- 1 - scrub brush/sponge
- 1 - CAT™ tourniquet
-

Miscellaneous Side Pocket:

- 1 - adult BP cuff
- 1 - SAM™ splint
- 1 - hand held nebulizer
- 1 - IV pressure bag
- 1 - strobe light signal device
-

Main Compartment:

- 1 - 1000 ml normal saline IV bag
- 1 - 10 drip IV tubing
- 1 - size 4 King LTSD™ supraglottic airway
- 1 - Asherman Chest Seal ™
- 1 - 16 fr Foley catheter
- 1 - Foley leg bag
- 2 - Depends adult diapers
- 1 - pack of Wet Ones™ sanitary wipes
- 1 - Stiff neck c-collar (adjustable adult size)
- 1 Pocket Blue™ inflatable bag valve with mask
- 1 - Adult EZ-IO™ battery driver and 2 needles (15 gu x 25 mm)
- 1 - Ambu™ handheld suction device

Appendix Fourteen Will Smith's (MD, EMT-P) Medical Kit (continued)

Airway Bag:

- 1 - gum elastic bougie (Asherman stylet)
- 1 - Comfit™ ET tube holder
- 1 - stethoscope
- 1 - pocket pulse oximeter (extra batteries)
- 1 - Magill forceps (large)
- 1 - adult endotracheal tube stylet
- 1 - endotracheal tube (1 each: sizes 5-0, 6-0, 7-0, 7-5, 8-0)
- 1 - nasogastric tube (18 fr)
- 1 - endtidal CO2 colormetric intubation confirmation device
- 1 - eye protection shield/facemask
- 1 - 3-0 silk suture on straight needle (SC-2)
- 1 - Vent Tubing with 1 way valve for remote ventilation
- 2 - 14 gauge x 3.25" Needles for chest decompression
- 3 - oral pharyngeal Airways (OPA-various adult sizes)
- 3 - nasal pharyngeal airways (NPA – 30 and 32 fr)
- 2 - 10 ml Syringe
- 1 - laryngoscope handle (AA)
- 1 - Macintosh 4 stainless steel blade
- 1 - Miller 3 stainless steel blade
- 1 - scalpel #11 blade
- 1 - Chloraseptic™ Swab
- 1 - povidone/iodine Swab
- 1 - BAAM™ whistle device (for nasal intubation facilitation)
- 2 - Petrolatum vaseline gauze 3x9 inch
- 2 - Heimlich valve and tubing

Oxygen Kit (10 kg):

- 1 - Carbon Fiber DD-lite oxygen tank (up to 3,000 psi)
- 1 - adult nasal cannula
- 1 - Oxymizer® nasal cannula
- 1 - nonrebreather face mask
- 1- extension tubing and adapter
- 1 - TPOD™ pelvic binder
- 1 - spider straps
- 2 - oral pharyngeal airways (adult sizes)
- 1 - large charcoal blanket (Ready-Heat ™)
- 1 - size 4 King LTSD™ Supraglottic airway
- 1 - bag valve mask (traditional)
- 1 - bag of nitrile gloves (appropriate provider size)
- 1 - hand held nebulizer
- 1 - SAM™ splint
- 1 - Kerlix gauze 4"

Appendix Fifteen Comparison of Communications Options for Wilderness Response

Option	Weight	Initial Cost per unit	Ongoing Cost	Capital investment required to increase range/capacity
RAVNet Radio (in vehicle)	Heavy	Already in place	Low	Significant. eg Cann River est $0.5million
HF Radio (in vehicle)	Heavy	Moderate	Low	Moderate
VHF Radio (Handheld SMR)	Moderate	Moderate	High - expensive calls, use of network	Significant. eg Cann River est $0.5million
UHF CB Radio (Handheld)	Moderate	Low	Low	N/a - line of sight only
GSM Mobile Phone (Telstra)	Light	Low	Moderate	N/a - out of AV control
Satellite Phone (Iridium)	Moderate	Moderate - $1499 for Iridium 9575 Extreme)	Moderate (starts @ $45/month)	N/a
SPOT Personal Satellite communicator	Light - 147 grams	Low	Moderate (starts @ $19.95/month)	N/a
InReach Personal Satellite communicator	Light - 198 grams	Low	Moderate (starts @ $19.95/month)	N/a
Personal locator beacon	Light	Moderate	Moderate	N/a
EAS Pager Network	Light	Low	Low	Significant. 97% coverage in Victoria. Lacking in remote areas.

Appendix Fifteen Comparison of Communications Options for Wilderness Response (continued)

Option	Coverage	Battery Life
RAVNet Radio (in vehicle)	Variable - tends to be poor in mountainous terrain.	N/a
HF Radio (in vehicle)	Determined by choice of licensed frequencies. Statewide achievable	N/a
VHF Radio (Handheld SMR)	Variable - tends to be poor in mountainous terrain.	1 day. Depends on usage
UHF CB Radio (Handheld)	line of sight to nearby radio or repeater base	2 days. Depends on usage
GSM Mobile Phone (Telstra)	Variable - tends to be poor in mountainous terrain.	1 - 4 days. Depends on usage. A limiting factor for extended use
Satellite Phone (Iridium)	Global coverage but relies on passing satellites	1 - 2 days. Depends on usage
SPOT Personal Satellite communicator	Variable - users global star satellites Requires clear view of sky	2 - 14 days. Depends on on time and settings
InReach Personal Satellite communicator	Global coverage but relies on passing satellites (iridium) Requires clear view of sky	2 - 14 days. Depends on on time and settings
Personal locator beacon	Whole of world - needs view of sky. Activation can take hours in remote areas	>24hrs once activated
EAS Pager Network	97% coverage of Victoria - can be poor in remote areas	5 - 7 days

Appendix Fifteen Comparison of Communications Options for Wilderness Response (continued)

Option	Weather Resistance / Robustness	Interagency compatibility	Large scale incident
RAVNet Radio (in vehicle)	N/a	No	Useful - ?ability to change to incident channel
HF Radio (in vehicle)	N/a	With co-operation of other agencies	Useful
VHF Radio (Handheld SMR)	Water resistant	Yes	Limited - Useful if network operable
UHF CB Radio (Handheld)	Water proof models available	Interagency and community interoperability possible	Useful
GSM Mobile Phone (Telstra)	Poor - waterproof cases available	Yes	Useful - system can become overburdened with many users
Satellite Phone (Iridium)	Poor - kept in waterproof box	Yes	Useful
SPOT Personal Satellite communicator	Good	Yes - utilised by other agencies	Useful
InReach Personal Satellite communicator	Good	Not currently	Useful
Personal locator beacon	Good	No	Limited
EAS Pager Network	Poor	Yes - if cap codes are programmed into unit	Useful for broadcast messages and targeted messages

Appendix Fifteen Comparison of Communications Options for Wilderness Response (continued)

Option	Small scale incident	Voice v Data	in vehicle / remote from vehicle
RAVNet Radio (in vehicle)	Useful	Voice and data	In vehicle - When user remote from vehicle system relies on cloning to vehicle
HF Radio (in vehicle)	Useful	Voice and data	In vehicle only
VHF Radio (Handheld SMR)	Useful	Voice only	Remote
UHF CB Radio (Handheld)	Useful	Voice only	Both but only locally
GSM Mobile Phone (Telstra)	Useful	Voice and data	Both
Satellite Phone (Iridium)	Useful	Voice and data	Both - with view of sky
SPOT Personal Satellite communicator	Useful	Data only - simple preset messages only	Both - with view of sky
InReach Personal Satellite communicator	Useful	Data only - SMS / Email up to 160 characters when paired with phone/iPod. Preset messages.	Both - with view of sky
Personal locator beacon	Useful	Data only - Can only send a electronic signature that it has been activated. No detail.	Both - with view of sky
EAS Pager Network	Useful	Data only	Both

Appendix Fifteen Comparison of Communications Options for Wilderness Response (continued)

Option	GPS enabled?	Other functions	Range
RAVNet Radio (in vehicle)	In vehicle system displays location. No location when remote from vehicle	Ability to make phone calls in vehicle	3 - 30km terrain and base set dependent
HF Radio (in vehicle)	Yes	Phone calls	National. Vehicle to Vehicle or base.
VHF Radio (Handheld SMR)	No	Phone calls	3 - 30km terrain and base set dependent
UHF CB Radio (Handheld)	No	Nil	1 - 15km, power and terrain dependent
GSM Mobile Phone (Telstra)	Optional	Mapping software, clinical apps, other apps	Nearest tower 35 - 50km max
Satellite Phone (Iridium)	Optional	Nil	Satellite system dependent - most of world
SPOT Personal Satellite communicator	Yes (find me SPOT)	Nil	Satellite system dependent - most of world
InReach Personal Satellite communicator	Yes - sends location with every message	Confirms message sent successfully	Satellite system dependent - most of world
Personal locator beacon	Optional	Nil	Whole of world
EAS Pager Network	No	Can record times	Within existing network (97% Victoria)

Appendix Fifteen Comparison of Communications Options for Wilderness Response (continued)

Option	Emergency assistance button?	Level of training required	Other comments
RAVNet Radio (in vehicle)	Yes	Moderate, particularly for phone function.	Needs development for interagency use. Personal experience indicates coverage gaps even in urban areas.
HF Radio (in vehicle)	Yes - Codan NGT duress + location	Programmable for ease of use.	Useful in vehicle comms when buying a small no of units for a specialist group. Useful interagency tool.
VHF Radio (Handheld SMR)	No	High	Useful remote from vehicle comms when buying a small no of units for a specialist group. Useful interagency tool
UHF CB Radio (Handheld)	No	Moderate	Useful for paramedic to paramedic comms in the field. Useful interagency tool
GSM Mobile Phone (Telstra)	No	Nil - commonly used	Relies on coverage. Must be Telstra. Can get in vehicle and remote from vehicle aerials as accessories. SMS messaging useful in wilderness settings.
Satellite Phone (Iridium)	Yes	Moderate	Relies on satellite coverage which is not 100% reliable. Satellites pass at certain time intervals. Must have clear view of sky.
SPOT Satellite communicator	Yes	Moderate	Not 100% reliable. One way messaging only. No confirmation of message sent.
InReach Satellite communicator	Yes	Moderate	Iridium is most reliable satellite network.
Personal locator beacon	Yes - its only function	Moderate	Simple emergency one way communication only. Not appropriate primary comms for a professional emergency service agency.
EAS Pager Network	No	NIl - commonly used	Simple one way communication only

Appendix Sixteen Ambulance Victoria, Remote/Wilderness Response Work Instruction

Work Instruction:	Remote/Wilderness Response	**Document No:**	WIN/OPS/160
Date First Created:	1 July 2012	**Version:**	1.0
Authorisation:	General Manager Regional Services	**Date This Version Approved:**	30 August 2012
Applicable to:	Rural		

1. PURPOSE

To describe the storage, maintenance, activation and use of the Wilderness Response Pack (WRP), to ensure case review of remote/ wilderness responses and to undertake an annual audit to ensure compliance with this Instruction.

2. INSTRUCTIONS

2.1. Storage and Maintenance:

2.1.1. WRPs (AKA: the Pack) are stored in a locked, steel cabinet at the following Ambulance Victoria Hume Region locations:- Bright; Corryong; Mansfield & Mount Beauty

2.1.2. A secured key safe is located with the cabinet. The code to the safe is issued to personnel at the Branch trained in the use of the Pack and the Duty Manager (DM)

2.1.3. The Packs are sealed with a tamper-proof tag which is signed and dated. Cabinets are locked and sealed with a signed and dated tamper-proof seal.

2.1.4. Sleeping bags are to be dry-cleaned after every use and stored in the cabinet in breather bags external to the pack.

2.1.5. An equipment checklist (Appendix A) is stored inside the cabinet

2.1.6. The list is itemised in sequence as per order in the Pack.

Appendix Sixteen Ambulance Victoria, Remote/Wilderness Response Work Instruction

2.1.7. Items with the potential to go out-of-date are highlighted and the date due for changeover is to be noted.

2.1.8. The earliest expiry date is to be recorded on the tamper proof seal on the cabinet

2.1.9. Inspections are to be recorded on the checklist and dated.

2.1.10. A quarterly inspection of the pack and it's contents is made for damage, wear and tear, aging, mould and dampness.

2.1.11. All batteries are to be stored externally to their device and changed half-yearly.

2.2. Activation:

2.2.1. Where an Event is recognised as occurring in a remote/wilderness setting and there is a clearly defined need or potential need for the use of the Pack to support both crew and/or patient(s), in the case of the responding crew being advised by the Dispatcher, the Dispatcher will also advise the DM.

2.2.2. Where the responding crew recognises the Event as occurring in a remote/wilderness setting, they will advise either the Dispatcher or the DM direct. In both cases the Emergency Response Plan (ERP) is also to be activated by the DM. (see Appendix B, Operational Flowchart)

2.3. Use:

2.3.1. The pack is only to be used when responding with other controlling Emergency Service Organisations (ESOs).

2.3.2. The modular First Aid Pack, Appendix C, is to be utilised in any circumstance where the carrying of normal Ambulance equipment may cause a risk to safety.

2.3.3. Where the modular First Aid kit is to be utilised, its contents are to be divided up, the Paramedic taking what he/she deems necessary or,

following consultation, these may be carried by members of other agencies in the responding party.

2.3.4. A rendezvous point is to be established with the other responding agencies prior to accessing the patient(s) to establish liaison and undertake a risk analysis. Refer to 2.8 - Risk Management

2.3.5. Depending upon the known current status of the patient(s), the role of the second Paramedic/ACO may be to remain with the vehicle to manage communications and liaise with other ESOs/agencies.

2.3.6. In the event that two Paramedics are required to attend the patient(s), it is desirable that the second officer is equipped with a WRP to enable self sufficiency for possible overnight deployment. Under these circumstances the ERP escalation must be in place to allow for Ambulance Emergency Operations Centre (AEOC) coordination of a second pack.

2.3.7. All logistical/tactical decisions will be made by the paramedic in consultation with the Health Commander and Emergency Management T eam.

2.4. Risk Management:

2.4.1. A documented risk assessment must be conducted pre and post every Wilderness response deployment using the Wilderness Response Risk Assessment form – Appendix D.

2.4.2. Dynamic Risk Assessments must be conducted by the response team continuously throughout the deployment.

2.5. Case Review:

Using the Wilderness Response Risk Assessment form, a case review is to be conducted on every occasion where the WRP is activated. The purpose for this is to ensure staff employ a risk analysis approach to such events, analysing the current controls (processes), looking at what worked well, what did not work well and document any improvements, (short or long term controls) that could be implemented for future events.

Appendix Sixteen Ambulance Victoria, Remote/Wilderness Response Work Instruction

3. RELATED DOCUMENTS

- AV Emergency Response Plan 2009

1. WORK INSTRUCTION REVIEW

The Regional Manager shall ensure the review and update of this Instruction every two years.

2. DOCUMENT MANAGEMENT

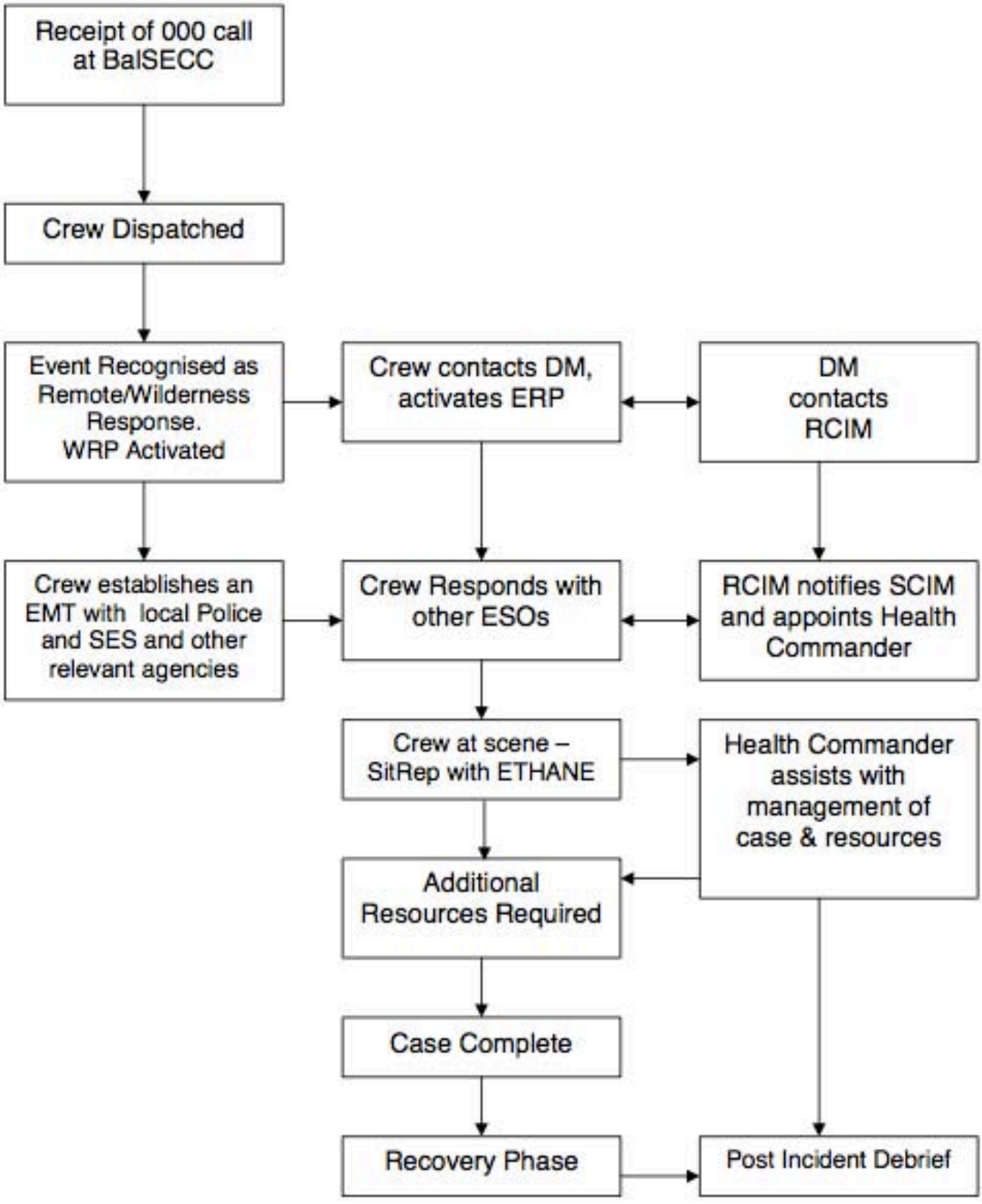
The TRIM reference for this document is QQQ/12/84

3. DEFINITIONS

Term	Definition
WRP	Wilderness Response Pack
ESO	Emergency Service Organisation
ERP	Emergency Response Plan
Modular First Aid Kit	Small, defined weight, individual weatherproof bags containing specific items eg:- Airway, Drugs, Resuscitation, Splints
RA	Risk Assessment
AEOC	Ambulance Emergency Operations Centre

Appendix Sixteen Ambulance Victoria, Remote/Wilderness Response Work Instruction

Operational Flowchart



Appendix Seventeen Burke County EMS Special Operations: Wilderness specific protocols of interest

MODIFIED WOUND CARE

Long-term management of wounds requires wound cleansing to prevent infection.

Procedure*

Wound Cleansing

1. Remove foreign material from the wound. Wash a wide area around the wound with soap and water. Shallow wounds such as burns and abrasions may be washed directly on the wound surface.

2. Irrigate the wound with clear water. High volume/pressure is best. Potable water should be used for irrigation.

3. Cover clean wound with sterile dressing moistened with 1% povidone iodine solution to prevent outside contamination and bandage.

4. Re-cleanse wound and change dressing regularly (daily) or when soiled or soaked.

5. See Antibiotic Protocol for antibiotic indications and treatment.

Impaled Objects

1. The objective is to cause the least injury from further movement and to prevent infection or tissue damage.

2. Remove impaled objects that are unwieldy and cannot be stabilized when significant movement will occur during transport. The object to be removed should not be on or adjacent to a major artery. An example of an object that would be acceptable to remove is a long metal stake not close to major artery in extremity impeding adequate packaging).

Hemorrhage

Blood flow should be controlled in hemorrhaging wounds using direct pressure
and elevation. If these measures are unsuccessful a hemostatic dressing should be applied. Proximal pressure points should be utilized until bleeding stops. Any additional dressings should be applied on top of the hemostatic dressing.

Note

Analgesia should be used for all procedures.

Appendix Seventeen Burke County EMS Special Operations: Wilderness specific protocols of interest

DISLOCATIONS

- Attempt to reposition or reduce a dislocation should be made if distal circulation is impaired and/or if transport time is >2 hours. If patient meets these criteria to have dislocation reduced, attempt reduction as soon as possible.

- Check and document neurovascular status before and after any manipulation.

- Utilize appropriate analgesics using pain management protocol.

- "Simple dislocations" are those which refer to dislocations caused by indirect injury (lever or torque force applied at a distance from the joint.) Dislocations caused by direct injury (force at the joint) may be associated with fracture and should not be reduced unless necessary. Contact Medical Control, if possible, before any joint reduction and to discuss reduction of direct injury dislocations.

- **Digit Dislocation**
  Mechanism

  - Simple dislocations occur when force is applied to the shaft of the digit and the joint is "levered" apart. Dislocated digits can be angulated in a mediolateral plane, or they can override axially with a typical "bayonet" deformity.

  - Concurrent injury to adjacent nerves and vessels is possible. Compression of adjacent vessels often causes impaired distal circulation.

  - Fractures often occur with dislocated digits but do not change the initial field treatment.
    Assessment

  - Mechanism of injury is consistent with simple dislocation.

  - Patient is unable to move the injured joint

  - Early examination (before swelling) reveals the digit locked and angulated at a joint with a typical "bayonet" deformity.
    Treatment

1. Assess and document distal circulation and associated nerve impairment before and after any manipulation.

1. If patient meets criteria for reduction above, attempt reduction: apply firm traction to the distal segment and move it back into normal anatomical position. If the attempt to reduce the dislocation is met by resistance or a significant increase in pain, stop the procedure.

Appendix Seventeen Burke County EMS Special Operations: Wilderness specific protocols of interest

2. Immobilize by splinting or taping the injured digit to adjacent uninjured digit.

Shoulder Dislocation

Mechanism

- Shoulder dislocations usually occur with the arm abducted 90o from the body and are most commonly anterior dislocations. Recurrent anterior dislocations are common as the joint capsule is weaker

- Injury to the axillary nerve and/or brachial plexus is common. Any neurological deficits should be carefully documented.

- Posterior dislocations are generally treated in the same fashion as anterior dislocations.
  Assessment

- Mechanism of injury is consistent with simple dislocation.

- Patients often can describe a sensation that their shoulder is “out of socket”. They are unable to reach across their body and touch their other shoulder. The injured shoulder usually presents with a typical “hollow spot” deformity which is absent on the uninjured shoulder.

- Remember to assess and document distal neurovascular status before and after each treatment.
  Treatment

1) If patient meets criteria for reduction above, make an attempt to reduce the dislocation using either a) traction and rotation or b) simple hanging traction

a) Traction and rotation

1. Apply gentle and steady traction along the long axis of the humerus. If done correctly, this should significantly reduce pain. Guide patient into a comfortable supine position.

2. First guide the arm into a position of about 90o abduction and then into a position of full external rotation (position for throwing a baseball). Maintain light, gentle, and steady traction during this movement. This positioning of the arm should cause no significant increase in pain and will generally reduce pain if done correctly. Movement must be slow and gradual as positioning often takes up to 15 minutes. Movement that is too fast or unsteady results in muscle spasms and pain. The pain of muscle spasm is relieved by discontinuing movement and holding the joint in position using light, gentle and steady traction.

1. When the position of 90o abduction and full external rotation has been attained, hold the arm in that position and maintain light, gentle, and steady traction to relieve muscle spasm.

Appendix Seventeen Burke County EMS Special Operations: Wilderness specific protocols of interest

2. When the joint is in the correct position and the muscle spasm is effectively relieved, the dislocation will generally reduce spontaneously within 15 minutes. Joint reduction will usually be flet by both the patient and the rescuer.

3. If reduction does not occur, guide the arm into more gentle abduction (up to 120o, “high baseball position”). Continue light, gentle and steady traction and wait at least 15 minutes for spontaneous reduction.

4. After reduction (or to check for reduction), adduct the arm by bringing the elbow to the patient’s side and then internally rotating the arm. Maintain light, gentle and steady traction during movement.

5. Reassess distal neurovascular status, then sling and swathe to immobilize.

6. If pain increases significantly or if resistance to repositioning is encountered, stop the reduction attempt and immobilize. There is never a need to apply pressure to the axilla with a foot.

b) Simple hanging traction

1. Apply light, gentle, and steady traction along the axis of the humerus.

2. While maintaining light, gentle and steady traction, guide the patient to a comfortable prone position with the injured arm hanging down freely over the edge of the supporting surface.

3. The axilla should be at the edge of the supporting surface and should be protected by padding and the patient should be protected from falling.

4. As the weight of the hanging arm relieves muscle spasm and pain, spontaneous reduction often occurs.

5. Reduction usually occurs sooner if weight is added to the hanging arm. 10 to 15 lbs is generally sufficient. Weight should be taped or strapped to the patient’s arm rather than being held by the patient. Spontaneous reduction is clearly felt by the patient and may take up to 60 minutes.

6. After reduction, roll the patient to a supine position keeping the injured arm close to the trunk during movement, reassess neurovascular status and then sling and swathe for immobilization. If pain is significantly increased or there is resistance to repositioning, stop the reduction attempt and immobilize.

Appendix Seventeen Burke County EMS Special Operations: Wilderness specific protocols of interest

Patella Dislocation

Mechanism

- Simple patellar dislocations occur when a knee that is partially flexed has valgus stress applied, and the knee is forcibly extended. Recurrent dislocations are common as the medial patellar tendon stabilizer is weakened. Concurrent injury to adjacent nerves and vessels is rare.

- Simple patellar dislocations must be differentiated from knee dislocations, which are disruptions of the joint between the femur and the radius/ulna. Knee dislocations should not be reduced in the field.
  Assessment

- Mechanism of injury is consistent with simple dislocation. History of recurrent dislocation is common.

- Early exam (before swelling) clearly shows the patella dislocated laterally. *Treatment*

7. Check for distal neurovascular status before and after any manipulation.

8. If patient meets criteria for dislocation above, attempt to reduce dislocation. Loosen the patellar tendon by flexing the hip and straightening the knee. Then in the same motion firmly push the patella medically back into its normal anatomical position. Immobilize in full extension.

9. If reduction is unsuccessful, if pain increases significantly by manipulation, or if resistance to repositioning is encountered, stop the relocation procedure and immobilize.

ANTIBIOTIC THERAPY

Infections in the metabolically-compromised patient can be rapidly progressive. In the extended patient care scenario, the timely administration of antibiotics to certain patients can improve morbidity and mortality. Although the opportunity to define a causative organism may be lost, the clinical decision must be made on the immediate needs of the patient after considering risk versus benefit. Every effort should be made to consult with Medical Control prior to administering antibiotics.

Indications

- Patients with extended evacuation times

- Existing severe or potentially severe bacterial infections of body systems (respiratory infection, kidney infection, CNS infection, etc)

- High risk wounds such as complex soft tissue injuries, penetration injuries, open fractures, bites, and grossly contaminated wounds

Appendix Seventeen Burke County EMS Special Operations: Wilderness specific protocols of interest

- **Treatment**
  Levofloxacin (Levaquin)
  750 mg IV q24hr
  500 mg IV q24hr for patients with known renal insufficiency or failure
  Note
  As with any medication administration, monitor the patient closely and document time of administration, effect and any adverse/allergic reactions.

Appendix Eighteen **Teton County SAR Wilderness Protocols**

Teton County Search and Rescue (TCSAR) Jackson, WY

Medical Protocols

Updated: December 4, 2008

Appendix Eighteen **Teton County SAR Wilderness Protocols**

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Teton County Search and Rescue (TCSAR) - Jackson, WY Medical Protocol Summary and Authorization

Teton County Search and Rescue (TCSAR) – Jackson, WY in coordination with Jackson Hole Fire/ EMS is responsible for providing backcountry/wilderness EMS care to patients in remote isolated circumstances during search and rescue operations in Teton County, WY, and/or as requested by mutual aid agreements in other jurisdictions. When deployed outside Teton County, WY these protocols may be followed in good faith as part of the mutual aid request and to provide the best patient care.

CPR, First Aid, and Basic Life Support care should be followed as taught in various programs (i.e AHA, Red Cross, WMI (NOLS), WMA, NHTSA, State of WY EMT-B Certifications, etc). Advanced Life Support protocols for patient care are adopted from Jackson Hole Fire/EMS. Specific protocols for controlled substances have been developed specifically for TCSAR due to DEA security and accountability measures. It is the responsibility of the ALS Provider (EMT/RN/NP/PA/MD) to ensure proper security measures are provided at all times. The TCSAR Medical Director authorizes providers in good standing with TCSAR to perform patient care on TCSAR missions to their level of training. Patient care above the first aid level requires providers to hold current certifications.

All patient encounters will be documented on EMS Charts (www.emscharts.com) within 24 hours of providing care. It is the responsibility of the primary provider to ensure this occurs. One copy of the printed patient care record goes to the patient's record if transported to a hospital. A second copy is forwarded to the TCSAR Medical Director, and a third copy is given to the TCSAR Administrator. This documentation is very important for medicolegal reasons as well as QA for improving patient care.

See Jackson Hole Fire/EMS Protocols for full scope of ALS Providers (not included in this document)

These protocols can be accessed online: www.tetonwyo.org/fire

Included protocols:

- Wilderness Medicine Field Protocols by Wilderness Medical Associates (WMA)
  - Anaphylaxis
  - Wound Management o CPR
  - Spine Injuries
  - Joint Dislocations
  - Severe Asthma

- TCSAR Medication Protocols:

  - Fentanyl
  - Morphine
  - Diazepam (Valium)

Appendix Eighteen Teton County SAR Wilderness Protocols

WILDERNESS MEDICINE FIELD PROTOCOLS

by Wilderness Medical Associates

Conventional First Aid and EMT curricula are designed for an urban environment, and assume the availability of 911 communications and rapid ambulance transport to a hospital. Outdoor professionals have found the conventional medical protocols do not address the specialized wilderness context of delayed rescue transport in remote areas, prolonged exposure to severe environments, and the limited availability of medical equipment.

These protocols have been developed for use by appropriately trained individuals that regularly work in remote environments. They are based on the principles taught by Wilderness Medical Associates in Wilderness Advanced Life Support, Wilderness EMT, Wilderness First Responder, Wilderness Advanced First Aid, and Wilderness First Aid Courses.

AUTHORIZATION

Because the specialized nature of these protocols, it is generally recommended that the integration of these procedures into the emergency response field practices of outdoor and adventure education programs be specifically authorized by the management of the program, preferably with the guidance of an appropriate consulting medical professional. (See the Wilderness Medical Associates document entitled 'Consulting Physicians for Backcountry Outfitters and Experiential Education Organizations' for more information.)

The following conditions are recommended by Wilderness Medical Associates, and should be considered in establishing authorization of the use of these protocols into a program's emergency response plans:

1. The employee is on the job for the above named employer.

2. The transportation time to a hospital exceeds two hours except in the case of an anaphylactic reaction in which no minimum transport time is required.

3. The employee holds an unexpired Wilderness Advanced Life Support (WALS®), Wilderness and Rescue Medicine (WRM), Wilderness EMT (WEMT), Wilderness First Responder (WFR), Wilderness Advanced First Aid (WAFA), or Wilderness First Aid (WFA) certification from Wilderness Medical Associates, and the employee follows the specific procedures and techniques followed in that course. WAFA certified employees may only use protocols 1, 2, 3 and 4. WFA certified employees may only use protocols 1 and 2. (Careful review of the medical training background of employees is recommended to ensure complete understanding of these protocols by all employees.)

IMPORTANT NOTE

This document is not designed to be used as a reference for wilderness medical providers. Providers should refer to their original course textbooks for complete information on the use of these protocols. The above specified protocol has been authorized for use by those employees who are trained and certified in this skill as specified above.

Teton County Search and Rescue November 20, 2008 Date

Doug Meyer, TCSAR Administrator Will Smith, MD, EMT-P

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 1: ANAPHYLAXIS

Anaphylaxis is an allergic reaction that has life−endangering effects on the circulatory and respiratory systems. Anaphylaxis can result from an exposure to a foreign protein injected into the body by stinging and biting insects, snakes, and sea creatures as well as from the ingestion of food, chemicals, and medications. Early recognition and prompt treatment, particularly in a wilderness setting, is essential to preserve life. The onset of symptoms usually follows quickly after an exposure, often within minutes. The signs and symptoms reflect the resulting consequences of generalized vascular dilation, fluid leakage and lower airway constriction. Biphasic or recurrent reactions can occur within 24 hours of the original episode.

In addition to shortness of breath, weakness and dizziness, patients also frequently complain of generalized itching (particularly in the armpits and groin area). Physical findings include rapid heart rate, low blood pressure, and other evidence of shock, upper airway obstruction (stridor) and lower airway obstructions (wheezes) with labored breathing, generalized skin redness, urticaria (hives), and swelling of the mouth and face. Epinephrine should only be administered to patients having symptoms suggestive of acute anaphylaxis, an allergic reaction with systemic components.

1. Maintaining an open airway, put patient in a position of comfort. Initiate either positive pressure ventilations (PPV) or cardiopulmonary resuscitation (CPR) as indicated by clinical signs.

2. Inject 0.01 mg/kilogram (up to 0.3 mg) of 1:1000 solution of epinephrine* intramuscularly into the lateral aspect of the thigh or deltoid.

3. Repeat injections as soon as every 5 minutes if needed. More than 3 injections are rarely necessary .

4. Administer 25 – 50 mg of diphenhydramine by mouth every 4−6 hours if the patient is awake and can swallow.

5. Consider prednisone 40 – 60 mg / day (or equivalent dose of an oral corticosteroid).

6. Because a biphasic reaction can occur within the subsequent 24 hours, all patients experiencing an anaphylactic reaction should be evacuated to definitive care. Biphasic reactions should be treated in the same manner as the initial reaction, using epinephrine in the same dosage.

7. Arrange for transport to hospital

8. Consider an advanced life support intercept (ALS) if possible

Appendix Eighteen Teton County SAR Wilderness Protocols

9. The patient should remain out of the field for at least 24 hours and may not return without the examining healthcare professional's approval.

* -There is 1mg of epinephrine in 1 mL of epinephrine 1/1000; there are 0.3 mg in 0.3 mL of 1/1000. Preloaded commercially available autoinjectors deliver either 0.3 mg (standard adult dose) or 0.15 mg (standard pediatric dose).

- If the person weighs less than 66 lbs (30 kg), the doses are: epinephrine is 0.01 mg/kg; diphenhydramine is 1mg/kg; and prednisone is 1 - 2mg/kg.
- When using lbs, multiply the weight times 0.45 to get the weight/mass in kilograms.

Note to prescribing practitioner: Epinephrine is available in preloaded autoinjectors (e.g., Epi–Pens®, Twinject®) as well as ampules and vials. The organization may need a prescription from you to obtain prednisone, injectable epinephrine and syringes. Over– the–counter diphenhydramine should always be carried in addition to injectable epinephrine.

The above specified protocol has been authorized for use by Wilderness Medical Associates WALS®, WRM, WEMT, WFR, WAFA, and WFA trained employees of the employer named on page one provided that they meet the requirements of the authorization criteria listed on page one.

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 2: WOUND MANAGEMENT

In the management of all wounds, bleeding must be controlled by using whatever means are necessary. Wellaimed direct pressure is the preferred means and is almost always successful. Control of severe bleeding is a higher priority than wound cleaning. Once bleeding has been controlled:

OPEN WOUNDS

1. Cleaning a wound will involve a combination of the following procedures in an order that seems appropriate:

    a. Remove foreign particulate material as completely as possible.

    b. Wash the surrounding skin with soap and water.

    c. Irrigate the wound with at least 100 ml (ideally 1000 ml) of the cleanest water available. A final wash should be made with water of drinking quality.

2. High−risk wounds (e.g., some particulate material remaining, deep punctures, devitalized tissue within and/or surrounding the wounds, bites, open fractures, injuries involving damage to underlying structures) should be irrigated with large amounts of water under pressure. Ideally, pressure devices could include a 30 or 60cc with an 18 gauge catheter. If the wound cannot be completely cleansed because of residual foreign material or because of insufficient water, rinse the wound out with 1% povidone−iodine solution.

3. Cover the wound with a sterile bandage and splint or otherwise immobilize high−risk wounds if possible. Do not close with sutures or adhesive closures (butterflies).

4. Change the bandage and clean the wound regularly.

5. If an infection develops (e.g., red, tender, swollen, drainage of pus), apply warm compresses, allow drainage and irrigate open wounds. Infected wounds should be splinted or otherwise immobilized if possible.

6. Assess need for tetanus and rabies prophylaxis. High−risk wounds require tetanus prophylaxis every five years, all others every ten.

7. If the wound was the result of an animal bite, assess the risk of rabies exposure. The probability of rabies exposure from animal bites varies by geographic location. Check with state or local health agency for recommendations.

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 2: WOUND MANAGEMENT (continued)

SHALLOW WOUNDS (ABRASIONS AND MINOR BURNS)

1. Cleanse the wound with drinking quality water or a 1% povidone–iodine solution.

2. Apply an antibacterial ointment or cream and cover with a sterile, non–adherent bandage. Immobilize wound area if possible.

3. Inspect the wound and change the bandage regularly.

IMPALED OBJECTS

Remove all impaled objects unless doing so would cause further harm. Exceptions include impaled objects in the globe of the eye or when removal would result in severe pain or bleeding. Remove objects that interfere with safe transport or will cause more damage if left in place. After removal, treat as an open wound (see above).

NB: Some wounds may require additional treatment not possible in the field. These could include infections, unremoved impaled objects, high–risk wounds that cannot be adequately cleaned and injuries requiring cosmetic repair. Under such circumstances, arrange for transport to hospital.

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 3: CARDIOPULMONARY RESUSCITATION (CPR)

This protocol applies only to normothermic patients (core temperature > 90° F, 32° C) in cardiopulmonary arrest. CPR is initiated in unresponsive patients in cardiopulmonary arrest evidenced by pulselessness. To be effective, CPR must be started promptly. Even then, its benefits are limited.

1. Assess and treat according to standard ILCOR CPR guidelines.

2. If cardiopulmonary arrest persists continuously for over 30 minutes of sustained CPR, all treatment may be stopped.

3. If the patient recovers, support critical system function and arrange for transport to hospital. Consider ALS intercept if possible.

There are some circumstances where CPR should not be started. These include:

1. Any pulseless person who has been submersed in water for more than one hour and not connected to a source of air (e.g., SCUBA).

2. Any pulseless person with an obvious lethal injury (e.g., decapitation, exsanguination). This would include trauma from a penetrating object (e.g., ice ax to the chest or brain).

The above specified protocol has been authorized for use by Wilderness Medical Associates WALS®, WRM, WEMT, WFR, and WAFA trained employees of the employer named on page one provided that they meet the requirements of the authorization criteria listed on page one.

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 4: SPINE INJURIES

Spinal assessment criteria allow rescuers to determine the need and justification for spine stabilization in the presence of an uncertain or positive mechanism of injury. This evaluation focuses on patient reliability, spinal column stability and neurologic function. Adequate time must be allowed for the evaluation. A clear assessment means that there is no significant spine injury and no need for spine stabilization.

1. Assess the mechanism. If a positive or uncertain mechanism exists, protect the spine by whatever method is feasible and available. This could include (but is not limited to) manual stabilization in the in−line position.

2. Do a thorough evaluation including a history and physical examination. To rule out a significant spine injury the patient must meet all of the following criteria:

    a. Patient must be reliable. The patient must be cooperative, sober, and alert, and must be free of other distracting injuries significant enough to mask the pain and tenderness of the spine injury.

    b. Patient must be free of spine pain and tenderness.

    c. Patient must have normal motor/sensory function in all four extremities:

        - Finger abduction/adduction or wrist extension (check both hands)
        - Foot plantar flexion/extension or great toe dorsiflexion (check both feet)
        - No complaint of numbness and sensation intact to sharp and dull stimuli in all four extremities
        - If reduced function in one particular extremity can be attributed with certainty to a specific extremity injury (e.g., unstable wrist injury), that deficit alone will not preclude ruling out a spine injury.

3. If a significant spine injury cannot be ruled out, the patient should be stabilized in a safe and comfortable position on a board, litter or other appropriate carrying device. Arrange for transport to hospital.

NB: There are situations in wilderness and technical rescue where the risk of spine stabilization exceeds the presumed benefit. In these circumstances spinal stabilization may be deferred or modified until risk can be mitigated. In unstable scenes or with unstable patients the remote possibility of exacerbating a spine injury may not justify the additional risk associated with stabilization.

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 5: JOINT DISLOCATIONS

This protocol specifically applies to reducing dislocations of the shoulder, patella, and digits resulting from an indirect force; all other potential dislocations should be treated as one would treat any other potentially unstable joint injury (i.e. splint in a position that maintains stability and neurovascular function while facilitating transport). A history confirming an indirect injury to the affected joint and an examination with findings consistent with a dislocation must be obtained prior to attempting a reduction.

SHOULDER

1. Check and document distal neurovascular function including sensation over the deltoid region of the affected side.

2. With the patient supine and while still sitting adjacent to the dislocated shoulder, apply gentle traction to the arm to overcome muscle spasm. Gradually abduct and externally rotate the arm until it is at a 90 degree angle to the patient's body. This is most easily achieved by keeping the elbow in the 90 degrees of flexion throughout the maneuver. Hold the arm in this position ("baseball throwing position") and maintain traction until the dislocation has been reduced. Discontinue the procedure if pain significantly increases and/or if physical resistance is encountered.

3. Alternative methods of reduction include simple hanging traction and scapular manipulation. In addition, these two can be combined with the patient either lying facedown or sitting upright.

    a. Hanging traction: Have the patient lie facedown with the affected arm hanging unsupported. Secure approximately 3 – 5 kilograms to the patient's hand and allow the weight and gravity to fatigue the muscles until the shoulder is reduced.

    b. Scapular manipulation (This procedure may require 2 rescuers) – Have the patient either lie

4. facedown (as above) or sit upright. Apply traction to the affected arm and bring it forward to

5. shoulder level. While maintaining traction, stabilize the upper portion of the scapula with one hand and rotate the lower tip medially with the other hand.

6. Once either the dislocation is reduced or the rescuer decides to discontinue reduction attempts, adduct the humerus so that the elbow is alongside the body. Use a sling without a swathe for comfort, allowing for some degree of external rotation if possible.

7. Reassess and document distal neurovascular status and arrange for transport.

PATELLA

1. Check and document distal neurovascular function.

2. Gently straighten the patient's knee and flex the hip. If the patella has not spontaneously
reduced once the knee is fully extended, gently guide the displaced patella medially back into its normal anatomic position. Discontinue the procedure if pain significantly increases and/or if physical resistance is encountered.

3. Splint the knee in a neutral position (10–15 degrees of flexion). Stabilize the patella by taping or bracing it in place.

4. Reassess and document distal neurovascular status.

5. Arrange for transport to hospital. Patients may walk out if pain is tolerable.

DIGITS (FINGERS AND TOES, INCLUDING THUMB)

1. Check and document distal neurovascular function.

2. Apply axial traction distal and counter-traction proximal to the dislocated joint until the dislocation has been reduced. Discontinue the procedure if pain significantly increases and/or if physical resistance is encountered.

3. Splint in the anatomical position.

4. Reassess and document distal neurovascular status.

5. Arrange for transport to hospital.

Appendix Eighteen Teton County SAR Wilderness Protocols

PROTOCOL 6: SEVERE ASTHMA

Asthma is a chronic inflammatory disease of the airways that results in frequent hospital admissions. Fatalities occur each year. Every patient with asthma is at risk for a severe, acute exacerbation that requires aggressive management. Early recognition and prompt treatment, particularly in the wilderness setting may be essential to preserve life.

BLS ASSESSMENT AND TREATMENT FOR SEVERE ASTHMA

Patients with asthma who have progressed to respiratory failure present with deterioration in mental state (e.g., anxious, confused, combative, drowsy) in combination with any of the following:

- Shortness of breath(>30/min) that may be accompanied with wheezing
- Tachycardia (>100)
- Inability to speak in sentences
- Sweaty
- Unable to lie down

If a patient is not responding to or is unable to properly use his/her MDI (metered dose inhaler), proceed to the following:

1. Have the patient assume a position of comfort
2. Start supplemental oxygen if available: 4–6L/min by nasal cannula or 10–15 L/min with a NRM (nonrebreather mask).
3. Inject 0.01 mg/kilogram (up to 0.3 mg) of 1:1000 solution of epinephrine* intramuscularly into the lateral aspect of the thigh or deltoid.
4. Repeat injections as soon as every 5 minutes if needed. More than 3 injections are rarely necessary .
5. Administer prednisone at 40 – 60 mg (or equivalent dose of an oral corticosteroid).
6. Initiate PPV if breathing becomes ineffective (e.g., gasping or shallow respirations). Maintain a rate of 10–12 breaths per minute.
7. Once able to do so, have the patient self–administer 6–10 puffs from the MDI. This may be repeated every 20 minutes for a total of three doses.
8. Arrange for transport to hospital.

Appendix Eighteen Teton County SAR Wilderness Protocols

9. Consider an advanced life support intercept (ALS), if possible.

PROTOCOL 6: SEVERE ASTHMA (continued)

* There is 1mg of epinephrine in 1 mL of epinephrine 1/1000; there are 0.3 mg in 0.3 mL of 1/1000. Preloaded commercially available autoinjectors deliver either 0.3 mg (standard adult dose) or 0.15 mg (standard pediatric dose).

If the person weighs less than 66 lbs (30 kg), the doses are: epinephrine is 0.01 mg/kg; prednisone is 1 – 2mg/kg. When using lbs, multiply the weight times 0.45 to get the weight/mass in kilograms.

ALS ASSESSMENT AND TREATMENT FOR SEVERE ASTHMA

If patients progress to respiratory failure and develop any combination of the following:

- Gasping or shallow respirations
- V or less on the AVPU scale
- O2 saturations of <90% on supplemental oxygen

1. Initiate advanced airway management. Maintain a rate of 10–15 bpm.

    a. Poor lung compliance may be present (as evidenced by difficulty getting air in). Providing increased inspiratory flow/pressure may be necessary to ventilate the patient. Allow adequate time for exhalation.

    b. The increased ventilatory pressures can lead to barotrauma e.g., simple or tension pneumothorax. Monitor carefully. If the following signs and symptoms occur; new absence of lung sounds, and clinical deterioration e.g.., decreased perfusion, decreased O2 saturation, decreased mental status, initiate a chest decompression.

2. Continue beta–agonist inhaler agents through the ET tube if possible.

3. Administer 125mg methylprednisone IV (1 – 2 mg/kg for pediatrics) every 6 hours.

4. Continue with the administration of epinephrine as noted above.

Contributing factors such as cold temperatures, stress, and exercise should be controlled as much as possible. The above specified protocol has been authorized for use by Wilderness Medical Associates WALS®, WRM, WEMT, and WFR trained employees of the employer named on page one provided that they meet the requirements of the authorization criteria listed on page one.

Appendix Eighteen Teton County SAR Wilderness Protocols

Teton County Search and Rescue (TCSAR) - Jackson, WY

FENTANYL Protocol

IT IS UNDERSTOOD THAT THIS MEDICATION MAY BE ADMINISTERED BY A NURSE OR EMT-PARAMEDIC, ONLY AFTER VOICE AUTHORIZATION HAS BEEN GRANTED BY EITHER A WYOMING LICENSED PHYSICIAN OR A PHYSICIAN SUPPORT PERSON IE: NURSE PRACTITIONER (NP) OR A PHYSICIANS ASSISTANT (PA-C) ACTING AS THE AGENT OF A WYOMING LICENSED PHYSICIAN, OR BY A WYOMING LICENSED REGISTERED NURSE (RN), RELAYING THE AUTHORIZATION FROM A WYOMING LICENSED PHYSICIAN WITH WHOM THE NURSE HAS DIRECT COMMUNICATION.

IT IS ACKNOWLEDGED THAT IN MANY REMOTE SETTINGS WHERE TCSAR PATIENT CARE OCCURS COMMUNICATION FAILURE WITH MEDICAL CONTROL MAY OCCUR. IN THESE SETTINGS BEST JUDGEMENT OF THE PROVIDER SHOULD BE USED IN AHEREING TO THESE PROTOCOLS FOR PATIENT CARE. CONTACT WITH MEDICAL CONTROL SHOULD OCCUR AS SOON AS AVAILABLE, AND ALL CARE DOCUMENTED ON THE PATIENT CARE RECORD, INCLUDING COMMUNICATION FAILURE AND PROTOCOL(S) FOLLOWED. THESE CASES WILL ALL BE IMMEDIATELY FORWARDED TO TCSAR MEDICAL DIRECTOR FOR FURTHER REVIEW AND QA.

WYOMING LICENSED PHYSICIANS AND ADVANCED CARE PRACTICIONERS ARE AUTHORIZED TO ADMINISTER THIS MEDICATION WITHOUT MEDICAL CONTROL CONSULTATION, AND MAY PROVIDE DIRECT MEDICAL CONTROL TO ON SCENE PROVIDERS.

Class: Synthetic narcotic/opioid agonist

Pharmacology/Actions: Potent analgesic with short duration of action. Onset less than 5-10 min IV, Duration 30 min to 1 hour. Minimal histamine release, so less hemodynamic compromise as compared to Morphine.

Indications: Pain control.

Contraindications: Respiratory depression or insufficiency, hemodynamic instability/hypotension. Allergy to Fentanyl.

Precautions: Effects may be increased when given with other CNS depressants or skeletal muscle relaxants. Pregnancy Safety is Category C – give only if potential benefit justifies risk to fetus.

Special considerations: Monitor respiratory actions / efforts. Consider nasal route for pain control in time sensitive pt packaging situations. Consider use for reversal if significant respiratory depression occurs.

Dosage / Administration:

Adult	Pediatric
50-100 mcg slow IV/IO/IM/Intranasal every	1-4 mcg/kg slow
5-15 minutes as needed to control pain	IV/IO/IM/Intranasal every 5-15 minutes as needed to control pain

Note for Intranasal administration: Split total dose and give 1⁄2 dose per nare.

Appendix Eighteen Teton County SAR Wilderness Protocols

FENTANYL Protocol (continued)

Side effects:

Respiratory depression and apnea
Bradycardia
Hypotension
Nausea and/or vomiting
Decreased LOC / Drowsiness
Rigid Chest Syndrome – very rare and generally reported in pediatric patients with large doses

Storage:

- ·Fentanyl will be stored on the TCSAR Incident Command truck in the in the narcotics lock box and the truck will be secured in the locked TCSAR garage. In the event that the truck is parked outside of the secured garage the truck will be kept locked if not attended. Access to the lock box will be restricted to ALS providers and TCSAR administration.

- ·Additional seasonal helicopter resources may require a second storage location with the same security and documentation.

- ·The drug box(es) will be accessible only to persons authorized to provide this advanced level of treatment in the TCSAR organization and TCSAR administration.

Use and Documentation:

- ·Fentanyl will be maintained by TCSAR medical director or ALS designee following TCSAR / JH Fire/EMS SOPs and protocols.

- ·See current addendum with authorized ALS providers under TCSAR policies that are authorized to administer Fentanyl.

- ·Drugs that are carried in rescue packs will be signed out to persons authorized to use them, and then returned if unused at the end of the mission and kept accountable by the authorized ALS person.

- ·When a controlled drug is used on a SAR incident, this use will be documented on the patient care record and the TCSAR administration record for controlled drugs. The record shall include the date of administration, patient name, administered dose, ALS personnel signature.

- ·When a dosage smaller than the smallest available dose is used, the remaining portion (aliquot part) must be destroyed in the presence of an emergency department nurse or another TCSAR/JH Fire/EMS ALS provider and accounted for on the patient care record.

- ·Discrepancy and/or lost controlled substances shall be reported to the TCSAR Medical Director immediately and accounted for on a TCSAR incident report and will be investigated.

Maintenance:

- ·Replacement drugs will be obtained by the medical director for restocking and/or outdating.

- ·Routine inventories and spot checks will be done on the drug boxes to maintain accountability.

Appendix Eighteen Teton County SAR Wilderness Protocols

Teton County Search and Rescue (TCSAR) - Jackson, WY Morphine Protocol

Class: Narcotic/opiod agonist

Pharmacology/Actions: Extremely potent narcotic analgesic. It dilates peripheral vasculature (reducing pre-load and after-load and decreasing myocardial oxygen demand). Morphine Sulfate also tends to reduce the respiratory rate and tidal volume and causes pupils to constrict. It reduces apprehension and anxiety. The vasodilatation should cause no problems if patients are supine and not upright, volume depleted, or have a decreased cardiac output. The onset of action is immediate if given IV with onset in 1-2 min; Peak effects are seen within 20 minutes, duration 2-7 hours.

Indications: Pain control.

Contraindications: Respiratory depression or insufficiency, hemodynamic instability/hypotension. Allergy to Morphine.

Precautions: Effects may be increased when given with other CNS depressants or skeletal muscle relaxants. Pregnancy Safety is Category C – give only if potential benefit justifies risk to fetus.

Special considerations: Monitor cardiovascular and respiratory actions. Consider Narcan use for reversal if significant respiratory depression occurs. IV dosing must be given slowly.

Dosage / Administration:

Adult	**Paediatric**
2-5 mg slow IV/IO, 5-10 mg IM. May be repeated every 5- 15 minutes as needed to control pain.	0.1-0.2 mg/kg slow IV/IO/IM. May be repeated every 5-15 minutes as needed to control pain

Side effects: Respiratory depression and apnea

Bradycardia
Hypotension
Nausea and/or vomiting Decreased LOC / Drowsiness

Constricted pupils

Urinary retention

Storage:

- ·Morphine will be stored on the TCSAR Incident Command truck in the in the narcotics lock box and the truck will be secured in the locked TCSAR garage. In the event that the truck is parked outside of the secured garage the truck will be kept locked if not attended. Access to the lock box will be restricted to ALS providers and TCSAR administration.

- ·Additional seasonal helicopter resources may require a second storage location with the same security and documentation.

- ·The drug box(es) will be accessible only to persons authorized to provide this advanced level of treatment in the TCSAR organization and TCSAR administration.

Use and Documentation:

Appendix Eighteen Teton County SAR Wilderness Protocols

Teton County Search and Rescue (TCSAR) - Jackson, WY Morphine Protocol (continued)

·Morphine will be maintained by TCSAR medical director or ALS designee following TCSAR / JH Fire/EMS SOPs and protocols.

- ·See current addendum with authorized ALS providers under TCSAR policies that are authorized to administer Morphine.

- ·Drugs that are carried in rescue packs will be signed out to persons authorized to use them, and then returned if unused at the end of the mission and kept accountable by the authorized ALS person.

- ·When a controlled drug is used on a SAR incident, this use will be documented on the patient care record and the TCSAR administration record for controlled drugs. The record shall include the date of administration, patient name, administered dose, ALS personnel signature.

- ·When a dosage smaller than the smallest available dose is used, the remaining portion (aliquot part) must be destroyed in the presence of an emergency department nurse or another TCSAR/JH Fire/EMS ALS provider and accounted for on the patient care record.

- ·Discrepancy and/or lost controlled substances shall be reported to the TCSAR Medical Director immediately and accounted for on a TCSAR incident report and will be investigated.

Maintenance:

- ·Replacement drugs will be obtained by the medical director for restocking and/or outdating.

- ·Routine inventories and spot checks will be done on the drug boxes to maintain accountability.

Class: Benzodiazepine

Pharmacology/Actions:

Acts on the limbic, thalamic, and hypothalamic regions of the CNS to potentiate the effects of inhibitory (GABA) neurotransmitters, raising the seizure threshold in the motor cortex. The onset of action is 1-5 min if given IV; Duration: 15 min - 1 hr.

Therapeutic Effects:

Tranquilizer Anticonvulsant
Skeletal muscle relaxant Sedative

Indications:

Major motor seizures / Status epilepticus Muscle spasm
Adjunct for pain control
Severe Anxiety

Contraindications:

Respiratory depression or insufficiency, hemodynamic instability/hypotension. Allergy to Valium.
Pregnancy Class D – Possible Risk to Fetus

Appendix Eighteen Teton County SAR Wilderness Protocols

Diazepam (Valium) Protocol (continued)

Precautions:

Can cause venous irritation
Has short duration of effect

Do not mix with other drugs. Possible precipitation problems
Reduce dose by 50% in elderly patients or with known liver disease.

Special considerations: Monitor respiratory actions / efforts
Side effects may be potentiated when used in conjunction with narcotics

Dosage / Administration:

Adult	Paediatric
2.5-5 mg slow IV/IO over 2 minutes, 5-10 mg IM/PR. May be repeated every 10-15 minutes as needed.	1-0.2 mg/kg (max 5 mg per dose) slow IV/IO over 2 minutes. IM/PR doses also acceptable(max 10 mg IM/PR per dose). May be repeated every 10-15 minutes as needed to control pain

Side effects:

Respiratory depression and apnea

Bradycardia / Hypotension

Nausea and/or vomiting

Decreased LOC / Drowsiness

Storage:

- ·Valium will be stored on the TCSAR Incident Command truck in the in the narcotics lock box and the truck will be secured in the locked TCSAR garage. In the event that the truck is parked outside of the secured garage the truck will be kept locked if not attended. Access to the lock box will be restricted to ALS providers and TCSAR administration.

- ·Additional seasonal helicopter resources may require a second storage location with the same security and documentation.

- ·The drug box(es) will be accessible only to persons authorized to provide this advanced level of treatment in the TCSAR organization and TCSAR administration.

Use and Documentation:

- ·Valium will be maintained by TCSAR medical director or ALS designee following TCSAR / JH Fire/EMS SOPs and protocols.

- ·See current addendum with authorized ALS providers under TCSAR policies that are authorized to administer Valium.

Appendix Eighteen Teton County SAR Wilderness Protocols

Diazepam (Valium) Protocol (continued)

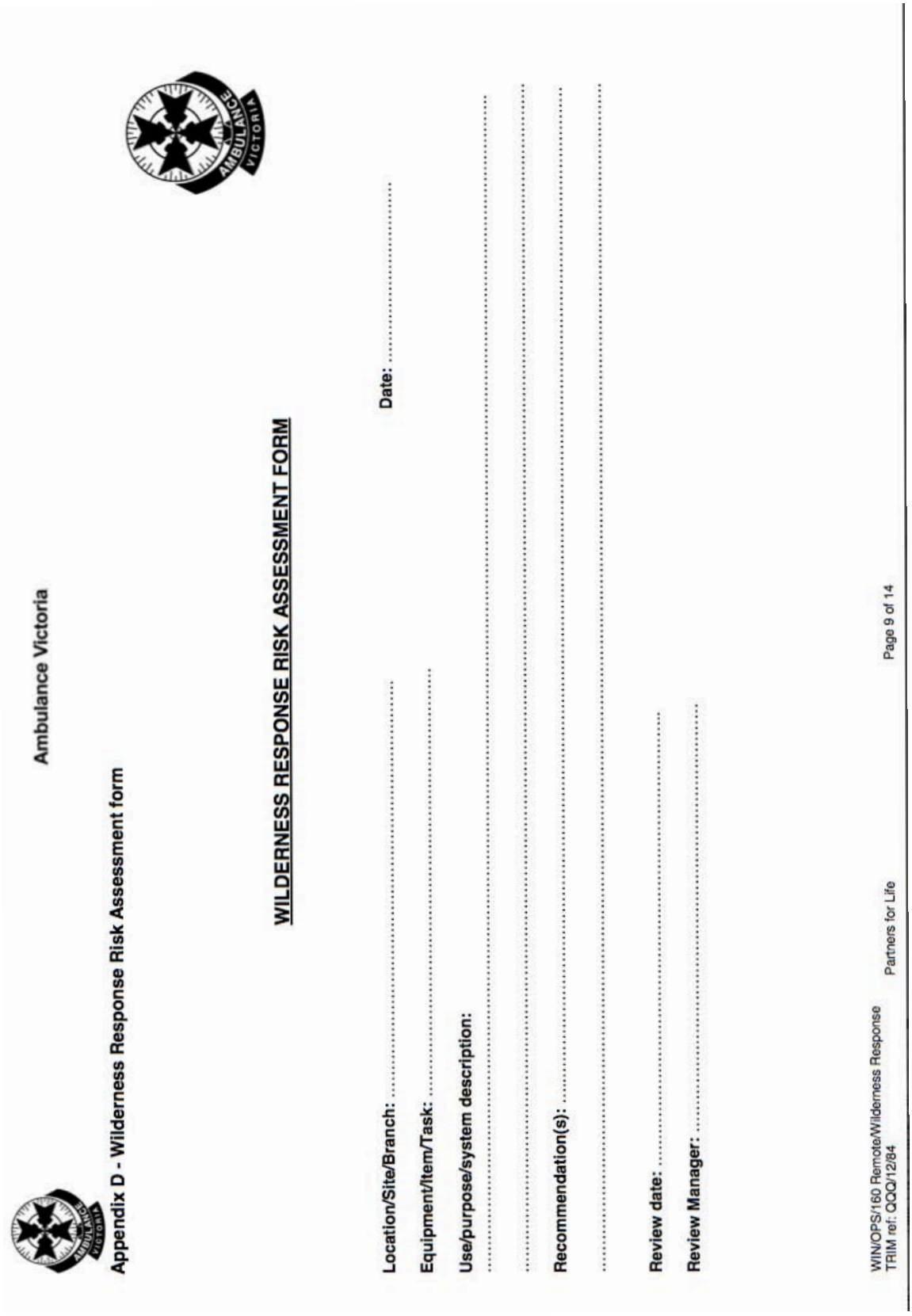
- ·When a controlled drug is used on a SAR incident, this use will be documented on the patient care record and the TCSAR administration record for controlled drugs. The record shall include the date of administration, patient name, administered dose, ALS personnel signature.

- ·When a dosage smaller than the smallest available dose is used, the remaining portion (aliquot part) must be destroyed in the presence of an emergency department nurse or another TCSAR/JH Fire/EMS ALS provider and accounted for on the patient care record.

- · Discrepancy and/or lost controlled substances shall be reported to the TCSAR Medical Director immediately and accounted for on a TCSAR incident report and will be investigated.

Appendix Nineteen

Ambulance Victoria :Wilderness response risk assessment pro forma



Ambulance Victoria

Appendix D - Wilderness Response Risk Assessment form

WILDERNESS RESPONSE RISK ASSESSMENT FORM

Location/Site/Branch: ..... Date: .....

Equipment/Item/Task: .....

Use/purpose/system description:
.....
.....
.....

Recommendation(s): .....
.....

Review date: .....

Review Manager: .....

WIN/OPS/160 Remote/Wilderness Response
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Partners for Life

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Appendix Nineteen Ambulance Victoria :Wilderness response risk assessment pro forma

Ambulance Victoria

TASK ANALYSIS

Steps in task	Digital Photo or Description	Risk / hazard What could cause injury	Risk Rating	Current Risk Control(s)
1. Activate Wilderness Response Pack				
2. Rendezvous with other ESO				
3. Approach to patient				
4. Treat patient				
5. Retrieve patient				

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Printed copies of this document are uncontrolled – refer to nAVigator for controlled version

Kerryn Wratt
MICA Paramedic
Ambulance Victoria

Appendix Nineteen

Ambulance Victoria :Wilderness response risk assessment pro forma

Ambulance Victoria

RISK ASSESSMENT MATRIX

	Consequence	Worker sustained minor or no injury resulting in no lost time,	First aid treatment, worker related lost time injury requiring modification to a work practice or procedure.	Medical treatment required including loss of consciousness resulting in multiple lost time.	Extensive injuries including permanent disability, severe injury with limb loss or dysfunction	Single or multiple deaths of employees
Likelihood		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Is expected to occur in most circumstances (Daily)	Almost certain	M	H	E	E	E
Will probably occur in most circumstances (Weekly)	Likely	L	M	H	E	E
Might occur at some time (Monthly)	Possible	L	M	M	H	E
Could occur at some time (Yearly)	Unlikely	L	L	M	M	H
May occur only in exceptional circumstances	Rare	L	L	L	L	M

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Appendix Nineteen

Ambulance Victoria :Wilderness response risk assessment pro forma

Ambulance Victoria

RISK CONTROL MATRIX

(red)	**Extreme risk**	Stop work. Immediate action required,
(yellow)	**High risk**	Senior management attention needed,
(orange)	**Moderate risk**	Management responsibility must be specified
(green)	**Low risk**	Manage by routine procedures

RISK CONTROL/IMPLEMENTATION PLAN

Risk Control Measure(s) - Consider hierarchy of control: Elimination, Substitution, Engineering, Isolation, Administrative and PPE	Person Responsible	Due Date	Completed
Short term control(s):			
Long term control(s):			

Comments:...

....

....

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