HOUSE OF COMMONS
CHAMBRE DES COMMUNES
CANADA

DEPLETED URANIUM AND CANADIAN VETERANS

Report of the Standing Committee on Veterans Affairs

Greg Kerr
Chair

JUNE 2013

41st PARLIAMENT, FIRST SESSION

DEPLETED URANIUM AND CANADIAN VETERANS

Report of the Standing Committee on Veterans Affairs

Greg Kerr
Chair

JUNE 2013

41st PARLIAMENT, FIRST SESSION

STANDING COMMITTEE ON VETERANS AFFAIRS

CHAIR

Greg Kerr

VICE-CHAIRS

Sean Casey
Peter Stoffer

MEMBERS

Eve Adams
Sylvain Chicoine
Bryan Hayes
Wladyslaw Lizon
Ben Lobb
Irene Mathyssen
Erin O'Toole
Manon Perreault
Bob Zimmer

OTHER MEMBERS OF PARLIAMENT WHO PARTICIPATED

Carol Hughes
Elizabeth May
Ted Opitz
Annick Papillon
Terence Young

CLERK OF THE COMMITTEE

Cynara Corbin

LIBRARY OF PARLIAMENT

Parliamentary Information and Research Service

Jean-Rodrigue Paré

THE STANDING COMMITTEE ON VETERANS AFFAIRS

has the honour to present its

ELEVENTH REPORT

Pursuant to its mandate under Standing Order 108(2) and the motion adopted by the Committee on Tuesday, February 5, 2013, the Committee has studied depleted uranium and Canadian veterans and has agreed to report the following:

TABLE OF CONTENTS

DEPLETED URANIUM AND CANADIAN VETERANS

Introduction

First used by the military in certain munitions and armoured vehicles during the first Gulf War in 1990–1991 and subsequently in the Balkans conflicts, depleted uranium (DU) has been a source of considerable debate within the scientific community and among veterans. All of the countries involved in these conflicts have had to address the concerns expressed by their veterans regarding the possible health consequences of DU exposure. The onset of symptoms with mysterious causes — termed “Gulf War Syndrome” — has often been attributed to DU.

In Canada, this issue came to the forefront at the end of the 1990s, but various studies subsequently refuted the existence of a link between DU and certain medical conditions afflicting veterans. The debate thus subsided, only to resurface in 2010 when a military veteran named Pascal Lacoste stated that he had received several medical diagnoses of DU poisoning. Mr. Lacoste went on a hunger strike in the fall of 2011 in an effort to have the authenticity of this diagnosis recognized by Veterans Affairs Canada. He relented when the Honourable Steven Blaney, Minister of Veterans Affairs, promised to have an independent scientific committee study the issue more extensively and produce recommendations for the Minister. The Scientific Advisory Committee on Veterans’ Health (SACVH) was thus created, and its report — confirming the validity of the previous scientific studies — was made public in February 2013.

In order to study the report of the SACVH more closely, the House of Commons Standing Committee on Veterans Affairs (the Committee) asked a number of scientists and veterans to testify on their reactions to the findings contained in the report.

The scientists who appeared as witnesses before the Committee all supported the report’s conclusions that it was unlikely that the medical conditions afflicting a number of veterans had been caused by DU exposure. They told the Committee that research in this area was now conclusive enough that it would be more constructive for veterans to have scientists look elsewhere for the causes of certain poorly understood medical conditions, and for the medical community to offer treatment adapted to the needs of veterans, regardless of whether the causes of their conditions were known or not.

For their part, several veterans who appeared as witnesses criticized the report for not being exhaustive and argued that calling something improbable does not necessarily mean it is impossible. Consequently, they were of the opinion that the benefit of the doubt should prevail and that DU exposure should at the very least be considered a possible cause of certain medical conditions, so as to support new research that might demonstrate this to be true.

Faced with these two intractable positions, the members of the Committee sought to establish clearly the principles upon which this conflicting testimony should be assessed.

The first of these principles is that the members of the Committee agreed to be predisposed in favour of veterans. With respect to DU, this meant that statements made by veterans were to be taken seriously, even though they might appear at first glance to be contradicted by scientific evidence. That is why the Committee members, with the support of research staff, carefully analyzed all of the documents that were submitted to the Committee, actively searching for any and all elements that might support veterans' contentions.

The second principle is that public policy must be founded on scientific evidence whenever such evidence is available. The members of the Committee have a responsibility to ensure that any recommendations made to the government by the Committee are supported by a conclusive body of evidence, regardless of whether this information represents a predominant line of research. Accordingly, the Committee relied upon recognized criteria as to what precisely constitutes "scientific" research:

- The methodology, raw data and results are subjected to anonymous peer review prior to publication in a recognized scientific journal with an editorial review board;

- The research results can be replicated independently by other researchers.

In the case of DU, the available research meeting these criteria is nearly unanimous in its support of the findings of the SACVH. Calling those findings into question would have at least required a significant minority of studies of similar calibre which, for whatever reason, were not as well-known as those forming the predominant line of research. Some witnesses stated that such research did in fact exist, but had not been included in the SACVH report. We examined carefully those other studies and were forced to conclude, with regret, that they did not live up to the same standards of scientific validity. Our first recommendation, therefore, is that research efforts, instead of focusing on DU, should, in the future, concentrate on the treatment of medical conditions that have complex or poorly understood causes, but that are in all likelihood attributable to military service.

The third principle is that veterans are entitled to the best possible care for the treatment of any condition that may be related to their military service, and that they have every right to expect recognition and the highest standards of service from any institution under the authority of an act of the Parliament of Canada. The Committee heard testimony from some veterans clearly indicating that challenges remain to be overcome in this regard. The statutes governing Canada's support for its veterans are intended to be generous and respectful of the profound dignity of their commitment. Regardless of whether a medical condition is related to DU, or even whether it is related to military service, every effort should be made to ensure that challenging a decision concerning access to medical services or financial benefits does not become an ordeal for veterans and their family members.

***

This report is divided into four sections. The first traces the origins of the DU debate, which led to the establishment of the Scientific Advisory Committee on Veterans' Health (SACVH); the second describes the contents and principal findings of the report produced by the SACVH; the third discusses criticism of the SACVH report, according to the type of document upon which such criticism is based; and the fourth discusses the criticism levelled at Veterans Affairs Canada and the Veterans Review and Appeal Board for their handling of files in which a connection to DU was invoked.

Our general conclusion is this: despite repeated attempts to do so over the past 20 years in high-quality studies, science has not established any clear link between the exposure of military personnel to DU and the medical conditions from which they now suffer. However, this does not mean that these medical issues are not otherwise related to the overall conditions to which these individuals were exposed during military service. We therefore recommend that, in cases where the causes of a condition afflicting a veteran are complex, not readily identifiable or patently unknown, it should be possible to presume with greater flexibility that a connection exists between that condition and the veteran's military service so as to avoid confrontations that do no justice to the sacrifice made by veterans or to Canadians' desire to treat veterans with the respect they deserve.

1. Origins of the Depleted Uranium Debate

Uranium is a heavy metal that exists naturally in the environment and is very weakly radioactive: "[on] average … there are four tonnes of natural uranium in one square mile of soil one foot deep."[1] To produce nuclear energy or nuclear weapons, uranium must be enriched. Specifically, the metal must be processed by increasing the concentration of its radioactive components and rejecting the less radioactive components. The rejected components are what make up depleted uranium. Because it is very dense, DU can be used to make armoured vehicles or extremely hard munitions. For example, when the tip of a round made of DU penetrates armour, rather than blunting, it will tend to sharpen, like a wooden pencil in a pencil sharpener, and at the same time produce high-intensity flames.

The Gulf War was the first conflict in which DU munitions were used. The allied forces expended about 320 tonnes of DU munitions.[2] DU munitions were then used in Bosnia in 1994–1995 and in Kosovo in 1999.[3]

During the Gulf War, about 4,600 members of the Canadian Forces were deployed in the region, half of them on the periphery of the battlefield during the combat operations that were conducted in the week of 23–28 February 1991. According to Ken Scott, former Director of Medical Policy at the Department of National Defence: "The closest Canadian

1 Ken Scott, Director, Medical Policy, Department of National Defence, *Evidence*, 22 March 2001, 1535.

2 Ibid.

3 Ibid.

unit to the fighting during the Gulf War was Canadian Field Hospital 1, 80 kilometres from the battlefields."[4]

When they returned, numerous Canadian soldiers, like those from the other allied countries, suffered from multisymptom health problems known as "Gulf War Syndrome". The condition is now referred to as "chronic multisymptom illness" (CMI) and is defined by the unexplained presence, for at least six months, of one of the following symptoms: chronic fatigue, mood and cognition disorders (depression, difficulty sleeping, difficulty concentrating, memory loss, anxiety) and musculoskeletal problems (joint and muscle pain). Other symptoms, such as gastrointestinal problems, may also be present.[5] Unlike post-traumatic stress syndrome, for which the diagnosis is more clearly defined, the symptoms associated with chronic multisymptom illness can vary widely.[6]

In 1993, the Gulf War Veterans Association of Canada was created to assist veterans of that conflict who are experiencing health problems. The Department of National Defence itself established a Gulf War clinic in 1995.[7] The clinic was closed in 1997, when it was observed that the health problems experienced by those veterans were similar to those experienced by veterans of numerous other peacekeeping missions, and in its place a network of "post-deployment" clinics was developed to treat the specific problems experienced by soldiers and veterans who have taken part in those missions.[8] A higher prevalence of this group of symptoms can apparently be found in most populations of soldiers who have taken part in operations. For example:

> […] chronic fatigue syndrome was originally described in 1750, when it was called febricula. Virtually all the literature on chronic fatigue syndrome until the mid-1940s is in the military medical literature. It is describing people who have returned from conflicts. At a presentation I was in two months ago there was a beautiful description of veterans returning from the Boer War and the Crimean War with these identical types of symptoms.[9]

Soldiers returning from the Gulf War who suffered symptoms similar to CMI suspected that the use of depleted uranium munitions was a possible cause. The United States Army also closely monitored the possible consequences among the people who were most at risk of high exposure.[10] DU was therefore included as one of seven risk sources in the first large-scale epidemiological study done to identify the potential causes

---

4 Ibid.

5 Institute of Medicine, *Gulf War and Health: Volume 9: Treatment for Chronic Multisymptom Illness*, January 2013, pp. 21-22.

6 Ibid., p. 11.

7 Ken Scott, *Evidence*, 22 March 2001, 1530.

8 Ibid., 1535.

9 Ibid., 1655.

10 U.S. Army Environmental Policy Institute, *Health and Environmental Consequences of Depleted Uranium Use in the U.S. Army: Technical Report*, June 1995.

of Gulf War Syndrome.[11] A similar study done in 1998 involving Canadian Gulf War veterans confirmed the increased prevalence of symptoms of CMI, but did not focus specifically on DU.[12]

In 2000, the Department of National Defence offered to test all Canadian members of the military and veterans who were interested in determining the level of depleted uranium in their urine. That led to the publication of a study in 2002 concerning 103 soldiers or veterans who had taken part in the Gulf War or in operations in the Balkans.[13] The study concluded that the concentration of uranium "was comparable to that of the Canadian civilian population exposed to normal and safe background levels of uranium. No [depleted uranium] was detected in the urine of any member of the study group".[14] The Standing Committee on National Defence and Veterans Affairs held an information session in March 2001 at which one of the authors of the study presented the preliminary conclusions, before the study was published.[15] A number of other studies subsequently done in the allied countries or by international organizations tended to confirm those conclusions.[16]

Notwithstanding the absence of scientific evidence that would establish a link between depleted uranium and CMI, doubts remain. In Canada, the debate took on new life in 2010, as a result of the moving testimony given by Mr. Lacoste, a veteran of Bosnia and East Timor who spent 14 years with the Canadian Forces, who asserted that his health problems were caused by depleted uranium poisoning:

> I passed tests proving that I am 61 times more radioactive than the acceptable limit. When I came back with medical proof to the military authorities, I was told two things. The first was that I had no right to get medical care from civilian doctors. Secondly, they told me, and they were laughing, to forget that because, legally, no Canadian soldier has ever been intoxicated with uranium.[17]

Although Mr. Lacoste was offered medical care to treat his health problems, there is no scientific research upon which Veterans Affairs could establish any causal link between those health problems and depleted uranium. Sometime previously, in late 2009, a British

---

11 The other sources of risk were pesticides, chemical warfare agents, biological warfare agents, vaccines, pyridostigmine bromide, infectious diseases, oil-well fire smoke, petroleum products, and psychological and physiological stress. Presidential Advisory Committee on Gulf War Veterans' Illnesses, *Final Report*, 1997, Chapter 4: "Gulf War Risk Factors."

12 Goss Gilroy Inc., *Health Study of Canadian Forces Personnel Involved in the 1991 Conflict in the Persian Gulf*, Vol. 1, Goss Gilroy Inc. Prepared for the Gulf War Illness Advisory Committee, Department of National Defence, Ottawa, (Ont.), 1998.

13 E.A. Ough et al., "An Examination of Uranium Levels in Canadian Forces Personnel Who Served in the Gulf War and Kosovo," *Health Physics*, 82(4):527–532, April 2002.

14 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 15.

15 Ken Scott, *Evidence*, 22 March 2001.

16 A sample of these studies may be found in the Bibliography to the Scientific Advisory Committee's study.

17 Pascal Lacoste, *Evidence*, 30 November 2010, 1715.

and an Italian court had ruled that there was a causal link between exposure to DU during military service and the deaths of two veterans.[18]

On 5 November 2011, Mr. Lacoste decided to go on a hunger strike to persuade the Honourable Steven Blaney, Minister of Veterans Affairs, to recognize the link between DU and the medical problems afflicting numerous veterans. Mr. Lacoste ended his hunger strike after Mr. Blaney agreed to conduct an investigation which resulted in the creation of the Scientific Advisory Committee on Veterans' Health (SACVH).

2. Report of the Scientific Advisory Committee on Veterans' Health

The creation of the SACVH was announced by the Honourable Steven Blaney, Minister of Veterans Affairs, in November 2011. The names of its initial members were released on 5 December 2011.[19]

Tasked with providing "expert advice to the Minister on specific Veterans' health issues", the SACVH was initially assigned to conduct a "study on depleted uranium".[20] Specifically, the SACVH was tasked to:

a) review and summarize the published scientific literature on the human health effects of depleted uranium and evaluate the strength of the evidence for causal relationships; and

b) assess the information concerning the potential exposures of Canadian military personnel to depleted uranium.[21]

The Minister tabled the SACVH's report on the subject in the House of Commons on 6 February 2013. Following the introduction, which sets out general information about depleted uranium and the methodology used, the SACVH's analysis is divided into four parts: a review of the relevant literature on the health effects of DU; an assessment of exposure by Canadian Forces personnel; a review of the relevant literature on the health effects of uranium on civilian populations; and a summary of the existing evidence relating specifically to the health effects of DU in theatres of operations where it was used.

The discussion of the effects of depleted uranium is therefore not new scientific research; it is a synthesis and assessment of the existing research. The SACVH's methodology in that regard is irreproachable. With respect to the possible exposure of CF personnel to DU, the SACVH did what had not previously been systematically accomplished: review the possible points of contact between CF operations and places where DU use has been documented.

---

18 See p. 22 of this report.

19 Veterans Affairs Canada, "Veterans Affairs Minister Steven Blaney Announces Members of New Scientific Advisory Committee on Veterans' Health," News release, 5 December 2011.

20 Ibid.

21 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 3.

Upon completion of its analysis, the SACVH arrived at the following seven conclusions:

1) Depleted uranium (DU) is potentially harmful to human health by virtue of its chemical and radiological effects.

2) Within a military setting, the highest risk of exposure to depleted uranium is in those who were: in, on or near vehicles hit with friendly fire; entering or near these burning vehicles; near fires involving uranium munitions; salvaging damaged vehicles; or involved in clean-up operations of contaminated sites.

3) It is unlikely that Canadian soldiers have been exposed to levels of depleted uranium which could be harmful to their health.

4) There is no consistent evidence from military cohort studies of adverse health effects that could be attributed to depleted uranium.

5) There is no strong evidence of adverse health effects reported in larger civilian studies with longer follow-up periods of populations with increased exposure to uranium (e.g., uranium production and fabrication workers).

6) Our finding that exposure to uranium is not associated with a large or frequent health effect is in agreement with the conclusions of other expert bodies.

7) There are many Veterans suffering from persistent symptoms following deployment or military conflict which, although not linked to specific exposures such as DU, can cause considerable suffering and can be effectively treated.[22]

The first six conclusions are based on analyses performed by the SACVH as part of its assigned task; however, the seventh conclusion is a general statement of opinion that is not directly supported by the SACVH's analysis results.

A. Effects of uranium on health

Depleted uranium is less radioactive than natural uranium, which is not, in itself, harmful to human health. However, prolonged exposure to uranium dust, for instance among people who work in uranium mines, is associated with well-documented risks of irradiation. Uranium and depleted uranium are health concerns when they are inhaled. When they enter the human body by other routes, they are eliminated from the body virtually completely.

22 Ibid., p. 2.

Urinalysis therefore appears to be the best method of detecting the presence of uranium or depleted uranium in the body.[23] Testing was done on about 5,000 NATO soldiers who took part in operations during which they were exposed to DU. Some of them still had fragments of DU shrapnel in their bodies, the result of friendly fire. They are the only ones whose tests revealed the presence of DU in their urine; to date, however, no adverse effect on their health has been connected to DU.[24]

Small particles present a radiologic risk that can result in lung cancer if they enter the body, but studies show that "it takes at least 10 years of exposure and perhaps even longer, before this risk is realized".[25] In chemical terms, uranium also presents a risk, as do all heavy metals (mercury, lead, plutonium, etc.). Prolonged exposure or exposure to a very high concentration can lead to irreversible kidney problems.

The SACVH concludes that in most situations in life, uranium does not pose any health problems. "Beyond the general public, there are groups of individuals who, through their employment, routinely encounter much greater exposures to [uranium]. Except in rare circumstances, these long term exposures do not negatively affect their health."[26]

B. Exposure of Canadian military personnel

The conditions that prevail in a theatre of military operations make it impossible to create the controlled environment needed for the most rigorous scientific analyses. For example, it is not possible to monitor the development of certain symptoms in a group of individuals who are known with certainty to have been exposed, as compared to another group of individuals who are known with certainty not to have been exposed.

We must therefore be satisfied with extrapolations from studies done of non-military populations. Although imperfect, "[these] epidemiological studies […] provide scientifically sound approximations of exposure of individuals and groups in non-military occupational settings."[27]

It is then necessary to determine the circumstances in which Canadian soldiers may have been exposed. According to the SACVH: "The Canadian Forces do not use DU munitions in their tanks or aircraft. […] None of the enemies facing coalition forces in any of the conflicts where Canadian groups were engaged, had DU weapons."[28] It was therefore the allied forces, essentially the United States and Great Britain, who used these munitions.[29] However, DU munitions were stored on board Canadian ships during the

23 Nicholas Priest, *Evidence*, 26 February 2013, 0855.

24 Pierre Morisset, Chairman, Scientific Advisory Committee on Veterans' Health, *Evidence*, 14 February 2013, 0855. See also: Nicholas Priest, *Evidence*, 26 February 2013, 0920.

25 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 7.

26 Ibid., p. 9.

27 Ibid., p. 10.

28 Ibid., p. 11.

29 Pierre Morisset, *Evidence*, 14 February 2013, 0850.

1990s, and it is probable that at some point or other, soldiers in the Canadian Forces handled those munitions, or that they were stored on military bases. However, simply carrying those munitions or being in proximity to them poses no health risk.[30]

The SACVH was tasked with determining whether Canadian soldiers might have been exposed, that is, might have inhaled DU dust produced on contact between munitions and an armoured vehicle, or during fires involving materials containing DU.

The Canadian soldiers whose exposure risk was considered to be highest were the 290 combat engineers stationed at Camp Doha in Kuwait in April 2001, at the point when a fire broke out there. However, the concentrations were "too low to produce any adverse health effects."[31]

The SACVH reviewed the other events during which Canadian soldiers might have been exposed, as well as the studies done concerning various cohorts of soldiers from other countries. It concluded that "[w]ith the exception of the U.S. cohort of friendly fire soldiers from the Gulf War, the SACVH found no evidence of any allied soldiers having been directly and specifically exposed to DU."[32]

C. Effects of uranium on civilian populations

The SACVH reviewed the studies that have been done to determine the link between exposure to uranium and certain illnesses, in particular cancer. The most rigorous studies were conducted on uranium mine workers. The conclusions are that the mortality rate there is in fact higher, but that it is attributable to exposure to radon, a harmful gas that is present in underground uranium mines and is apparently the cause of a large number of lung cancers. However, there are no studies that show any link between uranium exposure and higher risks of cancer.[33]

Nicholas Priest, who testified before this Committee, participated in studies conducted in Bosnia, Kosovo and Serbia with civilian populations. The object of those studies was to assess if the exposure to DU was significant enough to cause health concerns: "Our conclusions were that the amounts were insignificant."[34]

D. Existing studies of military populations

The SACVH also evaluated studies done in the United States, Great Britain, Italy, Scandinavia and the Netherlands relating to theatres of operations where depleted uranium was used, as well as the Canadian study of soldiers who were deployed in the Persian Gulf in 1990–1991.

---

30 Ibid., 0915.

31 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 11.

32 Ibid., p. 13.

33 Ibid., p. 19.

34 Nicholas Priest, *Evidence*, 26 February 2013, 0900.

The SACVH's conclusion is that "there is limited evidence, at the moment, to suggest an association between being involved in the Gulf and Balkans conflicts, and an increased risk of cancer or mortality."[35]

3. Criticism of the SACVH report

All of the scientific experts who appeared before the Committee stated that they agreed with the overall recommendations contained in the report produced by the SACVH. Conversely, the veterans who testified before the Committee and claimed to have medical conditions related to DU exposure were severely critical of the report. During his testimony, for example, Mr. Lacoste, the veteran whose efforts prompted the decision by the Minister of Veterans Affairs to set up the SACVH, called the report "bitterly disappointing".[36] The criticism levelled by veterans focused primarily on what they considered to be omissions. Essentially, those omissions were documents that the SACVH did not take into account.[37] To support their criticism, these witnesses submitted to the Committee an abundance of documentation which the Committee members, with the assistance of research staff, examined closely in a deliberate effort to find elements that might support the veterans' views.

Five main types of documentation were submitted:

1) Scientific studies whose raw data, methodology and results were published in a scientific journal with an editorial review board, with drafts subjected to anonymous peer review, and results that can be confirmed or replicated by other studies of similar calibre;

2) Studies published outside of peer-reviewed scientific journals (think tank reports, conference proceedings, submissions to parliamentary committees, briefs prepared by experts and filed in court, websites, newspaper articles, etc.);

3) Documents presenting government policies or directives;

4) Arguments to determine or dispute eligibility for medical services or financial benefits; and

5) Documents setting out medical opinions.

While these documents are all of undeniable value, they do not all carry the same weight when it comes to establishing scientific proof of a connection between DU exposure and certain medical conditions. Given that parliamentarians have a duty to base

35 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 27.

36 Pascal Lacoste, *Evidence*, 7 March 2013, 0850.

37 Some veterans also mentioned that the SACVH failed to take into account the views of certain experts. Since the value of an expert's views depends essentially on the research documents produced by that individual, only the documents themselves will be dealt with in this report.

their recommendations on the best possible evidence, it must be acknowledged that only the first group of documents have a true claim to scientific validity. Once the limits of what can be stated on the basis of scientific evidence have been clearly established, the other documents can serve to fuel the debate on what possible actions the government might take concerning these issues, or to evaluate specific cases, which is beyond the scope of a parliamentary committee's mandate. With regard to any and all matters of public policy, it is important to reiterate that none of the documents from groups 2 to 5 may supersede bona fide scientific studies.

E. Peer-reviewed scientific studies

Studies confirming the hazardous nature of uranium

The first conclusion set out in the SACVH's report is that "[d]epleted uranium (DU) is potentially harmful to human health by virtue of its chemical and radiological effects."[38] While scientific studies have confirmed this on numerous occasions, these findings cannot readily be extrapolated to a medical condition afflicting veterans. This is because very intense or prolonged exposure to the harmful effects of uranium is required in order for such risks to materialize.

The American research committee tasked with evaluating the possible causes of Gulf War veterans' illnesses also reached this cautious conclusion in reference to research suggesting the possibility of a risk:

> It is important to note […] that many of the recently-identified effects of DU developed after prolonged exposure to DU, at doses and in forms not encountered by most veterans during the Gulf War. Demonstration of the potential for DU, or other Gulf War-related exposures, to cause adverse effects is not equivalent to demonstrating that those exposures caused Gulf War illness or other adverse health outcomes in Gulf War veterans.[39]

There are currently no documents or testimony in existence that would provide conclusive evidence that Canadian soldiers suffered sufficient DU exposure to subsequently cause risks to their health. The scientific studies submitted to the Committee therefore reinforce the first conclusion of the SACVH report, but they do not challenge the inability of current research to demonstrate a connection between DU exposure and certain medical conditions afflicting veterans.

Animal studies

Having been critical of the fact that the SACVH had disregarded animal studies, Steve Dornan, a Canadian veteran of Bosnia and Afghanistan, gave the Committee a list of 43 animal studies focusing on the link between uranium exposure and certain illnesses. These studies are entirely credible, and it is reasonable to believe that some of their

---

38 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 2.

39 Research Advisory Committee on Gulf War Veterans' Illnesses, *Gulf War Illness and the Health of Gulf War Veterans: Scientific Findings and Recommendations*, November 2008, p. 93.

results could perhaps eventually be extrapolated to humans. However, such is not the case in the current state of research. Moreover, the degree of exposure remains an issue, since the intense or prolonged exposure to which animals in these studies are subjected cannot be compared to the level of exposure Canadian soldiers may have experienced. Lastly, the results of animal studies are not readily transferable to humans. According to one study submitted to the Committee by Mr. Dornan:

> All of [the data from animal studies] is only suggestive until it can be tied to meaningful human research. We do not even have a reasonable idea of the typical DU intake of people living in regions where DU munitions have been used. This lack of fundamental information makes extrapolation from animal data to humans a strictly academic exercise.[40]

It is for this reason that the results of animal studies are not sufficient to call the conclusions of the SACVH report into question.

During his testimony before the Committee, Mr. Lacoste stated that the SACVH report does not address the effects of uranium poisoning on the reproductive system.[41] The experiments supporting such assertions were also conducted on animals. The American Agency for Toxic Substances and Disease Registry, which is responsible for monitoring toxic substances and their effects on human health, has issued a *Public Health Statement for Uranium* summarizing the current state of research. It contains one passage on uranium and fertility: "Uranium has been shown to decrease fertility in some studies of rats and mice; other studies have not found this effect."[42] It is therefore possible to state that intense or prolonged exposure to DU could cause such effects to human health, but no such exposure of Canadian military personnel has been documented.

IRSN study

During his testimony on 21 March 2013, Mr. Dornan mentioned the omission of a French study published in 2010 under the auspices of France's Institut de Radioprotection et de Sûreté Nucléaire (IRSN).[43] In point of fact, this study is listed in the References section of the SACVH report,[44] and its findings are reported as follows: "there is limited evidence suggesting an association between internal exposure and increased risk for lymphatic and hematopoietic cancer and upper aero-digestive tract cancer."[45]

---

40 Wayne Briner, "The Toxicity of Depleted Uranium," *International Journal of Environmental Research and Public Health*, January 2010; 7(1), section 6, "Conclusions."

41 Pascal Lacoste, *Evidence*, 7 March 2013, 0850.

42 Agency for Toxic Substances and Disease Registry, *Public Health Statement for Uranium*, February 2013.

43 I. Guseva Canu et al., "Uranium carcinogenicity in humans might depend on the physical and chemical nature of uranium and its isotopic composition: results from pilot epidemiological study of French nuclear workers," in *Cancer Causes & Control*, November 2011;22(11):1563-73. doi: 10.1007/s10552-011-9833-5. Epub 2011 Aug 28.

44 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 29.

45 Ibid., p. 20.

This study focuses on 2,097 workers at one French uranium processing plant from 1960 to 2006. The object of the study was to assess the risk of mortality from lung cancer and lymphatic (nodes, mucosa, bone marrow and certain glands) and hematopoietic (blood cells) malignancies following "protracted, low-dose exposure to different industrial uranium compounds".[46] The novelty of this study is that it is the first to establish a possible link between lymphatic and hematopoietic cancers and prolonged exposure to low doses of reprocessed uranium compounds with little or no solubility. This reprocessed uranium essentially consists of spent fuel rods from nuclear power reactors. The authors of the study recognize the methodological limits of their work, owing to the limited nature of the sample upon which their findings are based. The study concludes with an assertion that the results are nonetheless interesting enough to warrant more extensive international collaboration on the subject:

> Though the statistical power of this study is still limited, we observed that the exposure to reprocessed uranium may increase the risk of lung cancer and of lymphatic and hematopoietic malignancies. This risk tends to increase with decreasing solubility of uranium compounds. [Our findings] need to be confirmed in more powerful dose-response analyses […], which is feasible in the framework of a large international collaborative project. [47]

The methodological limitations of the study are also noted in the SACVH report,[48] and Dr. Morisset discussed them during his testimony before the Committee:

> The one report that he said was revolutionary dealt not with depleted uranium but with reprocessed uranium. That is enriched uranium, not depleted uranium, that was being reprocessed. It has plutonium, americium, all kinds of other things, so I don't think it's very germane to the study. Plus it was a pilot study. They reported that as a pilot study, an initial pilot study, and they said that yes, they have some indication that perhaps there may be some increased cancers of a hematopoietic effect, which are multiple lymphomas. Fine. We think there may be. It is suggestive — that's their word — but we have to look at it more carefully.[49]

Apart from these limitations, what prevents us from extrapolating the results to the Canadian veteran population is essentially the time of exposure. Indeed, the subgroup of workers in which a higher health risk might be suspected was in direct daily contact with reprocessed uranium for an average period of approximately eight years.

The SACVH report also mentions Italian studies conducted on veterans of the conflict in the Balkans. Those studies found that the incidence of thyroid cancer and Hodgkin's disease is slightly higher among soldiers deployed during this conflict than it is in the general population. The SACVH questions the methods used in these studies, but

---

46 I. Guseva Canu et al., "Uranium carcinogenicity in humans might depend on the physical and chemical nature of uranium and its isotopic composition: results from pilot epidemiological study of French nuclear workers," in *Cancer Causes & Control*, November 2011;22(11):1563-73. doi: 10.1007/s10552-011-9833-5. Epub 2011 Aug 28.

47 Ibid., p. 10.

48 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 20.

49 Pierre Morisset, *Evidence,* 26 March 2013, 1020.

states that "[t]he increased risk for thyroid cancer warrants further research to determine if it is related to military occupational exposures."[50]

Study of U.S. soldiers with embedded shell fragments

The research published by Dr. Melissa McDiarmid's team concerning 84 U.S. veterans who are victims of injuries and have toxic embedded fragments in their bodies has often been cited in support of the argument that DU has no effect on health. Indeed, these soldiers have the greatest possible amount of exposure and, aside from a few variations that have been deemed statistically insignificant, no harmful effects have been linked to DU.

During her testimony before the Committee, Dr. McDiarmid referred to the findings of these studies:

> I think most people would agree that veterans in this group certainly are candidates for most likely being the most highly exposed people we can follow. We are happy that we have not seen any of what we would call uranium-related health effects, with the exception of the excretion of abnormally high uranium in their urine with the isotopic signature, the proof that it's depleted.[51]

The methodological limitations of this series of studies were mentioned in many documents that were tabled with the Committee but not published in scientific journals.[52] The most convincing criticism came from the Research Advisory Committee on Gulf War Veterans' Illnesses — the American committee tasked with preparing a summary of the available literature on Gulf War illnesses for the U.S. Department of Veterans Affairs.

> Reports on this cohort are often cited to indicate that there are no likely long-term effects of DU exposure, yet the limited types of information provided and the small number of veterans evaluated leave important questions unanswered. Most prominently, the study provides no information on possible associations between DU exposure and the chronic symptom complexes associated with Gulf War illness. And investigators have not reported on the occurrence of other health outcomes not previously expected to relate to DU exposure. Given the small size of this cohort, all health outcomes are of interest, even if they occur as single cases. But the small size of the cohort and lack of an unexposed comparison group mean the project cannot determine whether DU exposure is associated with common or uncommon diagnosed conditions of concern such as cancer.[53]

---

50 SACVH, *Depleted Uranium and Canadian Veterans*, January 2013, p. 23.

51 Melissa McDiarmid, Medical Director, Depleted Uranium Program, Toxic Embedded Fragment Surveillance Center, U.S. Department of Veterans Affairs, *Evidence,* 26 March 2013, 0905.

52 Robert Alvarez, in "Depleted Uranium Worker Cancer Rates and Presumptive Causation," criticizes the omission of significant studies that Ms. McDiarmid's team should have taken into account. Moreover, Keith Baverstock, in "Evaluation of the SCHER opinion on DU in 2010," goes so far as to suspect a deliberate lack of rigor.

53 Research Advisory Committee on Gulf War Veterans' Illnesses, *Gulf War Illness and the Health of Gulf War Veterans: Scientific Findings and Recommendations*, November 2008, p. 99.

In other words, the U.S. Research Advisory Committee felt that the parameters for these studies were so narrow that they could provide very little valid information to assess the link between DU and certain medical conditions. The rigid nature of these parameters was underscored by the U.S. Committee when it stated that two of the soldiers being monitored developed tumours, one of which was cancerous, but that this had not been reported. "Both cases were confirmed by the principal investigator of the study. Failure to mention these cases in most scientific reports on this cohort is puzzling. The study director indicated to the Committee that these cases were not included because they were not believed to be the result of DU exposure." Obviously, this fact alone is not enough to call the findings of the existing epidemiological studies into question; however, as noted by the U.S. Research Advisory Committee, it does illustrate the major gaps that still exist in the scientific literature on veterans' health problems.

Other studies

In his testimony before the Committee, Mr. Lacoste deplored the fact that the work done by Dr. Rosalie Bertell and Dr. June Irwin had been disregarded.[54]

The article by Dr. Bertell which Mr. Lacoste submitted to the Committee concerns the need to pursue research and calls into question the methodology used in the existing research that has so far rejected the connection between depleted uranium and Gulf War Syndrome.[55] This article constitutes a theoretical discussion and is of undeniable interest; however, it contains no new scientific information as such. The only empirical data upon which it rests come from a study that was not published in a scientific journal.[56]

During his testimony, Mr. Dornan also submitted a study by Patricia Horan of Memorial University in Newfoundland, published in 2002 in the journal *Military Medicine*.[57] This study was of a group of 27 patients who had voluntarily submitted urine samples. Using a new method of isotope identification, the presence of DU was detected in 14 of the 27 patient samples. The limits of this study essentially stem from the fact that its results were never replicated by another laboratory. Also, the study does not establish any link between the presence of DU and health problems.

---

54 Pascal Lacoste, *Evidence*, 7 March 2013, 1015. We cannot comment on the opinion of Dr. Irwin as no document presenting her viewpoint was tabled with the Committee.

55 Rosalie Bertell, "Depleted Uranium: All the Questions About DU and Gulf War Syndrome Are Not Yet Answered," *International Journal of Health Services*, Vol. 36, No. 3, 2006, pp. 503–520. A draft version of several of the hypotheses presented in this article is found in another paper by Ms. Bertell that was tabled with the Committee: "Gulf War Veterans and Depleted Uranium, prepared for the Hague, May 1999."

56 Hari Sharma, "Investigations of Environmental Impacts from the Deployment of Depleted-Uranium-Based Munitions," cited in Bertell, p. 519. The article is available online at: http://www.stopnato.org.uk/du-watch/sharma/du-report.htm.

57 Patricia Horan, L. Dietz and A. Durakovic, "The quantitative analysis of depleted uranium isotopes in British, Canadian, and U.S. Gulf War veterans," *Military Medicine*, 167:8, August 2002, pp. 620–627.

Similarly, an email in support of the arguments presented in the file of veteran A mentions a study on the toxic effects of depleted uranium on lung cells.[58] This study conducted on human cells confirms the hazardous nature of DU in cases of prolonged or intense exposure:

> Epidemiological studies have had a difficult time ascertaining the lung cancer risk posed by DU. Our data suggest that in human lung cells, significant clastogenicity is only observed at highly cytotoxic concentrations. Thus, many of the damaged cells will be removed by cell death, and thus if DU is carcinogenic in human lung cells, it may require a high dose or involve a non-genotoxic mechanism.[59]

In conclusion, the Committee considers it reasonable to state that questions remain unanswered with regard to the health effects of DU. A summary of these unanswered questions and of the existing gaps in research may be found in a 2008 report produced for the U.S. Department of Veterans Affairs on the subject of Gulf War illness.[60] Given the abundance of studies supporting the lack of any link between DU and adverse health effects, however, the findings of the SACVH report must be accepted.

F. Non-peer-reviewed studies

Most of the studies in this category have the same important limitation: they were not subjected to rigorous review by members of the scientific community. This does not mean that they are not valid, but peer assessment does constitute the best guarantee of the scientific validity of an analysis. Such non-peer-reviewed analyses are numerous, and they vary widely in quality. For the purposes of our report, we will concentrate our attention on two very substantive expert opinions. While they were not published in scientific journals, both were written by individuals who have numerous scientific publications to their credit.

Opinion by Dr. Chris Busby

The statement of opinion prepared by Dr. Busby[61] was submitted in support of an application for review in the case of A. It is an adaptation of a similar opinion Dr. Busby had prepared for a case involving the family of a British veteran, Stuart Dyson. In that case, a jury in a coroner's inquest found that in all likelihood a connection existed between Mr. Dyson's death and his exposure to DU.

Dr. Busby's opinion, like many others, criticizes the methodological assumptions used in the epidemiological studies that supported the absence of any link between DU

---

58 Sandra Wise et al., "Particulate Depleted Uranium Is Cytotoxic and Clastogenic to Human Lung Cells," *Chem. Res. Toxicology*, 2007, 20, pp. 815–820.

59 Ibid., pp. 819–820.

60 Research Advisory Committee on Gulf War Veterans' Illnesses, *Gulf War Illness and the Health of Gulf War Veterans: Scientific Findings and Recommendations*, November 2008, p. 89.

61 Chris Busby, PhD, "The [Illness of A] and his previous exposure to contamination from uranium weapons […]," 10 December 2009.

exposure and certain illnesses. The Committee members were informed several times about the limitations of the epidemiological studies. However, these methodological limitations are far from sufficient to cast doubt on the validity of the results of those studies. For that to happen, studies of similar scope arriving at diametrically opposite results would be needed. An Italian study published in 2002[62] seems to be the only epidemiological study that could potentially lay claim to such status. Dr. Busby's opinion is based exclusively on that study. However, the results of the Italian study have not been replicated in subsequent studies.[63]

Dr. Busby's opinion concludes in surprising fashion. Based on an article published in *The Lancet* in 2008 concerning a veteran of the conflict in Bosnia whose kidney tissue was saturated with enriched uranium, Dr. Busby deduced the following: "This result strongly supports the belief that there was contamination of Bosnia by Enriched Uranium, presumably from weapons usage, and that the contamination was such that it could become incorporated into human tissue. It follows that [A] will have been thus contaminated."[64] While it is obvious that we cannot express an opinion on a particular case, it seems to us that such a generalization and its accompanying unexpected leap from depleted uranium to enriched uranium fall well outside the fundamental bounds of scientific rigour.

Statement by Keith Baverstock

The Committee received a statement[65] by Dr. Baverstock, a retired professor with the University of Eastern Finland's Department of Environmental Science, which brings an interesting point of view to bear on the SACVH report. It indicates that epidemiological studies, since they are based on large samples, do not make it possible to state that all of the individuals in a particular sample were subjected to an equal health risk. In other words, it is possible that a small number of individuals in a given sample were subjected to a far greater level of exposure, but that this additional risk could not be detected because of the parameters of the study. This statement applies to all epidemiological studies, i.e., usually those that compare the incidence of a health problem in a group exposed to a particular risk factor to the incidence of that same problem in the general population or in a control group that has not been exposed. That is why it is necessary, whenever possible, to compare the results of such large-sample studies to the results of studies on smaller samples where the very high risk of exposure is a certainty. This is the case, for example, of studies conducted on U.S. military personnel living with embedded fragments of munitions containing DU. Since these studies focus on only 79 individuals, their statistical strength is obviously not comparable to that of epidemiological studies; that being said,

62 Ministero della Difesa, "Relazione Finale della Commissione istituita dal Ministro della Difesa sull'incidenza di neoplasie maligne tra i militari impiegati in Bosnia e Kosovo," Rome, 11 June 2002.

63 SACVH, Depleted Uranium and Canadian Veterans, January 2013, p. 23.

64 Chris Busby, PhD, "The [Illness of A] and his previous exposure to contamination from uranium weapons […]," 10 December 2009, p. 16.

65 "Statement by Keith Baverstock, PhD, Docent, Department of Environmental Science, University of Eastern Finland, Finland," document submitted to the Committee by Steve Dornan.

however, their advantage is the certainty that they involve the highest known risk factor. In his statement, Dr. Baverstock is critical of the statistical weakness of this second group of studies. In other words, in the first instance, statistical strength dilutes the individual cases that could reveal the existence of a risk; and in the second instance, there are not enough individual cases to support any statement whatsoever. Under these circumstances, it is difficult to see how any study could be convincing.

The ideal situation would be to have a large number of individuals we know with certainty suffered a very high degree of exposure. However, such a study cannot be carried out on humans because there are not enough individuals available who could be suspected of having been exposed to such a risk. Dr. Baverstock himself recognizes this problem: "It has to be accepted that as far as epidemiology has been applied to the issue of exposure to DU there is no positive evidence of related health effects. This absence of evidence cannot be taken to imply an absence of risk." However, the assessment of risk is based on the probability of a given risk materializing. And in Dr. Baverstock's own words: "There has been to date no epidemiological study to my knowledge that would be likely to reliably detect disease induced by DU."[66] The less a risk materializes, the more it becomes a purely theoretical risk. For more than 20 years, numerous epidemiological and other studies have been conducted in an effort to identify a link between the exposure of soldiers to DU and their subsequent health problems. None of these studies has managed to establish that connection. There will always be a theoretical possibility that such a link actually does exist but has not been detected. However, it would be unreasonable to base public policy recommendations on such a theoretical possibility, and it would be preferable to look elsewhere for the causes of the very real illnesses that may be afflicting veterans.

This judgement is consistent with the recommendations of a World Health Organization (WHO) report on the establishment of an association between an exposure and cancer: "When several epidemiological studies show little or no indication of an association between an exposure and cancer, a judgement may be made that, in the aggregate, they show evidence of lack of carcinogenicity."[67]

Dr. Baverstock's statement also criticizes some of the findings of the SACVH report, based upon this same WHO report, which concludes that: "All types of ionizing radiation are carcinogenic to humans."[68] That conclusion should be viewed as a warning to exercise caution in dealing with all possible forms of radiation. It also signifies that level of exposure is a determining factor identifying a possible link between exposure and illness. With regard to the exposure of soldiers to DU, no such link has been established among those who suffered the most intense level of exposure, and epidemiological studies have not revealed any harmful effects among those whose level of exposure was not as great. This does not mean that such a link might not be established in the future, or that it

66 "Statement by Keith Baverstock PhD, Docent, Department of Environmental Science, University of Eastern Finland, Finland", pp. 2-3.

67 World Health Organization, International Agency for Research on Cancer, A Review of Human Carcinogens, Volume 100D: Radiation, p. 18.

68 Ibid., p. 33.

might not be shown to exist in the case of a particular individual who was subjected to prolonged or very intense exposure. This is precisely the conclusion reached by Dr. Baverstock with regard to the SACVH report:

> I conclude that the report may serve a useful purpose in demonstrating that it is possible to serve in the armed forces in conflict areas where DU munitions are used and not run a higher than normal risk (compared to service personnel in other circumstances) of a notifyable disease such as cancer. The report, however, does not preclude the possibility that an individual actually exposed to DU dusts will run a risk of contracting a disease that is directly attributable to that exposure: DU is a confirmed human carcinogen.[69]

In the Committee's view, this conclusion seems reasonable. The possibility that future research will demonstrate a clearer link between DU exposure and certain harmful health effects must be kept open, as must the possibility that some individuals may have been subjected to particularly prolonged or intense exposure that would have subsequently affected their health. However, these are theoretical possibilities and specific exceptions, neither of which can serve to guide public policy making. In the current state of research, it would be unreasonable to presume the existence of a causal link between DU exposure and certain health problems that may afflict veterans.

Until such time as additional studies may eventually cast doubt on what is currently acknowledged as fact within the scientific community, veterans suffering from an illness with unidentified causes would, in our opinion, benefit more from research efforts conducted in a direction away from DU. Accordingly, the Committee recommends:

Recommendation 1

That the Government of Canada support research efforts focusing on the treatment of illnesses that have complex or poorly understood causes, but that can in all likelihood be attributed to military service.

G. Government documents

Documents in this category were submitted to the Committee in order to suggest that certain governments, parliamentary institutions or international organizations implicitly recognize the link between DU and certain health issues. In most cases, these consist primarily of precautionary measures to be considered, given the uncertainty surrounding the existence of a causal link.

- In a document published in February 2003, the U.K. Ministry of Defence established precautionary measures for the handling of material containing or potentially containing DU.[70] These general safety

69 "Statement by Keith Baverstock, PhD, Docent, Department of Environmental Science, University of Eastern Finland, Finland," p. 4.

70 U.K. Ministry of Defence, Safety Instructions, Hazard Management of Depleted Uranium on Operations, 27 February 2003.

instructions state several times that "DU does not present a significant health risk in most circumstances."[71] Several documents of a similar nature were submitted to the Committee, including one Canadian document. The measures described therein are essentially preventive and recognize the hazardous nature of uranium and of radioactivity in general.

- Two studies were conducted between 2003 and 2005 to determine the level of DU contamination in certain buildings of the Defence Research and Development Canada Research Centre in Valcartier (DRDC Valcartier).[72] A level of contamination in excess of the prescribed standard was noted in room 101 of building 251, but it was in an inaccessible location. The study concluded that "it is extremely unlikely that anyone would be exposed to this contamination, hence the hazard associated with this contamination is considered to be inconsequential."[73] A second study determined that "the level of radiological hazard" in three rooms in building 64 was not significant.[74]

- In May 2008, the European Parliament adopted a resolution urging its members and the international community to ban the use of depleted uranium weapons. This resolution nevertheless recognized that "despite the fact that scientific research has so far been unable to find conclusive evidence of harm, there are numerous testimonies as to the harmful and often deadly effects on both military personnel and civilians."[75]

- The United Nations has never adopted a resolution recommending a ban on the use of depleted uranium weapons. However, four resolutions have been adopted on the "effects of the use of armaments and ammunitions containing depleted uranium."[76] The last of these resolutions, containing essentially the same content as those that preceded it, "calls for a precautionary approach to the use of depleted uranium."[77] France, the United Kingdom, the United States and Israel voted against the resolution; Canada and 27 other countries abstained; and 138 countries voted in favour of the resolution.

---

71 Ibid., para. 7.

72 Sessional Paper 8555-411-11, p. 5-6.

73 Ibid., p. 5.

74 Ibid., p. 6.

75 European Parliament resolution of 22 May 2008 on (depleted) uranium weapons and their effect on human health and the environment — towards a global ban on the use of such weapons.

76 United Nations General Assembly, Resolutions 62/30 of 5 December 2007, 63/54 of 2 December 2008, 65/55 of 8 December 2010 and 67/36 of 3 December 2012.

77 United Nations General Assembly, Resolution 67/36 of 3 December 2012.

H. Legal or administrative documents

- A copy of a 41-page email message sent to the Honourable Peter MacKay, Minister of National Defence, on 1 February 2011 was submitted to the Committee. This email repeated the arguments in A's file before the Veterans Review and Appeal Board, a copy of which the Committee also received. The relevant documents mentioned in this email and in the file in question have been examined and cited in the appropriate sections of this report.

- During his testimony, Mr. Dornan questioned the ability of Canadian laboratories to test for the presence of DU and, by extension, the results of the tests conducted by the Department of National Defence in the early 2000s and published in a scientific study in 2002.[78] The document cited in support of this position[79] was written under the auspices of the Uranium Medical Research Centre, a not-for-profit organization directed by Asaf Durakovic, one of the co-authors of the Patricia Horan study cited above (see note 57). In his paper, Mr. Weyman argues that the Department of National Defence study is unreliable because the researchers were unable to identify the isotopic signature of the uranium identified in the urine samples. This assertion is true, and a subsequent study conducted for Defence Research and Development Canada confirmed this shortcoming.[80] However, this is ascribable to the fact that uranium was present in amounts below the threshold that would have permitted the identification of the isotopic signature: "The concentrations of total uranium in the urine of Canadian veterans were well within the range determined for non-occupationally exposed individuals."[81] In other words, regardless of whether the identified uranium was natural uranium or depleted uranium, the concentration was too low to pose a threat to the health of the veterans tested.

- A Veterans Review and Appeal Board decision in C's file was submitted to the Committee to support the assertion that Canada has already compensated veterans with DU-related health problems. However, this statement is inaccurate. In this particular file, the Board "[drew] a reasonable inference that the claimed […] condition is associated with the

78 Steve Dornan, As an individual, *Evidence,* 21 March 2013, 1005. The study is: E. A. Ough et al., "An Examination of Uranium Levels in Canadian Forces Personnel Who Served in the Gulf War and Kosovo ," *Health Physics*, 82(4):527-532, April 2002.

79 Tedd Weyman, 12 Years Too Late? How Canadian and U.S. Defense Departments reveal veterans' post-conflict follow-up programs are not capable of detecting depleted uranium.

80 Defence Research and Development Canada, Determination of Natural and Depleted Uranium in Urine at the ppt Level: An Interlaboratory Analytical Exercise, October 2002.

81 E. A. Ough et al., "An Examination of Uranium Levels in Canadian Forces Personnel Who Served in the Gulf War and Kosovo ," *Health Physics*, 82(4):527-532, April 2002, p. 531.

Applicant's service […]."[82] Even though some of the evidence in the file supported this association with DU, it is the sum of all risk factors associated with military service that was recognized as having reasonably caused the illness, and not DU as such.

- Based on the analyses presented by Mr. Busby,[83] a jury in a British coroner's inquest found in September 2009 that the death of Gulf War veteran Stuart Dyson was "more likely than not" attributable to the radioactive material contained in munitions.[84] In this case, according to media reports, the British Ministry of Defence filed a written deposition but did not call any witnesses during the inquest.

- On 1 December 2009, a Rome Civil Court found the Italian Ministry of Defence guilty of negligence and ordered the Ministry of the Economy and Finance to pay approximately 1.4 million euros to the family of a Kosovo veteran who had died from Hodgkin's lymphoma. Based on the documents filed as evidence with the Court, Judge Corrado Cartoni, stated that "a definite link exists between D.R.'s military service in an area where depleted uranium was used and the serious diseases that may result, including Hodgkin's lymphoma." [Translation][85]

- A referral by the Veterans Review and Appeal Board in A's file led to a ministerial review in the veteran's favour. This decision by the Minister, dated 16 March 2011, assigns no particular cause to the illness afflicting A, but concludes that the fact that the Canadian Forces did not proceed with an examination earlier contributed to the aggravation of the illness.

The relatively small number of administrative or legal documents that could be identified indicates that, to our knowledge, none of Canada's allies that participated in conflicts during which DU armaments were used has recognized in any way whatsoever the existence of a causal link between DU and certain illnesses that could afflict veterans. The British and Italian court rulings in this regard represent a remarkable exception that could potentially have snowballed and opened the door to several other similar cases. However, such was not the case.

I. Medical diagnoses and tests

A large number of documents presenting test results and medical diagnoses were submitted to the Committee. These opinions had served to support the files of various veterans seeking to obtain medical services or financial benefits. The SACVH, whose task

---

82 Veterans Review and Appeal Board Decision […] of 14 May 2008, p. 5.

83 Chris Busby, Depleted Uranium Causes Cancer.

84 "Ex-soldier died of cancer caused by Gulf War uranium", *The Telegraph*, 10 September 2009.

85 The complete text of the Court decision is available in Italian only at http://www.gestionecreditipubblici.com/news.asp?IDCategoria=1&IDNews=53.

was restricted to reviewing the published scientific literature, had no choice but to exclude, as indicated in its report, "case reports, cross-sectional studies and clinical studies of hospitalized Veterans, whatever the outcomes."[86] This exclusion does not imply any judgement as to the quality of medical diagnoses. Because it deals with the unstructured observation of a small number of cases, however, a medical opinion cannot take the place of the scientific research upon which such a medical opinion should be based.

During his testimony, Mr. Lacoste stated: "Different Canadian specialists […] have told me, on four occasions, that the only possible cause of my health problems was uranium poisoning."[87] In order to be established with a strong degree of probability, such a diagnosis should be based on recognized scientific research. On this subject, we will rely on the judgement of Dr. Morisset, who told the Committee: "I would have liked to be able to discuss with a physician who is purported to have made that diagnosis of depleted uranium intoxication to find out what they were basing their decision on. That's a very, very big question mark in my mind, very big."[88]

The principal medical opinions submitted to the Committee were the following:

- Dr. Malcom established de facto an association between A's medical condition and A's "deployment" and "time spent in Bosnia;" however, that link is not attributed directly to DU, but rather to A's exposure to "numerous hazardous substances."[89]

- A letter from Dr. Ruddy in A's file, dated 14 April 2009, suggested a direct link between A's exposure to DU and his illness.

- A letter signed by a military physician and dated 31 March 2010 suggested the possibility of a link between A's military service and his illness. This document refers to "numerous hazardous substances".

- A letter from Dr. Louis Fernandez, dated 31 August 2009, describes the evolution of A's illness, but does not relate it to any particular cause.

- In a letter dated 5 January 2010, Dr. David A. Macdonald confirmed Dr. Fernandez's diagnosis and wrote: "I am aware of studies that show an increased risk of malignancies, including lymphoma, in persons exposed to ionizing radiation. [A] has established that through carrying out his military duties, he was personally exposed to depleted uranium. While it can never be proven definitely that an individual's [condition] was caused by that individual's exposures, I believe that it is possible that A's

86 SACVH, Depleted Uranium and Canadian Veterans, January 2013, p. 20. See also: Pierre Morisset, *Evidence*, 14 February 2013, 0925.

87 Pascal Lacoste, *Evidence*, 7 March 2013, 0850.

88 Pierre Morisset, *Evidence*, 26 March 2013, 1025.

89 Email from Mrs. A to the Honourable Peter MacKay, 1 February 2011, p. 7.

occupational exposures played a role in the development of his [condition]."[90] This letter is very carefully worded, leaving the door open to the possibility that exceptional circumstances and a multiplicity of exposures to hazardous substances, including DU, could have resulted in health problems in one particular case. Moreover, this approach is supported by the Royal Society's studies: "The possibility of very slight effects which could exacerbate any adverse effects on the immune system from other toxic exposures present in modern warfare cannot be discounted."[91]

- A second letter from Dr. Macdonald in A's file, dated 8 September 2011, did not give a firm opinion on the causes of the illness, but did not at all appreciate the fact that the Veterans Review and Appeal Board had questioned the medical diagnoses established by Dr. Macdonald and Dr. Fernandez.

Another contentious issue concerns the reliability of tests for detecting the presence of uranium. Mr. Lacoste submitted to the Committee the results of a screening test to detect the presence of heavy metals from a hair sample. That test clearly detected an abnormally high level of uranium that needed to be explained.[92] The email submitted in support of A's file, conversely, indicates that no Canadian laboratory is capable of adequately detecting the presence of DU. These assertions are based on research not published in scientific journals that was conducted by the Uranium Medical Research Center. Directed by Dr. Durakovic, this centre is a non-profit organization bringing together researchers of all backgrounds who are opposed to nuclear energy. Another document submitted to the Committee presents the results of a test conducted in March 2003, at this same Uranium Medical Research Center, indicating an elevated DU level in F's urine. To be consistent, therefore, the assertion that no Canadian laboratories are capable of conducting such tests should hold regardless of whether the said tests are positive or negative.

The U.S. Department of Energy, however, has prepared a review of the literature on this subject that confirms the unreliability of tests using hair samples: "uranium measured in hair and nails cannot be assumed to arise wholly, or even mainly, from internally deposited uranium.[93]

Overall, the vast majority of the documents submitted to the Committee tend to confirm the findings of the SACVH report.

---

90 David A. Macdonald, letter of 5 January 2010, submitted to the Committee by A.

91 The Royal Society, The health hazards of depleted uranium munitions, Part II, London, 2002, p. 17.

92 Pascal Lacoste, *Evidence*, 7 March 2013, 0850.

93 R. W. Legget et al., Controlling Intake of Uranium in the Workplace: Applications of Biokinetic Modeling and Occupational Monitoring Data, January 2012, p. 8.

4. Criticism directed at Veterans Affairs Canada and the Veterans Review and Appeal Board

Other criticism contained in testimony and in documents submitted to the Committee did not focus on DU as such nor on scientific research, but was directed rather at the Veterans Review and Appeal Board. This criticism referred in particular to the interpretation of the so-called "benefit of the doubt" clause that must guide the evaluation of any application made by a veteran for compensation. The matter of DU differs somewhat from the debate usually surrounding this clause.[94] The benefit of the doubt concept applies when there is nothing to contradict the verbal or written evidence submitted by a veteran in support of a connection between a disability and military service. In the case before this Committee, there is scientific data contradicting the establishment of a causal link between DU and certain health problems. In order for this lack of causation to be called into question, fairly substantial exceptional circumstances would be needed to counterbalance the scientific information.

This does not mean, however, that the link between these same health problems and the military service of the person suffering from them must necessarily be discarded. In other words, the causal link between an individual's military service and that individual's health problems can be established without it being necessary or even possible to identify the specific "medical" cause of those health problems. For example, there is no known cause for chronic multisymptom illness (CMI). This does not prevent physicians from diagnosing CMI with an increasing degree of accuracy. Since CMI is highly prevalent among military personnel, it should be possible to attribute it to military service without having to identify the specifics of that service.

On several occasions during testimony, as well as in several documents submitted to the Committee, reference was made to the existence of a "presumed service connection" policy for DU. Under this presumptive policy, the causal link between DU exposure and a medical condition would not need to be demonstrated. Such a presumptive policy does in fact exist in the United States, but not for DU.

In the United States, the "presumptive disease" concept is applied in the case of veterans who engaged in activities that involved a risk of exposure to radiation. These radiation-risk activities are:

- Any participation in operations at Hiroshima and Nagasaki in 1945 and 1946; and

- Any participation in nuclear weapons testing.

These veterans do not have to prove a connection between their military service and illnesses. This presumption applies to the following diseases:

---

94 In this regard, see the Committee Report, *Restoring Confidence in the Veterans Review and Appeal Board*, December 2012.

- Cancers of the bile ducts, bone, brain, breast, colon, esophagus, gall bladder, liver (primary site, but not if cirrhosis or hepatitis B is indicated), lung (including bronchiolo-alveolar cancer), pancreas, pharynx, ovary, salivary gland, small intestine, stomach, thyroid, urinary tract (kidney/renal, pelvis, urinary bladder, and urethra);

- Leukemia (except chronic lymphocytic leukemia);

- Lymphomas (except Hodgkin's disease); and

- Multiple myeloma (cancer of plasma cells).[95]

There is also a presumed link between military service and amyotrophic lateral sclerosis, but the U.S. government does not consider this disease to be linked to exposure to radioactive material.

For other cases of radiation exposure during military service, including exposure to depleted uranium, the causal link with military service is evaluated on a case-by-case basis.[96] The U.S. government "may" recognize service-related exposure to DU for veterans who were "on, in or near vehicles hit with friendly fire; entering or near burning vehicles; near fires involving DU munitions; or salvaging damaged vehicles."[97]

The U.S. government introduced the notion of a presumptive connection to military service in 1921 for First World War veterans who were suffering from tuberculosis or neuropsychiatric disease.[98] More recently, it was used to offer benefits to individuals who had possibly been exposed to Agent Orange during their tour of duty in Vietnam. The Canadian government adopted this idea of presumption to compensate the presumed Canadian victims of exposure to Agent Orange.[99] A recent analysis prepared for the U.S. Congress provides a cogent summary of the challenge facing governments on this issue:

> Congress and the VA have relied on scientific evidence to establish presumptions. However, when the scientific evidence is incomplete and there is uncertainty on the question of causation or if other factors such as natural aging could also contribute to disease causation, Congress and the VA are faced with the challenge of instituting a transparent and equitable process to establish presumptions to compensate veterans for service-connected conditions.[100]

---

95 U.S. Department of Veterans Affairs, "Presumptive diseases related to ionizing radiation".

96 U.S. Department of Veterans Affairs, "Other diseases associated with radiation exposure".

97 U.S. Department of Veterans Affairs, "Depleted Uranium".

98 S. V. Parangala et al., U.S. Congressional Research Service, *Veterans Affairs: Presumptive Service Connection and Disability Compensation*, p. 4.

99 Veterans Affairs Canada, Agent Orange Ex Gratia Payment.

100 S. V. Parangala et al., U.S. Congressional Research Service, *Veterans Affairs: Presumptive Service Connection and Disability Compensation*, pp. 1–2.

In the case of Agent Orange, the National Academy of Sciences had studied the risks associated with such a presumption policy, and described them as follows:

> Certain studies (not even necessarily involving veterans), for example, showing that those exposed to [Agent Orange] dioxin have slightly higher rates of diabetes or prostate cancer, have resulted in an inexorable push to compensate all veterans with diabetes/prostate cancer even if it is likely that [Agent Orange] dioxin exposure is a determinative factor in only a small percentage of cases. Since it is impossible to know what role dioxin played in any particular case, all Vietnam veterans with diabetes and prostate cancer have been and are being granted presumptive service connection. Is this presumption fully supported by medical evidence? What amount of increase in occurrence rate is enough to warrant compensation? What approaches could be considered to alleviate this costly result?[101]

In 1994, the U.S. Congress passed a law recognizing a presumptive service connection for disabilities related to the Gulf War and caused by undiagnosed diseases. In 2001, the definition of "qualifying chronic disability" was expanded to include a "medically unexplained chronic multisymptom illness (such as chronic fatigue syndrome, fibromyalgia, and irritable bowel syndrome) that is defined by a cluster of signs or symptoms."[102] Several other similar presumptions have been established with variable conditions of eligibility. Since 1991, the National Academy of Sciences has been charged with providing the U.S. government with the scientific assessments it needs to determine whether or not a condition should be presumed to be connected to military service. This effectively places in the hands of scientists the responsibility for determining the validity of scientific evidence supporting a causal link between certain exposures that may occur during military service and certain medical conditions that research has demonstrated may be liable to result from such exposures.

In Canada, at present, the process by which Veterans Affairs Canada determines the value of scientific evidence used to establish or disprove a connection between military service and certain medical conditions should be clarified. Furthermore, from the testimony heard by the Committee and the abundant documentation submitted to the Committee, it seems clear that veterans are faced with a very cumbersome burden of proof when there is little research available, when the available research is inconclusive, or when the illnesses afflicting them are complex or have no readily identifiable cause. The addition of a degree of flexibility in cases where the connection between such illnesses and military service seems reasonable could help to avoid situations in which veterans and the government mutually refer each other to scientific studies. For these reasons, the Committee recommends:

---

101 National Academy of Sciences, Institute of Medicine, *Improving the Presumptive Disability Decision-Making Process for Veterans*, Washington, DC, 2008, p. 342.

102 S. V. Parangala et al., U.S. Congressional Research Service, *Veterans Affairs: Presumptive Service Connection and Disability Compensation*, p. 8.

Recommendation 2

That Veterans Affairs Canada associate itself with an independent scientific organization, such as the Canadian Institute for Military and Veteran Health Research or the Council of Canadian Academies, to provide it with independent scientific advice on the state of scientific research, in Canada and elsewhere in the world, to support or disprove the existence of a link between military service and certain health problems that may be afflicting veterans.

Recommendation 3

That Veterans Affairs Canada consider introducing a flexible mechanism that would make it possible to assess the connection between military service and certain medical conditions whose causes are complex, difficult to identify or poorly understood.

Conclusion

Barring any future research findings to the contrary, the study by the SACVH seems to demonstrate clearly that exposure to depleted uranium is not a plausible explanation for the presence of the symptoms being experienced by numerous veterans. This statement applies to all illnesses for which efforts to demonstrate a possible causal link with exposure to DU have been unsuccessful, and it is particularly true of chronic multisymptom illness (CMI).[103] Unfortunately, this means that veterans who might have suspected that their health problems were related to DU exposure still cannot find a satisfactory explanation for the cause of their health problems.

In the case of chronic multisymptom illness, the experts who spoke to the Committee all shared the opinion expressed clearly by Dr. Priest in his testimony: “Why we have this problem I don't know, but I'm convinced it's not related to depleted uranium.”[104] Dr. Priest also suggested that exposure to organophosphates used in insecticides would be a more plausible explanation for some symptoms related to the Gulf War, but that no complete study has been undertaken on this subject.[105] Retired Lieutenant Louise Richard, a veteran of the Gulf War, also spoke of the many inoculations she received, medicines she was required to take, the use of pesticides, and contact with Iraqi prisoners of war potentially carrying communicable diseases during the first days of the mission.[106] In the Committee’s view, these exposures to numerous risk factors, and not merely to one specific cause, appears to constitute sufficient explanation for the likelihood that a connection exists between military service and these complex medical conditions.

---

103 SACVH, Depleted Uranium and Canadian Veterans, January 2013, p. 50.

104 Nicholas Priest, *Evidence,* 26 February 2013, 1000.

105 Ibid., 0900.

106 Louise Richard, *Evidence,* 19 March 2013, 0910.

In dealing with chronic multisymptom illness, physicians thus can only offer to treat veterans' symptoms without being able to determine the source of the illness. This gap in medical knowledge regarding this syndrome, as well as the fact that it cannot be linked to DU, in no way signifies that this syndrome does not in fact exist as a specific illness:

> […] this entity does exist. We cannot wish it away; it does exist. It's been demonstrated very clearly, not just with the Canadians but with many troops. Essentially, among troops deployed by NATO countries, a number of them come back and they're not the same, and there's nothing that shows. It's not physical. It doesn't show up in a blood test. It doesn't show up on an x-ray. It doesn't show up in anything. It is a symptom. They are uncomfortable. They can't sleep. They're bothered. There's a whole array of symptoms.[107]

Dr. Eric Daxon of the Batelle Memorial Institute summed up clearly what seems to be the consensus position within the scientific community:

> With the exception of Level I exposures, that's the people in, on, or near at the time the vehicle was struck, it is unlikely that exposures to DU during this conflict were high enough to generate adverse health effects. This is not the same as saying our veterans are not ill possibly due to their service to our nations. What it does mean is that in seeking a method to determine the source of the illness, DU is a highly unlikely candidate. I believe we can best help our veterans by focusing on other sources of illness that have a higher likelihood of leading to effective treatment. [108]

In the United States, the agency tasked with making recommendations to the government concerning the health problems of veterans, the Institute of Medicine, has just published a report on the treatment that can be offered to veterans suffering from chronic multisymptom illness.[109] This will undoubtedly help to address the concerns expressed by the SACVH to the effect that it is "important to address barriers to treatment and rehabilitation such as inadequate physician education about these types of conditions, perceived stigma related to chronic poorly-understood symptoms, and concerns about disability and health care."[110]

The veterans who suffer from these illnesses will certainly welcome this treatment clarification, but it will be small comfort given the uncertainty that continues to exist regarding the actual causes of their health problems.

---

107 Pierre Morisset, *Evidence*, .

108 Eric Daxon, Research Leader, Battelle Memorial Institute (as an individual), *Evidence*, 19 March 2013, 1015.

109 Institute of Medicine, Gulf War and Health: Volume 9: Treatment for Chronic Multisymptom Illness, January 2013.

110 SACVH, Depleted Uranium and Canadian Veterans, January 2013, p. 51.

LIST OF RECOMMENDATIONS

APPENDIX A
LIST OF WITNESSES

Organizations and Individuals	Date	Meeting
Scientific Advisory Committee on Veterans' Health Pierre Morisset, Chairman of the Committee	2013/02/12	58
Scientific Advisory Committee on Veterans' Health Pierre Morisset, Chairman of the Committee	2013/02/14	59
As an individual Nicholas Priest,	2013/02/26	60
As an individual Pascal Lacoste,	2013/03/07	62
As an individual Eric Daxon, Research Leader, Battelle Memorial Institute **As an individual** Louise Richard, Marie Richard	2013/03/19	63
As an individual Steve Dornan, Rosanne Dornan **Department of National Defence** Janick Lalonde, Senior Advisor, Toxicology, Forces Health Protection, Canadian Forces Health Services	2013/03/21	64
Scientific Advisory Committee on Veterans' Health Pierre Morisset, Chairman of the Committee **U.S. Department of Veterans Affairs** Melissa McDiarmid, Medical Director, Depleted Uranium Program, Toxic Embedded Fragment Surveillance Center	2013/03/26	65

APPENDIX B
LIST OF BRIEFS

Organizations and Individuals

Baverstock, **Keith**

Dornan, **Steve**

Richard, **Louise**

Riordon, **Susan**

REQUEST FOR GOVERNMENT RESPONSE

Pursuant to Standing Order 109, the Committee requests that the government table a comprehensive response to this Report.

A copy of the relevant *Minutes of Proceedings* (Meetings Nos. 58, 59, 60, 62, 63, 64, 65, 66 and 73) is tabled.

Respectfully submitted,

Greg Kerr

Chair

SUPPLEMENTARY OPINION OF THE OFFICIAL OPPOSITION

The Standing Committee on Veterans Affairs on Depleted Uranium and Canadian Veterans, May 2013

New Democrats would like to thank the many witnesses who appeared before the committee for the study on Depleted Uranium and Canadian Veterans. New Democrats support the findings of this report but believe that the report's recommendations must be strengthened.

Currently, Recommendation 3 states:

> That Veterans Affairs Canada consider introducing a flexible mechanism that would make it possible to assess the connection between military service and certain medical conditions whose causes are complex, difficult to identify or poorly understood (p.53).

As it currently appears in the report, Recommendation 3 provides little comfort to veterans' with complex, difficult, or poorly understood health problems battling Veterans Affairs Canada for access to benefits and services. Offering a "flexible mechanism" is not enough to ensure that veterans' with complex health difficulties will get assistance from Veterans Affairs Canada. Veterans including Steve Dornan, Pascal Lacoste, Louise Richard, and many others should not have to jump through hoops, fight for benefits, or be denied access to help due to poorly understood or complex illnesses likely attributable to military or RCMP service.

Therefore, New Democrats suggest these lines be added to Recommendation 3:

> When a veteran with complex, difficult, or poorly understood medical conditions applies to Veterans Affairs Canada with a medical opinion that indicates their illness is likely attributable to military or RCMP service, VAC must apply generosity in offering appropriate services and benefits.

Furthermore, New Democrats suggest that the report include a fourth recommendation:

> Recommendation 4: That the federal government continue with further study and research on depleted uranium exposure (DU) and Canadian veterans.

In conclusion, New Democrats want the report's recommendations strengthened in order to ensure that the men and women of the Canadian Forces and RCMP that suffer from complex, difficult, or poorly understood illnesses or conditions likely attributable to service are well taken care of and eligible for benefits and services from Veterans Affairs Canada.

Respectfully submitted,

Peter Stoffer, MP, Sackville-Eastern Shore, Official Opposition Critic for Veterans Affairs
Sylvain Chicoine, MP, Chateauguay-Saint-Constant, Official Opposition Deputy Critic for Veterans Affairs
Irene Mathyssen, MP London-Fanshawe
Manon Perreault, MP, Montcalm