NZSAR
New Zealand Search
and Rescue

NEW ZEALAND AVALANCHE SEARCH AND RESCUE
Readiness Guidelines

A. Hoyle 2014

Acknowledgements

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INTRODUCTION

These guidelines have been developed as a tool to assist response agencies to readiness plan for an avalanche search and rescue response. They have been designed through consultation with the NZ and international avalanche industry. As these are guidelines they are not prescriptive and represent a flexible approach to readiness planning. This will allow regions to design plans that suit specific circumstances. These are not guidelines to performing avalanche rescue and as such, do not contain any technical concepts. SAR managers need to recognise that avalanche rescue is a specialist area and the best approach is to engage local experts in formulating any plans associated with Avalanche Rescue. In order to remain current guidelines, provision should be given for annual reviews incorporating feedback from the avalanche industry.

OBJECTIVE

The objective of these guidelines is: To enhance the quality and consistency of avalanche rescue *readiness, response and recovery* in New Zealand.

UNDERLYING GENERIC PRINCIPLES OF AVALANCHE RESCUE

Underlying Generic Principles of Avalanche Rescue
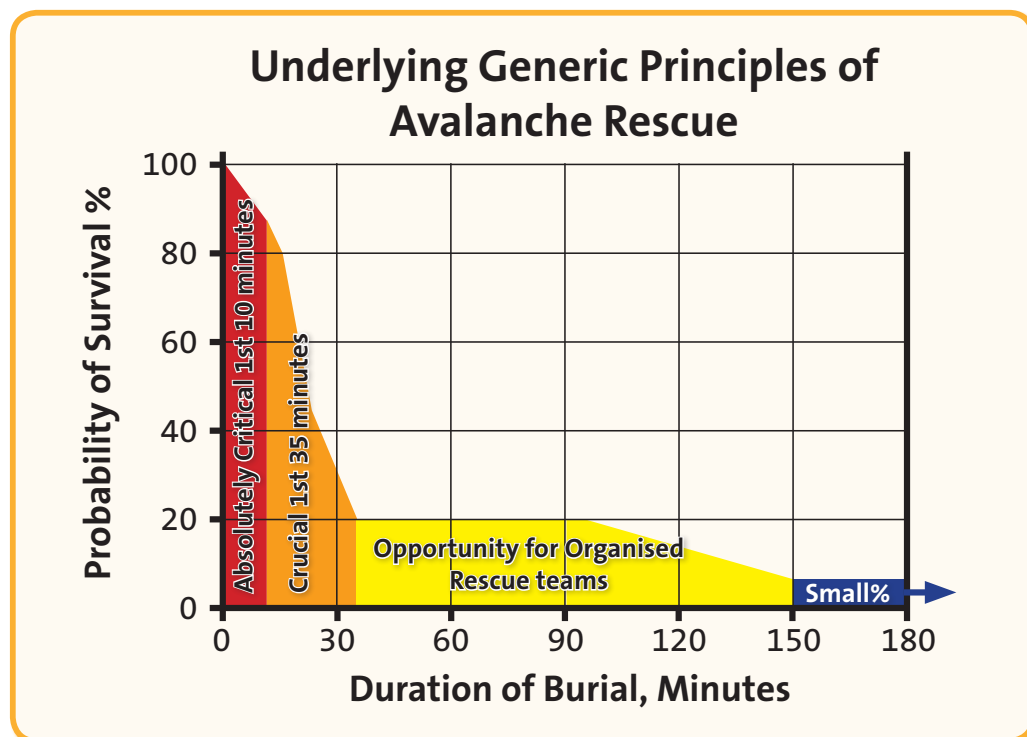
The survival time chart is indicative of the likely survival probabilities

1st phase – The survival phase. This is the absolutely critical 1st 10 minutes when most people are still alive. 10 minutes should be the target time that companion rescuers try to achieve.

2nd phase – Asphyxia phase. This is out to 35 minutes where the majority of people who survive the first 10 minutes die from asphyxia. This is caused by a mixture of hypoxia and hypercapnia. This is a crucial phase for companion rescuers as a fast rescue inside this time frame greatly increases survival rates.

3rd phase – The latent phase. People who survived the first 35 minutes now tend to survive for a longer period. This period goes to at least 90 minutes post burial and possibly out to 150 minutes. Due to the length of this phase and the environment, mild to severe hypothermia can be expected.

This is the time period when organised rescue teams can still make a significant difference by getting on site fast while the probability of survival is still higher than the small percentage that survive longer term.

4th phase – The final phase. People succumb to hypothermia complicated by hypoxia and hypercapnia (the triple H syndrome). A small percentage of people have survived long term so they should be given the best chance of being found alive by continuing rescue efforts until all hope of finding people have been exhausted.

Source: (Bogie & Hobman, 2012)

AVALANCHE RESCUE IS TIME CRITICAL

All avalanche rescue readiness guidelines should work to the following generic principles:

- **Safety**

- Avalanche rescue is exceptionally **time critical** – <u>minutes</u> matter.

- Avalanche Site Command is essential and pre-identified personnel should be transported to site as soon as practicable.

- All efforts must focus on the **first response** team(s) getting to the site. This includes **trained** avalanche rescuers and certified **avalanche dog** team(s).

- All avalanche burials should be considered **medical emergencies** and appropriate resources applied as such. Refer to Appendix H for detailed resuscitation algorithm.

- Effective **communications** are vital to a successful avalanche rescue.

Development of the readiness guidelines

Use the checklist in Appendix A to help your team or area develop a systematic working readiness guidelines for avalanche Search and Rescue. An effective avalanche rescue readiness guidelines should cover the first operational period (usually around 90 minutes).

Due to the time critical nature of avalanche incidents, the second and successive operational periods have less urgency. These periods can be dealt with effectively using a conventional SAR Incident Management Team (IMT) operating under the CIMS structure.

Local avalanche readiness plans should be reviewed and/or updated at least annually to ensure currency. **'Never Plan Alone'**.

Vulnerability assessment

Pre-planning for SAR purposes needs to incorporate the three main phases:

- Readiness

- Response, and

- Recovery

Under readiness the first step is to analyse the types of incidents that have occurred in the past in this region, the incidents that are occurring now and how these incidents are likely to change in the future.

Readiness guidelines structure

The structure of your readiness guidelines needs to be simple and succinct as it is designed to be used in a time critical emergency response. It also needs to be designed in such a manner that it can be utilsed as a working document to be worked through by potentially unskilled users. Consideration to the generic sections listed in Appendix A should be given. Some of these sections may not be relevant to your region and others not listed may need to be added. Keep the structure simple and to the point.

Organisational versus regional?

Successful avalanche rescue depends on a multiple agency response to a single emergency. This therefore relies on each agency or organisation having its own specific avalanche readiness guidelines that dovetails into the overarching incident plan.

Decide what sort of readiness guidelines you are building and who it is for. Work through it from that perspective.

Within regions, annual pre-season desktop exercises should be performed to check that all the plans mesh and all information within the plan is checked for currency (contact details etc.).

Documentation

Avalanche rescue depends on excellent documentation of events and actions starting with the initial callout through to the post incident debriefings. An avalanche rescue plan should facilitate simple, easy and effective documentation of all relevant information.

Communications

Effective communications are essential to any emergency response plan and avalanche rescue is no different. It is vital that a workable communications plan is developed and included in your readiness guidelines. This will involve cell phone numbers, radio channels and commercial operators' internal systems. Thought will need to be given to what challenges might be faced in certain geographic locations and how communications out of and into an avalanche site might be gained as early on as possible in the operation. **It is imperative that quick and accurate information gets to/from 111 call centre regarding avalanche incidents**. Since Ambulance may be the service requested by an informant, communication with ambulance call centres must be consistent with regional avalanche readiness guidelines.

Ideas: Radio, Satellite Phone, Cell Phone, E-mail, Telephone, Meetings, Fax.

Good communications are required before, during and after avalanche search and rescues. Evaluate and plan for as many options as possible in order to be more resilient in the event of failure of one or more type.

Public information

Avalanche rescues are newsworthy events and very soon after launching an operation of this nature it should be expected that media will be seeking information from your IMT. The readiness guidelines should provide for this and in larger events it may become necessary to designate a media liaison role within the IMT. All media enquiries should be directed to the NZ Police who can utilise national media channels to keep the IMT free of this distraction.

Key contacts

As mentioned above, avalanche rescue depends on excellent cooperation between commercial operators, Police, LandSAR and other organisations and all key contact points for your local agencies need to be listed in a table in the readiness guidelines.

Phone numbers and radio frequencies need to be updated pre-winter each year to ensure the plan is current. Contacts can be divided up into groups according to the role they are likely to play in an avalanche rescue i.e. Avalanche Site Commander, Team Leader, Incident Management Team.

Agency resources

Each organisation or agency in your region will have different resources available for avalanche rescue operations. All these resources should be listed in a table for each operator/agency and details should include; resource/quantity/location/contact details.

Risk management

Any avalanche rescue operation will involve risks from various hazards including but not limited to avalanches, exposure and alpine conditions. A strategy for managing the health and safety of all personnel involved must be in place and summarised in your readiness guidelines. One of the most effective and simple ways to achieve this is through defining minimum training and experience levels for leaders and rescuers on site.

Personnel must be accounted for at all times during an operation. This is part of the ASC role and should be duplicated in the IMT. Part of the recovery phase of an avalanche rescue should include consideration of Critical Incident Stress debriefing for those involved in the operation.

Go or No Go – Do the benefits outweigh the risks?

This will likely be one of the more important risk management strategies available to teams. All avalanche rescue readiness guidelines must have provision for the assessment of conditions on site and a "No Go" decision by the Incident Controller/Avalanche Site Commander. Avalanche specialists may be required to gather more information prior to sending personnel into the field. As always, the avalanche hazard needs to be constantly assessed to ensure that changes are made clear to the Incident Controllor/Incident Management Team and appropriate actions taken.

Avalanche risk

Avalanche risk can be managed by managing the components that make it up; vulnerability, exposure and hazard. In readiness planning for avalanche rescue it is vital that efforts are made to reduce all three of these components of risk at all times possible.

Avalanche Hazard can be reduced through active (explosives etc.) or passive (waiting) avalanche control. Exposure can be reduced by ensuring the safest route to and from the site is identified and used by personnel, managing how many people and resources are placed on the site and for how long and using helicopter search techniques as examples. Vulnerability can be reduced by equipping field personnel with appropriate equipment, training and leadership.

Safety officer

The concept of a safety officer is not a compulsory role in every avalanche rescue. In a small party rescue, safety is everyone's concern and responsibility. As the structure of a rescue grows, it will become important for an experienced avalanche specialist to be nominated "Safety Officer" by the Incident Controller. This role involves overseeing all aspects of the rescue to ensure any unsafe acts or conditions are rectified as soon as possible. The Safety Officer usually reports back to the ASC or IC directly.

Avalanche search and rescue training

Regular training is critical to successful avalanche rescue as with all other forms of rescue. In relation to the readiness planning phase, regular (at minimum, annually) review sessions should be held in regions with avalanche potential. Desktop scenarios are a good method of achieving this and ensure that your incident management team are current with the plan, the plan is accurate (phone numbers etc) and that the plan is workable.

Physical avalanche SAREX's should also be planned (and may coincide with desktop exercises) annually. Use the NZSAR SAREX guidelines to plan and undertake this event. Individual operators (Ski Areas, Guides etc) will perform in house training each winter as part of their safety plans.

CIMS roles for avalanche SAR

All avalanche rescues and rescue readiness plans should be managed using CIMS. Apart from the normal roles usually encountered in a SAROP there are some specialist roles required that are unique to Avalanche SAR. These are explained below and need to be included in your readiness plan so that all avalanche readiness plans are using the same terminology.

Avalanche Site Commander (ASC)

The ASC is responsible for overall site operations including safety, search techniques and application of resources on hand to the site and should be at least Avalanche Stage 2 qualified (or overseas equivalent) or in direct contact with someone who is. The first trained rescuer on site is, by default, considered the ASC until he or she can be replaced by a more suitably qualified person. Alternatively, the initial ASC may remain in that role and delegate other tasks such as searching to other rescuers as they arrive at site. The ASC reports directly to the Operations Manager.

Generic avalanche rescue reflex tasks

The following list represents some key tasks that need to happen quickly in most avalanche search and rescue operations:

- ✓ Initial call is taken, information gathered about incident – location, #'s, time of incident, weather on site.
- ✓ Contact with local Police(or via pre-existing MOU) to callout appropriate means of transport (Heli, groomer, snowmobile etc.).
- ✓ 1st Response Team to site ASAP (including ASC, Dog, Recco and Trained rescuers).
- ✓ Ensure site is safe, if not, what options are there to manage risk?
- ✓ Establish communications between ASC and IMT
- ✓ Callout more trained avalanche rescue personnel ready to go to site for back-up response as per Key Contact List or Resources List (other ski patrols, avalanche dogs, guiding companies, LandSAR etc).
- ✓ Advanced life support team contacted and informed of situation – en route to staging area.

CONCLUSION

These guidelines are not intended to be prescriptive instructions on how to perform avalanche search and rescue. They are designed as a living document to be used as a 'handrail' for readiness planning in avalanche search and rescue and thus should strive to meet or exceed current industry best practice both nationally and internationally. This can only be achieved through ongoing input from the avalanche and search and rescue industries in this country and internationally. For some Land SAR teams and regions the systems listed in these guidelines will already be in place and for others there may be some concepts that are new and or not applicable. Take what you can from this and use this as a tool each year when reviewing readiness plans. If there are things that need to be changed in this document and or avalanche search and rescue in NZ, the responsibility lies with those that discover this to communicate with the rest of the industry.

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READINESS GUIDELINES TEMPLATE

Listed here are the key elements of an avalanche rescue readiness guidelines, using the information provided above and local avalanche experts in your area formulate or check your existing readiness plan against these points to ensure they are considered. Readiness, Response, Recovery.

1. Vulnerability Assessment – Assess the need for avalanche rescue in region and identify the most likely scenarios. There may be 2 or 3 key scenarios that need to be planned for. See Appendix B for an Avalanche Rescue Vulnerability Assessment sheet.

2. Identify the region or limits of the response area the plan covers. This can be done with a map or described.

3. Identify the resources that are available to respond to an avalanche rescue – e.g. human, equipment and transport. These can be listed in a table similar to the one provided in Appendix C.

4. Identify the different notification pathways and how the initial call shall be documented. This will then drive the scale and type of callout required.

5. Outline key reflex tasking points to be performed as quickly as possible by initial point of contact. These should reflect the key generic principles listed at the start of this document:

   a) Local helicopter** operator called out to pick up 1st response team.

   b) 1st response team to site as soon as possible (2-4 trained rescuers, including ASC and dog if possible.

   c) Other agencies notified (police, LandSAR, commercial operators).

   d) 2nd back up response team on standby (2-4 trained rescuers, dog, doctor or paramedic).

   e) Advanced medical care to be dispatched as soon as possible.

6. A log sheet should be provided for recording actions that have been undertaken throughout the operation. It is also vital that all personnel involved are logged into and out of the field. Examples of log sheets are provided in Appendix D.

7. Memoranda of Understandings that are required to allow agencies other than the Police to initiate helicopter callouts should be developed regionally between the Police and relevant agencies.

8. A typical example of the likely incident management structure can be included as a prompt to get the initial operational structure defined.

9. A comprehensive communications plan needs to be created and included in the plan. See Appendix E.

10. Consideration must be made in the case of fatalities for access to site or photos for future coroner investigations.

11. Recovery plan – demobilising phase, what sort of debriefs are needed, what needs improving in the readiness plan, what equipment didn't work or was broken etc?

** Reliance on helicopter transport for all situations should be avoided, identify the quickest, most appropriate transport to site possible on the day.

AVALANCHE RESCUE VULNERABILITY ASSESSMENT

1. What incidents have happened in the past?

2. What incidents are happening currently?

3. What are the trends likely to be in the future?

4. How are avalanche incidents likely to be received?

6. List the resources that are nearby that will be of use in the event of an avalanche rescue?

AVALANCHE RESCUE RESOURCE LIST

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Incident Management Team: including local avalanche advisor(s)

Name:	Phone: WORK / HOME	Cell:

Avalanche Site Commander: NZMSC Stage 2 if possible

Name:	Phone: WORK / HOME	Cell:

Team Leaders:

Name:	Phone: WORK / HOME	Cell:

Team Members:

Name:	Phone: WORK / HOME	Cell:

Organisations: Helicopters, Ski Areas, Guiding Companies etc

Name:	Phone: / CELL	Radio:	Equipment:

LOG SHEET

Incident:		Date:
		Page: of

Time:	Description:	Initials:

Appendix E – Communication Plan

AVALANCHE RESCUE READINESS PLAN COMMUNICATIONS

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This comms plan should represent a concept of how communications might work at a typical avalanche rescue. Use it as a flexible guideline for assessing possible issues with comms in your area.

Date:	Incident:	

Location:		

Avalanche Site Command: Comms into and out of site

Radio (repeater?):	Phone:	Sat Phone:

Avalanche Site: On site Comms – to be confirmed by ASC

Radio Channel:	Voice:	Whistle:

Incident Control Point: All Comms in/out of ICP

Radio:	Phone:	Cell:	Fax:

Police:	Phone:	Cell:

Helicopters:

Aircraft name:	Phone:	Cell:

Medical:

Doctor(s) name:	Phone: WORK / HOME	Cell:

Medical: Other – District*

St Johns:	Phone:
Hospital:*	Phone:

* Nearest suitable hospitals equipped to deal with severe hypothermia should be researched and contacted when readiness planning.

AVALANCHE TELEPHONE CHECKLIST

Record information below then phone:

1. Mt Hutt Helicopters 03 302 8401

2. Police 111

(If you can't contact Mt Hutt Helicopters immediately phone 111 and get the Police to do it)

Your name:	
Your contact phone number:	
Your location:	
Time of avalanche:	
Estimated number of people trapped:	
Physical location of avalanche:	
Lat/long of avalanche: (if available)	
Size of debris: (width, length, depth)	
Wearing transceivers: (all, some, none)	
How many rescuers on site:	

Do they have communications: (record contact numbers)	Name:	Phone:

Current weather on site:	
What rescue equipment is already on site:	
What is currently happening on site:	

AVALANCHE MANAGEMENT STRUCTURE

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Example 1. Primary Structure – Incident Controller On-Site (span of control 1:4)

```
                        Avalanche Site
                          Command
                                        Safety Officer

Beacon Search          Visual Search          Shoveller / Prober
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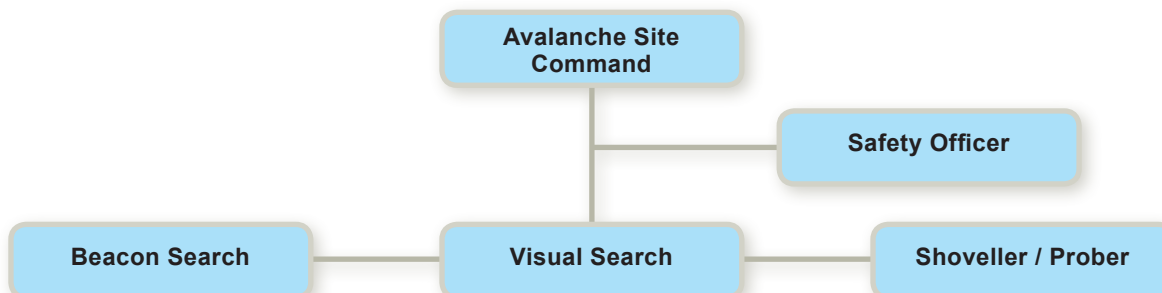
Example 2. Medium – Large Scale Structure – Incident Controller Off-Site (span of control 1:4)

```
Media Liaison          Incident Control          Safety Officer

Planning / Intelligence     Operations              Logistics

Avalanche Specialist   Avalanche Site Command      Scribe

Search Team Leader  Extrication Team Leader  Medical Team Leader  Helicopter Leader

Beacon Searcher        Shovellers              Medics            Helicopter 1

Prober                                                           Helicopter 2

Avalanche Dog Team

Recco Team
```
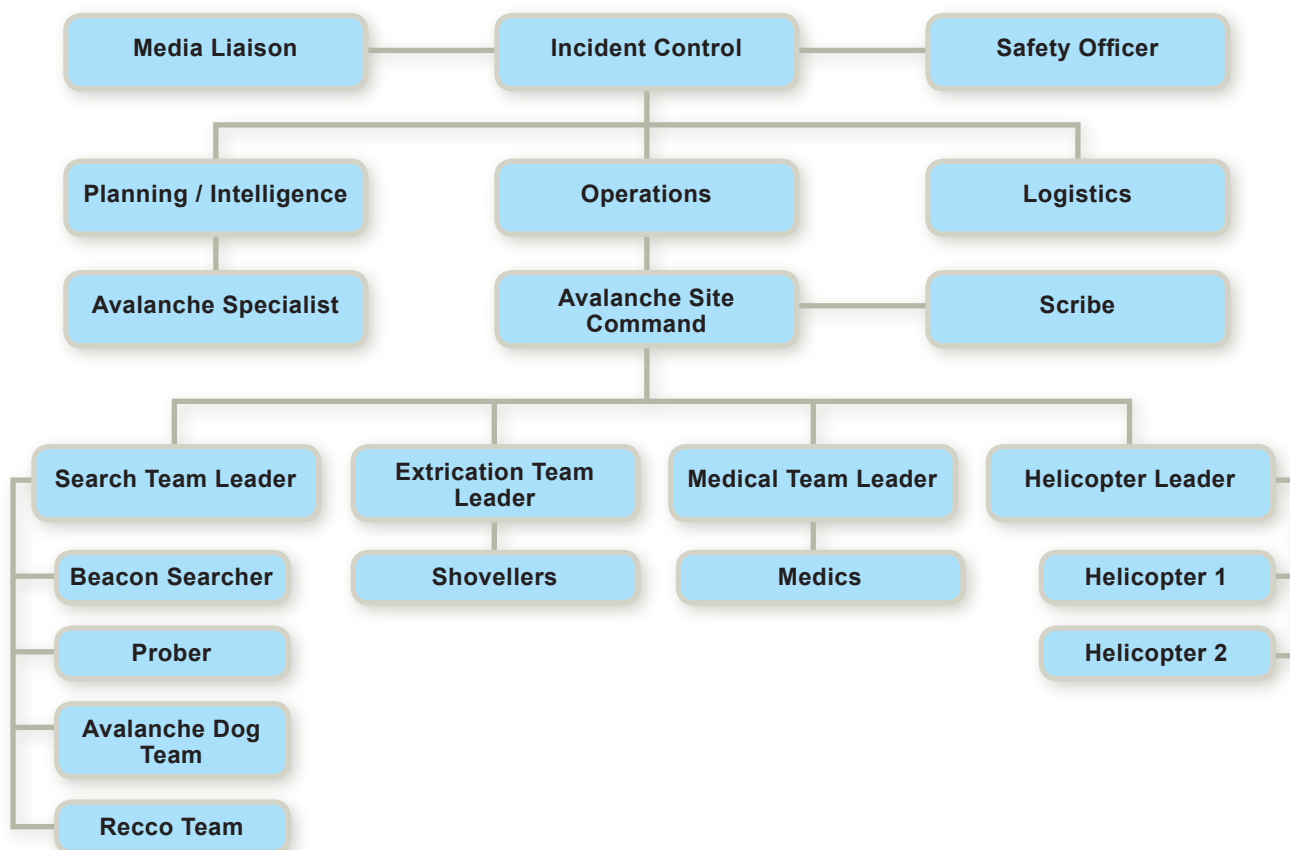
Source: Canadian Avalanche Association, 2010, pp. 72-79

![NZSAR New Zealand Search and Rescue]

AVALANCHE MANAGEMENT ALGORITHM

Assess Extricated Patient

Lethal injuries or whole body frozen — **YES** → **Do not start CPR[0]**

NO

Duration of burial (core temperature)[1] — ≤ 35min ≥ 32°C → **Standard ALS[2]**

≥ 35min ≤ 32°C

Patient response — **YES** → **Nearest ED if appropriate**

NO

Vital signs — **YES** → **Hospital with active rewarming[3]**

NO

Start CPR

NO

ECG: asystole — **NO** → **Hospital with CPB / ECMO**

YES

Patient airway — **YES or uncertain** → **Serum potassium*** — ≤ 12 mmol L^{-1} → **Hospital with CPB / ECMO**

NO

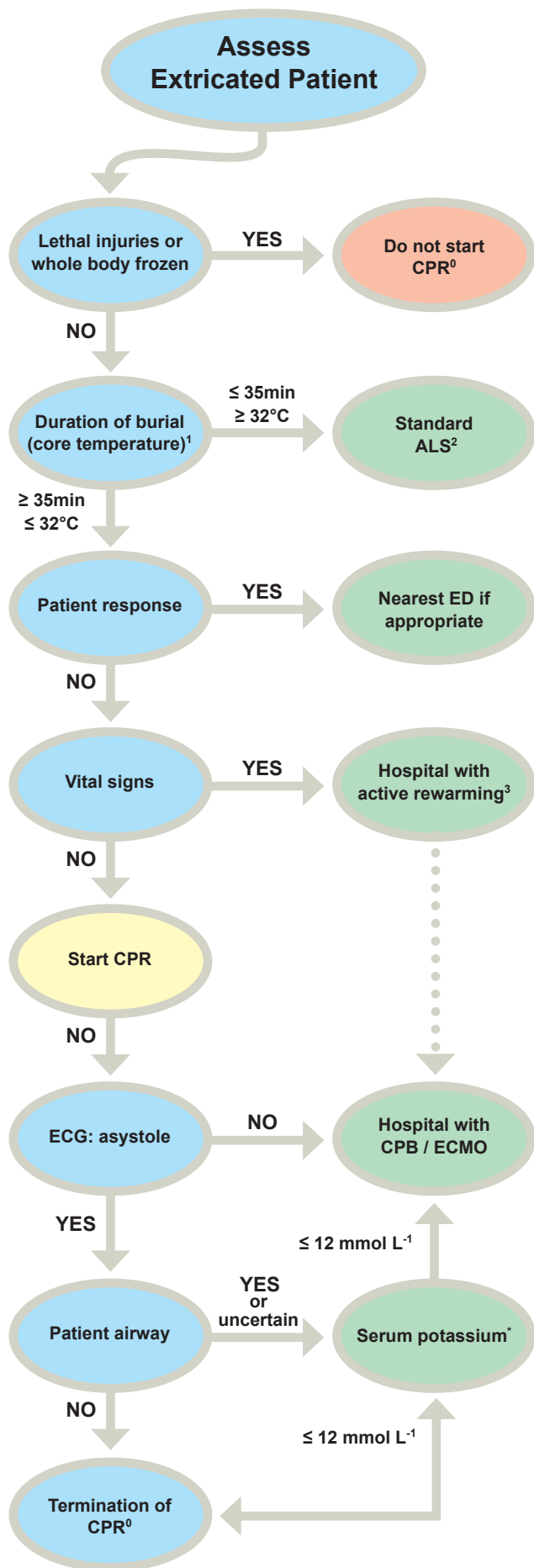**Termination of CPR[0]** ← ≤ 12 mmol L^{-1} — **Serum potassium***

Fig. 2. Management of the buried avalanche victim. In all cases gentle extrication and spinal precautions. Where appropriate core temperature and ECG monitoring, oxygen, insulation, heat packs on trunk; 0.9% NaCl and/or 5% glucose only if an intravenous or intraosseous line can be established within a few minutes; specific trauma care as indicated. [0]Clinicians may consider withholding resuscitation at the scene if it increases risk to the rescue team or if the victim is lethally injured or completely frozen. [1]If duration of burial is unknown core temperature may substitute. [2]Initaite standard ALS including ventilations and chest compressions as indicated. Resuscitation may be terminated in normothermic patients if ALS is not successful after 20 min. Transport victims with concern of respiratory (e.g. pulmonary oedema) or other-system injury to the most appropriate medical centre. [3]Hospital capable of advanced external or core rewarming. Patients who present with cardiac instability (ventricular arrhythmias, systolic blood pressure <90 mm Hg) or core-temperature <28°C should be transported towards ECC rewarming. Defibrillation beyond three attempts may be delayed until core-temperature >30°C. *If direct transport to ECC rewarming is practical, the nearest ED can be bypassed. If K+ at hospital admission exceeds 12 mmol L^{-1}, consider stopping resuscitation (after excluding crush injuries and consideration of the use of depolarizing paralytics); in an adult with K+ 8-12 mmol L^{-1} and other factors consistent with non-survival, termination of resuscitation should be considered. ALS, Advanced Life Support; ED, Emergency Department; ICU, Intensive Care Unit; ECC extracorporeal circulation.

Source: (Brugger, et al., 2013)