

Equitable and Consistent Support in New Zealand Law for Defence Force and Emergency Services Personnel: Regimes of Scientific Recognition and an Expanded Conceptual Framework

Rex Alexander¹

Samuel Mann

Otago Polytechnic NZ: Capable, College of Work Based Learning

DOI: <https://doi.org/10.66659/8vjw4853>

Published: October 3, 2026

Vol. 2, pp. 168–198.

How to cite: Rex Alexander, Samuel Mann. Equitable and Consistent Support in New Zealand Law for Defence Force and Emergency Services Personnel: Regimes of Scientific Recognition and an Expanded Conceptual Framework. Pollution and Diseases. 2026; Volume 2: 168–198.

DOI: <https://doi.org/10.66659/8vjw4853>

Abstract

This paper examines why historical and current protections have not consistently provided early recognition, diagnosis, treatment, return to service, or whole-of-life care for military and emergency services personnel affected by service-related psychological and physical harm. It applies Dmitry Nikolaenko's three regimes of scientific recognition—Accompanying Science, Warning Science, and Critical Reconstruction—to New Zealand Defence Force and emergency services contexts. The analysis considers psychological trauma, moral injury, cumulative occupational stress, cancers, and other chronic conditions associated with repeated exposure to toxins, toxic environments, and temperature-related stressors. Evidence is drawn from New Zealand legislation, operational arrangements, official reports, published research, compensation processes, and existing health data systems. The paper argues that Nikolaenko's model remains applicable when attention shifts from environmental contamination to human health, but that Critical Reconstruction does not by itself specify what must happen after institutional non-recognition has been identified. Two further regimes are therefore proposed. Critical Practice addresses immediate protection, monitoring, data preservation, redress, and operational change. Critical Regeneration redesigns the relationship between scientific inquiry, governance responsibility, law, occupational health, and operational practice so that future harm is recognized and acted on earlier. Together, the five regimes form the Nikolaenko-Alexander Model. Applied to New Zealand law and practice, the model identifies fragmented records, inconsistent legal coverage, high burdens of proof, and the absence of integrated long-term

¹ Corresponding author rex.alexander@envirocom.co.nz

monitoring. It provides a framework for more equitable recognition, support, and precautionary governance.

Keywords: Critical Practice, Critical Regeneration, Accident Compensation Corporation, work-related gradual process disease or infection, psychological trauma, moral injury, precautionary governance, duty of care

Key Points

1. Service-related harm may be visible in fragmented records long before it is recognized by scientific, legal, or compensation systems.
2. Critical Practice connects recognition of past failure to immediate protection, monitoring, redress, and operational change.
3. Critical Regeneration redesigns research, governance, law, and occupational practice so that future non-recognition is less likely to recur.
4. The expanded five-regime model exposes inconsistencies in New Zealand support for military and emergency services personnel.
5. Application of the expanded model is assessed for suitability to a wider application

Karakia

I offer the following Karakia to open this discussion. The Te Reo Māori wording was gifted to me for this study by Warrant Officer First Class Waiheke Cross Ngāti Tūmataunga | New Zealand Army

Whiria te tāngata, Whiria te kaha, Kia tū pakari ai te whānau, Kia mau te aroha me te rangimārie

Weave the people together, weave in strength, so that the family may stand strong, let love and peace endure.

‘The Captains and the Kings depart.’

The layers of meaning in those few words from Kipling’s ‘Recessional’ of 1897 (1) resonate with us still. They speak for not just the combatants leaving their ‘fields of glory,’ but to the hubris of empire, military adventurism, of The Great Game, expansionism, and with the conquest and the exploitation of indigenous peoples. We who are left face the legacies of what remains long after the tumult has died.

For those affected in spirit and body it has always been so.

What has changed over the last 200 years has been the ecological and health impacts of the technological change wrought by the industrial juggernaut supporting conflicts and the modern consumer society. What was once environmental damage measured in years became decades, now centuries, and even in the gravest extreme, millennia.

1. Introduction

This paper acknowledges the importance of, and seeks to build on original work developed for discussion by Professor Dmitry Nikolaenko: 'Military Contamination and Regimes of Scientific Recognition: A Conceptual Framework.' (2)

This paper extends Nikolaenko's three ideal-typical regimes—Accompanying Science, Warning Science, and Critical Reconstruction—by developing two further regimes: Critical Practice and Critical Regeneration. The resulting five-regime Nikolaenko-Alexander Model is then applied to service-related psychological and physical harm in New Zealand military and emergency services contexts.

This emerging professional space is at the intersection of legal, ethics, effects of chemical harm, politics, sociology, advocacy, medicine, governance, public policy, and leadership.

Critical Practice asks what must be done now to address the harms and risks revealed by the preceding stages. Nikolaenko's original regimes ask how action is technically managed, whether sufficient warning signs exist, and why those signs were not recognized and acted on earlier.

We therefore distinguish these two further concepts from the reconstruction that followed the accompanying and warning stages. Nikolaenko's Critical Reconstruction identified the historical and institutional production of non-recognition. **Critical Practice** now addresses the consequences of that failure through protection, monitoring, data capture, redress, and operational change across previously siloed agencies and services. The political and social climate to further pursue such practice is encouraging with a number of programs to identify and assemble data that have been officially recognized.

Critical Regeneration works at the level of the whole system: it redesigns the relationships between scientific inquiry, governance responsibility, and occupational practice so that future harms are more likely to be anticipated, recognized, disclosed, and prevented.

Critical Regeneration addresses professional practice through an integrated regime in which science, governance, and operational parameters are redesigned together. It links research, law, policy, employer duty of care, occupational health, operational standards, worker voice, monitoring, data capture, and redress into a continuing system of recognition and action.

While Nikolaenko develops the framework in relation to military contamination, we argue that the underlying model of scientific recognition has possible wider application, and explore that premise in this paper.

2. Methodology

We apply Nikolaenko's model to the context of a campaign for the equitable recognition and treatment of the medical and psychological conditions affecting persons from the New Zealand Defence Force and Emergency Services; Fire, Ambulance, and

Police, resulting from their service. The military and emergency contexts concern New Zealand services, although the deployments in both cases may be international.

We extend Nikolaenko's harms to the human harms resulting from service. These include psychological trauma, including mental injury, moral injury, and cumulative occupational stress potentially leading to PTSD, and long-term physical harms, including cancers and other chronic conditions associated with repeated exposure to specific toxins, toxic environments, and temperature related stressors. In each case, harm may be experienced by workers long before the effects are formally recognized by scientific, organizational, legal, or compensation systems. Evidence may exist in fragments: medical records, exposure histories, worker testimony, epidemiological patterns, operational reports, occupational health data, and coronial or compensation processes.

After briefly reviewing Nikolaenko's (2) model, we begin by describing the case of psychological harm during and following service as Case 1 (split for convenience into 1a military operational deployments, and 1b emergency services including military routine service). We then use Nikolaenko's model to frame understandings of this situation.

The analysis identifies a need to expand the framework into a five-regime Nikolaenko-Alexander Model. The expanded model is first applied to the psychological-harm case and then tested against a related but distinct case: medical harm resulting from service.

We then examine how Critical Practice and Critical Regeneration support changes to New Zealand law, to the interpretation and application of existing law, and to available redress pathways.

3. Nikolaenko's Model

Nikolaenko treats military contamination as a problem of scientific recognition as well as material harm. His concern is how scientific communities decide what counts as contamination, which evidence matters, how fragmented data are connected, how uncertainty is interpreted, where the burden of proof sits, and what action follows from incomplete knowledge. Data from toxicology, medicine, ecology, field observation, archives, and technical reports may exist, yet remain disconnected from each other and therefore fail to become a recognized process of harm.

He describes three ideal-typical regimes, (Table 1)

- **Accompanying science** accepts the military, state, or industrial objective as given. It asks how action can be technically managed, regulated, or normalized. Uncertainty tends to support continuation, and with the burden of proof often falling on victims, future science, or later courts.
- **Warning science** treats incomplete but converging evidence as sufficient grounds for precaution. It asks whether there are enough warning signs to restrict, monitor, disclose, suspend, or reconsider action. Here, uncertainty becomes a reason to act protectively.

- **Critical reconstruction** asks why harm was recognized late. It investigates how evidence became fragmented, delayed, disputed, or difficult to prove, and how scientific and institutional systems contributed to that non-recognition. Its outputs include reconstruction, accountability, institutional learning, and prevention.

The argument that Nikolaenko presents to colleagues working on different aspects of war related harm, including public health, is intended as a first step in a broader research program. The aim was to formulate a stable conceptual vocabulary for analysis; offering a theoretical framework for future empirical research.

“[His] central claim is that the study of military contamination must include not only the analysis of pollutants, exposure pathways, and health consequences, but also the analysis of the scientific regimes through which such consequences become recognized, denied, fragmented, postponed, or reconstructed.”

4. Case Study 1: Psychological Effects of Service

4.1 Case Study 1a: Psychological Effects of Military Operational Service

This paper accepts that psychological trauma is an inevitable facet of operational service, military conflict and peacekeeping reconstruction duties.

In the New Zealand context, while serving as members of the New Zealand Defence Force (NZDF) (3), the Defence Health section is responsible for the provision of primary health services and support for service people. Serving uniformed personnel may not generally seek medical services outside of their respective branch. On discharge, including on medical grounds, the service offers some support for Veterans and their families through NZDF4U, (4) and transitional support for 12 months post discharge with medical assistance provided by Veterans Affairs New Zealand (VANZ) (5) through public and private health providers.

For Qualifying Operational Service (QOS) deployments the NZDF currently manages the mental health and combat trauma of deployed personnel through pre-deployment preparation, in-theatre support, including having psychologists and medical staff deploy to operational areas to manage critical incidents, and through post-deployment reintegration.

Veterans of such deployments are covered by the Veterans Support Act 2014 (VSA'2014) (6) and Veterans Support Regulations 2014 (VSR'2014). (7)

VANZ cited by McBride (8) and McLaughlin (9) identified that the understanding of rates of mental distress within the NZ military and veteran community lags behind other nations.

A significant insider study by Grimm et al (10) 'Narratives of holistic mental health recovery in New Zealand Defence Force personnel' reports in the introduction on page 650 that:

“Despite exposure to extreme circumstances and stressors most military personnel show a resilient recovery profile. Even in veterans with a high lifetime exposure to

trauma, two-thirds nevertheless show low levels of psychological distress.” (10, p. 650).

Grimm et al. takes a positive approach in identifying, understanding and seeking to address mental health recovery pathways by incorporating Te Ao Māori health principles.

Individuals who enter the military today are generally healthier at baseline compared to the general populace. They appear, due in part to the ‘healthy soldier’ effect, to have a lower risk for mental health and negative social outcomes on recruitment due to current selection process screening.

That was not always the case through the 1950’s and 1970’s recruiting for Regular Force deployments to Korea, the Malayan Emergency, and Vietnam. Recruitment process screening improved for later deployments including but not limited to the Former Socialist Federal Republic of Yugoslavia (Bosnia, Croatia, Kosovo, Macedonia), Angola, Cambodia, Solomon Islands, Timor Leste, The Gulf Region, Iraq, and Somalia. (VANZ List) (11)

During service there is, at a personal level Grimm et al noted, a general lack of awareness of the traumatic mental risk factors due to the nature of service life which can lead to a reluctance to seek help even when encouraged to do so by NZDF online information resources. (12)

The cultural environment of the military community can affect whether mental distress help is sought at all due to an unwillingness to acknowledge that a problem exists. The perceived risk that stigma presents is a disincentive impacting on the individual’s fitness to serve in a cohesive effective operational unit. While help seeking within the military may be avoided, help sought outside the military healthcare system has the potential for misdiagnosis through lack of medical professional understanding of the military, poor engagement with providers, lack of data capture, and inappropriate case management. Those factors are all likely to lead to significant under-reporting.

Grimm et al cites research findings that the NZDF has a high proportion of at-risk groups for mental distress and suicidal behaviour. In a mixed active duty and veteran NZDF population, 10% were identified as likely to have clinically diagnosable PTSD with Māori more likely to be at risk of PTSD compared to NZ European members.

This is comparable to earlier research on NZDF Vietnam War veterans, which also found a 10% rate of PTSD. Anxiety and depressive disorders were the most common mental health issues leading to medical release from service over 2006 –2013 (9.2% of discharges) though with PTSD leading to medical release in only 0.5% of discharge cases.

One of the authors in the Grimm study was a contributing roundtable member of ‘Te Arataki – The Veteran, Family and Whanau Mental Health and Wellbeing Policy Framework’ (13) developed to address historic failures, lack of commitment, loss of

records and fragmentation of data across siloed governmental agencies and support organizations.

Te Arataki noted that compared to the general population, veterans experience fewer psychological impairments before age 30 but more from age 65 producing a long tail and the need for whole-of-life support for both the veteran and family.

A report commissioned by the Social Wellbeing Agency (SWA) (14) in 2024 (15) identified that

“To date, government agencies have been unable to source comprehensive data about the veteran population as there is no complete record of those who have served in the defence forces and no way to identify them in administrative data.”

The SWA study surveyed data from the Integrated Data Infrastructure (IDI) (16) established a decade ago by Stats NZ. (17) The IDI, closely watched by the international statistics community is the largest research database in the country. It combines 29 databases from different siloed government departments, containing eight billion data points on nine million New Zealanders between the 1980s to the current date.

As at 2021, and despite there being “no complete record of those who have served” the survey identified 44,000 veterans living in NZ dating back to WWII. We note from unofficial ex-military association records that a significant percentage of NZ veterans have emigrated to Australia and further afield (including recently to Ukraine as volunteers for operational deployment) and for which no data are available. IDI Disability information is available on 34,000 veterans living in NZ in 2021 indicating 34% with low impairment and 12% with high impairment. Across the age range of 50 to 80+ hearing loss is significantly above normal societal levels contributing to mental distress. As does unemployment rates which are 1.7 times the general population at 25% during the 24-month study period January 2018 to December 2019.

We would ask why it is that much knowledge still remains inaccessible, fragmented and dispersed, or whether deliberately or unintentionally made unavailable, or just lost.

4.2 Case Study 1b: Psychological Harm in Emergency Services and NZDF Routine Service

Personnel from these services are covered for psychological trauma under the Accident Compensation Act 2001 (18) section 21B – Mental Injury, administered by the Accident Compensation Corporation. (19) (See Appendix 2).

New Zealand’s Emergency Services, the country’s preparedness for fires, industrial incidents, accidents, spillages and contamination events, medical emergencies, and civil disturbances rests respectively with Fire and Emergency NZ (FENZ) (20) including Rural Fire services, St John Ambulance (21) and the NZ Police Force (22) incorporating 17 regionally distributed Armed Offenders Squads (AOS) and the Special Tactics Group (STG).

Two significant Fire and Emergency NZ studies highlight most of the same issues as those for NZDF Qualifying Operational Service deployments. The same

Accompanying Science, Warning Science, and Critical Reconstruction admonishments are equally applicable here.

‘Why We 360’ (23) an insider research project conducted by Josh Darby (2019) quoted a FENZ Senior Research Advisor Zoe Mounsey where she stated:

“It has been established that there is inadequate research to draw upon in assessing the presence, prevalence, and severity of psychological injuries specific to firefighters within Fire and Emergency...

The exact number of firefighter suicides remains difficult to quantify, as there are no records kept.”

A memorandum of understanding established in 2013 between FENZ and St John Ambulance established medical call co-response. Subsequently (although there may be other factors), between 2013 and 2018 the number of medical related Code Purple (immediately life threatening / fatal) calls for firefighters increased regionally on average 306% across the country.

Moreover for the busiest three regions the number of fatality callouts increased by nearly 2,000%. In the year 2017 – 18 some 14,000 medical incidents were attended.

While the majority of calls ambulance officers respond to are less serious; Codes Green, Orange and Red, firefighters who co-respond, see considerably fewer cases of recovery given the nature of purple calls. Darby relates “these experiences may indicate a sense of ‘mission failure’ which has been correlated with psychological distress leading to psychological injury.” That is not to downplay the effects on St. John responders, but the fatalities are balanced with more cases of successful interventions and potentially a greater sense of worth and role satisfaction.

One of Darby’s recommendations was for FENZ to implement changes to the incident reporting system, (not currently captured) to include such safety, health, and wellbeing (SHW) identifying data on medical calls and other potentially traumatic events.

A detailed report prepared for FENZ (2023) (24) Whanaungatanga Wellbeing Survey built on and significantly extended the Darby study while making comparisons where relevant to the Military and Police. It found no improvement in the intervening period. For PTSD the survey found 13.4% of uniformed firefighters met the threshold for probable PTSD.

Those figures were compared in referenced studies to 10% for the NZ Military and 14% for the NZ Police. For military combat, and the Police AOS and STG unit, the psychological issue of moral injury must be considered in the mental health risk profile.

The highest recorded levels of PTSD however at 30.9% was for uniformed FENZ communications centre employees.

There are significant implications for those workers making a claim under ACC s21B which denies cover for ‘work-related mental injury’ under the circumstances described in s21B(6) which states: “To avoid doubt, a person does not experience, see

or hear an event directly if that person sees, or hears it through a secondary source, for example (in 6(c)) hearing it on radio or telephone.” Section 21B(5) requires the person to see or hear an event directly only if involved in or as a witness to the event, or is in close physical proximity to the event at the time it occurs. A specialist legal opinion sought confirms: “s21B(6) does act to absolutely bar support staff from cover for mental injuries arising through vicarious exposure to otherwise-qualifying ‘events’”.

Section 21B crucially requires the event to comprise a single incident. The mental injury cannot result from a gradual cumulative process. Successful claims for work-related psychological trauma suffered by defence Routine Service and Emergency Service personnel have proven almost impossible. Contrastingly, legal counsel stated, “the High Court has confirmed that multifactorial causation does not preclude cover entirely, stating that causation is met provided the single event is a ‘material contributor,’” and opined, “[this as] a High Court decision routinely ignored by ACC.”

A further complication regards the employment status of volunteers. Because they are not deemed to be employed, volunteers do not receive cover for ACC under s21B or s30. There is currently political appetite for legislative change but only for FENZ Volunteers. (25) While rejected by the current government Select Committee, the cost of coverage for both psychological trauma and medical conditions including cancers was noted as less than \$NZ 0.5m. That rejection is countered by a subsequent 2026 report by economic research organization BERL (‘Business and Economic Research’) (26) finding that the New Zealand spend on medicines at 4.9% of health expenditure, and below the OECD average of 13.3%, would generate a GDP fiscal benefit return of \$1.93 for every dollar spent. While focused on medicine spend the report noted that:

- Better access to medicines improves disease management, reduces hospital demand, and extends healthy life expectancy.
- Increased funding supports higher workforce participation, reduces absenteeism and presenteeism, boosting productivity.

To put that in perspective:

- 86% of NZ’s firefighting workforce are FENZ registered volunteers covering 93% of the geographic landmass; acting under orders and facing toxic and stressful conditions no different to their paid permanent colleagues. (27)
- 66% of Hato Hone St John frontline ambulance personnel covering 97% of the country are volunteers. (28)

NZDF Routine Service including part-time Reserve personnel (remunerated and therefore eligible for ACC support) cover peacetime military service in New Zealand including deployments for civil emergencies, natural disasters, and humanitarian assistance throughout the Pacific working in an interoperable partnership with New Zealand’s and our Pacific neighbours’ Emergency Services. That function is a core part of the NZDF public service and regional duties working as part of the National Emergency Management Agency (NEMA) under CIMs (29) control and with Regional Pacific Authorities.

NZDF Routine service personnel are covered for psychological trauma under the Accident Compensation Act 2001 (18) section 21B – Mental Injury, administered by NZDF through an Accredited Employer Programme (AEP) on behalf of the Accident Compensation Corporation. (19) (See Appendix 2). Support is provided by the military under the AEP through a combination of on-base medical teams, military psychologists, social workers, chaplains, and the dedicated 24/7 helpline NZDF4U. (4) On discharge (or 5 years post diagnosis) coverage passes from the NZDF AEP to ACC often with incomplete service and military records.

Section 21B (unlike s.30) has no provision, despite public submissions, (deemed out of scope), for recognizing Defence Routine Service and the Emergency Services as ‘unique occupations’ which would allow claims to be considered as resulting from service due to the occupation, or as conclusively presumptive, rather than as individual claims.

4.3 Psychological Health Considered Through Nikolaenko’s Three-Regime Model

We use Nikolaenko’s model of ‘Accompanying Science’, ‘Warning Science’ and ‘Critical Reconstruction’ to frame an understanding of the situation regarding psychological health.

Nikolaenko addresses those failure points where he asks why data were not collected or connected, why monitoring was inadequate, why causal chains later became difficult to prove, and how institutional ignorance was produced.

4.3.1 Problems of Scientific Non-Recognition

In borrowing some words and phrases from Nikolaenko’s paper, some of which are in context, but expanding on others to contextualise the lack of cohesive evidence:

Data managed by the respective services are siloed and fragmented by definition. Amalgamated research studies do not group the causal conditions common to all services; instead, they are, if studied at all, analysed separately and therefore lack statistical significance due to limited cohort numbers.

In such circumstances, scientific rigor in parts may coexist but with a cognitive failure at the level of the whole which frequently leads to ACC declining claims because of insufficient conclusive medical evidence to prove causation.

The resulting harm is not always visible as a single or a limited number of events over time. Consideration of the psychological impact of a single isolated event denies the impact of continuing cumulative harm.

Thus the evidence may appear gradually, unevenly, and through dispersed indicators, recognition of which requires the transformation of such data into an understanding of long-term process of harm across all services. “That fragmentation becomes problematic when it prevents recognition of the process that gives meaning to the fragments.”

The problem of insufficient evidence is especially important in this context. The research relied on by the claimant and assessed by ACC Medical Advisors is almost always scientifically cautious and methodologically justified. But as Professor Nikolaenko asks; insufficient evidence for what? Insufficient for final causal proof? Insufficient for legal compensation? Insufficient for policy restriction? Insufficient for continuation of the status quo? These are, we agree not the same questions.

Psychological trauma is an inevitable risk of emergency service operations and military conflict, and historical harm to personnel across all of the services discussed here is well established. However, few protections can limit exposure to stressful events. No item of personal protective equipment can serve as a barrier between the senses and the mind.

There is no switch to turn off memory to overcome the normal protection of separation from the event through physical distance and distance in time.

Psychological trauma when viewed as a threat is only able to be mitigated through 'soft' barriers; preparation, knowledge, training, effective leadership, the mutual support of comrades, counselling, time in contact / recuperative rest, all to effect the building and maintenance of resilience.

In the end that may not be enough; voluntary or compulsory severance from service must then be, but often is not, accompanied by the respective service, support organizations', and legislated obligations for whole-of-life and family support.

Accompanying Science accepts the necessity of the service in the interests of society but asks how it can be pursued more effectively, safely, measurably, or defensibly even while requiring the activities to continue irrespective of known or incompletely known risks from the hazards.

Despite fragmentation or wilful disregard of the data, the activity is justified through proactive risk mitigation before the effects can be fully known or proven. Claiming 'that is the way it has always been' can never be a justification for not further investigating and collating scientific inquiry into the causal factors of the psychological effects of service and of treatment options. Society cannot use the necessity of a service as an excuse to ignore its psychological risks, and that relying on tradition amounts to institutional neglect.

Warning Science asks the question, given harm has not been conclusively proven, whether there is sufficient reason to continue, or whether there is sufficient reason to stop. Stopping emergency service or military activity is not an option. The question expressed in that way gives considerable weight to taking a precautionary approach.

Critical Reconstruction examines the failures and asks why the data were or became fragmented or was incomplete due to inadequately framed scientific inquiry, inadequate monitoring or inadequate or entirely absent record keeping. What has become lost, and either why or whether the information was ever collected.

Nikolaenko in defining the scope of Critical Reconstruction asks why this is so. Who acted without adequate monitoring? Who controlled the data? Who defined the relevant indicators? Who decided that warning signs were insufficient? And critically who benefited from the later impossibility of proof, making the point that the resulting uncertainty cannot be treated as neutral. It is part of the institutional history of the harm.

“It reconstructs the conditions under which harm became knowable in fragments but not actionable as a whole.”

4.3.2 What Is Missing from the Three-Regime Model?

When critically reviewing Nikolaenko’s theoretical framework, we find that repurposing the model from environmental science to address medical concerns does not compromise its validity; the core model fully retains its applicability.

Critical Reconstruction provides reasons for historic failures and asks why the process was not recognized earlier. “It reconstructs the conditions under which harm became knowable in fragments but not actionable as a whole.” In reflecting on the intent of Nikolaenko’s regime prompts the observation that reconstruction in this context is looking retrospectively at how years or decades later the casual factors and the reasons for non-recognition might be explained.

An examination of the consequences of those failures asks what must now be done to address the harms and risks revealed above. And then weaving the strands and the people together developing a fuller integrated process where science detects and interprets harm, governance that carries responsibility for acting under uncertainty, and practice that changes operational conditions.

The analysis therefore identifies a part of the process that Nikolaenko’s original model does not fully describe: the movement from retrospective recognition to present action and future system redesign.

5. The Developmental Logic of Critical Practice and Critical Regeneration

We first added a stage after Critical Reconstruction and called it Critical Action. Because reconstruction already contains a retrospective element of action, we separated the forward-looking component and named it Critical Practice. Critical Practice addresses what must be done now in response to the harms and operational risks identified through reconstruction. A further regime, Critical Regeneration, addresses how the system must be redesigned for the future.

- Critical Practice arises from the recognition of the accountability and the imperative to make appropriate change.
- Critical Regeneration is forward looking and aspirational. It becomes: ‘This is what we would like to see’ and is necessary to ensure mistakes of the past are not repeated

5.1 Critical Practice

This fourth ideal-typical regime asks what must be done now to protect, repair, compensate, and change organizational practices. Critical Practice addresses the consequences of that failure through protection, monitoring, redress, and operational change. (Table 3)

Critical Practice bridges the gap between retrospective reconstruction and action. It moves beyond fragmented and disconnected research toward insider research, organizationally commissioned research, and a clear commitment to act.

5.2 Critical Regeneration

Our fifth Regime, Critical Regeneration suggests then how science and precautionary governance can be redesigned so non-recognition is less likely to recur. Regeneration works at the level of the whole system: It redesigns the relationships between scientific inquiry, governance responsibility, and occupational practice so that future harms are more likely to be anticipated, recognized, disclosed, and prevented. It is future action focused putting the past, present, and future ‘decision makers’ on notice - proposing standing research programs, and establishing exposure registers with mandatory escalation and disclosure pathways - the defragging of all data (including historic) that could potentially have a bearing on establishing precautionary thresholds. The object is a redesign of the conditions, of science, and of precautionary governance so future harm is recognized and acted on earlier and more consistently.

We also add a new row across the regimes: Resolution. A continuous recognition to action system in which evidence, governance, and practice are connected before, during, and after deployment or service (Table 3).

5.3 Case 1 Considered Through the Expanded Nikolaenko-Alexander Model

We return to the psychological case study to consider whether and how the expanded Nikolaenko-Alexander Model adds insight.

Critical Regeneration takes us into the future of Defence Force Routine Service, of interoperability with Emergency Services to better manage Civil Defence and Emergency Management (CDEM) deployments to Global Warming related floods, wildfires, sea level rise conditions, earthquake, volcanic and tsunami emergencies.

The latter three hazards are especially relevant because New Zealand lies on the Pacific tectonic “Ring of Fire.” Continuing uncertainty and evolving research must become design requirements for precautionary governance. Related science and governance should be integrated so that future harm is recognised and acted on before needs become critical or insurmountable.

6. Case Study 2: Medical Effects of Service- and Work-Related Gradual Process Disease or Infection

Having developed the expanded Nikolaenko-Alexander Model with insights from a consideration of the psychological effects of emergency service operations and military conflict, it is useful to explore whether the expanded model holds up when used to frame a related but different set of circumstances. For that we consider a second case study, medical conditions – cancers and the like – following emergency service operations and military conflict.

This paper accepts that physical conditions, like psychological trauma, are foreseeable risks of emergency service operations and military conflict. Critical Reconstruction asks why relevant scientific research was not assembled as a continuing project across applied and fundamental research, retrospective government reviews and investigations, coroners' reports, and case law. It also asks why research was not commissioned early enough to inform precaution in operational or tactical decision-making. Critical Practice then asks what must now be done to address the resulting harm.

ACC Claims for work-related gradual process, diseases or infections (WRGPDI) must be proven to be caused by employment tasks (again precluding volunteers); and that is significantly problematic and a high bar to overcome for paid professional Emergency Services and Defence Force Routine Service personnel.

All applications are assessed by ACC on an individual basis against section 30 using a 3-Step process rather than recognizing Defence and Emergency Services as unique occupations. The recommendation to permit coverage for defined occupations was rejected by government following extensive consultation (at 11). (30)

The consultation process was mainly to update the ACC (18) Schedule 2 listing of conditions and causations to align with the International Labour Organisation (ILO) (31) List of Occupational Diseases. ACC s.30 and Sch 2 has an unused provision to recognise occupations which would have linked occupation with exposure, causation and disease. Such a listing would effectively enable the legal test of conclusive presumption.

Currently many applications for coverage for work-related medical conditions are disputed by the Corporation which has become increasingly litigious engaging and paying for external legal counsel from high-profile legal chambers to dispute claims. Firefighters both professional and volunteers are dying from aggressive cancers caused by the toxins they are exposed to; exposures proven by international research to be linked to their work. (32,33)

In a number of international jurisdictions, exposures associated with specified cancers are treated as conclusively presumptive consequences of service. In New Zealand, by contrast, claims are assessed and may be rejected on an individual basis. (34)

If rejected, reliance then reverts to the Public Health Service with diagnosis, treatment and rehabilitation significantly delayed with less-than-optimal, often fatal, outcomes.

“The burden of proof should not automatically fall on those who experience delayed consequences. Where action is capable of producing long-term, poorly reversible harm, the burden of precaution should fall on those who initiate or authorise the action.” (2)

6.1 Key Differences Between Accident Compensation and Veterans’ Support Legislation

We ask why it is that two Acts of Parliament can approach redress for medical conditions resulting from service in fundamentally different ways.

The Veterans’ Support Act and Regulations require Veterans Affairs NZ to apply benevolence in considering claims made by those with Qualifying Operational Service (QOS). Claims from those who have been exposed to toxins causative of the medical conditions from which they suffer.

VANZ must act in accordance with the principles of promoting equal treatment for equal claims; determined in accordance with substantial justice; and not in accordance with any technicalities, legal forms or legal rules of evidence, (VSA’2014, s10) (6) the antithesis of how the ACC legislation is currently administered.

Specifically listed conditions are treated as a conclusively presumptive result of service i.e. not able to be disputed irrespective of any confounding factors or legal argument to the contrary.

ACC argues that society owes a special debt and duty of care to those who have served in the military on operational duties, that is not disputed. We question why New Zealand’s Emergency Services should not be afforded a similar duty of care recognizing the toxic and psychologically challenging conditions faced, but instead are considered the same as the general populace.

The Veterans Support legislation is also not without significant flaws highlighted by decisions recognizing Qualifying Operational Service deployments and when and how deployments are made.

While the threat assessments have been made from an ‘operational’ and ‘environmental’ risk perspective, as required by s9 (6) of VSA’2014, the immediacy, the urgency of the request for military assistance typically occurs well before any quality research has been reviewed or commissioned into the environment that will be faced or is likely to be faced.

The operational tasking imperative means that personnel are committed to a combat theatre or high-risk peacekeeping environment post-conflict before a full and comprehensive analysis of the risks from the hazards are known so Far As Is Reasonably Practicable (SFAIRP).

Accompanying Science and Warning Science interrogation of the questions would suggest that the immediacy of the mission itself should not have primacy.

I would make the point here that I am describing New Zealand's commitments, a country usually many thousands of kilometres removed from any conflict. Militaries of countries adjacent to, or involved in active conflict face critical decisions and deployment timelines that are drastically reduced or entirely absent. That must not limit or restrict retrospective redress pathways. They must not be forgotten. They are never forgotten at the level of family and community. They equally must not be forgotten once the crisis has passed by the administration that committed them to action.

A historical example: The effects of the contaminant in the 2,4,5-T component of the defoliant Agent Orange, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) was officially only recognised through a NZ government Memorandum of Understanding (MoU) (35,36) 37 years after the last NZ troops had returned home.

The MoU and VSR'2014: Regulation 13 – Vietnam (7) identifies sixteen 'conclusively presumptive' toxin related medical conditions legally aligned to the US Academy of Sciences: Veterans and Agent Orange Study. The research concluded with Update 11 of 2018. (37)

Of the other conflicts post WWII, only exposure to Pacific nuclear testing and the Gulf War have been similarly recognised. There have been many Qualifying Operational Service deployments resulting in medical and psychological conditions that are not referenced by specific regulation conferring presumptive medical coverage.

Illustrative of the medical diagnostic uncertainties faced are that Gulf War Veterans have conclusively presumptive cover for conditions that are "medically unexplained chronic multi-system illnesses." Reliance for that cover was again based on US research leading to the (US) PACT Act (38) working alongside older Gulf War presumptive US legislation.

Typically it has taken decades for the medical evidence, or the legislative precedents from allied nations to the conflict to converge and for the evidentiary thresholds to be reached.

A current potential example: It may be that post the conclusion of the war in Ukraine – *Kia hora te Marino* (let peace be widespread) - that the New Zealand government receives a request to provide a Peace Keeping, medical team, or reconstruction contingent to assist in the rebuilding and stabilisation of the country and the restoration of *Kaitiakitanga* (the guardianship, stewardship, and the responsibility to protect and care for the natural environment and future generations). In preparation for such a multi-tasked deployment if requested, (or as a useful transdisciplinary training exercise if not), logic and the direction being examined in this paper would suggest that research on all conditions likely to be faced would have already been initiated before now to examine the immediate threats and risks from the hazards. Such research would need to be ongoing to address potential long latency

period medical conditions for inclusion in regulation as conclusively presumptive conditions of service for that potential future deployment.

Ukrainian independent researcher Tetiana Goncharova (39) states in her review article: “Neutrality in the face of aggression is not a morally or intellectually defensible position.” That warning in the context examined here could serve as an admonishment reworded as: ‘Scientific neutrality in the face of the health and psychological impact on military and emergency services personnel acting in support of society and the nation’s environment is not a morally or intellectually defensible position.’

Where there is uncertainty, where the ‘legal standard’ question ‘who knew or ought reasonably to have known’ cannot be satisfactorily answered then there is reason for precaution. Why and how the decisions came to be made historically and right up to present day deployments are legitimate public sphere questions with a resultant societal right to know.

In Table 5 we use the expanded Nikolaenko-Alexander Model to frame the medical effects of emergency service operations and military conflict. The implications of this framing are considered in Section 7.1, the implications of the expanded Nikolaenko-Alexander Model itself are in Section 7.2, and considerations for international applicability in Section 7.3, before concluding in Section 8

7. Discussion

7.1 Insights from the Expanded Model

In mapping Case Study 2 against and critically reviewing Nikolaenko’s theoretical framework, we find that repurposing the model from environmental science to address medical concerns does not compromise its validity; the core model fully retains its applicability for both psychological trauma and medical conditions resulting from service. As noted above shifting the model’s application from environmental science to medicine changes what is being measured, but it does not diminish its geographical or political validity

That appears to be irrespective of whether applied to NZDF deployments to war or peacekeeping zones, NZDF Routine Service internal NZ and Pacific deployments for disaster relief; and for the Emergency Services. Looking at firefighters, ambulance, and Police officers separately, the model again holds true for firefighter exposure to toxins and psychological trauma, and equally true for ambulance staff and Police exposed primarily to mental injury. The Police are exposed, along with NZDF war deployments to the potential for moral injury and therefore the consideration of the legality or justification of controlling armed offender incidents and warfare respectively.

7.2 Implications of the Expanded Model

We suggest that the two additional regimes are independent of place and service and can be applied across time to long-latency conditions extending throughout a person’s life.

My research has been undertaken in a New Zealand context across only those services acting under orders where the mission / object may and historically has taken precedence over considerations for the (at least long-term) welfare of personnel.

In the service of saving life I would speculate that the model has applicability across wider employed and volunteer sectors, examples including nursing, search and rescue - both urban and mountain, Royal New Zealand Coastguard, and surf lifesaving.

While compulsion is perhaps less of a factor, the sense of duty and the intensity of those duties would augur for inclusion and consideration under the model.

There are other speculative applications that might usefully be explored and studied further, including the suitability of New Zealand law to address the anomalies that the combined 5 ideal-typical regimes highlight and which are likely to be impacted by political imperatives and society's appetite for equitable change.

7.3 International Applicability

Psychological trauma and physical conditions resulting from exposure to stressors, toxins, and toxic environments are recurring features of military and emergency service. We therefore suggest that services in different countries can be considered through the common lens of Critical Practice and Critical Regeneration.

It is in the operational environment that there are differences. The contrast between the New Zealand military and emergency service scenarios and those of Ukraine make a stark contrast.

Those involved militarily in that theatre, and in the emergency service actions necessary to deal with the resultant fires and medical emergencies at scale, face critical condition judgement calls where the lack of protections differ dramatically from those of a nation at peace.

The immediate and long-term psychological effects on personnel and the medical effects of exposure to toxic environments are orders of magnitude greater.

Nikolaenko addressed current and future military contamination arising from such conditions. We contend that the model remains valid when it is extended from environmental contamination to its effects on human health.

8. Conclusions

1. The effects of service-related, psychological, and cancerous conditions, as well as diseases and infections, have historically been under-reported and divorced from academic research.
2. Historically, fragmentation, the lack of standardised record keeping, and disjointed processes across services and siloed responsible government agencies have resulted in incomplete health data capture.
3. Critical Practice requires an examination of all existing data, a recognition that harm has been caused and a commitment to redress.
4. Primary drivers continue to be mission accomplishment, which frequently overrides considerations for the health and safety of service personnel - military

and service tasks are frequently prioritised over the well-being of the personnel executing them.

5. Critical Regeneration will require interventions at all levels from task evaluation and practice change to policy and legislative change to ensure the maintenance of morale and operational effectiveness.
6. There has been little consideration of how service life impacts families. Service families would benefit from regular, planned, and dedicated support policies designed to reduce the psychological, emotional, and operational stresses of military and emergency service life.
7. Intervening earlier requires the services, service organizations and government agencies to work together and fund prospective academic and applied research. This research must focus on identifying the root causes of health factors common to the services.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgments

Not applicable

Funding

This research received no external funding

Data Availability Statement

No new data were created or analysed in this study

Closing Karakia

Mā te mahi tahi o tēnei rā

ka tata mai te tāhapatū o te rangi

mō ngā pāraeroa o āpōpō me ō rātou whānau

Our collective effort today brings the horizon closer for tomorrow's veterans and their families

WO1 Waiheke Cross

Appendix 1

The NZDF divides operational service into three main categories based on the nature of the mission and the level of risk:

- **Warlike:** Service in a state of declared war, conventional combat operations against an armed adversary, or peace enforcement between belligerents who have not consented to intervention (examples include Vietnam, and the 1990–1991 Gulf War)
- **Hazardous:** Service involving significant physical or operational risks, but short of full conventional combat.

- **Non-warlike:** Service involving a credible threat, but with a lower risk profile (such as standard peacekeeping duties with the consent of all parties).

The categories are assessed by the Chief of Defence Force (CDF), on the advice of specialist staff as to whether the operational and environmental risks of a deployment warrant consideration as Qualifying Operational Service (QOS) and subsequent medallic recognition.

The CDF reports to the Minister for Veterans who may determine that a deployment carries a significant risk of harm or meets the required threat threshold, and makes the official declaration. The Minister may consider any other matter if believed to pose additional operational or environment threat including the potential for psychological harm.

Appendix 2

ACC [The Corporation]: The New Zealand context introduces some unique features not applicable in other countries. Of most significance is the government social insurance scheme: New Zealand's Accident Compensation (ACC) Scheme. The legislation provides a universal 'no blame' approach to support and pay for treatment and rehabilitation for physical injuries. That part works relatively well. The Scheme covers all citizens at work or at home, playing sport or on the roads. Critically the Scheme removes the 'right to sue' and is funded by a range of compulsory levies.

The architect of the ACC Scheme Sir Owen Woodhouse was a distinguished Judge and liberal reformer who chaired the Royal Commission of Inquiry for Personal Injury in New Zealand from 1966 to 1967.

Unfortunately in both applicability and administration, the Scheme has drifted far from the original enlightened thinking of the Woodhouse report. (40) Less than half that report's bold, almost revolutionary recommendations went on to be included in the 1972 Act. "Informal and simple procedure: he said "should be the key to all proceedings.... Applications should not be made to depend upon any formal type of claim; adversarial techniques should not be used, and a drift to legalism avoided."

The Corporation, a government organization structured as a Crown Entity is litigating more aggressively than at any time in the last decade with the system becoming structurally adversarial. The system is under such load that assessment quality, natural justice, and rehabilitation obligations are being compromised and that undermines procedural fairness for the vulnerable and especially for self-represented as opposed to legally represented claimants.

Claims for work-related psychological trauma, diseases or infections (WRGPDI) must be proven to be caused by employment tasks.

ACC Futures Coalition - Tātau Kia Anga Mua:

The Coalition is a multidisciplinary group of lawyers, care providers, academics, and ACC service consumers set up to advocate the return of the Scheme to its original founding intent as advocated by Sir Owen Woodhouse DSC. The Coalition, (41) its

members, and supporters consider ACC as a ‘uniquely brilliant social insurance model, a step above and beyond the private insurance models that are predominant internationally.’ The Scheme currently has its faults.

ACC Futures if asked what would improve the ACC Scheme service delivery for Defence and Emergency services in New Zealand, in respect to s.30 claims, the largest omission between the Woodhouse report and the present Act is true administrative efficiency. Referring to the fifth principle:

“Fifth, the achievement of the system will be eroded to the extent that its benefits are delayed, or are inconsistently assessed, or the system itself is administered by methods that are economically wasteful”

- At [55], p39 (40), referring to the principle of *Administrative Efficiency*

The importance of this principle is covered by what “comprehensive rehabilitation” ought to mean:

*“The consideration of overriding importance must be to encourage every injured worker to recover the maximum degree of bodily health and vocational utility in a minimum of time. **Any impediment to this should be regarded as a serious failure to safeguard the real interests of the man himself and the interest which the community has in his restored productive capacity.**”*

- At [58], p40 (40), discussing the principle of *comprehensive rehabilitation*

ACC has now returned to a single-assessor model following disbandment of the previous Toxicology Assessment Panel. The system still lacks a triage mechanism for those likely to suffer death or injury imminently, without provision of timely entitlements. This triage mechanism is critical to ensuring the Corporation – which is acknowledged has both legislative timeframes within which a decision must be made, and finite resources with which to make that decision – performs its rehabilitative role as effectively and equitably as possible.

The second significant omission is less to do with the Woodhouse report, and more to do with a later addition to the scheme – the Code of Claimant’s Rights. It describes how ACC must behave in their engagements with claimants: fairly and efficiently, ensuring trust in, and understanding of the system being navigated by injured persons. There is no incentive on the Corporation to perform, and so performance wanes. If the Scheme is to improve there must be an incentive on the administering body to perform to the maximum of their ability, and that incentive is likely to be most effective where there are penalties for non or inadequate performance.

Table 1. Nikolaenko's three-regime model of scientific recognition. Source: Nikolaenko (2).

Parameter	Accompanying Science	Warning Science	Critical Reconstruction
Main Question	How can action be technically managed?	Are there sufficient warning signs to restrict or stop action?	Why was the process not recognized earlier?
Relation to Objective	The military or state objective is accepted as given.	The objective may be questioned under conditions of serious risk.	The history of the objective and its consequences is analysed
Object	Fragment: substance, dose, sample, local effect, norm	Configuration of warning signs	Long-term process and the organization of knowledge about it
Uncertainty	Reason to continue until harm is conclusively proven.	Reason for precaution when harm may be serious or irreversible.	Object of investigation: Why was knowledge incomplete
Burden of Proof	Often shifted to victims, future science, or later courts	Shifted towards those who initiate action.	Placed on the system that acted without adequate knowledge or monitoring.
Practical output	Continuation, regulation, technical optimisation	Restriction, monitoring, suspension, revision	Reconstruction, accountability, institutional learning, prevention

Table 2. Nikolaenko's three-regime model applied to psychological trauma in NZDF qualifying operational service, NZDF routine service, and emergency services.

Parameter	Accompanying Science	Warning Science	Critical Reconstruction
Main Question	Embedded or available psych support not historically actioned	Lack of assessment, records, and post action debrief. Lack of conclusive evidence	Retrospective assessment does not capture extent or scope
Relation to Objective	The mission or task has priority to act under orders	Unit discipline for mutual support, attitude of 'harden up.'	Stigma and resorting to alcohol masks the psych issues
Object	Low cohort numbers less statistical significance. Difficult to predict due to exposure and time issues	Discharge, termination of service, and retirement disrupts assessment processes	Lack of reliance on international data for robust statistical analysis
Uncertainty	Obscured by alcohol abuse and hierarchical avoidance of issue	Low morale, lack of operational efficiency and community objections to status quo	Inadequate legislation, lack of targeted research
Burden of Proof	Long lead time affects acceptance for diagnosis and treatment	Legal onus of proof on agencies inconsistently shifted to claimants	Historic lack of assessment, record keeping and monitoring. Responsible Authority issue avoidance and nonrecognition,

Parameter	Accompanying Science	Warning Science	Critical Reconstruction
Practical output	Amend legislation and admin of laws for equity	Retrospective health data mining. Re-build medical case files to extent possible.	Embed psych support, monitor and record, organizations to accept accountability

Table 3. Expansion of Critical Reconstruction into Critical Practice and Critical Regeneration.

Parameter	Critical Reconstruction	Critical Practice	Critical Regeneration
Main Question	Why was the process not recognized earlier?	What must be done now to address the harms and risks revealed by reconstruction?	How must science and governance be redesigned so non-recognition is less likely to recur?
Relation to Objective	The history of the objective and its consequences is analysed	Continuing operations are revised through duty of care, reduced exposure, and protection of personnel.	Future objectives are subject to standing scientific, legal, ethical, and occupational health scrutiny
Object	Long-term process and the organization of knowledge about it	Affected personnel, current operations, exposure pathways, health effects, legal duties, and practical protections.	The system of research, monitoring, data preservation, governance, commissioning, and accountability.
Uncertainty	Object of investigation: Why was knowledge incomplete	Residual uncertainty triggers protective measures, monitoring, and redress pathways.	Uncertainty becomes a design requirement for precautionary governance and prospective research.

Parameter	Critical Reconstruction	Critical Practice	Critical Regeneration
Burden of Proof	Placed on the system that acted without adequate knowledge or monitoring.	Accepted by government and employers as a duty to act, protect, monitor, and provide redress.	Placed on those authorizing and governing future operations to demonstrate adequate research, monitoring, and safeguards.
Practical output	Reconstruction, accountability, institutional learning and prevention	Legislative amendment, occupational protections, health surveillance, compensation/redress, best operational practices.	Standing research programs, exposure registers, independent review, mandatory escalation, preserved data, precautionary thresholds.
Resolution	Revisit past practice, identify failures of recognition and establish responsibility	Fix the consequences through operational, legal, medical, and occupational health action	Redesign the conditions of science and governance so future harm is recognised and acted upon earlier.

Table 4. Critical Practice and Critical Regeneration applied to psychological trauma in military and emergency services.

Parameter	Critical Practice	Critical Regeneration
Main Question	What processes must be put in place now to comprehensively capture the historic and current psych records	Ensure the whole psych eval and recording system is rebuilt so this siloed pattern is less likely to recur?
Relation to Objective	Identification of all avenues to provide support before, during and after action	Ensure continuing scientific, legal, ethical, occupational health, and practice-based scrutiny.
Object	Ensure no loss of records on discharge transition to civilian life, and whole-of-life care	Integrate relevant international data to achieve robust stats analysis including impact on family
Uncertainty	A trigger for precautionary governance, review, prospective research, protective practice, health monitoring,	Fund and commission research within the services, with Uni's, and through international service collaboration
Burden of Proof	Held by those who authorise, govern, commission, and operationalise harmful activities	Accepted by government and employers as a duty to act, protect, monitor, and provide redress.
Practical output	Fixes the psychological harms caused by operational stressors	Legislative amendment when deemed necessary
Resolution	Acceptance that harms have been caused and provides redress	Puts in place processes to protect those serving, those who have served and their families

Table 5. The Nikolaenko-Alexander Model applied to service-related physical harm.

Parameter	Accompanying Science	Warning Science	Critical Reconstruction	Critical Practice	Critical Regeneration
Main Question	Record incidents attended and likely toxin exposure events	Lack of detailed incident reporting long-term management of records, Lack of conclusive evidence	Retrospective review of inadequate records does not capture extent or scope	What must be done now to address the harms and risks revealed by reconstruction?	How must science and governance be redesigned so non-recognition is less likely to recur?
Relation to Objective	The mission or task has priority to act under orders	Service discipline for mutual support, attitude of 'harden up' rather than seek medical help	Stigma and resorting to alcohol or self-remedy to 'tough it out' limits data capture	Continuing operations are revised through duty of care, reduced exposure, and protection of personnel.	Future objectives are subject to standing scientific, legal, ethical, and occupational health scrutiny
Object	Low cohort numbers less statistical significance Difficult to predict due to exposure and time issues	Discharge, termination of service, and retirement disrupts medical data capture processes	Lack of international data for robust statistical analysis of numbers and type of medical conditions	Affected personnel, current operations, exposure pathways, health effects, legal duties, and practical protections.	The system of research, monitoring, data preservation, governance, commissioning, and accountability.

Parameter	Accompanying Science	Warning Science	Critical Reconstruction	Critical Practice	Critical Regeneration
Uncertainty	Obscured by individual and hierarchical avoidance of issue	Low morale, lack of operational efficiency and community, family objections to status quo	Inadequate legislation, litigious application of the law and lack of occupation targeted research on conditions and causation	Residual uncertainty triggers protective measures, monitoring, and redress pathways.	Uncertainty becomes a design requirement for precautionary governance and prospective research.
Burden of Proof	Long latency periods for cancers affects effective condition management	Legal onus of proof on agencies illegally shifted to claimants	Historic lack of assessment, record keeping and monitoring. Responsible Authority issue avoidance and nonrecognition,	Accepted by government and employers as a duty to act, protect, monitor, and provide redress.	Placed on those authorizing and governing future operations to demonstrate adequate research, monitoring, and safeguards.
Practical output	Amend legislation and admin of laws for equity	Retrospective health data mining. Rebuild medical case files to extent possible.	Improve identification of and record keeping for incidents attended organizations to accept accountability	Legislative amendment, occupational protections, health surveillance, compensation/redress, best operational practices.	Standing research programs, exposure registers, independent review, mandatory escalation, preserved data, precautionary thresholds.

References

1. Kipling R. Recessional. The Kipling Society; 1897. Available from: https://www.kiplingsociety.co.uk/poem/poems_recess.htm. Accessed 21 Sep 2026.
2. Nikolaenko D. Military contamination and regimes of scientific recognition: a conceptual framework. *Pollution and Diseases*. 2026 Jun. <https://doi.org/10.66659/bb4q9n88>.
3. New Zealand Defence Force. New Zealand Defence Force. Available from: <https://www.nzdf.mil.nz/nzdf/>. Accessed 21 Sep 2026.
4. New Zealand Defence Force. NZDF4U wellbeing support. Available from: <https://health.nzdf.mil.nz/support-providers/nzdf-community-wellbeing-support/nzdf4u-wellbeing-support>. Accessed 21 Sep 2026.
5. Veterans' Affairs New Zealand. Veterans' Affairs New Zealand. Available from: <https://www.veteransaffairs.mil.nz/>. Accessed 21 Sep 2026.
6. New Zealand. Veterans' Support Act 2014, No. 56. Wellington: New Zealand Legislation; 2014. Available from: <https://www.legislation.govt.nz/act/public/2014/0056/latest/DLM5537774.html>. Accessed 21 Sep 2026.
7. New Zealand. Veterans' Support Regulations 2014, LI 2014/369. Wellington: New Zealand Legislation; 2014. Available from: <https://www.legislation.govt.nz/regulation/public/2014/0369/latest/whole.html>. Accessed 21 Sep 2026.
8. McBride D, Samaranayaka A, Richardson A, Gardner D, Shepherd D, Wyeth E, et al. Factors associated with self-reported health among New Zealand military veterans: a cross-sectional study. *BMJ Open*. 2022;12(5). <https://doi.org/10.1136/bmjopen-2021-056916>.
9. McLaughlin R, Nielsen L, Waller M. An evaluation of the effect of military service on mortality: quantifying the healthy soldier effect. *Ann Epidemiol*. 2008;18(12):928-936. <https://doi.org/10.1016/j.annepidem.2008.09.002>.
10. Grimm CJ, de Terte I, Hodgetts D, Kearney S. Narratives of holistic mental health recovery in New Zealand Defence Force personnel. *Mil Psychol*. 2024;36(6):650-660. <https://doi.org/10.1080/08995605.2023.2250708>.
11. Veterans' Affairs New Zealand. List of qualifying operations. Available from: <https://www.veteransaffairs.mil.nz/eligibility/qualifying-service/list-of-qualifying-operations/>. Accessed 21 Sep 2026.
12. New Zealand Defence Force. NZDF psychology. Available from: <https://health.nzdf.mil.nz/support-providers/specialist-military-support/nzdf-psychology>. Accessed 21 Sep 2026.
13. Veterans' Affairs New Zealand. Mental health framework: Te Arataki. Available from: <https://www.veteransaffairs.mil.nz/about-veterans-affairs/our-programmes/mental-health-framework/>. Accessed 21 Sep 2026.
14. Social Investment Agency. Social Investment Agency. Available from: <https://www.sia.govt.nz/>. Accessed 21 Sep 2026.
15. Barr M, Young D. Building an evidence base for understanding veteran outcomes. Wellington: Social Wellbeing Agency; 2024. Available from: <https://www.sia.govt.nz/publications/Building-in-evidence-base-for-understanding-veteran-outcomes>. Accessed 21 Sep 2026.

16. Stats NZ. Integrated Data Infrastructure. Available from: <https://www.stats.govt.nz/integrated-data/integrated-data-infrastructure/>. Accessed 21 Sep 2026.
17. Stats NZ. Stats NZ. Available from: <https://www.stats.govt.nz/>. Accessed 21 Sep 2026.
18. New Zealand. Accident Compensation Act 2001, No. 49. Wellington: New Zealand Legislation; 2001. Available from: <https://www.legislation.govt.nz/act/public/2001/49/en/latest/>. Accessed 21 Sep 2026.
19. Accident Compensation Corporation. ACC. Available from: <https://www.acc.co.nz/>. Accessed 21 Sep 2026.
20. Fire and Emergency New Zealand. Fire and Emergency New Zealand. Available from: <https://www.fireandemergency.nz/>. Accessed 21 Sep 2026.
21. Hato Hone St John. St John ambulance services. Available from: <https://www.stjohn.org.nz/what-we-do/st-john-ambulance-services/>. Accessed 21 Sep 2026.
22. New Zealand Police. New Zealand Police. Available from: <https://www.police.govt.nz/>. Accessed 21 Sep 2026.
23. Darby J. Why We 360: an investigation of psychological distress, injury, and suicide within Fire and Emergency New Zealand. 2019. Available from: https://www.nzpfu.org.nz/media/website_pages/news/an-investigation-of-psychological-distress-injury-and-suicide-within-fenz/media_download_1.pdf. Accessed 21 Sep 2026.
24. Fire and Emergency New Zealand. Whanaungatanga wellbeing survey results 2023. Wellington: Fire and Emergency New Zealand; 2023.
25. United Fire Brigades' Association. ACC petition final report. Available from: <https://www.ufba.org.nz/news/ACC-Petition-Final-Report-Dec25>. Accessed 21 Sep 2026.
26. Business and Economic Research Limited. Economic and fiscal effects of an increase in medicines funding. Available from: <https://berl.co.nz/our-mahi/economic-and-fiscal-effects-increase-medicines-funding>. Accessed 21 Sep 2026.
27. United Fire Brigades' Association. Hidden in Plain Sight: An independent valuation of the contribution of New Zealand's volunteer fire force. United Fire Brigades' Association; 2024. Available from: <https://www.ufba.org.nz/sites/default/files/2024-06/UFBA%20Hidden%20in%20Plain%20Sight%20-%20Volunteer%20Fire%20Force%20Valuation%20Report.pdf>. Accessed 29 Sep 2026.
28. Hato Hone St John. Hato Hone St John puts spotlight on volunteers. Hato Hone St John; 2023. Available from: <https://www.stjohn.org.nz/news--info/news--articles/hato-hone-st-john-puts-spotlight-on-volunteers2/>. Accessed 29 Sep 2026.
29. Officials' Committee for Domestic and External Security Coordination. Coordinated Incident Management System (CIMS). 3rd ed. Wellington: Department of the Prime Minister and Cabinet; 2019.
30. Ministry of Business, Innovation and Employment. Updates to ACC (revised 2025). Available from: <https://www.mbie.govt.nz/dmsdocument/30870-updates-to-accident-compensation-regulatory-settings-proactiverelase-pdf>. Accessed 21 Sep 2026.
31. International Labour Organization. ILO list of occupational diseases (revised 2010). Geneva: International Labour Organization; 2010. Available from: <https://www.ilo.org/media/336656/download>. Accessed 21 Sep 2026.

32. Saskatchewan Workers' Compensation Board. Firefighter occupational disease coverage. Regina (SK): Saskatchewan Workers' Compensation Board; 2026. Available from: <https://www.wcbask.com/firefighter-occupational-disease-coverage>. Accessed 21 Sep 2026.
33. Wilson J. Alberta expands cancer coverage for firefighters. Canadian Occupational Safety. 2023 Apr 10. Available from: <https://www.thesafetymag.com/ca/topics/safety-and-ppe/alberta-expands-cancer-coverage-for-firefighters/442213>. Accessed 21 Sep 2026.
34. Stec AA, et al. Carcinogenicity of occupational exposure as a firefighter. *Lancet Oncol*. 2022;23(8):985–986. Available from: <https://pubmed.ncbi.nlm.nih.gov/35780778/>. Accessed 21 Sep 2026.
35. Veterans' Affairs New Zealand. Viet Nam veteran Memorandum of Understanding. Veterans' Affairs New Zealand; 2006. Available from: <https://www.veteransaffairs.mil.nz/about-veterans-affairs/our-programmes/working-with-viet-nam-veterans/viet-nam-veteran-memorandum-of-understanding/>. Accessed 29 Sep 2026.
36. Veterans' Affairs New Zealand. Support if you served in Viet Nam. Veterans' Affairs New Zealand. Available from: <https://www.veteransaffairs.mil.nz/a-z/support-if-you-served-in-viet-nam/>. Accessed 29 Sep 2026.
37. National Academies of Sciences, Engineering, and Medicine. Veterans and Agent Orange: update 11 (2018). Washington (DC): National Academies Press; 2018. <https://doi.org/10.17226/25137>.
38. US Department of Veterans Affairs. The PACT Act and your VA benefits. Available from: <https://www.va.gov/resources/the-pact-act-and-your-va-benefits/>. Accessed 21 Sep 2026.
39. Goncharova T. The long shadow of wartime chemical pollution: reflections on the Vietnam War and contemporary conflicts. *Pollution and Diseases*. 2026;1:70-78. <https://doi.org/10.66659/pd.2025.003>.
40. Royal Commission of Inquiry. Compensation for personal injury in New Zealand: report of the Royal Commission of Inquiry. Wellington: Government Printer; 1967. Available from: <https://fyi.org.nz/request/9632/response/32430/attach/html/2/Woodhouse%20Report%20Compensation%20for%20Personal%20Injury%20in%20NZ.pdf.html>. Accessed 21 Sep 2026.
41. ACC Futures Coalition. ACC Futures Coalition. Available from: <https://accfutures.org.nz/>. Accessed 21 Sep 2026.