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The Use of Human Subjects in Chemical Warfare Agent Experiments: An Ethical Perspective

By/par

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Acknowledgements

The ethical analysis presented in this paper is based on historical facts; it would not have been possible without the foresight and dedication of a number of individuals. At the then Defence Research Establishment Suffield in the early 1970s, Mr Bryan Laidlaw and Mrs Ruth Letersky recognised the significance of old field trial documents that had been stored away for years and then meticulously catalogued and preserved them. Their work ensured that many details of the wartime work at Suffield were not lost. In latter years, Ms Jennifer Faust from DRDC Suffield spent many hours retrieving and collating trial information.

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Nomenclature

ACHRE ..... Advisory Committee on Human Radiation Experiments (U.S.)
CWA ..... Chemical warfare agent
CWATRP ..... Chemical Warfare Agent Testing Recognition Program
CWL ..... Chemical Warfare Laboratories
DRDC ..... Defence R&D Canada
DRDC Ottawa ..... Defence R&D Canada - Ottawa
DRDC Suffield ..... Defence R&D Canada - Suffield
SES ..... Suffield Experimental Station

Abstract

We present an assessment of the ethical issues related to the use of human subjects in chemical warfare agent trials in Canada during and after the Second World War. The assessment is based on a clear presentation of the facts that surround the issue, derived from historical records. The facts are then analysed within an ethical framework based on utilitarian principles and on the concepts of just war. The conclusion of the analysis is that, in light of the policies that controlled the experiments and the unique conditions created by a global war, the experimentation was justified, even in cases where the subjects received significant injury. It is also concluded that, by failing to keep adequate records and by not making the information accessible to medical authorities and to the former subjects, Canada and its institutions did not meet their responsibilities towards the veterans.

Résumé

On présente une analyse de l'environnement éthique des expériences scientifiques avec des agents de guerre chimique qui utilisèrent des sujets expérimentaux humains durant et après la deuxième guerre mondiale. Cette analyse se base sur les faits historiques qui se rapportent à cette expérimentation. Un cadre éthique, dérivé de l'utilitarisme et des concepts de la guerre juste, est ensuite utilisé afin d'évaluer ces faits. En vertu des politiques régissant les expériences et des circonstances uniques que crée une guerre mondiale, on juge que les expériences étaient acceptables, même dans les cas où les sujets subirent des blessures sévères. En ne conservant pas les documents qui se rapportaient aux expériences et en ne mettant pas l'information disponible aux médecins et aux sujets expérimentaux, on conclu aussi que le Canada et ses institutions ont manqué à leurs devoirs envers les anciens combattants.

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Introduction

... military pragmatism, not ideological correctness, was the guiding principle of defence science research in Canada, Great Britain, and the United States during the Second World War.[1]

On February 19, 2004, the Honourable David Pratt, Minister of National Defence and the Honourable John McCallum, Minister of Veterans Affairs, announced that the Cabinet had approved a $50M program to recognise, by means of a $24,000 payment and a certificate, the service of veterans who had participated as human subjects in chemical warfare agent experiments in Canada between 1940 and 1975.[2] In many respects the establishment of this program, the Chemical Warfare Agent Testing Recognition Program (CWATRP), marked the end of a public discussion that had begun 16 years earlier with the publication of *Deadly Allies: Canada's Secret War, 1937-1947*[3] by John Bryden, which described the fact that Canada had carried out chemical warfare agent (CWA) experiments involving the use of soldiers as test subjects at the Suffield Experimental Station[4] (SES), Alberta.

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[1] Donald Avery, *The Science of War: Canadian Scientists and Allied Military Technology during the Second World War* (Toronto: University of Toronto Press, 1998), 265.

[2] Canada. Department of National Defence, "Defence and Veterans Affairs Ministers Announce Payments for Chemical-Test Veterans," http://www.forces.gc.ca/cwatrp-pregc/engraph/news_release-announce_e.asp (accessed February 01, 2006).

[3] John Bryden, *Deadly Allies: Canada's Secret War, 1937-1947* (Toronto: McClelland and Stewart, 1989).

[4] During the Second World War, the research station at Suffield was named the Joint U.K./Canada Field Experimental Station (FES), the Experimental Station Suffield (ESS) and the Suffield Experimental Station (SES). In 1966, SES was renamed Defence Research Establishment Suffield (DRES). In 2001, the laboratories were renamed Defence R&D Canada – Suffield (DRDC Suffield). Similarly, the chemical research laboratories in Ottawa were subsequently named Chemical Warfare Laboratories (CWL), Defence Research Chemical Laboratories (DRCL), Defence Chemical, Biological and Radiation Laboratories (DCBRL), Defence Chemical, Biological and Radiation Establishment (DCBRE), Defence Research Establishment Ottawa (DREO) and Defence R&D Canada – Ottawa (DRDC Ottawa). Throughout this paper, the names SES and CWL will normally be used.

In the ensuing years, this issue would receive more public attention. In May 2000, further to pressure applied by Mr Bryden (then a Liberal Member of Parliament) and by a small group of veterans led by Mr H. Friesen, a plaque commemorating the contributions of these veterans was unveiled at Suffield by the Honourable Art Eggleton, Minister of National Defence (MND). Insight Film and Video Productions aired the documentary "Secret War: The Odyssey of the Suffield Volunteers".[5] In May 2001, the MND approved a request from the Office of the Ombudsman for the Department of National Defence and Canadian Forces to investigate complaints from a number of former subjects; the report of this investigation was released to the public in late February 2004.[6]

Most of the media attention, however, resulted from the January 30, 2004 filing of a class action suit on behalf of the former SES subjects, naming as defendants the ministers of National Defence and Veterans Affairs, as well as the National Research Council. Along with the lawsuit, the primary activists, Messrs Friesen and Tanner, launched a well-coordinated media campaign that kept the issue in the public eye.

Inasmuch as the CWATRP sought to address the responsibility that Canada has towards the human subjects, none of the documents (Deadly Allies, Secret War or the Ombudsman report) nor the Insight Film and Video Productions documentary can be considered as definitive works upon which one could assess whether these experiments were 'right' or 'wrong'. All lack rigor or accuracy in presenting[7], understanding and

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[5] George Erschbamer, *Secret War: The Odyssey of the Suffield Volunteers*, ed. Insight Film and Video Productions, Television (Vancouver, 2001), http://www.insightfilm.com/secretwar.html (accessed February 17, 2006).

[6] André Marin, *Complaints Concerning Chemical Agent Testing during World War II* (Ottawa: Department of National Defence, 2004), http://www.ombudsman.forces.gc.ca/reports/special/MustardGas.pdf (accessed February 17, 2006).

[7] For example, in a radio interview (CBC, The House, 01 April 2005), Mr Marin stated that the subjects had been "hosed" with chemical agents. Such words are technically inaccurate and create visual and emotional responses that obscure the issue; such is not normally expected from officials.

analysing the facts surrounding the issue and fail to put them in perspective; as such, their conclusions are doubtful.

This paper seeks therefore to assess if the exposure of human subjects to chemical warfare agents in experimental programmes during and after the Second World War presents residual ethical issues that need to be recognized and/or rectified. The first part gives a clear statement of the facts surrounding the experimentation. This is followed by a summary of three theoretical ethical frameworks that could be used to assess the experiments. In many ways, the issue is similar to that of the use of human subjects in some radiation experiments in the U.S.; the paper will therefore see if parallels exist between the latter and those performed in Canada. We then provide an overview of the evolution of the rules governing human experimentation since the beginning of the 20th century.

The information is then analysed considering the manner in which the subjects' option to volunteer was respected and the efforts the experimenters took to minimize the harm that they would suffer. In the analysis, the special conditions created by a nation at war are considered. Finally, the study will discuss the post-war responsibility that the Government has with respect to the subjects.

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Historical Overview

This war is one of brains and scientific ingenuity rather than one of man power, mass infantry and massacre. Our job is to lick the Germans under Hitler.[8]

1. Background

Like many nations, Canada signed the 1925 Geneva Protocol ("Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare") and ratified it on May 6, 1930. However, in signing Canada indicated that it reserved the right to the retaliatory use of chemical weapons (this reservation was withdrawn in 1999).[9,10] During the 1920s and 1930s, the development of long-range bombers, new chemical agents (e.g. lewisite) and improved munitions, amongst others, meant that chemical warfare, if waged again, would be very different from that which had been experienced during the First World War.

Considering the above and the fact that chemical weapons had been used by Italy in Ethiopia in 1935, there was no guarantee that the Geneva Protocol would be respected in the future. Canada therefore began preparations for defending against, and preparing for, chemical warfare before the outbreak of war. The early work was carried out by the Director of Mechanization and Artillery in cooperation with the National Research Council (NRC) and was aimed at the production of respirators and anti-gas ointments. In

[8] Wartime Diary of Sir Frederick Banting Diary, (University of Toronto Rare Book Room, October 20, 1939), quoted in Avery, *The Science of War: Canadian Scientists and Allied Military Technology during the Second World War*, 266.

[9] Federation of American Scientists, "Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare," http://www.fas.org/nuke/control/geneva/text/geneva1.htm (accessed February 17, 2006).

[10] U.S. Department of State, "Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare," http://www.state.gov/t/ac/trt/4784.htm (accessed February 17, 2006).

1941, all chemical warfare activities were put under the coordination of the Army's Directorate of Chemical Warfare and Smoke (DCWS), including the creation of two new establishments. The first, the Chemical Warfare Laboratories (CWL) in Ottawa, continued the defensive work carried out by the NRC. The second, at Suffield, undertook work in defensive and offensive warfare and field trials requiring large safety zones, which it could carry out on its 2600 km^2 range.[11]

2. Summary of Use of Human Subjects in Chemical Warfare Agent Trials

The experimental work that was performed at SES and CWL covered many aspects of chemical warfare: development of protective equipment and medical counter-measures, assessment of the effects of agents and the assessment of the battlefield effects of such weapons. To perform those studies, some of the trials saw the employment of soldiers served as human subjects.[12]

At both CWL and SES, the vast majority of trials that used human subjects were performed using sulphur mustard; other substances[13] used were nitrogen mustard, phosgene, cyanogen chloride, hydrogen cyanide, lewisite and ammonia. In the post war period, a limited number of tests were done with nerve agents (sarin, VX). In both periods, tests were also carried out with simulants, substances that mimic the behaviour of CWAs, but which lack their toxic effects.

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[11] Canada. Department of National Defence, *Suffield Experimental Station War Diary,* May 1941.

[12] In most documents, human subjects were referred to as "physiological observers". All subjects were male.

[13] In this paper, chemical warfare agents are defined to include: choking gases (chlorine, phosgene, diphosgene), vesicants (sulphur mustard, nitrogen mustard, phosgene oxime, lewisite and mixes), blood agents (hydrogen cyanide, arsine, cyanogen chloride) and nerve agents (tabun, soman, sarin, cyclo-sarin, VX, VE), as well as mixtures that contain appreciable quantities of those compounds.

SES EXPERIMENTS

SES had access to a large range where battlefield conditions could be readily simulated. During the Second World War, it carried out work that included CWA exposure of soldiers to aerial sprays or to sprays from simulated artillery rounds. In other tests, men were contaminated by performing manoeuvres in areas previously contaminated either by aerial sprays or artillery. In some trials, the protection afforded by uniforms impregnated with anti-gas compounds was evaluated. In some of these tests, subjects wore uniforms in contaminated environments; in order to provide a comparative assessment of the protective effectiveness of the compounds, patches of the material were cut out from the uniform, typically on the back of the shoulders. The near-term (1-6 hours) effects of contamination by agents were studied by having the contaminated subjects perform post-exposure activities such as marching, digging trenches, standing or sitting. Tests were carried under various meteorological conditions (cold and warm weather, hot and humid environments) in order to understand the effects of these variables. In addition, drop tests were carried out; these tests included the deposition of drops of agents on the forearm.

In the post war years human testing continued, albeit at a much reduced pace; exposure levels were also significantly decreased. There are no recorded tests with human subjects in the late 1940s. In the 1950s, there were few tests and the subjects were likely all SES staff members; this included two experiments during which staff members were exposed to the nerve agent sarin.[14]

[14] Clément Laforce, Jennifer Faust and Dennis Guertin, *Finding Aids: Field and Laboratory Trials at Suffield and Ottawa, 1941-1975, Volumes 1A-1G & 2A-2H* (Suffield, AB: Defence R&D Canada - Suffield, 2006).

During the period 1960-68, SES concentrated its chemical research on nerve agents. In light of the high toxicity of these agents, simulants were typically used. There were a number of tests that studied the properties of the nerve agents sarin and VX and in which subjects were exposed to very small quantities of agent.

There were also some tests dealing with the effects of medical countermeasures (atropine, caramiphen[15]); nerve agents were not used and the subjects typically signed informed consent forms.

Of note in the post-war period is the "Spot Check series" a set of five exercises held at Wainwright and Sarcee between 1960 and 1966 that had as a general aim the assessment of the effects of nerve agent warfare on the operations of company size units. The nerve agent simulants TBP (tributyl phosphate) and TOF (tri-(2-ethylhexyl) phosphate) were used. In the fall of 1968 SES ran a large event, Exercise Vacuum, whose aim was "To test, under realistic battle conditions, new defensive doctrine, training agents, clothing and equipment designed as a result of shortcomings brought out in previous trials…"[16] Almost 2000 men participated in Exercise Vacuum, which was held on the Suffield range. Simulants (mainly based on the tear gas CS) were used in the experimental phase of Exercise Vacuum.

Prior to Exercise Vacuum, a series of tests (Projects Adobe and Bell Hop I & II) were held that were aimed at assessing the usefulness of a diluted form of mustard, TA 66/1,[17] as a training agent. Use of TA 66/1 was limited to these experiments and to the

[15] Tests with caramiphen also were carried at CWL.

[16] Canada. Department of National Defence, "EX VACUUM Visitors Brochure," *DRDC Suffield Record #2003-4266* (1968).

[17] TA (training agent) 66/1 consisted of a 13% solution of mustard diluted in diethyl phthalate.

training (non-experimental) phase of Exercise Vacuum, in 1968. Subjects that participated in the evaluation of TA 66/1 wore full protective gear.

Harvey[18] and Laforce *et al.*[19] have examined all records retained by Defence R&D Canada and have compiled lists of chemical experiments (e.g. trials performed as part of the chemical defence programs) wherein human subjects were used. From those lists, an estimate of the number of subjects at SES has been derived and is presented in Table 1; the table also shows the number of individual trials from which this data was derived. It should be noted that the data presented in the table is an overestimate of the actual number of subjects that participated in chemical trials. In a number of cases, the trial records do not state how many subjects were used; in those instances, the number of subjects in the experimental plan, which typically was higher than the number of available subjects, was used. It is believed that most subjects used during the war were military. After the war, when the establishment came under the Defence Research Board, about half of the subjects were civilian SES staff.

[18] R. B. Harvey, *Field Trials with Human Observers (Mustard Gas)* (Suffield, AB: Defence Research Establishment Suffield, 1990).

[19] Laforce *et al.*, *Finding Aids: Field and Laboratory Trials at Suffield and Ottawa, 1941-1975, Volumes 1A-1G & 2A-2H*

Table 1 – Number of Human Subjects in Chemical Trials at SES

Type of Experiment	With CWAs	With non-CWA Simulants	%
1941-1945			
Assessment of the effects of agents	479	147	16
Assessment of the effectiveness of protective equipment.	130	103	6
Assessment of the effectiveness of medical treatments/countermeasures.	148	41	5
Assessment of the battlefield effects of chemical warfare agents.	2,810	113	73
Evaluation of test methods and/or simulants.	6		0
Total: Second World War	**3,573**	**404**	**100**
Approximate number of individual trials	135	31	
Post-War			
Assessment of the effects of agents	--	--	--
Assessment of the effectiveness of protective equipment.	30	144	4
Assessment of the effectiveness of medical treatments/countermeasures.	223	312	8
Assessment of the battlefield effects of chemical warfare agents.	224	1,317	34
Evaluation of test methods and/or simulants.	235[20]	133	3
Exercise Vacuum (assessment of doctrine, training agents, clothing and equipment)	--	2,000[21]	51
Total: Post-War	**712**	**3,906**	**100**

CWL EXPERIMENTS

CWL continued the work previously undertaken by the NRC, largely in the areas of the development of medical countermeasures, the effectiveness of protective equipment and in the comparative assessment of different CWAs. Most of these experiments involved the deposition of drops of agent (typically three 5 ml drops) on the volar surface of the forearm, the exposition of part of the forearm to agent vapour (typically by putting the arm over a beaker) or gas chamber trials of respirators with cyanogen chloride.

Few detailed trial records from CWL have survived. Based on the research done by the CWATRP, however, it is estimated that roughly 3,500 subjects were used during the war; this number likely includes those who participated in pre-1941 tests directed by the NRC. Less than 10% of these were part of trials where simulants were used. Ten percent of the trials had as a purpose the evaluation of the effects of different agents; twenty five percent were directed at assessing protective equipment. The purpose of the remainder (65%) was to develop and evaluate medical treatments.

In the post-war period, CWL used approximately 1,950 human subjects in chemical trials; the vast majority of these (~90%) took part in trials where simulants were used. 95% of these trials were in support of the development of protective equipment (respirators, suits, gloves) and the remainder were in support of research in the development of ointments and decontaminants. A small number of the CWL tests were performed at SES; those subjects are included in the tallies for both establishments.

In both periods, it is likely that most CWL subjects were military.

In total therefore, a maximum of 14,000 subjects were used at both research stations. Of these, approximately 7,630 participated in experiments where chemical agents were used. It is worth repeating that these are overestimates.

3. Approval Process for Experiments

The work carried out at SES and CWL was coordinated by the Directorate of Chemical Warfare and Smoke in Ottawa. Close collaboration for the overall programme was maintained with the U.S. and the U.K. through the Chemical Warfare Inter-Service Board and the United States - U.K. - Canadian Chemical Warfare Advisory Committee.[22]

At SES, specific research problems were assigned to lead scientists, who would prepare an experimental protocol detailing the aims of the activity, the resources that would be required, the measurements that would be taken, as well as any specific meteorological conditions under which the trial was to be carried out. Before being approved, this protocol would then be reviewed or amended by all sections that had applicable expertise (e.g. chemistry, field experimental, physics & meteorology sections, etc.). Trials were scheduled on a weekly basis.

In the case of trials involving the use of human subjects, the lead scientist typically was a physician.

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[22] Avery, *The Science of War: Canadian Scientists and Allied Military Technology during the Second World War*, 122-150

4. Recruitment of Subjects/Regulations Concerning the Use of Subjects

Few of the veterans with whom the author has spoken remember details of the means by which they had been selected for service as subjects. However, the CWATRP has retrieved documents that contain the regulations for the selection and treatment of the subjects.[23,24,25,26] One set of these [24] is particularly instructive in that it is complete and does show some evolution in the regulations in 1942 from those in effect previously; it is reproduced at Appendix 1. It is noted that the documents, while labelled as drafts, are very similar to those included in the other sets.

The following is observed:

- service as a subject was meant to be voluntary;
- only medically fit personnel were to be used;
- the subjects had to have attained an acceptable level of anti-gas training for the type of test in which they participated;
- duration of service at CWL was five to ten days; at SES, this period was one month;
- the subjects were to be paid an additional $1.00/test; minimum compensation was $10.00. At SES, additional amounts (up to $20.00) could be paid to subjects receiving severe lesions. In addition, SES subjects typically received two days of extra leave for each week of presence at SES. At CWL, the men were free from any other duty while on service as a subject;

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[23] Library and Archives Canada, "Chemical Warfare - Laboratories - General: Supply of Subjects for Physiological Tests," *RG 24, National Defence. Series C-1, Reel C-5002, Vol. 2, Finding Aid 24-14,* (1942-43).

[24] Library and Archives Canada, "Chemical Warfare - Inter-Service Committee Minutes: Information for Prospective Subject for Physiological Tests (E. S. Suffield)," *RG 24, National Defence. Series E-1-b, Volume 5435, File 457-3-4, Finding Aid 24-100,* (June 29, 1942).

[25] Library and Archives Canada, "RCAF Detachment Suffield - Physiological Subjects and Tests on," *RG 24, National Defence. Series E-1-b, Vol. 5248, File 19-68-20, Finding Aid 24-100,* (1942).

[26] Library and Archives Canada, "16th/22nd Saskatchewan Horse Routine Orders: Item 1054 - Prospective Subjects for Physiological Tests," *RG 24, National Defence. Series C-3, Vol. 14251, Reel T-12717, Serial 1053, Finding Aid 24-60* (September 1941).

- all tests were to be under the supervision of a Medical Officer;
- the subjects would not be returned to their units unless they were declared fit for duty;
- the information bulletins, which were to be posted at the units recruiting the subjects, included the mention that lesions could result from the service. However, that for SES also mentions that "no personal injury is likely to result".[27]

As part of their service, the subjects were required to sign a security warning in which they promised not to reveal any detail of the tests in which they participated. The requirement to maintain secrecy continued after the war. For example, the July 16, 1945 Part I orders for the No. 131 Canadian Infantry (Basic) Training Centre state:

> It is essential that … all personnel are fully aware that upon their return to civil life, when seeking civil employment or at any subsequent time, no disclosure may be made either orally or in writing of any such classified information.[28]

It is noted that offences were punishable by a "fine not exceeding $2,000, or by imprisonment for a term not exceeding seven years with or without hard labour, or to both fine and imprisonment."[29]

During the Second World War, a private's pay ranged between $1.30 and $1.50 per day[30]. There are no recorded instances where a subject took part in 10 tests;[31] therefore, a subject that did not suffer from severe lesions would receive a minimum of

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[27] A possible explanation for this apparent contradiction is that the lesions were expected to be minor, especially those resulting from drop tests.

[28] Library and Archives Canada, "War Diary, No. 131 Canadian Infantry (Basic) Training Centre, *RG 24, National Defence, Volume 17295*. (July 1945).

[29] ibid.

[30] LCol B. Sutherland, CWATRP Program Manager, personal communications with the author, May 2006.

[31] Laforce *et al.*, *Finding Aids: Field and Laboratory Trials at Suffield and Ottawa, 1941-1975, Volumes 1A-1G & 2A-2H* and other DRDC Suffield archives.

$10.00. At SES, he would also be granted one week's leave (equivalent to $9 to $10). For a subject receiving a severe lesion, the cash amount would be doubled. For their service therefore, the subjects received compensation, including the value of the leave, worth between 50% (no severe lesions) and 75% (with severe lesions) of their basic monthly pay.

Preliminary data gathered by the CWATRP indicates that at SES approximately 20% of the subjects came from the District Depots and thus would not have been adequately trained before volunteering for service at Suffield.[32] SES therefore defined a comprehensive training program for the subjects.[33] Analysis of the CWATRP data indicates that these men participated in most types of trials performed at SES and were not selected for minor trials.

Well after the end of the Second World War, informed consent forms started to be used at both CWL and SES. The earliest such document is dated 1966.

[32] LCol B. Sutherland, CWATRP Program Manager, personal communications with the author, April 2006.

[33] Canada. Department of National Defence, *Suffield Experimental Station War Diary,* January 1942.

5. Injuries Sustained by the Subjects

Most of the subjects that took part in tests at CWL received drops of agent on the forearm (with or without anti-gas ointments) – "drop tests". As such their physical injuries would likely be limited to reddening of the skin (erythema) or blistering (vesication) in the exposed area (see Figure 1).

The types of trial performed at SES were more varied. At one end of the spectrum, a number of soldiers sent to SES to serve as subjects never took part in trials – they were cancelled or delayed. Others took part in trials where, for a variety of reasons, they were not exposed to CWAs and as such, did not sustain any injury. The majority of subjects, however, experienced at least some degree of injury to the skin, from minor erythema and/or vesication from drop tests or exposure to liquids and/or vapour in field trials (Figures 1 and 2). Finally, a small number of men received more serious injuries, either from significant exposure in field trials or from vapour burns in hot and moist areas of the body (groin/buttocks/armpits) as a result of the wearing of contaminated clothing (Figures 3 and 4).

In field experiments, the subjects always wore their respirators. There are no records of fatalities.

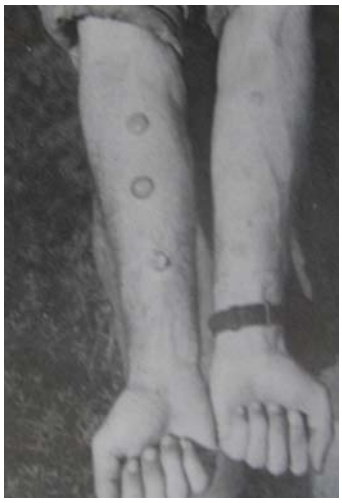

Figure 1: Blisters from "drop tests"
Source: Goodwin, Bridget, *Keen as Mustard*, (St Lucia, Qld: University of Queensland Press, 1998), 361.

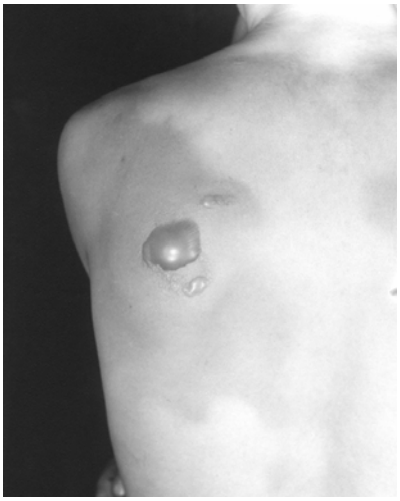

Figure 2: Blister on the back of subject
(likely from direct exposure through cut-out in uniform in a field trial).
Source: DRDC Suffield archives.

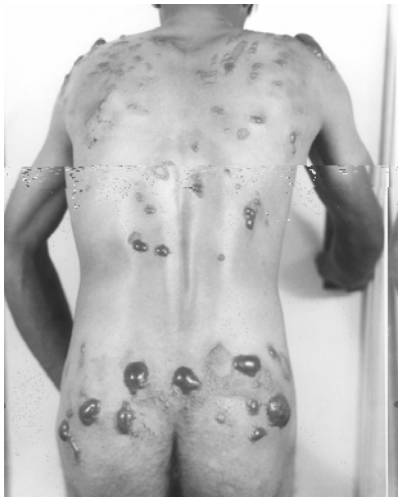

Figure 3: Severe blistering
(likely from aerial spray).
Source: DRDC Suffield archives.

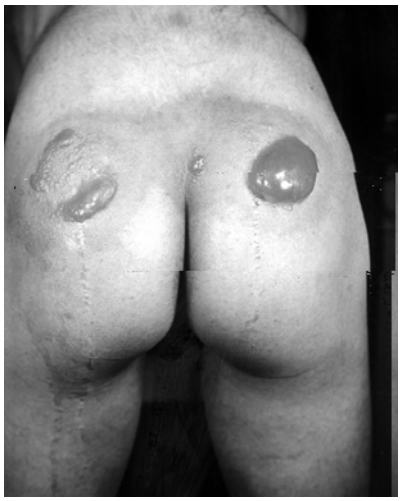

Figure 4: Burns on the buttocks
(likely from vapour burns).
Source: DRDC Suffield archives.

6. Non-Experimental Exposures

It has been estimated that during the First World War, nearly 125,000 tons of chemical warfare agents were used; between 1 million and 1.3 million casualties are recorded, with at least 91,000 of these fatalities.[34] While the usefulness of chemical agents as weapons of war still remains a topic of debate, they remain weapons of fear to this day.

It is however generally accepted that proper gas discipline greatly reduced the effectiveness of a gas attack. During the Second World War, Canada adopted a comprehensive gas training program to ensure that its soldiers were well prepared to survive gas warfare. This program, adapted from that in use in the U.K., is detailed in the 1942 Gas Training pamphlet.[35,36] The basic training program included 22 lessons of 45 minutes each and covered subjects such as the nature of war gases, respirator training, detection and decontamination, etc. The program also required the trainee to enter a gas chamber filled with either chlorine or adamsite (a vomiting agent) with his respirator; he would then be asked to remove the respirator, lift its side or briefly re-enter the chamber without a respirator. It was not uncommon for the trainees to be nauseous. In addition, a decontamination drill in the training program required that a drop of mustard be deposited on the forearm of some trainees, to be immediately decontaminated.

It is believed that most, if not all, army personnel would have received this training during the war. At least 20 sites across the country were equipped with the

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[34] Tim Cook, *No Place to Run: The Canadian Corps and Gas Warfare in the First World War* (Vancouver: UBC Press, 1999), 214-216.

[35] The War Office, *Gas Training 1942* (Reprinted in Canada, July 1942: The War Office, 1942).

[36] The War Office, *Gas Training 1942 (Amendments no.1)* (Canada: The War Office, 1943).

facilities to give this training.[37] It is not known if such training continued after the war; however, it is assumed that the use of adamsite and chlorine would have ceased with the introduction of the tear gas CS in the late 1950s.

The aim of gas training was not to create casualties but to instil gas discipline in men that were being trained for the front and to give them confidence in their equipment. Obviously, the concentrations of gases used in these training sessions would have been such that no long-term effects were expected; however, the practical exercises were designed to be realistic. Bjarnason has studied the possible effects of exposure to chlorine gas in a chamber as part of this training program; he concluded that it was unlikely that the level of exposure would cause any long-term effects.[38]

Finally, a number of soldiers were assigned to chemical units other than SES and CWL (namely S11 Canadian Chemical Warfare School (CCWS) at Suffield, S3 and S4 Small Arms Training Schools at Nanaimo, BC and Long Branch, ON, respectively).[39] These units were engaged in training activities and did not perform experiments. Like the SES and CWL staff, the members of these units could have been exposed to CWAs, either through their normal duties or as a result of accidents.

Marin[40] and Erschbamer [41] do not differentiate between training or occupational exposure and experimentation; they thus obscure the issue of the use of human subjects in CWA experiments. That some soldiers worked or took their training at SES or worked at

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[37] Aldershot, Barriefield, Brandon, Brockville, Calgary, Camp Borden, Chilliwack, Dundurn, Esquimalt, Farnham, Gordon Head, Halifax, Long Branch, Nanaimo, Petawawa, Red Deer, Shilo, Stoney Point, Three Rivers and Valcartier were among stations that received stocks from SES to carry out gas training; see: Library and Archives Canada, "CW - General - Training Expedients Offensive," *RG 24, National Defence. Reel C5003. File HQS 4354-1-7-2. Vol. 2*.

[38] S. G. Bjarnason, *Chlorine Gas Toxicity* (Suffield: DRDC Suffield, 2005).

[39] ADGA Group Consultants Inc., *Warfare Agent Disposal Project, Contaminated Sites Database: Final Report (Contract no W2187-03WAD1/001/SV)*, 2005).

[40] Marin, *Complaints Concerning Chemical Agent Testing during World War II*, 1-19

[41] Erschbamer, *Secret War: The Odyssey of the Suffield Volunteers*

S11 CCWS led many of them to associate all SES activities with experimentation and many do not report (nor remember) the other parts of the training program. It would be entirely natural not to remember, 50 years later, a series of lectures; on the other hand, a short gas chamber visit that left one gasping for air or caused one to vomit would be more apt to leave an indelible memory.

At first glance, the distinction between training and experimentation may seem artificial, but one should note that:

- some human experimental subjects in chemical warfare agent trials were exposed to levels sufficient to cause serious injury; the level of exposure in training sessions was less severe;
- unlike trainees and workers, subjects were not advised of the nature of the experiments in which they were asked to participate (at least during the Second World War. Post-war subjects benefited from informed consent);
- in some instances, where the aim of the experiment was to assess the effect of the agents, medical treatment may have been delayed, or not provided unless the exposure was severe; and
- in other instances, the experimental exposures may have created recurring medical conditions. In light of the secrecy of the experiments and of the solemn promise that the subjects gave to maintain security of classified activities, they may have been subsequently unable to access medical help or Veterans benefits for those conditions.

7. Health Effects of Chemical Warfare Agents

The full description of the health effects caused by exposure to chemical warfare agents is clearly beyond the scope of this paper. As with all toxic substances, the effects of exposure to CWAs depend on many factors, including the mode and duration of exposure and the dose received. Lifestyle and psychological factors will also influence the effects of CWA exposure. Thus, in assessing the health of a former subject, it is not sufficient to take into account any immediate term injury that he would have received; the long term effects, physical and psychological, should also be considered. Pre-experimental training and nature of consent would tend to reduce the anxiety level felt by the subject during the test. Thus the long-term maintenance by governmental authorities of a veil of secrecy surrounding the experiments, if not actual denial of their occurrence, coupled with lack of adequate medical follow-up, could complicate any post-event effect.

By necessity, there is a good body of knowledge on the acute short-term effects of CWAs – that knowledge was instrumental in the selection of these substances as warfare agents in the first place. For some agents, there is sufficient information to establish relationships between exposure and longer-term effects. For example, in 1993 the U.S. Institute of Medicine carried out a comprehensive study of the health effects of mustard and lewisite exposure on U.S. human subjects and workers exposed to these agents.[42] The authors found that the evidence indicated causal relationships between exposures such as those created in chamber or field trials and certain health conditions (such as respiratory and skin cancers, skin and lung diseases, etc.); they also determined that for a

[42] Constance M. Pechura, David P. Rall and Institute of Medicine (U.S.). Committee to Survey the Health Effects of Mustard Gas and Lewisite, eds., *Veterans at Risk: The Health Effects of Mustard Gas and Lewisite* (Washington, D.C.: National Academy Press, 1993).

few other diseases (such as acute nonlymphocytic leukemia, reproductive dysfunction), "the data were *suggestive* but not completely clear"[43] (emphasis in original text). For yet other diseases (e.g. gastrointestinal, haematological and neurological diseases, etc.), there was insufficient information to establish links, but that this it was important to emphasize there were no reasons to conclude that such links did not exist.

Finally, the authors noted that the conditions under which the chamber and field experiments were carried out could lead to adverse psychological effects (long-term mood and anxiety disorders, PTSD, etc.) and that these "may have well been magnified by susbsequent secrecy, fears about the health risks, and institutional denials."[44]

Of interest is the fact that the authors of the study concentrated on those experiments where exposure levels were more acute than those experienced in drop tests; their conclusions are presented in the context of a discussion of gas chamber and field trials. This emphasis is likely the result of previous studies indicating the lack of evidence linking low level exposures (such as those in drop tests) to any long-term health condition.

exposure levels were measured, the data typically refer to the immediate doses; there was no attempt to measure that received by wearing contaminated clothing after the initial contamination. Further, data that would correlate doses to subsequent health problems has never been collected; it is doubtful if sufficient medical records exist.

Similar studies have not been done in Canada. However, in light of the similarities between the tests performed in the U.S. and those carried out in Canada (especially the SES field trials), it is very likely that the findings of the Institute of Medicine study apply to the subjects of field trials at SES; it is also possible that the subjects of other trials were not exposed to doses sufficient to cause long-term physiological problems.

8. Experimentation in Other Countries

Experiments of the type described here were not limited to Canada. Similar research programs were carried out in the United Kingdom (Chemical Defence Experimental Station, Porton), India (Chemical Defence Research Establishment), the United States (Edgewood, San José Proving Grounds in Panama, Dugway Proving Ground in Utah, Bushnell Proving Ground in Florida and others)[47] and Australia (Experimental Stations at Innisfail and Prosperine, Queensland). It is beyond the scope of this paper to present those in detail but their general nature and the methods used were similar to those used at SES and CWL.[48] In order to maximize the value of the research, these experi-

[47] It is reported that close to 60,000 U.S. soldiers participated as subjects in chemical warfare experiments. Most of these (~56,000) took part in drop tests. See: Pechura, Rall and Institute of Medicine (U.S.). Committee to Survey the Health Effects of Mustard Gas and Lewisite, *Veterans at Risk: The Health Effects of Mustard Gas and Lewisite*, v.

[48] Pechura, Rall and Institute of Medicine (U.S.). Committee to Survey the Health Effects of Mustard Gas and Lewisite, *Veterans at Risk: The Health Effects of Mustard Gas and Lewisite*

mental programs were collaborative, particularly among Canada, the U.S. and the U.K.[49,50]

Human subjects were also used by Japan[51,52] and Germany. [53,54] In these countries, however, the nature of the experimentation was significantly different. Subjects were typically concentration camp inmates (Germany), prisoners of war or from occupied countries (Japan). They were rarely volunteers, and if they were, it can be argued that the subjects volunteered to escape the fate that was reserved for them in the concentration camps or prisons. Additionally, the nature of the experiments was such that death of the subjects was the most common outcome, either from the experiments or at the hands of their captors, after the tests.

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[49] Avery, *The Science of War: Canadian Scientists and Allied Military Technology during the Second World War*

[50] Gradon Carter and Graham S. Pearson, "North Atlantic Chemical and Biological Research Collaboration: 1916-1995," *The Journal of Strategic Studies* 19, no. 1 (March, 1996), 74-103.

[51] Toshiyuki Tanaka, *Hidden Horrors: Japanese War Crimes in World War II* (Boulder, Colo.: Westview Press, 1996).

[52] Yuki Tanaka, "Poison Gas: The Story Japan Would Like to Forget," *Bulletin of the Atomic Scientists* 44, no. 10 (October, 1988), 10-19.

[53] Joel Levi, "Medicine, the Holocaust and the Doctors' Trial" in *Bioethical and Ethical Issues Surrounding the Trials and Code of Nuremberg: Nuremberg Revisited*, ed. Jacques J. Rozenberg, Vol. 74 (Lewiston: Edwin Mellen Press, 2003), 111-130.

[54] Michael I. Shevell, "Neurosciences in the Third Reich: From Ivory Tower to Death Camps," *The Canadian Journal of Neurological Sciences* 26, no. 2 (May, 1999), 132-138.

The Ethics of Human Research

Ethics is the attempt to develop a set of principles that apprehends the intuitions of human society; there is no decision procedure in ethics; you cannot feed the available information into a black box, apply the relevant ethical principles and receive an answer.[55]

The preceding section summarized the historical data; other than providing a few interpretive comments, no attempt at judging the events was made. In this section, a review of some ethical theories will be presented with a view of selecting a framework by which a judgement can be made of the use of human subjects in CWA experiments. The unique circumstances that are created when a nation is at war, as well as the post-war environment will be considered.

Pojman describes ethics as "that branch of philosophy that deals with how we ought to live, with the idea of the Good, and with such concepts as 'right' and 'wrong'".[56] Theoretical ethics seeks to establish frameworks within which the concepts of right and wrong can analysed; ideally, these concepts would be universal and time-invariant. Applied ethics then uses these frameworks to try to solve moral problems. However, the reality is that ethical theories remain philosophical constructs; they are not amenable to immediate use and can, if improperly used, lead to contradictory solutions. They are nevertheless essential in framing an ethical analysis.

[55] Michael Hooker, "Framing the Issues" in *The Microbiologist and Biological Defense Research:*

1. Ethical Frameworks

ETHICAL RELATIVISM

In examining the morality[57] of the use of military human subjects in CWA experiments, it seems intuitive to immediately conclude that today's human research principles do not apply *in toto* to the past. After all, societal norms in the 21st century seem vastly different than those that existed in the 1940s. Canada is not engaged in the struggle that was the Second World War. Furthermore in the past 60 years, Canadian society has been fundamentally transformed: by today's standards, Canada in 1940 was certainly paternalistic, if not outright racist. Why then should we judge yesterday's actions by those rules and principles that form the basis of today's society?

This construct is called conventional ethical relativism and implies that morality is a product of culture. Since cultures vary and evolve, it would then deny the existence of universal and time-invariant moral principles and thus leads to inconsistencies. For example, the practices of slavery or sati[58] could be judged ethical in societies that allowed them in the past. By taking such arguments to the extreme, it could also be argued under ethical relativism that multi-cultural societies would allow different moral codes.[59]

Some actions can never be considered as ethical under any circumstance:

> …the passing of fifty years in no way changes the fact that Hitler's extermination of millions of people was wrong, nor does it erase or even

[57] In this paper, no distinction is made between the terms 'ethics' and 'morality'.
[58]

> diminish his culpability. Nor would the passing of a hundred years or a thousand do so.[60]

The issue under study relates to the assessment of activities that saw the deliberate injury of human subjects. Such activities would not be allowed (or even considered) in today's society. Yet sixty years seems too short a period to accommodate the required change in basic moral principles that guide that society; the evolution of Western culture since the Second World War does not give a sufficient basis from which to justify/invalidate the use of human subjects in CWA experiments. Therefore, since ethical relativism does not readily accommodate universal ethical principles, it is natural to reject it as a means assessing actions such as those studied in this paper.

UTILITARIANISM

Another perspective that can be taken rests on the argument that the Allied nations were engaged in an unprecedented conflict, one that, at least in the early years, included the real potential of defeat at the hands of the Axis. The use of chemical weapons by the enemy could have greatly affected the outcome. In this context, defensive preparedness and the building of a retaliatory capability were critical elements of Allied strategy. In his address at the 2005 dedication of a plaque commemorating the service of the Suffield subjects, DND's Assistant Deputy Minister for Science and Technology, Dr R. Walker, stated that:

> The work that was carried out at Suffield was part of a comprehensive allied effort to deny the enemy the flexibility of using chemical

[60] Advisory Committee on Human Radiation Experiments, *Final Report of the Advisory Committee on Human Radiation Experiments* (New York, NY: Oxford University Press, 1996), Chapter 4.2, 2 of 16, http://www.eh.doe.gov/ohre/roadmap/achre/report.html (accessed February 14, 2006).

> weapons. Blitzkrieg had replaced trench warfare; new developments such as long range aircraft and new explosives had changed the battle-field. Chemical warfare, should it happen, would also be different. Many questions had to be answered, such as:
>
> - What would be the effects on troops if chemical agents were sprayed from aircraft?
> - How many of them would still fight and how many would require immediate medical attention?
> - How effective were the soldier's protective equipment and the new anti-gas ointments?
> - What would happen if and when soldiers had to manoeuvre in contaminated environments?
>
> In the context of the Second World War, these questions and many others required urgent answers. It also required that soldiers place themselves in harm's way and become human subjects. [61]

In other words, Dr Walker argued that the human subjects' service was required to reduce the potential of greater injury being done to their comrades on the front and to help preserve their nation: the end justified the means.

This kind of argument is part of a version of teleological ethics: utilitarianism, whose roots can be found as far back as 440 BCE (Sophocles) and which was developed by Jeremy Bentham and John Stuart Mill.[62] The principles of utilitarianism can be summarised as "The greatest happiness for the greatest number" or "The greatest good for the greatest number".[63] Utilitarianism is often cited to explain the decisions taken by medical personnel in triage. In non-therapeutic medical research, these principles imply

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[61] Robert W. Walker, "ADM (S&T) Speech: Suffield Experimental Station Memorial Plaque Dedication Ceremony," (August 26, 2005).

[62] Pojman, *Ethics: Discovering Right and Wrong*, 108

[63] G. A. Hannah, "Seizing and Holding the Moral High Ground: An Introduction to Ethical Theories" (Toronto: Canadian Forces College Research Paper, in preparation).

that, in assessing the ethics of an action, one should consider if the goals of that action justify the means by which it took place.

At first glance, utilitarianism seems well suited for the problem at hand. However as with all ethical theories, its application to a concrete issue is not straightforward. In assessing if the end justifies the means, one would, for example, require an authoritative judgement of the validity of statements such as the following:

- the creation of a retaliatory chemical capability by the Allied nations had as a consequence that chemical warfare was not waged during the Second World War;
- the facts that there were no chemical casualties in combat during the war and that the knowledge thus gained helped build an enduring chemical defensive capability outweigh the injuries (physical and psychological) sustained by the human subjects at SES and CWL.

Similar questions can be posed in the post-war scenario, during the Cold War. Since these statements contain elements of facts that did not occur, they cannot be proven conclusively. Even if they could, the authority that would be asked to weigh the means against the end must be beyond reproach. In a discussion of the applicability of utilitarianism to the assessment of the morality engaging in war, Coates states:

> …the overall and long-term consequences of an act or policy are not only unknowable in advance but uncontrollable by the agents themselves, being as much the product of chance and circumstance as of deliberate design. In effect, and in its more extreme and rationalist forms at least, moral consequentialism requires of the moral agent the kind of knowledge that theologians like St Augustine attributed to divine providence and philosophers like Hegel attributed to the ‘cunning of

> reason': in short, the kind of knowledge that is beyond any moral agent.[64]

Alternatively, the facts surrounding an issue must be sufficiently persuasive to allow a mere mortal, not the Providence or the Philosopher King, to make a valid judgement. In a collection of essays dealing with the application of ethical analysis to practical matters (euthanasia, animal rights, etc.), Rachels notes that his "considered opinion about utilitarianism was that it is false because it cannot account for our duty to treat people according to their individual deserts."[65] However, noting the results of his practical analyses that form part of the collection, he further writes:

> Utilitarianism is the position I seem to have ended up with, as the result of thinking about a lot of different issues, even though I never aimed at any such destination.[66]

The principle of utilitarianism may well prove useful in the current context. Its application will require other considerations; some as described below.

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[64] A.J. Coates, *The Ethics of War* (Manchester: Manchester University Press, 1997), 172.

[65] James Rachels, *Can Ethics Provide Answers? And Other Essays in Moral Philosophy* (Lanham, MD: Rowman & Littlefield, 1997), ix.

[66] ibid., ix

MILITARY ETHICS: JUST WAR

> *The question of whether any and all means are morally acceptable for the sake of national security and the national defense is a complex one. Even in the case of a representative democracy that is not an aggressor, it would be wrong to assume that there are no moral constraints in the time of war*"[67]

Violent conflicts have been part of society since its beginnings, yet society differentiates between criminal violence (clearly an unethical behaviour) and violence carried out in the name of the state in wartime. This distinction is achieved by constraining the conditions under which war is waged, as well as the conducts that are allowed when war is contemplated. These concepts are embodied in various international conventions (such as the Hague Convention, the Charter of the United Nations, etc.).

> The principles commonly called 'just war criteria' provide an organized schema for determining whether a particular conflict is morally justified. As one might imagine, any such framework will inevitably fall short of providing moral certainty.[68]

In a discussion of the biological defence program in the U.K., Hooker[69] posits that the ethics of biological warfare are better addressed within the field of the ethics of warfare, rather than medical ethics; this would also apply to chemical warfare.

The criteria that are assessed to determine if a war is just are typically variations of the following:[70,71,72]

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[67] Advisory Committee on Human Radiation Experiments, *Final Report of the Advisory Committee on Human Radiation Experiments*, Roadmap, Chap 4.2, 11 of 16

[68] Cook, *The Moral Warrior: Ethics and Service in the U.S. Military*, 28

[69] Hooker, *Framing the Issues*, 84

[70] Cook, *The Moral Warrior: Ethics and Service in the U.S. Military*, 28

[71] A. J. Coates, *The Ethics of War* (Manchester: Manchester University Press, 1997).

[72] William V. O'Brien and Anthony C. Arend, "Just War Doctrine and the International Law of War" in *Military Medical Ethics - Volume 1*, eds. Thomas E. Beam and Linette R. Sparacino (Falls Church,

1. Just cause
2. Legitimate authority
3. Public declaration
4. Just intent
5. Proportionality
6. Last resort
7. Reasonable hope of success
8. End of peace

While these criteria are intended to consider war as a whole, it is instructive to consider them when applied to the use of human subjects. Of those criteria, the fourth, fifth and, to a certain extent, the seventh merit evaluation. In this context, the just intent requirement would be met if it can be argued that the experimentation was carried out solely in support of the legitimate purposes of the war (e.g. to prevent casualties or to support the combat capabilities of one's troops), and not in support of other aims (e.g.: to pursue one's own scientific career). Reasonable hope of success speaks to the need of the experimentation to yield information that would be useful in terms of the war effort. "The proportionality requirement is that the damage done in the war should be worth it."[73] This is then closely related to the utilitarian 'the end justify the means' concept.

The questions posed at the SES Plaque Dedication Ceremony (p. 28) are valid. Chemical warfare in 1942 would have been different and deadlier than that which had been waged 25 years earlier. The SES and CWL research programs made extensive use of laboratory tests and experimental animals but there was still a requirement to use human subjects: laboratory studies and animal models could simply not reproduce battle-field conditions nor the human physiology. Further, the experimental process at SES ensured that the experiments were valid and supported the aims of the program.

VA: Office of the Surgeon General, United States Army, 2003), http://www.bordeninstitute.army.mil/ethicsbook_files/Ethics1/default1.htm (accessed February 17, 2006).

[73] Cook, *The Moral Warrior: Ethics and Service in the U.S. Military*, 30

Thus, by leading to an assessment if the ends of an action justify the means taken to achieve it, the application of the just war criteria leads to the same difficulties as those related to using utilitarianism and thus, do not immediately provide a basis for a definitive judgement to the issue at hand.

2. The Advisory Committee on Human Radiation Experiments Report

Another approach to the problem is to review other instances where human subjects were used in experimental studies that would not be acceptable in today's environment. In 1994, U.S. President Clinton appointed the Advisory Committee on Human Radiation Experiments (ACHRE). ACHRE's tasks were wide in scope and included, amongst others, researching the history of human radiation experiments in the U.S. between 1944 and 1974 and identifying the applicable ethical and scientific standards that would single out any wrongdoing related to these experiments. The Committee included fourteen members drawn from a wide range of scientific, legal, medical and health fields (including a member from the general public). ACHRE was also asked to make recommendations aimed at preventing recurrences. In considering the ethical background, the Committee was to:

> consider whether (A) there was a clear medical or scientific purpose for the experiments, (B) appropriate medical follow-up was conducted; and (C) the experiments' design and administration adequately met the ethical and scientific criteria, including standards of informed consent, that prevailed at the time of the experiments and that exist today.[74]

[74] Advisory Committee on Human Radiation Experiments, *Final Report of the Advisory Committee on Human Radiation Experiments*, Preface: The President's Charge, 1 of 2

The ACHRE studied a large number of experimental instances where humans were exposed to radiological elements,[75] not all of which bear direct resemblance to the use of subjects at SES and CWL. There are, however, sufficient similarities in the conditions under which some experiments were carried out to warrant a close scrutiny of the Committee's findings and recommendations. The types of experiments that closely match that of those performed at SES and CWL included:[76]

- the observation of nuclear explosions;
- the conduct of military operations (manoeuvres, damage assessment, decontamination) on a nuclear battlefield;
- the assessment of eye filters to reduce the effects of the nuclear flash;
- the measurement of the radioactive environment of mushroom clouds by flying through them, either as a human subject or as an experimental worker.

Consent, informed or not, was often not part of the experimental protocols, in spite of a 1953 mandatory Department of Defence policy to that effect.[77] Further, it is noted that some experiments were judged as being flawed in that their design would not yield valid data; these still proceeded since they also incorporated elements of training for the troops participating.

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[75] For example: non-therapeutic research on children, whole body irradiation research, research on prisoners, atmospheric releases of radiation, human experimentation during nuclear tests; observational research on uranium miners and on residents of the Marshall Islands.

[76] Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs, *Report on Search for Human Radiation Experiment Records: 1944-1994, Vols 1 & 2* (Springfield, VA: U.S. Department of Commerce, 1997), http://www.defenselink.mil/pubs/dodhre/index.html (accessed February 14, 2006).

[77] In February 1953, U.S. Secretary of Defense Wilson issued a memorandum detailing the restrictions for the use of human subjects in atomic, biological and chemical experiments by the Department of Defense. The memorandum embodied the precepts of the Nuremberg Code, including informed consent. The memorandum was classified Top Secret and as such, received limited distribution. It is reproduced in its entirety in the ACHRE Report (Chapter 1.3, 9-12 of 18).

In fulfilling its mandate, the ACHRE Committee adopted a two-tiered ethical framework. The first assesses the morality of the actions that led to the experimentation; the second seeks to assess if blame or praise can be attributed to the agents (individuals or institutions). The Committee noted the variety of ethical frameworks in existence but adopted three standards by which to fulfill its tasks. The first standard is fundamental and describes basic principles that it stated were not limited by time and context; these are defined as:

1. one ought not to treat people as mere means to the ends of others;
2. one ought not to deceive others;
3. one ought not to inflict harm or risk of harm;
4. one ought to promote welfare and prevent harm;
5. one ought to treat people fairly and with equal respect;
6. one ought to respect the self-determination of others.

The second and third standards are time and context dependent: the policy environment guiding the actions of the government agencies that carried out the experiments and the professional ethics of the personnel that performed the work.

In essence, the Committee rejected ethical relativism, at least with respect to the six basic moral principles. The first of these principles seems to reject utilitarianism as a framework for judging injury-inducing human experimentation; however, the Committee noted that other factors can modify the weight or importance ascribed to these principles and as such, is not a rejection of utilitarianism:

> … the obtaining of consent and an intention to benefit … also can transform the moral quality of an act that involves the imposition of harm or risk of harm. One important way to make the imposition of a

> risk or harm justifiable is to obtain the person's permission for the imposition.[78]

The application of the second and third standards does accommodate an element of evolution in conduct:

> …it would be inappropriate to blame the clinicians or researchers of the 1940s and 1950s for not adhering to the *details* of a standard that emerged through a complex process of cultural change that was to span decades. At the same time, however, it remains appropriate to hold them to the general requirements of the basic moral principles that underlie informed consent – not treating others as mere means, promoting the welfare of others, and respecting self-determination.[79]
> (emphasis in original)

The ACHRE report discusses the possibility that national security considerations may require that individual freedoms be sacrificed, to some extent, for the greater good; this would allow for some modification to the basic principles. Unfortunately, the Committee did not examine this issue in depth since it did not find that any of the experiments it studied had a valid national security exemption (some experiments were in violation of standing policy; others were classified in order to avoid embarrassment, and not to protect state secrets). Therefore, the Committee did not consider that the study of the morality of war was part of its mandate, other than noting that some moral constraints apply to warfare.[80]

Finally, with respect to the human subjects in the trials noted above, the Committee made the following findings:

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[78] Advisory Committee on Human Radiation Experiments, *Final Report of the Advisory Committee on Human Radiation Experiments*, Chapter 4.3, 2 of 10

[79] ibid.

[80] ibid.

- the subjects were not exposed to risks greater than other soldiers that were performing similar activities, but who were not experimental subjects;
- successful precautions were taken to shield the subjects from serious harm;
- the government did not keep the records that would assist the veterans to establish the exposure levels to which they were subjected or to identify all who participated.

ACHRE drafted 18 recommendations. From these, the following may apply to the study of the SES/CWL experiments:

a. **Recommendation 3**: that the government offer an individual apology to those subjects who participated in a radiation experiment from which the subject was not gaining a medical benefit when a) the subject did not offer an acceptable consent and b) their selection as a subject was considered to be an injustice.

b. **Recommendation 6:** that all veterans (not only subjects) who participated in these tests be considered for compensation in the similar fashion as those who took part in atmospheric testing or the occupation of Hiroshima or Nagasaki since the latter were already being recognised. In this context, the Committee noted that the participants in atmospheric testing faced risks similar to those experienced by non-subjects.

In addition, the Committee made a number of recommendations related to the revision of the national rules for the use of human subjects in therapeutic and non-therapeutic experimentation. Special mention is made of the requirement that any research involving the use of military personnel be structured such that volunteers are not

unduly influenced by line of command and that the policy environment clearly distinguish between experimentation and training activities.

In summary, the ACHRE adopted a utilitarian approach and put an emphasis on the need to respect the regulations and codes of ethics existing at the time of the experimentation. It further stated that if the harm done to the subjects is similar to that suffered by non-experimental workers and trainees, then the both groups should be treated in the same way. The Committee also highlighted the requirement to keep records sufficient to identify all subjects and the exposures that they experienced.

3. Evolution of Rules Governing Human Experimentation

Medical therapeutic research in one form or other is likely as old as medicine itself; that rules should govern such experimentation is also not a new concept. For example, Amiel *et al* [81] discuss the concepts developed by Pierre-Charles Bongrand in his 1905 thesis. They report that Bongrand concluded that experimentation carried out for the development of scientific knowledge, while immoral, was at times necessary. Bongrand also emphasized that the scientific aims had to be sound and that the subject had to express his/her willingness to participate; that the subject should be suitably compensated is also raised as an issue. In 1907, in an address to the Congress of American Physicians and Surgeons, William Osler discussed the morality of medical research and set out two essential conditions: "absolute safety" and "full consent".[82]

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[81] Philippe Amiel, Séverine Mathieu and Anne Fagot-Largeault, "Acculturating Human Experimentation: An Empirical Survey in France." *Journal of Medicine & Philosophy* 26, no. 3 (June, 2001), 285-298-2, http://search.epnet.com/login.aspx?direct=true&db=aph&an=4663969 (accessed January 27, 2006).

[82] Sydney A. Halpern, *Lesser Harms: The Morality of Risk in Medical Research* (Chicago: The University of Chicago Press, 2004), 3.

The above should be viewed as individual opinions and cannot be considered as codes of conduct. Still, prior to the Second World War, there were a few national attempts to impose guidelines on human experimentation: in Prussia (1900), Germany (1931) and Russia (1936).[83]

The promulgation of the Nuremberg Code in 1947 marks the beginning of the codification of principles to regulate the use of human subjects in medical experiments. The code puts great emphasis on the requirement that subjects should grant full and informed consent and have the right to withdraw. All experimentation should be based on sound scientific principles and the scientists in charge should be qualified; ideally, animal experimentation should precede the performance of the work and suffering and injury should be minimised. [84,85]

The principles of the Nuremberg Code were included in the United Nations' Universal Declaration of Human Rights, which was accepted by the original signatory nations to the Charter of the United Nations[86,87]; however, they were not immediately put into effect. Still the guidelines that regulated research, and the extent to which researchers respected them, continued to evolve. In the U.S., the precepts of the Nuremberg Code were promulgated as requirements for some Department of Defense (DoD) experiments in 1953 (see note 77) but the policy was classified and applied only to

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[83] Sev S. Fluss, "The Evolution of Research Ethics: The Current International Configuration," *Journal of Law, Medicine & Ethics* 32, no. 4 (2004), 596-603.

[84] Evelyne Shuster, "The Nuremberg Code: Hippocratic Ethics and Human Rights," *Lancet* 351, no. 9107 (March 28, 1998), 974.

[85] Jenny Hazelgrove, "The Old Faith and the New Science: The Nuremberg Code and Human Experimentation Ethics in Britain, 1946-73." *Social History of Medicine [Great Britain]* 15, no. 1 (2002), 109-135.

[86] David T. Marshall, *The Law of Human Experimentation* (Toronto: Butterworths, 2000), 14.

[87] CIHR Strategic Training Program in Vascular Research, "Module 1: Ethics in Health Research", http://www.robarts.ca/CIHR_VTP/VASCPROG/Research_Ethics/module1/module_1.htm (accessed May 11, 2006).

experiments performed by DoD personnel. In 1964, the World Medical Association adopted the Helsinki Declaration (deliberations had started 11 years earlier[88]); this declaration added to the subject-centric principles of the Nuremberg Code by placing "the onus for ethical conduct on the obligations of the researcher to the research subject."[89] It also introduced the need for the review of an experimental protocol by a committee of peers. The Helsinki Declaration is a living document; it has been revised five times since its promulgation. Of special interest is that the Declaration does not discuss non-therapeutic research in detail; it does however, stipulate that "the interest of science and society should never take precedence over considerations related to the well being of the subject."[90,91]

In a June 1966 paper in the New England Journal of Medicine, Dr Beecher published an analysis of a large number of U.S. experimental medical studies and noted that a significant number of them presented ethical problems (e.g. improper consent, research abuse).[92] This, and other considerations, led to the 1979 publication by a National Commission of the Belmont Report[93] that became the basis from which further

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[88] Jonathan D. Moreno, "Goodbye to all that," *Hastings Center Report* 31, no. 3 (May/June, 2001), 11.

[89] Jack P. Landolt, *DRDC Guidelines for Human Subject Participation in Research Projects* (Toronto: Defence R&D Canada - Toronto, 2003).

[90] Aurora Plomer, *The Law and Ethics of Medical Research: International Bioethics and Human Rights* (London: Cavendish Publishing Limited, 2005), 27.

[91] World Medical Association, "World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects," http://www.wma.net/e/policy/b3.htm (accessed April 03, 2006).

[92] Henry K. Beecher, "Ethics and Clinical Research," *The New England Journal of Medicine* 274, no. 24 (June 16, 1966), 1354-1360.

[93] United States: National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, *The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research.* (Washington: Bethesda The Commission, 1979), http://www.fhi.org/NR/rdonlyres/e5yfdirwhseugjtdn7odgz2rpmw2njkzrv5kwzxcpakk3nmzyexlscp6e5iqo7w6y3tavbfehcpycg/RETCCRBelmontReport.pdf (accessed February 14, 2006).

U.S. human research proceeded. It also institutionalised the concept of the committee review system.

In Canada, the Medical Research Council implemented its first guidelines in 1978, though by that time many institutions had already issued their own procedures[94] (for example in 1966, SES was using written informed consent forms that included the right of the volunteer to withdraw from the experiment). Since then, the Canadian guidelines have evolved; their most recent formulation (the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans) was issued in August 1998. The guidelines are mandatory for all researchers and institutions receiving funding from the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada and the Social Sciences and Humanities Council of Canada.[95] The policy statement is also applicable to all human research carried out or sponsored by the Department of National Defence[96] and Defence R&D Canada.[97]

The Tri-Council Policy mandates that Research Ethics Boards (REBs) shall review all projects. It also lists ethical principles that shall guide human research: respect for human dignity, respect for free and informed consent, respect for vulnerable persons, respect for privacy and confidentiality, respect for justice and inclusiveness, the balance of harms and benefits, the minimisation of harm and the maximisation of benefits. The

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[94] Marshall, *The Law of Human Experimentation*, 111

[95] Medical Research Council (Canada), Natural Sciences and Engineering Research Council Canada and Social Sciences and Humanities Research Council of Canada, *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans / Medical Research Council of Canada, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada* (Ottawa: Medical Research Council of Canada, 1998), http://www.pre.ethics.gc.ca/english/policystatement/policystatement.cfm (accessed February 17, 2006).

[96] Canada. Department of National Defence, *Research Involving Human Subjects,* DAOD 5061-0, August 20, 1998, http://www.admfincs.forces.gc.ca/admfincs/subjects/daod/5061/0_e.asp (accessed April 29, 2006).

[97] Landolt, *DRDC Guidelines for Human Subject Participation in Research Projects*

last three principles admit the concept of non-therapeutic research. Their application would seemingly provide a means to assess the utilitarian concept of the end justifying the means.

The Policy also discusses compensation for subjects:

> In research projects where subjects will be compensated, REBs should be sensitive to the possibility of undue inducement for participation, such as payments that would lead subjects to undertake actions that they would not ordinarily accept.[98]

The Department of National Defence currently authorizes maximum daily payments of $56.05 for soldiers volunteering to become test participants and where "exposure to abnormal stress and discomfort is anticipated".[99] For a private in the standard group, this represents approximately 36% of the daily pay rate; for a volunteer receiving a higher rate of pay, this percentage obviously decreases.[100]

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[98] Medical Research Council (Canada), Natural Sciences and Engineering Research Council Canada and Social Sciences and Humanities Research Council of Canada, *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans / Medical Research Council of Canada, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada*, 2.8

[99] Canada. Department of National Defence, "Stress Allowance for Test Participants", article 205.48 in *Compensation and Benefits Instructions*, (Ottawa: DND, 2005), http://www.forces.gc.ca/dgcb/cbi/engraph/home_e.asp?sidesection=6&Section=205.48&sidecat=22&Chapter=205#205.48 (accessed April 29, 2006)

[100] Canada. Department of National Defence, *Cost Factors Manual 2005/2006*, (Ottawa, DND, 2005), Page 1-2 and Table 1-1.

Discussion – applying the ethical frameworks

…moral reasoning cannot proceed on the basis of the comfort of universal ethical rules or codes. Indeed, it cannot rely on any simplistic theory that purports to provide answers to ethical dilemmas by pretending to gauge incommensurable situations with a single measuring stick. Non-trivial ethical issues involve rivalrous goods and evils and dilemmas that are unsoluble, undecidable by rational reflection.[101]

1. Assessing the Canadian Experiments

The preceding sections discussed the facts surrounding the use of human subjects by SES and CWL in chemical warfare agent trials, based on the surviving documents. This was followed by a discussion on ethical frameworks that may provide a context by which a judgement could be made as to the ethical nature of the experiments. The theory of ethical relativism, while seemingly intuitive, was found to be inadequate. The principles of utilitarianism and Just War Theory were found to be more useful, but their application is not evident and requires a judgment of the worth of the harm done to the subjects relative to the benefits that the experiments provided.

The ACHRE Committee, in assessing a similar issue, also rejected ethical relativism. It based its analysis on six principles that it considered to be time-invariant and independent of context but it noted that other factors can affect how one interprets these principles. In particular, the ACHRE Committee emphasised the importance of informed consent and of the respect of the regulations applicable to human experimen-

[101] Dr Gilles Paquet, "The Burden of Office, Ethics, and Connoisseurship," (December, 1996), 5, http://www.gouvernance.ca/index.php?page=embed&lang=ce&embed=publications/97-16.pdf (accessed March 18, 2006).

tation. The Committee acknowledged that national security could modify the basic principles but since it concluded that national security had no bearing on the cases it studied, it did not elaborate further. Finally, it noted that governments have responsibilities to the subjects that survive the experiments; primary among those is the need to keep adequate records. This responsibility exists irrespective of the morality of the experiments.

A review of the rules governing human experimentation showed that the concepts of informed consent, minimisation of harm and adequate compensation (neither too low nor too high) of the subjects have been in existence for over 100 years. However, they were not codified in a fashion that could be termed as 'universal' until the late 1940s. Still many countries, including Canada, did not adopt such guidelines until much later.

Following the thoughts expressed by Paquet in this section's opening citation, there is no single measuring stick by which to asses the SES and CWL experiments; the gauge must be multi-pronged. It is therefore proposed to use a utilitarian approach in conjunction with Just War Theory precepts. As with the ACHRE methodology, special attention will be given to the conditions under which the subjects volunteered, how they were compensated and whether sufficient precautions were taken to minimise the harm to which they were subjected. Further, the current guidelines regarding compensation of the subjects will be compared with those used during the Second World War.

In this context, we are then seeking answers to the questions listed below. The discussion will first address the Second World War context, then that which existed during the Cold War.

- Were the subjects true volunteers?

- Were they adequately trained, briefed and compensated and were the injuries kept to a minimal level?
- Were the experiments scientifically valid and required?
- Does the fact that Canada was engaged in the Second World War, then the Cold War, modify the answers?
- Did the government and/or its institutions have responsibilities post-conflict and if so, were they carried out?

TRUE VOLUNTEERS? / COMPENSATION

The regulations (and the posters circulated at the units) described in pages 13-15 and reproduced in Appendix 1 clearly show that the intent was for the subjects to volunteer for the trials. The requirement that all subjects be physically fit, appropriately trained and that all field trials required the subjects to wear a respirator shows that attention was given to minimise the extent of injuries. Compensation, which varied between 50% and 75% of the basic monthly pay, was certainly adequate. In discussions between DRDC Suffield staff and former subjects between 1998 and 2006, most veterans remembered that they had received extra pay and leave. Many of them remembered the details of the gas chamber part of the gas training curriculum. Few of them remembered volunteering nor did they state they were ‘ordered to volunteer’; however, it should be noted that asking if the veteran had volunteered for the service was not part of the questions normally asked by DRDC Suffield and thus, it cannot be concluded on this basis alone that the regulations were not respected.

The above assumes that enlisted men who volunteered were not subject to undue influence by their peers and/or command elements. It is known that SES frequently had too few volunteers for the trials that were planned. That extra pressure could have been applied cannot therefore be discounted; there is, however, no evidence that this occurred.

In a number of instances, veterans reported that, in light of the injuries that previous volunteers had received, the reverse occurred: they would have been advised not to volunteer.

It was noted at page 15 that roughly 20% of the subjects came to SES from the District Depots, before they would have completed basic training and that there is no indication that they were restricted from participating in certain types of tests. However, that SES instituted a special gas training program to address this lack of knowledge implies that the regulations were respected. Assuming that the training program was delivered as intended, and there is no indication that it was not, the soldiers would have been sufficiently informed about the dangers of chemical agents. There still remains, in hindsight, a suspicion that such use of partially trained men, even if well-informed, was not the best solution.

Marin states that the subjects received a "modest pay increase".[102] There is also mention in Erschbamer's film that the basic pay increase of $1.00 per test was ridiculously low. In fact, the remuneration for the tests varied between 50% and 75% of the basic daily pay rate for uninjured (i.e. no severe lesions) volunteers and those that received severe lesions, respectively. According to the principles of the current Tri-Council Policy, one should then examine if such a rate was too high and sufficient to constitute undue inducement; if it did, the argument that the subjects were true volunteers would be weakened.

The 1942 benefit of 50% for a subject not receiving severe lesion compares relatively well with that of 36% or lower for a modern-day volunteer experiencing abnormal stress and discomfort. Further, this issue is one of regulation and not neces-

[102] Marin, *Complaints Concerning Chemical Agent Testing During World War II*, 2

sarily of basic ethical principles; therefore, a certain evolution in the details of a code of conduct can be accommodated. As such, as noted by the ACHRE, that the *details* of current practise were not in effect does not imply that the wartime regulations were unethical.

As a whole, it can be concluded that, during the Second World War, the SES/ CWL subjects were volunteers and that the conditions under which they volunteered met the intent of the rules in effect at the time.

MINIMISATION OF HARM

The majority of subjects suffered minimal physical harm, notably at CWL. At SES, a few men sustained casualty-level injuries.[103] This was not accidental – the questions requiring study included the assessment of battlefield casualties in realistic conditions. This information would then have been used in preparing to defend against and to wage chemical warfare in the context of Second World War conditions. Still, these experiments do not meet basic ethical principles such as those used by the ACHRE in that the human subjects were used as means to the ends of others and they were subjected to harm.

A review of most of the experimental protocols that were used to plan the experiments shows that, in the author's opinion, appropriate scientific investigations were defined and that the answers sought supported the aims of the chemical warfare program. The SES approval process, requiring the review of peers, guaranteed as much as possible that all field work was legitimately required.

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[103] Injuries of a type or extent that would preclude a soldier, no matter what his intent, to continue in the performance of his duties.

The sixty years that have passed since the wartime tests does however offer the opportunity to exercise a better hindsight. Early in the war, it can be argued that there was a clear need to assess the effects of chemical agents as they would have been used in that war (e.g. aerial sprays) and to compare the effects of different agent formulations. However, these types of experiments continued well into 1945. By that time, less harm would have been done if manikins, instead of human beings, had been used and that, by the appropriate correlation to previous results, the late war trials could have been carried out without the need of human subjects. Admittedly, this observation does not account for the wartime sense of urgency but it does raise the possibility that a certain momentum existed at war's end that resisted changes in proven methods, which would argue against the ethical nature of the experiments.

SECRECY

Some veterans reported recurring medical conditions after the war; this is not unusual for mustard burns. In light of the classified nature of the experiments, all subjects were given written warning of the need to maintain secrecy. Few records were de-classified before the mid 1980s. Further, the medical records detailing the injuries and/or treatment of the injured soldiers were not generally available to the physicians that treated the veterans. The veteran seeking medical treatment was then faced with the dilemma of breaking his promise by revealing the cause of his injuries to a physician that could not find any record that would support his statements.

During the war, the reason for classifying the SES/CWL work is likely linked to the need to keep the enemy from knowing the details of one's military capability or from

benefiting from the research being performed; such restrictions are valid. It has been argued that one of the reasons why chemical agents were not used during the Second World War was that they would offer no distinct tactical advantage.[104] This then implies that both sides believed that the enemy's retaliatory capability more or less matched its own. Prior to the war, Germany developed nerve agent munitions, substances much deadlier than those available to the Allies and unknown to them. Cook states that the Germans believed that the Allies had developed the same substances.[105] It can therefore be proposed that if Germany had known that the Allies' chemical warfare capability did not include nerve agents, their decision not to wage chemical warfare might have been reversed. In this context, secrecy was even more critical.

Regardless, the 1942 regulations for the use of human subjects clearly state that adequate medical records were to be maintained and, if classified, were to be forwarded to Headquarters.[106] Thus, that the Department failed to make those available (or knowledge of their existence) after the war to physicians treating veterans cannot be justified on the basis of national security. Even if there was a continuing national security requirement to maintain secrecy after the war, methods could have been devised for ensuring that some physicians had appropriate access to the classified information.

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[104] Avery, *The Science of War: Canadian Scientists and Allied Military Technology during the Second World War*, 123

[105] Cook, *No Place to Run: The Canadian Corps and Gas Warfare in the First World War*, 227

[106] It is believed that these medical records no longer exist. Despite extensive searching, the CWATRP was unable to find them. Conversely, it may be that no classified record was created; medical records of subjects that were injured have been found on their service files.

JUST WAR CONTEXT

If one judges that the Second World War, in opposing the Nazi regime and Imperial Japan, was a just war, one then admits that the Allies had the moral right to require actions and sacrifices of its soldiers and citizens that would not normally be acceptable (within the restrictions imposed by the applicable international conventions). As discussed earlier (pp. 31-33), an assessment of the ethics of the chemical warfare experiments in a just war context is reduced to arguing for just intent, proportionality and reasonable hope of success. It has already been stated that the latter is related to the scientific validity of the experiments and, as discussed at page 47, this criterion is largely met. It was noted that the first, just intent, is met if the aims of the experimentation supported legitimate war purposes. Since the experiments were in support of the legal right to maintain a chemical warfare retaliatory capability, this criterion is also met.

The essential question therefore is to determine if the strategic advantage of developing a credible chemical warfare capability, both as a deterrent and for retaliatory purposes, justifies the harm done to the subjects. In a discussion of human experimentation in the U.S. during the Second World War, Rothman concludes that:

> wartime inevitably promotes teleological, as opposed to deontological positions. The greatest good for the greatest number is the most compelling precept to justify sending some men to be killed so that others may live...[107]

He then argues that other factors, such as the scientific validity of the experimental evaluations are nevertheless essential.

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[107] Rothman, *Strangers at the Bedside: A History of How Law and Bioethics Transformed Medical Decision Making*, 50

As such, it can be reasonably argued that the wartime conditions sufficiently modify the ethical environment to justify, if not on a moral basis, then at least on a realistic one, the use of the human subjects. Thus with respect to the actions taken during the war, and considering the points discussed above, it would be difficult to blame the researchers that carried out the experiments or the institutions that supported them.

EXPERIMENTATION IN THE COLD WAR ERA

The arguments presented above relate primarily to the Second World War; they do not readily translate in the post-war years.

The threat of chemical warfare continued after the end of the Second World War; even with the availability of nuclear weapons, the possibility that chemicals would be used in combat could not be discounted. New and deadlier agents were developed (notably the V-agents, persistent nerve agents with toxicities much higher than those developed by the Germans). Nations maintained large stockpiles of chemical weapons: the declarations to the Organisation for the Prohibition of Chemical Weapons (OPCW) by the signatory nations include 8.6 million chemical munitions (70,000 metric tons of agent).[108] Russia alone reported 40,000 tons of agents.[109] (These figures are derived from the declarations of the nations when the Chemical Weapons Convention entered into force, in 1997; they are, however, indicative of the level of threat that existed during the Cold War).

While the Cold War involved a level of threat much greater than that experienced during the Second World War (e.g. nuclear annihilation), society as a whole lived in an

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[108] Organisation for the Prohibition of Chemical Weapons, *The Chemical Weapons Ban: Facts and Figures*, (May 09, 2006), http://www.opcw.org/factsandfigures/index.html (accessed May 13, 2006).

[109] Russian Munitions Agency, *Stockpiles of chemical weapons in the Russian Federation*, (April 25, 2003), http://www.munition.gov.ru/eng/zapasho.html (accessed May 13, 2006).

environment that was essentially one of peacetime; as such, the concepts of Just War do not apply. In this paper, we have stated that the experimental conditions after 1950 were different than those during the war: the likelihood of harm was significantly reduced; the subjects were typically more knowledgeable (if staff, they understood the risks; if soldiers, they were typically well trained beforehand); and the use of informed consent became the norm. Of that basis, it can be concluded that the post-war experimentation would be justifiable.

POST-WAR ACCESSIBILITY TO RECORDS

While most subjects did not suffer physical harm that would be associated with any long-term health effect, a number of subjects did receive injuries that would make them susceptible to the health issues identified by the U.S. Institute of Medicine (pp. 21-23).

The science of toxicology was still in its infancy at war's end; however, experience with First World War chemical casualties did indicate that long-term health issues were probable, though those were largely to the lungs as a result of inhaling mustard vapours.[110] This should have been known by the scientific and medical staff; it would have been reasonable to institute the means to monitor the health of the more severely injured subjects.

That responsibility was institutional, but not specifically assigned to any specific agent and thus was not fulfilled. That such a failure occurred can be partly explained by the following:

[110] Cook, *No Place to Run: The Canadian Corps and Gas Warfare in the First World War*, 218-221

- the general demobilisation that followed the Second World War would have left scarce resources to perform this task;
- many of the SES and CWL staff left the service and/or the establishments to pursue their pre-war careers;
- in 1947, control of SES and CWL passed from the Department of Defence to the civilian Defence Research Board, which had no direct responsibility for war veterans; and
- in addition to a major change-over in staff, the chemical program was significantly altered until 1950.[111] This hiatus may have provided a discontinuity that would have hindered an effort to consolidate the information.

Admittedly, in light of the fact that the threat of chemical warfare continued into the Cold War years (it still exists today), much of the scientific information was still classified and could not be released. Still, it appears that the Government failed in recognizing its obligation in the first place; in the ensuing years, knowledge of the issue faded, and this contributed further to the veil of secrecy and mistrust that surrounded the experiments. In particular, a policy of openness would have favoured a better understanding of the actual exposures that most subjects received, would have allowed authorities to reassure them and, hopefully, toned down some of the more negative and ill-informed publicity that surrounded the issue.

[111] During this period, SES devoted significant effort in the development of technologies to disperse insecticides in support of the Department of Agriculture.

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Conclusions

The greatest harm from past experiments … may be the legacy of distrust they created.[112]

This paper sought to determine if the use of human subjects in CWA experiments presented ethical issues that would need to be recognized and/or rectified. The Second World War was a total war. It saw a number of events that will forever remain unacceptable by any measure (e.g. the Holocaust, the use of slave labour in Germany, the mistreatment of war prisoners by Japan). Other actions, such as the fire-bombing of Munich and Dresden and the use of nuclear weapons, will continue to be subjects of controversy. Regardless, Canada and her allies were engaged in a just conflict and, for the most part, respected the treaties limiting the actions they could take in waging war. If a state has the right, moral or not, to ask its soldiers to commit violence and possibly to give their life in support of a just conflict, then it must be concluded that it has the right to ask them to participate in legitimate activities that support that conflict.

The discussion in the preceding pages points to a conclusion that, within the realities of war, the use of human subjects in experiments that saw them exposed to chemical warfare agents was justified, even in cases where the subjects received significant injury. The subjects were suitably trained volunteers; the experiments in which they participated were valid both in aim and in execution. Further, the conditions under which the experiments were carried out meet the principles of Just War.

[112] Advisory Committee on Human Radiation Experiments, *Final Report of the Advisory Committee on Human Radiation Experiments*, Summary: Historical Context, 8 of 13

As with all ethical analyses, this is not a definitive statement – ethical analysis is not prescriptive; rather, the discussion has attempted to consider relevant facts and to interpret them in the context of an appropriate ethical framework.

This conclusion does not mean that the researchers and the institutions within which they worked are free from responsibility, or possibly blame. A nation has a clear responsibility towards its veterans and a duty to support those who were injured in the course of their service, no matter how the injuries were sustained. In particular, the failure of SES, CWL and Defence Headquarters to maintain adequate records, and to make those accessible to the individuals that needed them, cannot be easily justified.[113]

The controversy that surrounded the publication of *Deadly Allies* was not sufficient to prod the Department into fully researching the issue. Admittedly, DRDC did considerable research, collated a large amount of information and continued its support of former subjects that contacted DRDC or were referred by other government departments and agencies. However, overall there was insufficient effort to advise the former subjects that their promise of secrecy was no longer in effect and the onus remained on the veteran to take the initiative. It finally took a concerted effort by a small group of veterans, the threat of a class action suit, a media campaign and an investigation by the Ombudsman to

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[113] DRDC Ottawa kept very few records that would be of use to former subjects. Most of the reports written by the scientists on the experiments still exist, but these typically deal with the results of the experiments and are rarely useful in assisting subjects who seek the personal details of the tests in which they participated.

DRDC Suffield has a rather complete set of records describing the field experiments it carried out from the earliest day of its creation; it has few records of experiments that were carried out in laboratories. That the field records still exist is fortuitous as they originally did not form part of the official library holdings; they had been stored in an abandoned building by the staff that ran the field trials. In the 1970s, personnel clearing this building re-discovered the records, had the foresight to recognize their significance and to catalogue them.

Library and Archives Canada holds many records that were directly relevant to the comprehension of the chemical program; the CWATRP made extensive use of these records. However, many of these records are still classified and thus are not directly accessible by all.

cause the Department to seek Cabinet approval for the creation of the CWATRP and the assignment of dedicated resources to manage it.

In closing, it is worth noting that the analysis presented herein does not imply that the Chemical Warfare Agent Testing Recognition Program is unwarranted, even if it was approved without knowledge of all relevant facts and, to a certain extent, as a reaction to misinformation. There was an understanding that some veterans could have had difficulties in obtaining medical treatment because adequate records of the experiments had not been kept. Further, considering that chemical warfare elicits strong negative reactions, there was a valid political element into the decision to implement the Recognition Program.

It is finally worth noting that the CWATRP, in supporting all former experimental subjects, no matter what level of injury they sustained, goes much further than comparable support given in allied countries.[114] This, in part, addresses the lateness of the recognition.

[114] For example, the U.S. Department of Veterans Affairs only recognizes whole body exposure; this would exclude subjects of drop tests. See: United States: Department of Veterans Affairs, "Final VA Rule on Claims Based on Mustard/Lewisite Exposure", http://www.gulfweb.org/doc_show.cfm?ID=25 (accessed March 02, 2006).

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Appendix 1 – 1942 Regulations for Use of Subjects

H.Q.S. 4354-9-12[115]

PROPOSED REVISION OF REGULATIONS GOVERNING
USE OF SUBJECTS IN PHYSIOLOGICAL TESTS

GS-SD-398(b)
29 Jun 42.

[115] Library and Archives Canada, *RCAF Detachment Suffield - Physiological Subjects and Tests on*

SUMMARY OF PROPOSED AMENDMENTS

(Incorporating regulations approved by the Administrative Committee of the Chemical Warfare Inter-Service Board, 12 Jun 42 and recommendation of C.W. Labs., Ottawa D. Pay, D.O.A. and D.G.M.S.

Present Regulations	Proposed Regulations
1. Basic Pay - $1.00 per day for every day on which subject is tested.	Basic Pay - $1.00 per test.
2. Maximum Compensation for lesions ---------- $20.00	Maximum compensation for severe lesions ---------- $20.00
3. Basic rate to be paid in cash.	At Suffield, total compensation to be paid at end of month. Added Minimum compensation to be $10.00 where period of service is one month; and to be an appropriate proportion of $10.00 when the period is other than one month.
4. Volunteers for Suffield from M.D. 13 only.	Volunteers for Suffield from M.Ds. 10, 11, 12, 13 and, if necessary, from other Districts.
5. Volunteers for Ottawa from M.Ds. No. 2, 3 and 4.	Volunteers for Ottawa from M.Ds. 2, 3, 4 and 5.
6. C.W. Labs. only can use partially-trained soldiers.	Extended to Suffield, but degree of A.G. training to be taken into account.
7. C.W. Labs. only can use Category "C" personnel.	Extended to Suffield.
8. Suffield only can use personnel of establishment.	Extended to C.W. Labs.
9. Volunteers much be British in origin and thoroughly reliable.	Unit Commanders to satisfy themselves that subjects provided are thoroughly reliable.
10. Reg. re Medical Supervision	Extended to Suffield. Added duties of M.O. i/c Physiological Tests: 1. To describe suitable Category "C" personnel. 2. To ensure restriction of scope of tests given to partially-trained soldiers. 3. To give a number to each subject and to keep a record of tests.
11. "Medical Officer"	"Medical Officer i/c Physiological Tests"
12.	Subjects not to be drawn from T.Cs. so as to interfere with course of training.
13.	No subject to be returned to his unit for ordinary duty unless certified as medically fit.
14.	Subject number to be placed on M.F.S. 2. Case sheets to go to Districts Records Officer when not secret and to Officer i/c Records N.D.H.Q. when secret.

GS-SD-398(b)
29 Jun 42.

(DRAFT)

REGULATIONS GOVERNING THE USE OF VOLUNTEERS FOR PHYSIOLOGICAL TESTS

(Incorporating regulations approved by the Administrative Committee of the Chemical Warfare Inter-Service Board, 12 Jun 42, and recommendations of C.W. Labs., Ottawa, D. Pay, D.O.A. and D.G.M.S.)

SUBJECTS

1. Volunteers for Experimental Station, Suffield, are required to serve a period of one month and those for Chemical Warfare Laboratories, Ottawa, a period not exceeding two weeks. (A maximum of 100 per month is required for Experimental Station, Suffield, and 30 per week for Chemical Warfare Laboratories, Ottawa).

2. No subject shall be returned to his unit on ordinary duty unless certified as medically fit in accordance with the provisions of paragraph 15(f).

3. Volunteers for Chemical Warfare Laboratories, Ottawa, may be obtained from Military Districts Nos. 2, 3, 4 and 5. Volunteers for Experimental Station, Suffield, may be obtained by D.O.C. M.D. No. 13 from Military Districts Nos. 10, 11, 12 and 13; and from other Military Districts in Canada, at the discretion of D.O.C. M.D. No. 13, when necessary.

4. Personnel of the establishments of stations giving physiological tests may volunteer as subjects and if accepted, may be paid additional pay as laid down in Article 206, F.R.&.I., (Can.), as amended.

5. Subjects shall not be drawn from Training Centres so as to interfere with a course of training that is already in progress.

6. Whenever possible, quotas will be filled by Category “A” and “B” personnel only. The Medical Officer i/c Physiological Tests, however, will draw up, for the information of Unit Commanders, a description of Category “C” personnel acceptable for physiological tests. In cases where insufficient Category “A” and “B” personnel are available the monthly quota may be completed with such Category “C” personnel.

7. Subjects must be free from any venereal diseases, active infections, skin diseases, etc. Subjects who are under treatment for V.D.G. and V.D.S. are not suitable.

8. In the interest of security Unit Commanders must satisfy themselves that subjects provided are thoroughly reliable.

9. A statement outlining in a general way the nature and purpose of tests, remuneration and other conditions, will be supplied, by the Station concerned, for the use of Officers selecting subjects.

PAY AND EXPENSES

10. Rules governing payment of physiological test subjects are set forth in Article 206, F.R.&.I. (Can.), as amended.

11. Transportation, within the city of Ottawa, will be provided for weekly quotas of subjects from their quarters to Chemical Warfare Laboratories in army trucks. Smaller parties will be given street car tickets by the Medical Officer in charge of Physiological Tests.

12. The monthly return of expenditure will be certified by the Medical Officer i/c Physiological Tests and will be supported by acquittance rolls, duly receipted, for all amounts paid out.

13. Other transportation costs, ordinary pay, rations and quarters of personnel attached for physiological tests to Experimental Station, Suffield, and to Chemical Warfare Laboratories, Ottawa, will be a charge against the votes that bore them before the personnel proceeded to such service.

MEDICAL SUPERVISION

14. A Medical Officer shall be in charge of the Physiological Tests. While this duty may not occupy his full time, it will be his primary duty.

15. It will be the duty of the Medical Officer i/c Physiological Tests:

(a) to be present at all tests.

(b) to insure that tests given to partially-trained soldiers shall be restricted in scope so as to conform to the degree of anti-gas training that they have attained.

(c) to examine all subjects who have undergone tests, at least once a day until any lesions produced are healed beyond risk of secondary infection.

(d) to give personal supervision to treatment of lesions.

(e) to order hospitalisation if necessary and to direct treatment in hospital.

(f) to certify to the fitness of the subject to return to ordinary military duty.

(g) to prepare a description of Category “C” personnel acceptable for physiological tests.

(h) to assign to each subject a number and to keep opposite that number a record of the tests given to the subject.

(i) to authorize additional compensation in accordance with the provisions of Article 206(c), F.R.&.I. (Can.).

MEDICAL RECORDS

16. The subject number referred to in 15(h) above shall be entered upon the M.F.M. 2 of the physiological subject. In the event of the M.F.M. 2 not being available at the place where test is given, the O.C. of the Unit to which the subject belongs will be communicated with and requested to enter the subject number upon it.

17. In the event of personnel exposed to physiological tests entering hospital, Case Sheets will be kept in the ordinary manner. The Chief Superintendent, Suffield, and the O.C., Chemical Warfare Laboratories, respectively, will decide whether or not the information contained in any such Case Sheet is of a secret nature. Case Sheets not containing information of a secret nature will be included in the man's documents and forwarded in the ordinary manner to the District Record Officer. Case Sheets containing information of a secret nature will be forwarded under secret cover to the Officer i/c Records, N.D.H.Q.

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APPENDIX "A"

REGULATIONS FOR PHYSIOLOGICAL SUBJECTS

ADMINISTRATIVE ARRANGEMENTS

FOR EXPERIMENTAL STATION, SUFFIELD

REQUISITION

1. The Chief Superintendent, Suffield, will submit to Headquarters, Military District No. 13, on or before the 1st and 15th of each month, a statement of the number of physiological subjects required in the next party. Wherever there are insufficient volunteers from Military District No. 13, the D.O.C., M.D. 13, will call upon Military Districts Nos. 10, 11, and 12 and at his discretion upon other Military Districts in Canada.

REPORTING FOR DUTY

2. The party of physiological subjects requested by the Chief Superintendent by the first of each month will report, in charge of an officer, to the O.C. Troops at the Experimental Station, Suffield, on the 15th of the month in which the request was made. The party requested by the Chief Superintendent by the 15th of each month will similarly report but on the 1st of the following month.

DOCUMENTS

3. The officer in charge of the party will bring the necessary personnel documents to the Station with the party. At the expiration of one month's service the documents will be returned to him.

DELAYED ACTION TESTS

4. Tests involving delayed action will not be carried out during the week preceding return of physiological subjects to their original units.

PAYMENT OF SUBJECTS

5. Subjects will be paid by the Station Paymaster at the end of their period of service as physiological subjects.

LEAVE

6. Extra leave of two days per week may be granted to volunteers on the approval of the Chief Superintendent. When weekly leave is not taken, a full week may be taken upon completion of three weeks satisfactory service as a subject.

OTHER DUTIES OF SUBJECTS

7. Volunteers will be held available for all ordinary Station duries *[sic]* when not required for tests or observation, and when certified as medically fit by the Medical Officer i/c Physiological Tests.

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APPENDIX "B"

REGULATIONS FOR PHYSIOLOGICAL SUBJECTS

ADMINISTRATIVE ARRANGEMENTS FOR C.W. LABS, OTTAWA

REQUISITIONS

1. The Medical Officer in charge of Physiological Tests will submit to the officer in charge of C.W. Labs., Ottawa, on or before the 20th of each month, a statement of his weekly requirements for subjects for the ensuing month. The officer in charge of C.W. Labs., will submit requisitions to the Directorate of Organization and Administration (A.P.3) by the Wednesday preceding the Monday on which the subjects are to report.

IDENTIFICATION AND REPORTING FOR DUTY

2. Subjects will report for duty to the Medical Officer in charge of Physiological Tests, Room 3121, National Research Laboratories, Ottawa, as requisitioned. Each subject will be provided with a separate letter of identification from their unit bearing the unit medical officer's approval of his medical fitness to act as a subject.

DETAILED INSTRUCTIONS

3. On reporting to the Medical Officer in charge of Physiological Tests, each subject will be given a form instructing him when and where to report. Additional instructions may be endorsed on this form as necessary. It will be surrendered on completion of service.

RELEASE FROM SERVICE

4. On completion of service and any necessary subsequent period of medical supervision, the subject will be given written notification, signed by the Medical Officer in charge of Physiological Tests, to report for ordinary military duty. A copy of this notification will be sent promptly to the officer issuing the identification, or other designated duty.

MEDICAL FACILITIES

5. Space will be provided in Chemical Warfare Laboratories for the use of the Medical Officer i/c of Physiological Tests as required. Space (preferably a separate room) will also be provided in the vicinity of the quarters of the subjects in order to facilitate daily inspections and treatment of ambulatory cases.

PAYMENT OF SUBJECTS

6. Subjects will be paid the basic rate of $1.00 in cash at the time of exposure and any additional compensation under Article 206, F.R.&.I. (Can.) at the end of their period of service as physiological subjects. For this purpose an advance of cash may be made to the Medical Officer i/c of Physiological Tests, who will submit to the District Paymaster a monthly account, in duplicate, of expenditure incurred. Attention is drawn to the provisions of Article 49, F.R.&.I. (Can.) which are applicable to physiological subjects on duty at C.W. Labs., Ottawa.

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OTHER DUTIES OF SUBJECTS

7. In order to permit adequate observation and continuity in experiments, subjects will not be required to perform any other duties during the period of their service. During the time subjects are not required for tests, they will be given leave, subject to necessary restrictions as to hour of return to barracks, etc. they should be provided by their units with such passes or other documents as are necessary to give effect to these privileges.

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APPENDIX "C"

INFORMATION FOR PROSPECTIVE SUBJECTS FOR PHYSIOLOGICAL TESTS (E.S. SUFFIELD) (to be posted on unit notice boards)

1. Human subjects are needed in studying the action of chemical used in War on the body. Trained and partially-trained soldiers are eligible for this service.

2. Whenever possible, the monthly quota will be filled by men in Category "A" and "B". But the physiological tests are by no means dangerous to all men in Category "C". Poor eye-sight or flat feet, for example, in no way affect the reaction of any individual to a test. Whenever an insufficient number of Category "A" and "B" is available, certain classes of men in Category "C" will be acceptable as physiological subjects.

3. All chemicals tested are first tried in fully-equipped laboratories, and the actual tests on the human subject are carried out under scientific control, so that no personal injury is likely to result. Tests given to partially-trained soldiers will be restricted in scope, to conform to the degree of anti-gas training that they have attained.

4. Soldiers accepted will be required to serve for one month at the Station.

5. They will be paid $1.00 per exposure in addition to their ordinary pay. The minimum of such additional pay for the month of service is $10.00 per man. In addition to the above amount the Medical Officer i/c Physiological Tests may authorize compensation up to a maximum of $20.00 for any single severe lesion resulting from a physiological test.

6. Extra leave of two days per week may be granted to volunteers on the approval of the Chief Superintendent. Where weekly leave is not taken, a full week may be taken upon completion of three weeks' satisfactory services as a subject.

7. Volunteers are held available for all ordinary Station duties when not required for tests or observation and when certified as medically fit by the Medical Officer i/c Physiological Tests.

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APPENDIX "D"

ORDER

(For the Approval of the Governor-General in Council)

FINANCIAL REGULATIONS AND INSTRUCTIONS FOR THE CANADIAN ACTIVE SERVICE FORCE (CANADA) – AMENDMENTS (NO.)

Financial Regulations and Instructions for the Canadian Active Service Force (Canada) are amended as follows:

Delete Article 206 and substitute new Article as follows:

"PHYSIOLOGICAL TESTS"

"206 (1) Volunteers accepted for physiological subjects will be paid extra pay at the following rates and conditions:

(2) (a) For each individual exposure in which a volunteer is used as a physiological subject $1.00 per exposure.

(b) Where the period of service as a physiological subject is one month, the minimum of such additional compensation shall be $10.00, for periods other than one month, the minimum shall be an appropriate proportion of the said sum of $10.00.

(c) The Medical Officer i/c physiological tests may authorize compensation additional to that set forth in paras. 2(a) and 2(b) up to a maximum of $20.00 for any single severe lesion resulting from a physiological test.

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Department of National Defence[116]
Research Establishment (CW) Ottawa

INFORMATION FOR PROSPECTIVE SUBJECTS FOR PHYSIOLOGICAL TESTS

Human subjects are required for physiological tests in connection with various aspects of chemical defence. In the present instances these tests are being made with blister gases. The subjects will be exposed to the gas on small areas on the forearm, generally 1/2 inch diameter, under carefully controlled conditions. Most exposures will be of a few minutes duration but occasionally they will be for longer periods. In most cases the only result is a red spot or a blister not bigger than the exposed area (1/2 inch). These spots or blisters are not painful and are not dangerous, generally the only discomfort being itching. A medical officer specially qualified for the work will supervise all tests and the treatment of all blisters.

Subjects accepted for duty will serve for a period not exceeding ten days and generally not longer than five days. During that period they may be exposed once or twice but they must report for duty each day as directed.

All subjects will be paid one dollar in cash at each exposure in addition to the regular army pay and an additional bonus in cash for long exposure, any blisters they sustain or any other special reasons, payable at the end of period of service. Transportation will be provided when necessary, either by truck or by streetcar.

Subjects will be exempt from all parades during their period of service. They will report for duty as subjects as directed, but the time required each day will generally not be more than three hours and often will not exceed half an hour. Subjects will be free to use the remainder of the time as they please within the restrictions of military leave.

The tests for which subjects are required are of considerable importance. In general their aim is the improvement of the protection of troops from the effects of blister gases. Subjects may therefore be contributing to their own safety on action service or to saving civilian women and children from serious injury. While they are performing this highly patriotic and humanitarian service, the subjects will earn some extra leave with only short periods of duty for the actual tests.

[116] Library and Archives Canada, *Chemical Warfare - Laboratories - General: Supply of Subjects for Physiological Tests,* circa 1942-43

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