

Competing Understandings of What Constitutes Knowledge in the Agent Orange Debate in New Zealand

Summary

This paper, like the preceding papers in this series, is extracted and adapted from a much broader ongoing research project. This one explores the underlying sociological and epistemological framework the research study is built upon. That revolves around the different knowledge and understandings (epistemology) of the various participants, broadly described in sociological terms as the public (including veterans and their claim makers), policy makers and scientists.

I also briefly describe some of the factors affecting policy making, specifically the employment of the precautionary principle, and the public perception of risk.

The main areas in which there are different understandings affecting the Agent Orange debate are in science and law. Those two areas have been explored in previous papers¹. Scientific misunderstanding is explored in greater detail in the body of this paper.

Understanding the misunderstanding between these three broadly defined groups (scientists, policy makers and public) is the key, I think, to unravelling the complexity and chaos of the Agent Orange debate. The problem however with introducing complexity and nuance into the study is that most of the participants view things through a single lens, often in black and white terms. I think we need to adopt a broader view.

When we recognise and understand the misunderstanding, we see then why the different participants have been talking past each other for decades. And are still.

Introduction

The Agent Orange debate in the USA, Australia and New Zealand from about 1978 onwards has been characterised by chaos and confusion as the protagonists duelled in the courts, at inquiries, and in the media.

They have long misunderstood and misinterpreted the understandings of the other, and the relevance or importance of the various issues and evidence raised. The debate has become heated with accusations made and parried, and in some cases it has degenerated into abuse and threats, by and against the makers of the Agent Orange claim.

¹ Available at <https://putatara.net/agent-orange/>

Cutting through the chaos and confusion has been difficult. In this ongoing series of papers I adopt and adapt epistemological and sociological frameworks to examine the history, science, law and politics of Agent Orange in an attempt to bring a degree of clarity to the matter. It is not an easy task. Hopefully it will all come together sometime in 2018.

Recognising the different perceptions about what constitutes knowledge and understanding is, I think, the key to understanding the evolution of the Agent Orange debate.

The Framework of the Agent Orange Study

The series of papers posted into this Group has an underlying theme, seeking to unravel the chaos and confusion. In the examination of the Agent Orange narrative and debate I have adopted two complimentary approaches in order to tie together the many strands of the study.

The first approach is sociological, borrowing from social science an aspect of social problem theory, describing how issues are conceived, constructed as social problems by “claim makers”, and promoted to policy makers as issues deserving of remediation and resolution through policy intervention. The proponents of the Agent Orange Narrative can be seen as claim makers who constructed a social problem seeking remediation and resolution.

The second approach is epistemological in which I explore the different and conflicting perspectives on what constitutes knowledge, and the consequent understandings and misunderstandings of the participants; being in general terms in this examination scientists, policy makers, and the public, including Vietnam veterans and their supporters.

The gap in those understandings is analysed in two main areas:

- (1) The scientific method and process; and
- (2) The differing legal burdens of proof, and their relevance in different settings; i.e. in criminal law, civil law and repatriation law (or veterans' law).

The examination of scientific understanding will also borrow from social science the theory of the sociology of knowledge, and explore competing ideas about the validity of scientific knowledge. All of that had some influence on the evolution of the Agent Orange debate. It was a lot more complex than realised by the veteran community.

Social Problem Theory and Claim Makers

Social problem theory is a sociological construct to describe social problems in society. The *objective* theory of social problems seeks only to describe the problem. *Constructionist* social problem theory seeks to describe how social problems arise, how they are promoted to the public,

and sometimes accepted as social problems deserving of remediation or resolution by policy makers.

A Vietnam veteran and professor of sociology, Wilbur J. Scott, has written about Vietnam veterans' claims from within that theoretical perspective:

“One approach [objective social problem theory] presumes that a problem exists when acts or conditions become severe or aggravated. In this view, if exposure to asbestos, radon or dioxin causes cancer, the evidence will eventually accumulate and invite discovery. In contrast a constructionist approach argues that participating activists and organised interests create social problems by advancing competing claims and versions of evidence. Accordingly phenomena become recognised as problems because they have been sponsored successfully rather than because they are inherently troublesome”².

Given that after many decades the Agent Orange evidence has not eventually accumulated and invited discovery I have adopted the constructionist theory. The constructionist theory of social problems is described in greater detail by sociologist Professor Donileen Loseke:

“Social problems [are] the activities of individuals or groups making assertions of grievances and claims with respect to some putative conditions.” Within this perspective, constructionists are to examine claims-making, which is defined in behavioral terms as “demanding services, filling out forms, lodging complaints, filing lawsuits, calling press conferences, writing letters of protest, passing resolutions, publishing exposes, placing ads in newspapers, supporting or opposing some governmental practice or policy, setting up picket lines or boycotts.” Notice that this activity has nothing to do with social problem conditions. All attention is on the activity of people who say things and do things to persuade audience members to evaluate a condition as a social problem”³.

Claim makers are central to the construction of social problems. They define the problem, publicise it, build an audience or constituency around the promotion of the problem, and lobby policy makers in order to convert them to the cause, and thus to implement policy designed to remedy the problem.

“Social problems claims-makers are creators of meaning; if they are successful then the meanings they create are socially shared”⁴.

² Scott, W., Competing Paradigms in the Assessment of Latent Disorders: The Case of Agent Orange, in *Social Problems*, Vol. 35, No. 2, April 1988, pp 145-158.

³ Loseke, Donileen R.. *Thinking about Social Problems: An Introduction to Constructionist Perspectives: 0 (Social Problems and Social Issues)* (Kindle Locations 3852-3857). Aldine Transaction. Kindle Edition.

⁴ Loseke, Donileen R.. *Thinking about Social Problems: An Introduction to Constructionist Perspectives: (Social Problems and Social Issues)* (Kindle Locations 3926-3927). Aldine Transaction. Kindle Edition.

Thus it was with the Agent Orange Narrative in the USA, Australia and New Zealand. It was a claim making narrative.

Policy makers prioritise the problems they do address, and not all social problems result in policy. The aim of claim makers is to prioritise their claims in the eyes of the policy makers.

Claim makers may also seek to influence the science by convincing policy makers to invest in scientific research that will, or might (or might not) validate the scientific claims of the claim makers.

The claim is not necessarily supported by the science or other relevant expertise, but it does often reflect genuine social concern. It may even be disproved at a legal or scientific level of proof, but that does not necessarily resonate with the public, or prevent the claim from being addressed by policy making in response to public demand.

Moral and Intellectual Authority and Contested Truths

The struggle of claim makers to make their voices heard can also been seen as a struggle over the question of who possesses moral and intellectual authority. In the case of the Agent Orange claim, it was about whether or not the claim makers would defer to the greater wisdom and authority of the policy makers, or vice versa.

In broader society, and in a rapidly evolving post-1960s cultural environment, deference to the expert was in rapid decline during the development of the Agent Orange claim. That aspect of the contest then introduces the question of whose Truth shall prevail. Science can produce facts but not Truths in the moral and political domains.

Sociologist and emeritus professor Frank Furedi writes on the revolt against deference:⁵

“Politicians now find it all too easy to retreat behind the experts. And they are happy for issues to be complicated, rather than simplified, explained and resolved.”

“The problem is not expertise in itself. Society needs expert authority on technical and scientific matters. But it does not need expert authority for political decision making; in that sphere, rather, it needs people to exercise their own political judgement”.

“... politics and morality are not appropriate subjects for the pronouncements of experts. Science can certainly provide facts, but not truths. It is only through the public interpretation of facts that people arrive at truths”.

“... different attitudes towards the truth will not be decided by the ‘facts’, but by the contestation of cultural authority”.

⁵ Furedi, F., On Truth: a Revolt Against Deference, in Spiked Review, March 2017.

In New Zealand from about 1982 to 2005 the contest was almost entirely about the facts and which version of the facts would prevail. The underlying contest might have been about political authority and moral liability, and the government's duty of care towards its war veterans and their families. But the contest was instead narrowly conducted, for over twenty years by the early claim makers, around the validity of the science. Or at least the contest over the validity of the science of Agent Orange was allowed to overshadow the social, moral and political issues.

The writer did unsuccessfully try to convince a few of the claim makers to focus on the social, moral and political issues rather than the science.

It was not until a second set of claim makers (Masters, Miller and Collins) intervened in 2003 that the contest moved, or was dragged, into the political sphere, although the late Geoff Braybrooke MP had twice unsuccessfully attempted to achieve that in 1983 and 1990, with private members bills in the parliament. But in those few years from 2003 to 2006 the political debate was still focused on the science.

And when the third group of claim makers (RNZRSA and EVSA) took ownership of the claim in 2006 the contest moved into the moral domain, and moral suasion succeeded where contested science had not. But not entirely, for not everything the early claim makers wanted was achieved.

Agent Orange Claim Making – Contested Truths

In the Agent Orange debate in the USA the claim makers quickly built a support base within the policy making establishment, specifically in the Senate and in the House. By 1991 the US legislature had acted to remedy many of the claims of Vietnam veterans, and by 1994 remedies had been enshrined in law and regulation. These were policy decisions not necessarily supported by the science, but were based on presumption. In Australia the legislature had also acted in the veterans' favour by 1994, based largely on the acceptance of the American justification, not necessarily on scientific cause and effect. New Zealand claim makers did not seem to appreciate the difference between policy based on presumption, and policy based on science.

In New Zealand the original claim makers⁶ active from about 1982, did not succeed, largely because they did not build a constituency that reached into and included policy makers, and also because they did not seem to fully understand the alternative approaches to policy. They were primarily focused on proving their version of the science, as opposed to a political and moral version of the social problem that would be accepted by the policy makers. There was an alternative approach adopted by US and Australian claim makers in 1994, but that seemed to elude the New Zealand claim makers.

⁶ Vietnam Veterans Association of New Zealand (VVANZ)

It was therefore not until 2003 that the new group of claim makers⁷ succeeded in bringing the policy makers to the table. Ironically their approach was the same as the claim makers they displaced, but they had the advantage of political support⁸. Following their initiative a third claim maker group⁹ took over in 2006 and finally negotiated new conditions with policy makers based on an alternative approach acceptable to the policy makers.

However the conditions that were finally negotiated were rejected by the original claim makers who had been members of VVANZ, and bitter recriminations were expressed in a series of email exchanges and in the media. The WAI 1401 claim lodged in 2007 at the Waitangi Tribunal is the direct result of that dissatisfaction, instigated by a group of the initial claim makers.

As I describe in earlier papers the scientific evidence of Agent Orange, or the lack of it, has not changed from the beginning of the Agent Orange debate in 1978 in the USA until the present. There is still no scientific consensus about whether or not Vietnam veterans were exposed to environmental toxins in sufficient dosage to cause a variety of health conditions. And there is still no evidence to suggest that the children and grandchildren of male veterans have been affected.

However many in the public, including veterans and their families, and many in the media, believe that the science has changed. But what really changed was the policy makers' resolution and remediation of a social problem, using presumption, an old and established policy device not reliant on scientific, medical or legal certainty. Presumption has been described in two previous papers.¹⁰

Scientists, Policy Makers & the Public: Different Understandings

A lack of understanding of the scientific method and process is a root cause of a great deal of the confusion and contested truths. Scientists typically are unable to effectively communicate the nuances and tentative nature of their conclusions to the public, and the public typically is unwilling to accept anything less than certainty from the science.

As a result, on the one hand scientists, the medical profession and policy makers have often held that the public is ignorant of or misled about the evidence. Veterans have even been accused of inventing causation in order to fraudulently gain war service entitlements.

⁷ Colonel John Masters, Major Ross Miller and Judith Collins MP who instigated the Parliamentary Health Select Committee inquiry.

⁸ The National Party.

⁹ Royal New Zealand Returned and Services Association (RNZRSA) and Ex-Vietnam Services Association (EVSA) who negotiated a Memorandum of Understanding with the NZ Government in 2006.

¹⁰ At <https://putatara.net/agent-orange/>

On the other hand the public, in this case, the media and Vietnam veterans and their families, have often accused scientists and policy makers of bias, fraud, perjury, denial and cover-up.

Talking past each other.

Policy makers in the USA, Australia and New Zealand at various times have taken various positions on either side and in the middle of the debate. Indeed much of the antagonism surrounding the Agent Orange issue in New Zealand was prolonged by policy makers' own lack of understanding of the complexity of the issue, and by their inaction.

It is tempting to analyse the Agent Orange issue only from an historical, scientific, medical, or legal perspective, to determine which of the protagonist groups is "right" or "wrong" based on the empirical evidence, or upon one's knowledge and understanding of the empirical evidence. However that ignores the social and political perspectives of the issue. By turning to an epistemological and sociological analysis we might gain a more complete understanding, across the many perspectives.

Most of the Agent Orange debate is about degrees of risk to the health of veterans and their families, stemming from the alleged exposure of the veteran to Agent Orange and other toxic chemicals in South Vietnam. Positions taken in the debate range from the belief that there was no risk whatsoever, or negligible risk, and therefore no health effects; to the widespread belief that every disease, disorder, disability, defect and death suffered by the veteran and his progeny post-Vietnam can be attributed to exposure to the toxic environment of the Vietnam War.

It is a deep and wide gulf.

In her 2001 article, "*Analytical Paradigms: The Epistemological Distances between Scientists, Policy Makers, and the Public*"¹¹, Professor Theresa Garvin¹² offers an analysis from which we might begin that exploration of competing understandings. She aims to provide, "*a framework that outlines the differences in how knowledge and information is created and used around risky and uncertain environmental health issues*".

Garvin classifies the key players in the understanding of risk into the three groups; Scientists, Policy Makers and the Public. The classification is general rather than specific as there is often overlap between the three groups with some people in their various roles being involved in two or even three of the groups. There can also be different understandings

¹¹ Garvin, T., 2001, *Analytical Paradigms: The Epistemological Distances between Scientists, Policy Makers, and the Public*, in *Risk Analysis*, Vol. 21, No. 3.

¹² Dr. Garvin's primary research interests are at the intersections between health, communities, and environmental issues. She utilizes social science methods to investigate how people interact with their environments, how environments influence human health, and the role of space and place in people's constructions of nature.

within the groups. Nevertheless that general classification does provide a convenient framework to explore, analyse, and evaluate the different and competing understandings in the Agent Orange debate.

Scientists are those producing and validating knowledge in the natural sciences employing the “scientific method”. In the case of the Agent Orange debate they include scientists employed in academia, by government agencies, and those employed by corporations. The latter includes those who worked for the chemical companies producing Agent Orange and other pesticides. Scientists may therefore be involved in the policy making process. Some are also involved in claim making. Roger A. Pielke Jr., a professor of environmental science at Colorado University, has pointed out that scientists are frequently involved in political debate, using their scientific credentials to advance political agendas.¹³ All scientific commentary therefore is not necessarily value neutral science.

Policy makers are those engaged in the political decision-making process. They include elected officials or politicians, bureaucrats, scientific advisors, technocrats and consultants.

The *Public* in the Agent Orange debate includes the general public, Vietnam veterans and their families, the organisations and lawyers that represent them, media and other commentators, film and documentary makers, writers, bloggers, and also the very influential environmental lobby.

The Agent Orange debate and narrative is heavily influenced by environmentalism.

In her book on the psychology of risk¹⁴ Dame Glynis Breakwell explains Garvin’s hypothesis:

“The significance of the differences between experts and lay people in risk perceptions is recognised. To these differences are attributed many of the problems that arise when decisions have to be taken about controversial hazards. Garvin said that scientists, policy-makers and the lay public employ different, though equally legitimate, forms of rationality when evaluating evidence and generating knowledge about hazards.

She opines that scientists use scientific rationality, policy-makers use political rationality and the public use social rationality. This may sound glib but it is shorthand for a proposition that the three work with different analytical paradigms.

Scientists look for legitimate evidence from studies that adhere to the scientific method and base dismissal of conflicting evidence also on this

¹³ Pielke, R., *When Scientists Politicize Science*, Regulation, Spring 2006, pp 28-34.

¹⁴ Breakwell, Glynis M.. *The Psychology of Risk* (Kindle Locations 2078-2093). Cambridge University Press. Kindle Edition. Professor Breakwell is a social psychologist and an active public policy adviser and researcher specialising in leadership, identity process and risk management.

method. Estimates of the certainty of conclusions are given in probabilistic terms. Complex issues are analysed by compartmentalisation of their elements, and knowledge is recognised as specific and limited. Knowledge is achieved in the scientific paradigm through incremental accumulation of evidence.

Policy-makers look for evidence that is readily available and from any source. Its legitimacy is perceived in terms of its political, economic and social implications. Evidence is dismissed if it is not politically expedient to acknowledge it. Conceptualisation of certainty is thus context-specific. For complex issues, only those elements that are immediately known to need to be understood are examined. The knowledge that results is instrumental and contextualised. It is applied to the current situation only.

The public use popular sources. Evidence is legitimated through 'received wisdom' and dismissed if it fails to be considered 'common sense'. Degrees of uncertainty are not easily recognised: a thing is, or it is not. Understanding of complex issues is constrained by the access to limited sources. Knowledge is tacit, experiential and individualised. Knowledge accumulation is not systematic but focuses upon personal history.

If scientists, policy-makers and the public do “employ different, though equally legitimate, forms of rationality when evaluating evidence and generating knowledge about hazards” then we have the beginnings of an understanding of the competing positions in the Agent Orange debate. It remains to explore those positions to identify the different rationalities, leading to the different “truths”.

In his history of Agent Orange¹⁵ Edwin Martini offers a similar epistemological analysis in relation to the Agent Orange debate:

“Questions of exposure, risk, and consequences were debated ad nauseam in courtrooms and congressional hearings in the United States, Australia, New Zealand, and elsewhere in the late seventies and eighties, veterans, scientists, and policymakers repeatedly squaring off at the powerful confluence of experiential reality, scientific knowledge, and state authority. Veterans stridently pressed their case on exposure despite evidentiary gaps in the historical record, and they grew frustrated both with lawmakers, who demanded proof of exposure and causal links to specific illness, and with scientists, who could not provide such proof. As veterans and other citizens affected by Agent Orange sought specific, knowable facts about what Agent Orange might have done to them and their loved ones, they situated their own experiences

¹⁵ Martini, Edwin A.. 2012, Agent Orange: History, Science, and the Politics of Uncertainty (Culture, Politics, and the Cold War) (Kindle Locations 3140-3154). University of Massachusetts Press. Kindle Edition. One of the few (if not the only) histories of Agent Orange written by an historian. Dr Martini specialises in American history. He has taught and written on the history of the Vietnam War.

and beliefs as a powerful counter narrative to those set forth by science and the state.

“But narratives are rarely equal, and knowledge is never neutral. In her study of “biological citizenship” and the Chernobyl nuclear disaster, Adriana Petryna writes, “The processes of making scientific knowledge are inextricable from the forms of power those processes legitimate and even provide solutions for.” The same is true of debates over the effects of Agent Orange, which were shaped by “multiple, intersecting, and competing epistemologies.” While veterans and their advocates made powerful cases through their personal narratives, they were immersed in legal and political structures that continued to privilege objectively measurable effects over experiential bodily trauma. In their challenges to these structures, Vietnam veterans around the world have relied on memory, personal testimony, and the power of their experience to contest both scientific knowledge and state authority. As I argue, however, they have often done so in problematic ways, relying on the language of conspiracy and cover-up to offset historical and evidentiary gaps. Whether in the form of so-called popular epidemiology or populist protest, one must consider the experiential narratives of the veterans alongside what the equally imperfect and always incomplete documentary record, both scientific and historical, reveals about the limits of Agent Orange exposure and the likelihood that it is (or is not) to blame for a variety of health conditions among veterans, civilians, and their offspring”.

Wayne Hall makes a similar observation in a 1989 paper¹⁶ about the Australian Evatt Royal Commission:

“The Agent Orange controversy is too large and untidy, the skein of scientific, political and ethical issues too entangled, to permit a co-operative disentanglement that will satisfy the general public or Vietnam veterans. The arguments of proponents and opponents do not seem to make contact with each other. At times, the two sides seem to live in two worlds defined by very different ways of thinking about and ‘seeing’ the evidence, in much the same way as Hanson ¹⁷ has argued Tycho Brahe saw the sun ‘rise’ while Kepler ‘saw’ the earth rotate to bring the sun in view”.

My ongoing research attempts to unravel and disentangle the issues, and to expose the bases of the *“very different ways of thinking about and seeing the evidence”*.

There are two broad Agent Orange narratives.

¹⁶ Hall, W., The Logic of a Controversy: The Case of Agent Orange in Australia, in *Sm. Sci. Med.* Vol. 29, No. 4, 1989, p 542. Professor Hall has worked in the fields of addiction, mental health and public health, addressing socially important and intellectually challenging scientific and policy questions that lie at the intersection between human biology and history.

¹⁷ Hanson, N., *Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science*, Cambridge University Press, 1965. Professor Hanson is a philosopher of science.

The first is about Agent Orange, the herbicide, and the objective known scientific facts about its toxic TCDD/dioxin component and its effects on human health. This is the narrative adopted from soon after the war by the US, Australian and New Zealand governments and their veterans' affairs agencies.

The second is about Agent Orange as a cultural and environmental phenomenon, an evolving global narrative as well as a narrative about veterans of the Vietnam War, and the Vietnamese population. This narrative is a mixture of politics and science of varying quality, used to further the aims of the many parties to the second narrative. In this narrative Vietnam veterans and their families and the Vietnamese population are seen as victims of Agent Orange.

They are contested meanings of Agent Orange giving rise to heated and sometimes vitriolic debate.

And, as I hope we shall see in this ongoing series of papers, causing the protagonists to talk past each other with little or no common ground.

I have written about scientific and legal understandings and misunderstandings in some detail in previous papers.¹⁸ In this paper I cover again most of the ground covered in my paper of 30 March 2018 "*Science – An Easter Story*". However I extend my analysis of the scientific process, and explore how science itself has been a contested arena throughout the whole Agent Orange debate.

Scientists and Science

The root cause of much of the misunderstanding of science is worth re-stating.

Correlation is not Causation

Veterans Affairs New Zealand is required by legislation and regulation to recognise a number of presumptive conditions, listed below. Despite widespread belief, none of them (except perhaps chloracne) have been scientifically and medically proven to have resulted from (or have been caused by) veterans' exposure to a "*toxic environment*". They are all presumptive conditions, based on correlation (or association). They are based on benevolent political decisions and policy, not on science.

Veterans Affairs New Zealand states in its documentation:

"The Institute of Medicine of the US National Academy of Sciences (IOM) has identified that exposure to dioxin or to herbicides used in Viet Nam can lead to long term health effects.

"Chronic Lymphocytic Leukaemia (including hairy-cell leukaemia and other chronic B-Cell leukaemia's), Soft-Tissue Sarcoma, Non-Hodgkin's

¹⁸ Available at <https://putatara.net/agent-orange/>

Lymphoma, Hodgkin's Disease, Chloracne, Porphyria Cutanea Tarda, Multiple Myeloma, Respiratory Cancers (Lung, Bronchus, Larynx, Trachea), Prostate Cancer, Acute and Subacute Peripheral Neuropathy, Type 2 Diabetes, Hypertension, AL-Type Primary Amyloidosis, Parkinson's Disease, Ischaemic Heart Disease, Stroke."¹⁹

All of those currently accepted conditions said to be related to the toxic environment in Vietnam have been established by correlation not causation. They are presumptive conditions based on correlation. And those correlations (or associations) have not been established by research on Vietnam veterans. They are tenuous associations based on research into other populations such as those known to have been occupationally or accidentally exposed.

The Institute of Medicine of the US National Academy of Sciences, the organisation that has identified those associations, has quite clearly stated that it has been unable, after twenty years of monitoring and evaluating global research, to identify any actual exposure of Vietnam veterans to Agent Orange and other defoliants, other than those Operation Ranch Hand personnel who mixed and sprayed the chemicals.

The root cause of misunderstanding about science in general is the root cause of the widespread misunderstanding of the science of Agent Orange; correlation is not causation.

What is Correlation?

In springtime in Europe hares gather in open grassy fields for the annual ritual of courtship and mating. The male hares compete with each other for the favours of the females. Such is the strength of their ardour that when humans venture into the same fields the hares stand their ground.

From time immemorial those human observers noticed that hares were often seen alongside nests of coloured or variegated eggs. Those naïve observers put the two together (correlation) and concluded that hares laid eggs. And so today we celebrate Easter with bunnies, and chocolate eggs wrapped in coloured foil.

We celebrate a tradition based on faulty reasoning about cause and effect, confusing correlation with causation:

*"It is human nature to see correlation and imply causation. The reason that correlation can occur between two things without there necessarily being a causal relationship is explained by something known as a confounding factor – the real, unseen cause of the correlation".*²⁰

¹⁹ NZ Veterans Affairs Form. Viet Nam Veterans Annual Medical Assessment (AMA), Part 2, para 17.

²⁰ Warner, Anthony. *The Angry Chef: Bad Science and the Truth About Healthy Eating* (Kindle Locations 153-155). Oneworld Publications. Kindle Edition. Anthony Warner is a chef with a strong interest in the science of nutrition (and a sense of humour). He has an undergraduate degree in chemistry that obviously informs his views, although he proclaims that he has forgotten all he learnt.

In this case the confounding factor, or alternative explanation, is that at springtime in Europe the lapwing lays its eggs in nests on the ground in those same fields. The lapwing doesn't stand its ground when humans enter its domain, but quietly disappears, leaving its eggs to be observed in the care of hares (or rabbits if you don't know the difference).

Whilst that instance of faulty reasoning about cause and effect may now seem obvious, the modern human mind is still prone to the same error in attributing cause and effect. None more so than in matters of scientific inquiry, and especially so in the Agent Orange debate.

The mind leaps backwards from effect to cause without considering alternative explanations, or confounding factors. In each instance of disease careful scientific or medical diagnosis would explore the myriad of known causes (confounding factors) of the health conditions of Vietnam veterans without leaping immediately to the Agent Orange conclusion. Family history is only one of those myriad factors, and "*unknown causes*" remains one of the main factors in the aetiology or attribution of the causes of disease.

The plural of anecdote is not data

In understanding that correlation does not equal causation we must also understand that even large numbers of positive examples of correlation (anecdotes) do not constitute proof. Anecdotal "evidence" in the absence of any exploration of possible and probable confounding factors is not necessarily evidence.

*"The problem we face is that superstition and belief in magic are millions of years old whereas science, with its methods of controlling for intervening variables to circumvent false positives, is only a few hundred years old. Anecdotal thinking comes naturally, science requires training."*²¹

Uncertainty

The predominant characteristic of scientific knowledge in environmental health is uncertainty.

"The scientific approach is the enemy of certainty" ²²

Toxicology experiments to determine the toxicity of various substances are conducted on laboratory animals and definitively prove cause and effect, based on a measured dose of a specific toxicant, administered either orally or by injection to a specific species of laboratory animal, of a specific gender, age and physical condition. The cause and effect relationship thus determined holds true for those unique conditions.

²¹ Shermer, Michael. *The Believing Brain: From Ghosts and Gods to Politics and Conspiracies---How We Construct Beliefs and Reinforce Them as Truths* (p. 64). Henry Holt and Co.. Kindle Edition

²² Taverne, D., *The March of Unreason: Science, Democracy, and the New Fundamentalism*, Oxford, 2005, p 282.

However the application of the results of those experiments to the human animal is an inexact extrapolation of the laboratory evidence. Given the marked and acknowledged difference in toxic effects from species to species (e.g., between guinea pigs and hamsters, or even between different breeds of mice or rats), and the ethical injunction on human testing, at best the extrapolation of laboratory results in non-human species to the human is an estimate, strongly influenced by the precautionary principle (see later).

Epidemiology is the study and analysis of the distribution and determinants of health and disease conditions in defined populations. It is an inexact science that produces statistical associations that rarely prove cause and effect relationships; cigarette smoking and asbestos inhalation being two notable and rare exceptions. The size of the sample population has a direct effect on the reliability of the statistical association, as does the presence, known and unknown, of confounding factors. Nevertheless the public, including veterans, are wont to interpret epidemiological associations as causation; that is, finite evidence of cause and effect. They are however, correlations.

Genetic and epigenetic science is still in its infancy in relation to environmental hazards and other factors that affect genetic mutation and genetic expression. It is an enormously complex science, almost always simplified and misinterpreted by the media and the public. Genetic science is discovering cause and effect relationships between specific genes, or groups of genes, and specific illnesses or disorders. But epigenetic science is still exploring how the expression or non-expression of those genes might or might not result in the expression of that illness or disorder, and the biological and chemical processes that influence that genetic expression. The presence of a specific gene, group of genes, or genetic mutation does not necessarily result in the expression of the associated illness or disorder.

Cause and effect relationships in genetic and epigenetic science are still uncertain, although in the popular mind cause and effect is settled, once published in the media.

The scientific method and process

The five steps of the *Scientific Golden Rule*, the Scientific Method are:

- (1) Make an observation. Scientists are curious about the world.
- (2) Form a question. After making an interesting observation, the scientific mind determines to find out more about it.
- (3) Form a hypothesis.
- (4) Conduct an experiment.
- (5) Analyse the data and draw a conclusion.

Which is simple to understand, and leads many to believe that the conclusions thus drawn represent a final understanding. But the scientific

process does not stop there, with a conclusion from a single experiment or series of experiments being accepted as definitive evidence. Although the media and the public will often accept the conclusions of a single experiment as evidence.

*“Science does indeed possess a lot of very interesting facts. But at the edges, at the coal face of science, there is always going to be uncertainty and doubt. The interesting parts of science are where the disagreements are, and when there are disagreements, the public is likely to be left confused. We are easily led by a disconsolate media to believe that science is broken. This doubt and ambiguity is likely to leave the instinctive brain unsettled, because if there is one thing it hates it is uncertainty”.*²³

The willingness to be proved wrong, and an expectation that other scientists working in the same field will attempt to prove conclusions wrong, is an essential attitude in the scientific process. Disagreement is a positive sign that the scientific process is working.

It often takes years or decades of research and experimentation and disagreement by the global scientific community (the scientific “hive mind”) to remove or even reduce the uncertainty. In the process there are many thousands of experiments that end up going nowhere. Research is peer reviewed and published in scientific journals. Other scientists will attempt to validate or invalidate the findings by replicating the research, or conducting other research. System reviews, or meta-analyses, are conducted to compare and analyse the results of all of the relevant research, world-wide.

Cognitive psychologist Steven Pinker sums up the scientific process:

*“An endorsement of scientific thinking must first of all be distinguished from any belief that members of the occupational guild called “science” are particularly wise or noble. The culture of science is based on the opposite belief. Its signature practices, including open debate, peer review, and double-blind methods, are designed to circumvent the sins to which scientists, being human, are vulnerable”.*²⁴

“A respect for scientific thinking is, adamantly, not the belief that all current scientific hypotheses are true. Most new ones are not. The lifeblood of science is the cycle of conjecture and refutation: proposing a hypothesis and then seeing whether it survives attempts to falsify it. This

²³ Warner, Anthony. *The Angry Chef: Bad Science and the Truth About Healthy Eating* (Kindle Locations 2437-2440). Oneworld Publications. Kindle Edition.

²⁴ Pinker, Steven. *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress* (p. 390). Penguin Books Ltd, 2018, Kindle Edition.

*point escapes many critics of science, who point to some discredited hypothesis as proof that science cannot be trusted”.*²⁵

In the process the science remains contested and uncertain until eventually a scientific consensus is reached. Or not. In the case of Agent Orange and its effects on Vietnam veterans, their children and grandchildren – not, or at best, not yet.

How environmental and health science is understood is also culturally mediated:

*“How harm is viewed is underwritten by a cultural script that informs communities about its meaning. Perceptions of harm, pain and suffering are mediated through cultural norms. In this respect, twenty-first-century Western societies have a uniquely low threshold for experiencing the anxiety that can emanate from uncertainty”.*²⁶

The public, unable to grasp the reality of incomplete or unsettled evidence, and to deal with uncertainty and ambiguity, will often grasp at a media over-simplification of a single study or group of studies to form or confirm a belief, and to eliminate uncertainty. In the absence of lapwings the public prefers to draw cause and effect conclusions from the statistical association (or correlation) of hares and eggs.

But correlation is not causation. And science is inherently uncertain, the scientific process aiming to reduce if not eliminate that uncertainty.

As Agent Orange claim making began in the 19670s the science of the herbicide and its TCDD/Dioxin contaminant was still in its infancy. The science developed alongside the claim making. In that process the chemical industry certainly did contribute to the uncertainty of the science of Agent Orange, as did government science, and academic science. But even without the involvement of the chemical industry in the debate, the science would have remained contested and uncertain.

The Science Wars

The post-Vietnam era has also been a time when science has come under siege from many quarters. As part of that war the characteristic uncertainty of science has been used as a tool to discredit science.

The disdain for science may be found in surprising quarters: not just among religious fundamentalists and know-nothing politicians, but

²⁵ Pinker, Steven. Enlightenment Now: The Case for Reason, Science, Humanism, and Progress (p. 391). Penguin Books Ltd, 2018, Kindle Edition.

²⁶ Furedi, Frank. What’s Happened To The University?: A sociological exploration of its infantilisation (p. 37). Taylor and Francis. Kindle Edition.

*among many of our most adored intellectuals and in our most august institutions of higher learning.*²⁷

Shawn Otto²⁸ identifies three fronts in the war on science:

- (1) The identity politics (postmodernist) war;
- (2) The ideological (religious) war; and
- (3) The industrial war.

The industrial war on science grew out of the challenges industry faces from science:

*“In order to protect their business models from regulatory disruption, several industries have begun to develop business strategies to coopt or create uncertainties about science that does not support their business models. For ideas on how to do this, they turned to the arguments developed by the postmodernist and religious wars on science, and merged them with new insights from the field of public relations”.*²⁹

This “Science Wars” analysis focuses on identity politics and its role in the Agent Orange debate. The ideological war is essentially religious and has not played any role in the Agent Orange debate.

Science has long had its critics but it was the publication of Thomas Kuhn’s *The Structure of Scientific Revolutions* in 1962 that sparked a fierce and ongoing intellectual battle between the critics and defenders of science. This became known as the *science wars*³⁰. Based largely on Kuhn’s concept of scientific paradigms the debate is essentially about whether or not science is strictly about rational and objective inquiry that provides certainty and assurance (facts), or whether scientific theories are social constructs.

The relevance of the science wars to the AO debate is that they began at the beginning of the Vietnam War and grew in intensity as the disputation about the science of AO grew in intensity. Traditional or *normal* science was being challenged. The postmodernists of academia were at the forefront of the challenge, with a competing epistemology or theory of knowledge.

Postmodernism and Anti-Science

Muslim scholar Ziauddin Sadar describes the postmodern influence:

‘Postmodernism suggests that almost everything that provides meaning and a sense of direction in our lives is meaningless – such as religion,

²⁷ Pinker, Steven. *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress* (p. 387). Penguin Books Ltd. Kindle Edition.

²⁸ Otto S., *The War on Science: Who’s waging it, Why it matters, What we can do about it*, Milkweed, 2016, pp 171-337.

²⁹ Otto, S., 2016, p 258.

³⁰ Sardar, Z., *Thomas Kuhn and the Science Wars*, Postmodern Encounters Series (Ed Appignanesi, R.), Icon Books (UK) and Totem Books (USA), 2000.

history, tradition, reason and science. It also argues that all truth is relative".³¹

Identity politics or postmodern intellectual orthodoxy took hold in the humanities in the universities from the 1980's onwards. The postmodernist perspective holds that science is itself a culturally and socially constructed form of knowledge with no greater validity than other culturally or socially constructed knowledge. The postmodernist might claim that the competing constructions of knowledge have equal validity, or perhaps that the understandings of the public have greater validity than those of the scientists.

Edwin Martini comments on how postmodernism has influenced that debate in relation to Agent Orange:

"Closely related to the rise of environmentalist thinking during the lifespan of Agent Orange is the growing contestation of a modern mindset grounded in scientific rationalism. The Enlightenment ideas that are the philosophical foundation of modernity presumed that the natural world is ruled by universal laws that can be known with certainty through rational thought and scientific inquiry. Over the course of the twentieth century such authority was impugned on several fronts, including science itself, as relativity theory and quantum mechanics affirmed the role of contingency and uncertainty in nature. During the second half of the century postmodern thinkers expanded on the implications of this shift, affirming the role of uncertainty, the importance of experience, and the value of alternative epistemologies in the search for truth. The ascendancy of postmodernism lay in the growing resistance to experts who based their professions of authority largely on their privileged access to various forms of sanctioned scientific and historical knowledge. This repudiation often came from everyday citizens, who offered their own experiences, including their bodily trauma, to problematize experts' assumptions, findings, and recommendations. In the wake of a series of epidemiological investigations that found no clear link between exposure to Agent Orange and types of cancer and birth defects, for instance, citizens in communities affected by the agent have practiced a popular or populist epidemiology that combines anecdotal evidence with existing scientific studies and information gathered from official, state-based sources".³²

Ziauddin Sardar writes that an important force of transition in postmodernism is a belief in the social construction of reality.³³

³¹ Sardar, Ziauddin. *Islam Beyond the Violent Jihadis: An Optimistic Muslim Speaks (Provocations)* (Kindle Locations 126-127). Biteback Publishing. Kindle Edition.

³² Martini, Edwin A. "Agent Orange: History, Science, and the Politics of Uncertainty (Culture, Politics, and the Cold War)" (Kindle Locations 368-379). University of Massachusetts Press. Kindle Edition.

³³ Sardar, Z., *Postmodernism and the Other: The New Imperialism of Western Culture*, Pluto Press, 1998, p 23.

The theory of the social construction of knowledge has many influential adherents:

*“Hungarian born Karl Mannheim co-founded the sociology of knowledge, which looks at the processes involved in “knowing” the world. He claimed that we “see” the world through the lenses of our culture and ideologies, and as a function of our position in society; “truth” is relative and depends on subject-positions”.*³⁴

*“Born in Austria, Peter Ludwig Berger is best known for his idea that “reality” is constructed through a kind of social consensus, as explained in his book, The Social Construction of Reality (1966), written with Thomas Luckmann”.*³⁵

*“The disagreement is between the claim that scientific knowledge is based on – and caused by – evidence, logic, rational inference, and the claim that it is based on and caused by social factors, interests, agendas (which are largely hidden or unacknowledged)”.*³⁶

Interests and agendas are blamed for much of the science with which Agent Orange claim makers disagree.

The Media

That postmodern perception of scientific knowledge has influenced much media reporting and public debate.

*“As newspapers were grappling with obsolescence, yellow journalism had already spread from AM talk radio shows into TV with the advent of cable news. This trifecta – talk radio, the Internet, and cable news – combined to devalue the factual reporting that once kept society balanced, supplanting it with the opinion wars of the new media. Having trained at postmodernist universities, many emerging leaders in journalism didn’t recognize this as a problem. It wasn’t their role to discern the reality of things, they believed. Truth was subjective, a matter of one’s perspective.”*³⁷

That development has resulted in a lack of real investigative journalism and a great deal of the uncritical acceptance of the Agent Orange Narrative by the media. It has heavily influenced public perceptions, including the perceptions of Vietnam veterans.

³⁴ Beeden, Alexandra. The Sociology Book (Big Ideas) (Kindle Locations 6625-6627). Dorling Kindersley Ltd. Kindle Edition.

³⁵ Beeden, Alexandra. The Sociology Book (Big Ideas) (Kindle Locations 6702-6704). Dorling Kindersley Ltd. Kindle Edition.

³⁶ Benson, O., Stangroom, J., Why Truth Matters, Continuum, 2006, p 65.

³⁷ Otto, S., The War on Science: Who’s waging it, Why it matters, What we can do about it, Milkweed, 2016, p 155.

From “Normal” to “Post Normal” Science

Although the postmodernists seek to use uncertainty to discredit science and the scientific endeavour, uncertainty is still a hallmark of the scientific search for objective meaning. Post normal science seeks to validate uncertainty within the scientific endeavour.

Thomas Kuhn (1962) described ‘normal science’ as the existing orthodoxy to which he famously gave the name ‘paradigm’.

*“In this essay, ‘normal science’ means research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice. Today such achievements are recounted, though seldom in their original form, by science textbooks, elementary and advanced. These textbooks expound the body of accepted theory, illustrate many or all of its successful applications, and compare these applications with exemplary observations and experiments”.*³⁸

According to Kuhn, scientists cling to the existing accepted paradigm (normal science) long after it ceases to be relevant, until eventually it is displaced by a new paradigm that revolutionises scientific thinking. And the new paradigm, by its inevitable incomplete understanding, contains the seeds of its own demise, replaced by the next paradigm.

*“To be accepted as a paradigm, a theory must seem better than its competitors, but it need not, and in fact never does, explain all the facts with which it can be confronted”.*³⁹

Nutritional scientist T. Colin Campbell also describes normal science:

*“Normal science means anything that doesn’t challenge the prevailing paradigm— the agreed-upon story of how the world is. “Normal” doesn’t mean “good” or “better” in any way; it just means that the researcher has refrained from asking questions whose answers are considered already known and no longer subject to debate”.*⁴⁰

Using Kuhn’s description of ‘normal science’ as the inner core of scientific endeavour, the concept of ‘post normal science’ was developed in the 1990’s by Silvio Funtowicz and Jerome R. Ravetz as a scientific approach

³⁸ Kuhn, Thomas S.. The Structure of Scientific Revolutions: 50th Anniversary Edition (p. 10). University of Chicago Press. Kindle Edition.

³⁹ Kuhn, Thomas S.. The Structure of Scientific Revolutions: 50th Anniversary Edition (p. 18). University of Chicago Press. Kindle Edition.

⁴⁰ Campbell, T. Colin. Whole: Rethinking the Science of Nutrition (p. 27). BenBella Books, Inc.. Kindle Edition.

for situations outside the ring of certainty, where “*facts are uncertain, values in dispute, stakes high and decisions urgent.*”⁴¹

*“Indeed, if our safety, health and environment issues were so much in flux that ‘applied science’ were ineffective most of the time, then we would be in a very bad way indeed. So far at least, we have not done too bad a job of maintaining the routine work of monitoring, inspecting and regulating the various systems on which our civilization depends. But we know that in many critical cases, especially our major environmental problems, that straightforward ‘applied science’ is not effective. What next?”*⁴²

Science in the post-normal era is often uncertain. That is so in climate science and environmental science. It is so in the aetiology⁴³ of disease, and in many other scientific areas. Normal science is still valuable in providing facts where facts are amenable to discovery, but in the post normal scientific era uncertainty is the new normal.

*“Post-normal science reminds us that there are hosts of urgent policy problems involving science, for which routine expertise is totally inadequate, and for which even the best professional knowledge and judgment are insufficient”.*⁴⁴

Yet the Agent Orange claim makers persisted in their quest to scientifically and medically “prove” their claims.

Uncertainty Revisited

Where routine expertise is inadequate, the science is often contested, and remains uncertain. Uncertainty has been the hallmark of Agent Orange toxicology, epidemiology, and genetics from the 1960’s to the present.

Vietnam veterans were raised in an era when the concept of ‘*normal science*’ held sway. They had been groomed by school and society to expect science to provide certainty. They did not accept uncertainty, and campaigned against it, sometimes accusing scientists and policy makers of denial, cover up and fraud.

“Along with ‘objectivity’ the other great falling idol of contemporary science is ‘certainty’. This is an even steeper descent, for certainty has been the hallmark of genuine science, for teachers and for propagandists, for a very long time indeed. And of course there is a large core of science whose certainty is not in doubt, at least not in the short run. But when we

⁴¹ Ravetz, Jerome. The No-Nonsense Guide to Science (No-Nonsense Guides) (Kindle Location 259). New Internationalist. Kindle Edition.

⁴² Ravetz, Jerome. The No-Nonsense Guide to Science (No-Nonsense Guides) (Kindle Locations 1037-1040). New Internationalist. Kindle Edition.

⁴³ Cause, origin; specifically : the cause of a disease or abnormal condition.

⁴⁴ Ravetz, Jerome. The No-Nonsense Guide to Science (No-Nonsense Guides) (Kindle Locations 1061-1063). New Internationalist. Kindle Edition.

leave the realm of that ‘normal’ science and go out to where the real challenges are, then we find that certainty has been left far behind. The traditional teaching and propaganda of science have given us very little preparation for this new state of affairs; and so it is vitally important for us to get clarity about it”.⁴⁵

Scientific uncertainty often presents policy makers with a dilemma:

“When we come to policy-related research, the choice of burden of proof can be crucial; and this is a prior policy, or political, decision. If there is evidence of harm, but not quite of sufficient strength to pass the stringent tests of significance that are appropriate for lab science, do we count it as a ‘fact’ worth publishing? If we reject it, it is forever buried in someone’s lab notes. In that case, the relevant expert community, and the general public, remain in ignorance; the warning is lost from view. Of course, if all ambiguous evidence of harm is published, then the public might be unduly alarmed. This is a very familiar situation in medical research on diseases, drugs and treatments. There is no easy answer. But it is clear that the choice of burden of proof for policy-relevant research can reflect the balance of the relevant policy interests”.⁴⁶

Issues concerning the burden of proof were explored in the 22 April 2018 paper, “*Agent Orange and the Law*”.⁴⁷ Policy makers are often required to make policy in the absence of scientific certainty. In veterans’ affairs presumption has long been the policy device to overcome the uncertainty and to give the benefit of the doubt to the veteran claimant.

Scientists are People

Lord Bertrand Russell advised that in evaluating science we would do well to remember that scientists are not infallible; they are people, with the same evolutionary inherited habits of mind as the rest of us:

“When the man of science is dealing with technical matters that do not touch upon the prejudices which he shares with the average man, he is more likely to be right than anyone else. But unfortunately very few men of science are able to retain their impartiality when they come to matters about which they feel strongly”.⁴⁸

And again he advised:

⁴⁵ Ravetz, Jerome. *The No-Nonsense Guide to Science (No-Nonsense Guides)* (Kindle Locations 1138-1143). New Internationalist. Kindle Edition.

⁴⁶ Ravetz, Jerome. *The No-Nonsense Guide to Science (No-Nonsense Guides)* (Kindle Locations 1506-1512). New Internationalist. Kindle Edition.

⁴⁷ Available at <https://putatara.net/agent-orange/>

⁴⁸ Russell, B., *Are Men of Science Scientific*, 24 February 1932, in *Mortals and Others* (Routledge Classics) (Kindle Locations 1117-1119). Taylor and Francis. Kindle Edition.

“The general public cannot tell which among scientists is to be trusted and will therefore be wise to be very sceptical whenever they hear a man of science giving a confident opinion about a matter on which he has strong prejudices. Men of science are not supermen and are as liable to error as the rest of us”.⁴⁹

Confronted by the inability of science to reach consensus, by competing scientific beliefs, and the resultant scientific uncertainty, the layman, whether policy maker or public, would be well advised to consider adopting the advice given by Russell in the introduction to his *Sceptical Essays* (1928):

“The scepticism that I advocate amounts only to this: (1) that when the experts are agreed, the opposite opinion cannot be held to be certain; (2) that when they are not agreed, no opinion can be regarded as certain by a non-expert; and (3) that when they all hold that no sufficient grounds for a positive opinion exist, the ordinary man would do well to suspend his judgment”.⁵⁰

But that is not how the human mind normally works.

Understanding Science

This has been a fairly lengthy examination of the nature of science. The epistemological distance between the scientist, the policy maker and the public, and the resultant misunderstanding, is a central feature of the Agent Orange debate. A clear understanding of the scientist, and the scientific method and process, is essential if the intricacies of the debate are to be unravelled and understood.

To be informed about these issues, ideally policy makers and the public should better understand science. And scientists need to understand policy making.

Sir Peter Gluckman on Science and Policy in New Zealand

New Zealand’s Chief Scientific Advisor, Professor Sir Peter Gluckman, has made some interesting and apposite observations about the role of science in policy making:

“... scientists think that they know a lot, and therefore when they recommend something government must act on it. The reality is scientists may know a lot but there’s a lot they don’t know, and their input into the policy process may be limited. We live in a democracy, and there’s more than logic that enters into political decision making. Most areas that cause contention are where science is not complete and there are considerable values involved and the values are really what’s in

⁴⁹ Russell, B., *Mortals and Others* (Routledge Classics) (Kindle Locations 1136-1139). Taylor and Francis. Kindle Edition.

⁵⁰ Russell, B., *Sceptical Essays*, Allen & Unwin, 1928. Routledge Classics Edition, 2004, p 2.

dispute, and the attacks on science are a proxy for the value discussion.”⁵¹

He might well have been referring to the Agent Orange debate in New Zealand over the last nearly forty years. We have been debating the science instead of getting to the nub of the matter.

Policy Makers

General

Policy makers would like the scientists to provide certainty, black and white answers, to enable evidence based policy, if that is what they are aiming for. That is not often forthcoming. Policy makers will then sometimes selectively choose the “evidence” upon which they base their evidence based policy.

Conversely they may be motivated by moral or political belief or ideology, by their values, or a desire to placate the public, and those motivations are sometimes at odds with the science.

Evidence is not necessarily, some would say not often, the basis of policy. The roots of public policy are many and convoluted. In contested policy making the scientists press their understanding of the issue whereas claim makers promote their narrative as the primary policy narrative. That was so in New Zealand for decades.

Risk Management in Policy

In risk management and environmental health policy makers, in concert with the environmental lobby, have developed and adopted the *precautionary principle*⁵² by which they set a very low safety level for exposure to environmental toxins.

Social scientist Dame Glynis Breakwell has written extensively about the psychology of risk:

*“The precautionary principle essentially proposes that if it is suspected that it is plausible that an action or policy may cause harm, even in the absence of scientific consensus that it is harmful, then it should not be undertaken”.*⁵³

Philosopher of science Jerome Ravetz analyses science from a social and ethical perspective:

“The Precautionary Principle advocates measures to anticipate, prevent or minimize adverse effects of scientific progress where there are threats

⁵¹ Gluckman, P., quoted in Otto, S., *The War on Science: Who’s waging it, Why it matters, What can we do about it*, Milkweed, 2016, p 389.

⁵² Taverne, D., *The March of Unreason: Science, Democracy and the New Fundamentalism*, Oxford, 2005, pp 168-191.

⁵³ Breakwell, G., *The Psychology of Risk*, Cambridge University Press. Kindle Edition, 2007, 2009, 2014. Kindle Locations 386-387.

*of serious or irreversible damage. Lack of full scientific certainty should not be used as a reason for postponing such measures”.*⁵⁴

The estimated safe level set for environmental toxins can be as much as 1000% below an estimated safety level indicated by scientific research. Government environmental protection agencies set their policy according to the precautionary principle, not always according to the scientific test of cause and effect, or even to correlation.

The opposing view is that there are levels of environmental exposure (thresholds) below which there is no threat to human health.

*“Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy”*⁵⁵.

That gulf too is deep and wide. Serial iconoclast Michael Fumento⁵⁶ presents an alternative to the precautionary principle in seven tenets:

Tenet 1: Everything is a gamble, and everyone is a gambler. We face and live with multiple risks in our everyday lives.

Tenet 2: Many gambles involve the possibility of death. Like driving, or overeating. Or combat.

Tenet 3: Something is going to kill you. The chance of dying is 100%. There is no cure for death.

Tenet 4: Anything can kill you. The causes of death are limitless.

Tenet 5: Practically nothing is guaranteed to kill you.

Tenet 6: The chance of injury is high but dropping. The chance of illness is high but dropping.

Tenet 7: People affect their own odds. People can avoid or take unnecessary risks. For instance smoking, drinking and overeating increases the odds of early death. And combat.

The risk of cancer is an example of how we over-estimate some risk and ignore other risk.

The approximate causes of cancer death are tobacco (33%), diet including obesity and inactivity (30%), infections (18%), reproductive factors and hormones (7%), ionising radiation (6%), heredity (5%), occupation (3%), alcohol (3%), UV light (1%), pollution (<1%), medicine (<1%), industrial products (<1%), food additives (<1%)⁵⁷.

⁵⁴ Ravetz, Jerome. The No-Nonsense Guide to Science (No-Nonsense Guides) New Internationalist. Kindle Edition, Kindle Locations 152-154.

⁵⁵ Paracelsus (1493-1541), the father of toxicology.

⁵⁶ Fumento, M., Science Under Siege: How the Environmental Misinformation Campaign is Affecting Our Laws, Taxes, and Our Daily Life, Quill, 1993, 256-273.

⁵⁷ Omenn, G., Preventable Causes of Cancers: Revisiting the 1981 Doll and Peto Report (PowerPoint), University of Michigan School of Public Health. 20 July 2011. Accessed at:

<https://encrypted.google.com/#q=Omenn+Preventable+causes+of+cancers+revisiting+the+doll+and+peto+report>

That analysis was first conducted in 1981 by Professors Doll and Peto ⁵⁸. It was widely disputed at the time by both the environmental and Agent Orange lobbies because it tended to disprove or cast doubt on some of the claims about the cause and effect relationships between Agent Orange and other pollutants, and multiple cancers. However the 2011 Omenn research quoted above amalgamates the results of six subsequent studies that confirm the general 1981 estimates of Doll and Peto (1989, 1991, 1996, 1997, 2000, 2013).

A 2015 paper from Vanderbilt University⁵⁹ states that 35 years after the Doll and Peto research their findings hold generally true.

Omenn observed that obesity and inactivity was a growing problem. A recent (2017) paper has even suggested that obesity now rivals smoking as one of the leading preventable causes of cancer. ⁶⁰

There is a different view of course, well represented by journalist and eco-social activist Robert Allen, based in Ireland, and who has written extensively about Agent Orange: ⁶¹

*“This is why the story of dioxin is a cautionary tale. It is a clue to the reason why we are all suffering from a range of cancers and a multitude of illnesses. Four out of five cancers in the western world are caused by environmental factors – by pollutants we put into our bodies”.*⁶²

And in 1974 at a press conference the American Cancer Society announced that 94% of all human cancers were environmentally caused.⁶³

Once again there is a wide gulf between the different understandings of risk.

We tend to ignore the everyday risks in our lives (like smoking, drinking, eating and driving) that pose a measurable risk of causing illness, injury or death. We tend to magnify the risks that pose the least threat of illness, injury or death (like environmental toxins and air travel, or in this day and age, terrorism).

The psychology and policy of risk, and the safe environmental exposure levels set according to the precautionary principle, are often misunderstood by policy makers, by the media and public, and confused with scientific certainty of cause and effect.

⁵⁸ Doll, R., Peto, R., The causes of cancer quantitative estimates of avoidable risks of cancers in the United States today, *Journal of the National Cancer Institute*, 1981, 66(6):1.191-1.308).

⁵⁹ Blot. W., & Tarone, R., Doll and Peto’s Quantitative Estimates of Cancer Risks: Holding Generally True for 35 Years, *JNCI J Natl Cancer Inst* (2015) 107(4): djv044. Available at: <https://academic.oup.com/jnci/article/107/4/djv044/894954>

⁶⁰ Sceneay, J., McAllister, S., The skinny on obesity and cancer, in *Nature Cell Biology*, 28 July 2017, 19(8): 887-888.

⁶¹ <http://www.bluegreeneearth.com/>

⁶² Allen, R., *The Dioxin War: Truth and Lies About a Perfect Poison*, Pluto, 2004, p xvii.

⁶³ Burkett, B., Whitley, G., *Stolen Valour, How the Vietnam Generation Was Robbed of its Heroes and its History*, Verity Press, 1998, p 528.

Policy makers are then often required to make difficult decisions:

*“... the difficulty faced by regulators who must make judgments on the basis of incomplete scientific knowledge on the one hand and public fear on the other”.*⁶⁴

And in the case of toxic chemicals the information needed to make evidence based decisions is elusive:

*“When toxic chemicals are at issue, a regulatory agency has few options beyond extrapolating animal data to humans. Yet health effects on humans are rarely proved in the case of environmental chemicals to which the public is variably exposed at subacute levels that can only be estimated (and then only in the crudest approximation)”.*⁶⁵

The policy maker is often trapped between the uncertainty of the science and the certainty of public perception.

Publics

The public is concerned about social, economic, health and environmental problems that affect or may affect them and their families personally. In the resolution or remediation of those problems the public seeks certainty and concrete solutions from both scientists and policy makers, and is confused and sometimes angered by uncertainty and ambiguity, and resultant inaction. The concerns or problems may be based in reality, or on mere belief. In either case they are real social problems.

The public's understanding of the science is formed by the media including social media, by lobby groups, and by activists. It is rarely a reflection of the actual science. Popular science values certainty and newsworthiness, and does not often reflect the characteristic uncertainty of science. Ambiguity is not news.

After hundreds of thousands of years of evolution the human mind is wired to look for and perceive cause and effect relationships in the everyday world.

“Causal reasoning is the basis of human cognition; it's in large part what the mind does. Yet not all aspects of it are equally easy. We reason both forward and backward. Forward reasoning is thinking about how causes produce effects. We use it to predict the future, how events today will cause events tomorrow..... Reasoning backward is reasoning from effects to causes. Doctors do it to diagnose the cause of symptoms and mechanics do it to diagnose what's wrong with your car. Backward causal reasoning generally involves explanation, figuring out how something that happened came about. It's easier for us to reason

⁶⁴ Tschirley, F., Dioxin, Scientific American, Vol 245, No 2, February 1986, p 29.

⁶⁵ Ibid, p 34.

forward— from cause to effect— than diagnostically from effect to cause”.⁶⁶

Almost all of the anecdotal evidence produced to validate the Agent Orange claim reasons from the widely held assumption of exposure of sufficient dose (dose-response) over sufficient time (time-exposure) to cause health effects, forwards to the disease, disorder, defect, disability or death. Reasoning backwards, or diagnostically, would indicate a multitude of other possible causes from which the diagnostician would seek to extract probable causes. As is often the case however, under diagnosis the cause may elude detection, and remain unknown.

“People ignore alternative causes [confounding factors] when reasoning from cause to effect because their mental simulations have no room for them, and because we’re unable to run mental simulations backward in time from effect to cause”.⁶⁷

The human mind is perplexed or confused when confronted by uncertainty and ambiguity. The mind will usually grasp for an explanation rather than suspend judgement and live with the uncertainty. Our brains sideline or suppress the ambiguity and uncertainty of the real world and create coherent interpretations where they don’t exist.

Nobel Prize recipient Daniel Kahneman and his collaborator the late Amos Tversky discovered systematic human cognitive bias and handling of risk.

“Ambiguity tends to be suppressed”

“Clearly we're equipped, and that is something that we have inherited, we're equipped for the perception of causality. It neglects ambiguity and suppresses doubt and, as mentioned, exaggerates coherence”.

“We see the world as much more coherent than it is.”⁶⁸

In ancient times mythology provided that coherence and certainty, eventually replaced by religion serving the same purpose. In the scientific era we live with uncertainty and ambiguity, confronted by the reality of uncertainty that was always there in the natural world, but we still long to create coherence, and do create it, where it doesn’t exist.

The Agent Orange narrative provides coherence and certainty.

The building of the Agent Orange Narrative, its promotion by claim makers, and widespread acceptance by the public including the media and

⁶⁶ Sloman, Steven; TBC. *The Knowledge Illusion (Expert Thinking)* (Kindle Locations 820-829). Pan Macmillan UK. Kindle Edition.

⁶⁷ Sloman, Steven; TBC. *The Knowledge Illusion (Expert Thinking)* (Kindle Locations 867-868). Pan Macmillan UK. Kindle Edition.

⁶⁸ Kahneman, D., *The Marvels and the Flaws of Intuitive Thinking*, Edge Master Class 2011, 9 December 2011. <https://www.edge.org/conversation/the-marvels-and-flaws-of-intuitive-thinking>

Vietnam veterans, had a life of its own alongside and in opposition to the scientific consensus. And it was built and given coherence by ignoring the difference between causation and correlation, the root cause of much of the misunderstanding of science.

Understanding the Legal Issues

As mentioned ad infinitum the misunderstanding of the scientific process and the science of Agent Orange is one of the main causes of the gulf between understandings in the Agent Orange debate. A lack of knowledge of the legal issues is the other.

The differing legal burdens of proof are so central to understanding the evolution of the Agent Orange Narrative that they have been explored in three of my previous papers, all available online⁶⁹:

- 24 March 2018 – Science, Law and Presumption;
- 22 April 2018 – Agent Orange and the Law; and
- 29 April 2018 – Agent Orange and Presumption.

In order to accommodate the very real concerns of war veterans, in the absence of scientific proof the legal concept of presumption has been implemented in veterans' legislation and regulation to give the benefit of the doubt to the war veteran. It accommodates scientific and medical uncertainty and does away with the need for evidence of causation.

It is a simple concept not widely recognised, that has been present in New Zealand war veterans' law for several decades. A lack of knowledge about presumption has been behind much of the misunderstanding in the Agent Orange debate.

Summary

This paper, like the preceding papers in this series, is extracted and adapted from a much broader ongoing research project. It explores the underlying sociological and epistemological framework the research study is built upon. That revolves around the different knowledge and understandings (epistemology) of the various participants, broadly described in sociological terms as the public (including veterans and their claim makers), policy makers and scientists.

I have also briefly described some of the factors affecting policy making, specifically the employment of the precautionary principle, and the public perception of risk.

The main areas in which there are different understandings affecting the Agent Orange debate are in science and law. Those two areas have been explored in previous papers. Scientific misunderstanding is explored in greater detail in the body of this paper.

⁶⁹ At <https://putatara.net/agent-orange/>

Understanding the misunderstanding between these three broadly defined groups (scientists, policy makers and public) is the key, I think, to unravelling the complexity and chaos of the Agent Orange debate. The problem however with introducing complexity and nuance into the study is that most of the participants view things through a single lens, often in black and white terms. I think we need to adopt a broader view.

When we recognise and understand the misunderstanding we see why the different participants have been talking past each other for decades. And are still.