CHEMICAL WARFARE
IN AUSTRALIA
CHEMICAL WARFARE IN AUSTRALIA

GEOFF PLUNKETT

2007
DEDICATION

To all those who were involved in Australia’s chemical warfare history.
Winning with Intelligence
Judy Thomas
Duntroon
Darren Moore
The Warrior Poets
Robert Morrison
The History of the Royal Australian Corps of Transport 1973–2000
Albert Palazzo
Defenders of Australia
Albert Palazzo
The Fight Leaders
D. Butler, A. Argent and J. Shelton
Operation Orders
Pat Beale
Little by Little: A Centenary History of the Royal Australian Army Medical Corps
Michael Tyquin
Red Coats to Cams: A History of Australian Infantry 1788 to 2001
Ian Kuring
Bowler of Gallipoli: Witness to the Anzac Legend
Frank Glen
Vets at War
Ian M. Parsonson
Only One River to Cross: An Australian Soldier Behind Enemy Lines in Korea
A.M. Harris

The Fragile Forts: The Fixed Defences of Sydney Harbour 1788-1963
Peter Oppenheim
Tracks of the Dragon: A History of Australian Locating Artillery
Keith R. Ayliffe & John M. Posener
Persian Expedition: The Australians in Dunsterforce 1918
Alan Stewart
Never Late: The 2/9th Australian Infantry Battalion 1939-1945
Gordon Dickens
To Villers-Bretonneux
Peter Edgar
Madness and the Military: Australia's Experience of the Great War
Michael Tyquin
The Battle of Anzac Ridge 25 April 1915
Peter D. Williams
Doves Over the Pacific: In Pursuit of Peace and Stability in Bougainville
Reuben R.E. Bowd
The Lionheart: A Life of Lieutenant-General Sir Talbot Hobbs
David Coombes

This collection is a joint venture between the Australian Army History Unit and Australian Military History Publications
# CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The Armourers Remember: Gassed World War I Diggers</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Chemical Weapons Procurement: The Initial Debate</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Chemical Weapons Procurement and Their Retaliatory Use:</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>A Necessary Insurance Policy</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Importation</td>
<td>29</td>
</tr>
<tr>
<td>5.</td>
<td>Chemical Warfare Agents in Australia</td>
<td>38</td>
</tr>
<tr>
<td>6.</td>
<td>The Armourers Remember: The Need for Secrecy</td>
<td>50</td>
</tr>
<tr>
<td>7.</td>
<td>Chemical Warfare Organisation</td>
<td>59</td>
</tr>
<tr>
<td>8.</td>
<td>Royal Australian Air Force Training</td>
<td>75</td>
</tr>
<tr>
<td>9.</td>
<td>Army Training</td>
<td>91</td>
</tr>
<tr>
<td>10.</td>
<td>The Chemical Warfare Units</td>
<td>100</td>
</tr>
<tr>
<td>11.</td>
<td>Production and Storage</td>
<td>128</td>
</tr>
<tr>
<td>12.</td>
<td>The Armourers Remember: The Storage Sites</td>
<td>139</td>
</tr>
<tr>
<td>13.</td>
<td>The Armourers Remember: Daily Routine at the Chemical Warfare Sites</td>
<td>190</td>
</tr>
<tr>
<td>14.</td>
<td>Transportation: The Armourers’ Stories</td>
<td>201</td>
</tr>
<tr>
<td>15.</td>
<td>The Chemical Warfare Plan</td>
<td>225</td>
</tr>
<tr>
<td>16.</td>
<td>The Armourers Remember: The Experimental Stations and the Brook Island Trials</td>
<td>236</td>
</tr>
<tr>
<td>17.</td>
<td>Liaison: Interservice and International</td>
<td>274</td>
</tr>
<tr>
<td>18.</td>
<td>The Armourers Remember: Accidents, Incidents and Medical Treatment</td>
<td>281</td>
</tr>
<tr>
<td>19.</td>
<td>Stockage Policy and Disposal</td>
<td>302</td>
</tr>
<tr>
<td>20.</td>
<td>The Armourers Remember: Disposal of the Chemical Warfare Stocks</td>
<td>319</td>
</tr>
</tbody>
</table>
contents continued

21. Sea Dumping 331
22. The Aftermath: The Armourers Reflect 359
23. Chemical Weapons Convention and Other Arrangements 374
24. Conclusion 377

Appendices
A. Chemical warfare agents present in Australia 384
B. Summary of codes used for the most common types of chemical agents in existence in World War II 420
C. Transportation between storage sites 423
D. Ships 430
E. Ships – safety issues 447
F. Chemical munition types 450
G. Field trials with 25-pounder shells 517
H. Storage sites 552
I. Summary of stockage rates per site 586
J. The Chemical Warfare Plan (SWPA) 593
K. Chemical warfare units 598
L. RAAF stocks available for disposal 599
M. Disposal 602
N. Chemical weapons timeline 624
O. Air raid precautions (ARP) – civilian defence 631
P. Classification of war gases 643
Q. Japanese chemical warfare munitions 649
R. Gas incidents – World War I 690

Bibliography 709
Index 711
In responding to the invitation to provide a foreword for Geoff Plunkett’s excellent account of Australia’s preparedness for this aspect of war in 1939–1945, I am grateful for the opportunity to pay tribute to those servicemen who received little recognition for their dedicated work due to wartime secrecy.

Early in 1942, with the Japanese southward advance causing Australia to prepare for possible invasion, one aspect of particular concern at Army Headquarters was: would chemical weapons be used by Japan as had happened in China? Photographs of Chinese blister gas casualties were studied, but little was known of Japanese preparedness for large-scale chemical attack.

The most knowledgeable officer available to study this was Major D. O. Shiels, Chemical Adviser on the Engineer-in-Chief’s staff. With his medical degrees supplemented by doctorates from the University of London and Melbourne, and service in the 1st AIF, he was well placed to assess the risk Australia faced. His proposals to import stocks of offensive chemical weapons and to form specialist army units are well documented in Geoff Plunkett’s account.

My own involvement in this field came about quite suddenly. In June 1942, while serving as a company commander in the 2/14th Infantry Battalion, my Commanding Officer, Lieutenant-Colonel Arthur Key (who paid the supreme sacrifice in the Kokoda Track campaign a few months later), called me and said, ‘The General wants you on divisional headquarters as a GS03 for chemical warfare.’ Without thinking, I said ‘Yes sir, how long do I think about it?’ His reply, ‘This is not a job offer, this is an order!’ left me in no doubt. On reflection, I realised that completion of a science degree before enlisting and service as a brigade intelligence officer in Syria had led to my selection for the new posting.

My recollection of subsequent events includes a term at the Army Gas School to learn the latest protective measures for troops in the field, followed by an interview with Major Shiels when he asked me to form and equip an engineer unit to examine enemy weapons and ammunition captured during campaigns. This unit became 2/1 Chemical Warfare Laboratory and kept me very fully occupied for the remainder of the war. Collaboration and help from American units of the US Chemical Warfare Service was outstanding and we were encouraged to obtain help and advice from many service and civil personnel with due regard for secrecy requirements.
Secrecy measures were guided by ‘the need to know’ principle and the overall situation was known to very few people. It is certainly a fine achievement to have such a complex national summary of the situation compiled from many diverse sources.

J. C. McAllester  
Major RAE (retired)  
2/1 Australian Chemical Warfare Laboratory  
March 2004

Captain (later Major) Jim McAllester of the 2/14th Australian Infantry Battalion and then head of the 2/1st Australian Chemical Warfare Laboratory prepares targets for the improvised rifle range on which thirty servicemen from the 5th Field Regiment will fire to test their marksmanship (the best available measure of military efficiency using grouping practice with 12-inch targets at 30 yards) after being exposed to the effects of gas at Townsville in November 1942.

© Australian War Memorial 029284
Jim’s focus on the personnel who served in Australia’s Chemical Warfare Service is an important one. They are a neglected part of Australia’s history and this can in part be attributed to the secret nature of their work. For the RAAF side of the ledger the dedication and bravery of the chemical warfare personnel can be no better put than by Group Captain T. Lightfoot, the Director of Armament who, immediately after the war, noted: ‘It is desired to record officially the outstanding services rendered by the RAAF during the recent war years, and since the war ended, by all chemical warfare personnel.’ He made special mention of the RAAF chemical warfare armourers, those responsible for the unloading, transportation, maintenance and disposal of chemical warfare stocks during and after the war, commending them in the ‘execution of their arduous and, at all times, dangerous duties’ which ‘involved much hazardous work in the off-loading from ships of bombs and bulk containers, the destruction or decanting of “leakers” and the decontamination of ships’ holds.’ Noting the disposal of RAAF chemical munitions and bulk stores from November 1945 to April 1946, he added: ‘It is fair statement that the disposal of these gas stocks ranks with the more difficult and dangerous tasks undertaken by RAAF ground staff personnel. During this type of operation, the men have, at times, literally paddled in liquid phosgene on the ground, the concentration given off being such that service respirators broke down and the personnel had to be temporarily relieved.’ The burn disposal at Newnes State Forest in ‘mountainous, timbered country, resulted in nearly all personnel engaged becoming casualties at some stage and in varying degrees, because such concentrations of mustard gas were encountered that no service protective equipment was adequate to counter them.’ The outstanding contribution of the chemical warfare staff was reiterated to the author by Squadron Leader Arthur Trewin who headed the RAAF Chemical Warfare Section.

Geoff Plunkett
March 2004
I had the very special privilege of interviewing, countless times each, the surviving staff of Australia’s Chemical Warfare Service, without whom there would be no story to tell. The narrative was greatly enriched by their contribution as not all is recorded in written form. The focus of this book is, as it should be, on the personnel as, although chemical weapons are now topical, the story of Australia’s chemical warfare staff is not often discussed and in many cases ignored.¹

Major Jim McAllester, who headed the 2/1st Chemical Warfare Laboratory, was involved with this study from the beginning and had a hand in everything. With enduring patience, an excellent memory and recourse to notes made during the war, he wonderfully brought to life the Army’s involvement with chemical weapons. Jim also reviewed the whole manuscript and provided the foreword. Squadron Leader Arthur Trewin, head of the RAAF chemical warfare arm, over the course of several years helped the author build up a picture of the RAAF’s contribution. Forever helpful and having spent so much time developing this history, it was a great sadness that he was unable to read the published book, having passed away before its completion. June, his widow, kindly made available his personal war diary after his death.² Alas, the numbers dwindle every year. Lieutenant-Colonel Norman Carter, who headed the Army’s Chemical Warfare Service, pointed me to his History of Directorate of Military Operations (Chemical Warfare Section) Land Headquarters written at the end of the war in 1945. It is heavily quoted throughout this book and was an invaluable resource on all aspects of the Army experience.

Arguably the most dangerous and underrated job was that of the RAAF chemical warfare armourers/fitter armourers who daily maintained, stored and shifted the bombs and containers and were necessarily exposed to the highly toxic war gases. One did not need to be in the front line to face daily dangers, a point reiterated by the Director of Armament in his comment that the duties of the armourers had ‘at all times’ been dangerous. All the available chemical warfare personnel

1  See, however, the pioneering efforts of the The Gillis Report: Australian Field Trials with Mustard Gas 1942-1945, Australian National University, Canberra, 1985; and the book by Bridget Goodwin.
2  It is now with the Australian War Memorial, private record PR03361.
Picture drawn by RAAF chemical warfare armourer Frank Moran for the reunion of RAAF chemical warfare staff at Penrith, Sydney, in 1990. The caption reads ‘To all our mates who did their job selflessly and got nothing in return’, a response to a lack of recognition of their role and the possible health effects.

© RAAF Chemical Warfare Armourers
were subjected to endless interviews and complied with unending patience and enthusiasm despite being embittered by a lack of official recognition and possible health effects, a sentiment best expressed in a caption to a sketch drawn by Frank Moran for the 1990 reunion of armourers and chemical warfare staff: ‘To all our mates who did their job selflessly and got nothing in return’. Their dedication and bravery is unquestioned and it was again, a very great privilege to discuss their story. I am thus grateful to Donald Betts, Bill Boyd, Bunny Bruce, Frank Burkin, Geoff ‘Tassie’ Burn, Mel Carney, Ivor Conway, John Crawford, John Ennor, Harry Evans (driver), Tom Faram, Brian Fennel, Kevin Garr, Victor Hicks, Rodney Hill, Frank Hughes, Les Johnson, Bob Langsford, Ian Learmonth, Ray Minahan, Frank Moran, Les Parsons, Noel Stoneman and Ron Watts as well as their wives and families. Thanks to Ron Barker from the Chemical Research Unit at Bowen for his testimonial and discussions. All the chemical warfare armourers assisted in the interpretation of the RAAF photos and by reviewing the manuscript, Tom Faram became my RAAF referee. Mrs Boardman (widow of Norm Boardman) and Thelma Ritrow (widow of Alan Ritrow) also passed on their knowledge. All the armourers and their families generously offered their privately held photos for the book. These included the families of the late Les Bellis (Michael, son), Jack Taylor (Hazel, widow) and Cliff Williams (Stewart, son). The fact that they exist at all is remarkable as the armourers were strictly forbidden to take photos. Some, however, did so surreptitiously (including Frank Moran, John Crawford and Jack Taylor) or asked ‘friendly aliens’ (Army personnel) to take them on their behalf. We are glad the rules were broken. As Frank Moran commented:

You have a small camera in your pocket and you keep it loaded and you see a photo—see a picture you want, so you pull out this camera and take it and put the camera away again and nobody knows anything about it. Of course the boys around me knew. But fortunately none of the upper hand—they didn’t know what was going on. And I used to send the film to a factory in Sydney and they would have the film done and send it back to me. It was always sent back by the drivers who would go to town; we’d pick them up occasionally. Fortunately I wasn’t scolded or anything, because they didn’t know about it.

3 Passed away 2006.
4 Passed away 2003.
5 Passed away 2006.
6 Passed away 2004.
7 Frank’s entire photo record (with negatives), which has given to the author, will be donated to the Australian War Memorial. The collection is a combination of photos Frank shot during the war and ones he copied from other armourers after the conflict.
John Crawford added:

Yeah, I had a little camera, it’s only a little 120 sized thing and films were not plentiful. I didn’t care about a lot of things. They could have court-martialed me, that would have been the best thing they could have done. I just wanted to get out of the bloody place, that’s all.

Sylvia Stolz related her experiences with the chemical warfare research station and directed me to her personal collection of photos now held in the Australian War Memorial, some of which I have used. Bill Lewis and Jim Munro recalled their experience at No. 1 Base Ammunition Depot and Bill provided me with several Army chemical warfare training documents and recounted the clean-up of Darra (US chemical warfare depot) after the war. Stuart Glover was a Radio Officer on the Idomeneus.

I am most grateful to the following Defence personnel, both current and past, who either gave advice, provided data or gave general support: Major Graeme Andrews, Mollie Angel, Captain Michael Armstrong, Barbara Bartley, Lieutenant-Colonel Greg Bowyer, Captain Bradley Davis, Leigh Edwards, Warrant Officer Class 2 Gary Fletcher, Paul Galvin, Peter Hanlin, Major Ross Hall, John Howell, Michele McDonald, Josy Meyer, Sally McOrist, Klaus Popp, James Ryan, Major David Rye, Major John Shore, Major David Thomas, John Tilbrook, Major Mark Walton, David Wilson, Warrant Officer Class 2 Chris Young.

The manuscript was expertly reviewed by Prof. Julian Robinson, Dr Thomas Stock, Dr Ralf Trapp, John Hart, Ron Manley and Jeff Osborne (chemical warfare munitions). Their interest was overwhelming and their comments greatly strengthened the book. Prof. Julian Robinson gave much advice on the chemistry and nature of the agents during the evolution of the study while Jeff Osborne kindly made available his superb private collection of chemical munitions photos, all at no cost.

I thank the staff at the Australian War Memorial for all their assistance and single out Geoff Bruster, Mike Cecil, Robyn Van-Dyk, Mike Etzel, Ric Pelvin and Ian Smith amongst many. Similarly, the staff of the National Archives of Australia in both Canberra and Melbourne were vital to the completion of the book, Brian Pitcher being especially helpful.

Ron Parsons passed on his considerable expertise on ships.

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8 Foreign Affairs and Trade.
9 Foreign Affairs and Trade.
As there have been so many contributors I apologise profusely to those whose names do not appear in the listings.

A book was undreamt of. John Tilbrook was agitating somewhere at the beginning for this to become so. While others may have hesitated, the challenge was taken up by Roger Lee, Australian Army Historian. Indefatigable from beginning to end, he took on a topic that is not easy to carry. There are few precedents for countries publishing such a detailed account, acknowledging mistakes were made and injuries sustained. Further, the Army History Unit, headed by Roger, paid for all the photos and gave me free rein which has allowed for a superb and as complete as possible a photographic record which is as valuable as the text—this is a visual history as much as a written one. The Army History Unit also paid for the editing, proofing, map creation, and some production costs. In addition, Roger funded the transcription of a series of filmed interviews undertaken with the RAAF chemical warfare armourers and Army staff. He was adamant that the surviving chemical warfare staff should have their own voice in the book. All in all this has been an expensive business. It has been done without a profit motive and solely with the intent to produce an important history which forms part of the Australian Army history collection. Roger is first and foremost a historian. Emma Robertson, formerly of the Army History Unit, was involved in all aspects of the book’s preparation. Simply put, the book would have been impossible without the support of the Army History Unit.

With the exception of Jeff Osborne’s weaponry shots, all of the photos in this book were taken at the time the events occurred. Unless otherwise stated, the testimonials are all from RAAF chemical warfare armourers. Apart from Bunny Bruce, Vic Hicks, Bob Langsford and Ron Watts who submitted written answers to questions posed by the author, all the armourers were interviewed by the HQTTC (Army) film crew. Jack Brown was interviewed by an ABC film crew during the production of Keen as Mustard. Bill Lewis and Jim Munroe were Army Inspecting Ordnance Officers.
Much love to my long-suffering work colleagues who allowed this arcane predilection: John Baylis, Bernie Dawes, Gary Doburn, Steve Foster, Senka Kajtez-Mathews, Eli Kwok, Rod Niven, Tom Sullivan, Luc Vuong and Karl Winstone.

So that a permanent visual record can be kept and a documentary on ‘Australia’s Mustard Gas Men’ be made, in March and April of 2005 film crews from HQTTC (Army) interviewed the surviving RAAF chemical warfare armourers as well as three Army staff, Jim McAllester, Bill Lewis and Jim Munro. My grateful thanks to Les McClaren (Producer), Paul Ingram (Director), Jorge Farre and Roland Linssen (Directors of Photography) and Yasmin Tadich (Production Coordination). Andrew Axon (Director of photography) and Jason Silsby (Sound engineer) filmed Bill Lewis and Jim Munroe in Canberra. It was a special time. Kerrie McGovan organised the tape transcriptions while we thank Penny Flanagan for working her way through them.

The book was superbly edited by Cathy McCullagh, always with a great attention to detail and a great belief in the project. Cathy was involved with this project for three years and helped me wade through 25 hours of transcripts. In her own time Cathy visited Glenbrook tunnel and met Geoff Burn. The result is a great credit to you. I and the chemical warfare armourers salute you, we owe you a great debt. Thanks to Terry McCullagh for the indexing. Keith Mitchell produced the fine maps. Many thanks to Margaret McNally for laying out the text. I am also indebted to Australian Military History Publications and Clive Baker, the publishers of this book. They paid for the remaining production costs, undertook its promotion and put it all together, again with no thought of a profit motive. For more on Australian Military History Publications, refer to the website at: http://www.warbooks.com.au/

Much love also, of course, to my family, the Beckster, Skippy, Spook and Steady.

If anyone has any additional information, corrections or photographs, I would love to hear of these. I am also seeking information on the *Idomeneus* mustard gas incidents at both Melbourne and Sydney. In addition to these, I would welcome information on the Australian and New Zealand (ANZAC) experience of chemical weapons in World War I. Whether it be the wartime and postwar experience of the diggers, doctors, nurses, civilians and any other personnel, all aspects are of great interest to me. Email me on: Geoff.Plunkett@defence.gov.au or Geoff.Plunkett@gmail.com.
Mustard gas stocks burning at Newnes State Forest, west of Sydney, in early 1946. Burning was found to be an effective method of disposing of bulk supplies of mustard. The bright flare in the centre is the result of two cases of thermite incendiaries which had been mixed with the mustard stocks. The incendiaries were hexagonal bars approximately 1.75 by 15 inches which aided in intensifying the fire. Burnt out Chemical Special No. 6 drums can be seen in a pile in the foreground to the left.

© RAAF Chemical Warfare Armourers
In the dark days of World War II, Australia faced the looming menace of an approaching Japanese force, surging rapidly southwards in a hostile wave. The Japanese were not only regarded as ruthless and fanatical fighters; they were known to possess and to have used chemical weapons with little compunction for their hapless victims. Faced with such a threat, Australia’s only option was to build its own stock of chemical weapons sufficient to provide for a retaliatory strike if that proved necessary. Australia faced a stark choice in its desperate race to acquire a chemical defence: it could either produce its own chemical weapons, or import these weapons from elsewhere. The slow pace of bureaucratic decision-making proved the ultimate decider. While debate on the domestic production of chemical weapons raged within government and senior military circles for the better part of five years, Australia quietly imported chemical weapons in a bid to build a credible defence and continued to do so until the end of the war. Today, sixty years on, most Australians remain unaware of the fact that their country held close to a million individual chemical munition weapons, at least sixteen different types of mustard gas, and some thirty-five types of chemical weapons at fourteen major storage depots. Tragically two men lost their lives as a result of exposure to mustard gas and a third died of tuberculosis aggravated by mustard gas.\textsuperscript{10}

This book paints a picture of the plethora of little-known chemical weapons activities in Australia during World War II, the processes and organisations designed to shape this form of warfare and the experiences of those men and women whose day-to-day involvement with chemical agents lingers into their current lives. The product of extensive and meticulous research, the stories that comprise this volume are based on varied and fragmentary information from sources both personal and published. The book describes the development of national policy and warfare plans. It examines agents and munitions, their procurement and disposal. It covers the organisational structure of chemical weapons facilities,

\textsuperscript{10} A Defence file created in 1975: ‘PQ No. 580 by Sen Jessop Re: Number of servicemen who died as a result of poison gas tests conducted during WWII’ was destroyed later as it carried a ‘routine statement of fact’ relating to a parliamentary question. It is presumed not to have listed any individual deaths.
the complex logistics involved in their handling and transport, and the training essential to equip Australia’s defence forces with the vital knowledge of their use. Finally, the book describes Australia’s approach to chemical weapons in the postwar period, governed by its position as a State Party in Good Standing to the Chemical Weapons Convention. From those first desperate days when this nation faced the grim reality that its very survival might depend on a credible defence against chemical weapons, Australia has become a driving force in the movement to ban the proliferation of such weapons.
## List of Photographs, Maps and Figures

### Photographs

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Captain (later Major) Jim McAllester prepares targets for the improvised rifle range, Townsville, November 1942.</td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>Picture drawn by RAAF chemical warfare armourer Frank Moran.</td>
<td>xiii</td>
</tr>
<tr>
<td>3</td>
<td>Badge created for the reunion of RAAF chemical warfare staff at Penrith, Sydney, in 1990.</td>
<td>xvi</td>
</tr>
<tr>
<td>4</td>
<td>Mustard gas stocks burning at Newnes State Forest, early 1946.</td>
<td>xviii</td>
</tr>
<tr>
<td>5</td>
<td>Australian soldiers gassed by mustard gas, France, 27 May 1918.</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>A group of unidentified Australian soldiers suffering from the effects of mustard gas, 27 May 1918.</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Members of the Australian Light Horse Brigade, Palestine? 1917.</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Informal outdoors group portrait of members of the 1st Australian Divisional Signal Company, Gallipoli, Turkey, circa July 1915.</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>J.R.H.E. Turner, uncle of RAAF chemical warfare armourer Bunny Bruce, who was gassed in France in World War I.</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>RAAF chemical warfare armourers, the ‘Mustard Gas Men’ just outside Glenbrook railway chemical weapons storage tunnel, August 1944.</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Defence Minister Street and Prime Minister Menzies trying on gas masks, 28 June 1940.</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>A 4.5-inch quick firing howitzer bursting chemical shell.</td>
<td>13</td>
</tr>
<tr>
<td>13</td>
<td>Wellington aircraft with a Smoke Curtain Installation (mustard gas spray tank) attached underneath.</td>
<td>14</td>
</tr>
<tr>
<td>14</td>
<td>A 65-lb bomb, essentially a kerosene can which burst on impact.</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>RAAF chemical warfare armourer Frank Moran in front a Beaufort Bomber, Bowen, Queensland.</td>
<td>18</td>
</tr>
<tr>
<td>16</td>
<td>General Douglas MacArthur during his inspection of the 9th Australian Division at the Atherton Tableland training area, 5 July 1943.</td>
<td>21</td>
</tr>
<tr>
<td>17</td>
<td>Captured Japanese gas respirators, 14 September 1943.</td>
<td>24</td>
</tr>
<tr>
<td>18</td>
<td>A captured Japanese toxic smoke generator filled diphenylecyanoarsine, June 1945.</td>
<td>24</td>
</tr>
<tr>
<td>19</td>
<td>Enemy anti-gas respirator display at Wesley College museum, Melbourne, 14 August 1943.</td>
<td>25</td>
</tr>
<tr>
<td>20</td>
<td>‘The possibility of the Japanese army using poison gas ... clerical staffs at camp headquarters have to wear their respirators for an hour each day’, 7 June 1942.</td>
<td>27</td>
</tr>
</tbody>
</table>
Japanese gas mask found at Milne Bay, Papua New Guinea, 1 October 1942.

Army trucks taking chemical weapons from Darwin to 88 Mile by road (circa April 1944).

US chemical weapons storage depot at Darra, Brisbane.

Method of storage and dispersal of M47A2 100-lb mustard gas bombs. Charters Towers, Queensland, mid-1943.

View from east end cutting of Glenbrook chemical weapons storage tunnel, mid-1943.

A 25-pounder chemical shell bursting during the gas shell shoot at Townsville, November 1942.

Anterior surface of elbow of a serviceman after he had been exposed to the effects of mustard gas, Forbes, February 1943.

An observer who has been overcome by mustard at a gas trial at Singleton in January 1943.

RAAF chemical warfare ‘sniper’ crew with 0.303 rifles at No. 19 Replenishing Centre, Talmoi, January 1946.

Storage shed at Marrangaroo railway cutting for 250-lb phosgene bombs, mid-1943.

RAAF chemical warfare armourers from Talmoi chemical weapons storage depot.

No. 1 gun of ‘F Troop’, 2/2 Field Regiment, Royal Australian Artillery, firing a 25-pounder gas shell at Forbes, February 1943.

The administration and accommodation area at Marrangaroo designed to appear from the air as a small country town.

Reunion of RAAF chemical warfare staff and their families, 1990.

The mobile workshop of the 2/1st Australian Chemical Warfare Laboratory, 17 August 1943.

Lieutenant J.W. Mumford visiting the 2/1st Australian Chemical Warfare Laboratory observing the progress of a test, 3 May 1943.

Lieutenant C. H. Bull of the 2/1st Australian Warfare Laboratory examining a Japanese respirator container, 17 August 1943.

View of the camouflaged plant used to charge US-manufactured levinsenstein mustard gas into bombs. Charters Towers, Queensland, mid-1943.

Close-up of one unit of the mustard gas charging plant at the US chemical warfare storage depot at Charters Towers, Queensland, mid-1943.

RAAF aircrew trainees wearing respirators. Somers, Victoria, 27 March 1941.

Possibly Doug Brock or Geoff ‘Tassie’ Burn doing maintenance on 250-lb bombs at Marrangaroo, mid-1943.

Personnel of Fort Direction, Hobart Coast Artillery. Tasmania, 26 April 1943.

Filling a mustard gas spray tank on a RAAF Beaufort bomber for training purposes at the Land Headquarters Gas School at Bonegilla, March 1943.

RAAF chemical warfare armourers in full anti-gas gear.

East cutting to chemical warfare storage tunnel at Glenbrook, mid-1943.

Members of 123 Australian General Transport Company advancing through a smokescreen during anti-gas training. Ross, Tasmania, 14 April 1943.

Personnel at 4 Base Ordnance Depot (the return stores depot), repairing gas masks, 8 November 1944.

Three soldiers in training demonstrate the wearing of gas masks. Flemington, Victoria, December 1939.

Lance Corporal G. St. John, Australian Women’s Army Service (AWAS), using a gas warning rattle. Melbourne, Victoria, 15 March 1943.

Members of the Australian Women’s Army Service putting on their anti-gas respirators during a gas attack instruction period. Melbourne, Victoria, 15 March 1943.

Private A. Mathers and Private S. Cahill at 4 Base Ordnance Depot disinfecting respirators. Fitzroy, Victoria, 8 November 1944.

Flying Officer Taylor (RAAF) filling a hydrogen balloon at Townsville, November 1942.

Competitor in the 24th Australian Infantry Brigade respirator race. Kairi, Queensland, 31 July 1943.

Chemical warfare armourer disposal crew from No. 19 Replenishing Centre, December 1945.

Aerial view of the RAAF Chemical Research Unit airfield at Bowen, 30 January 1945.

Sergeant P.W. Brunton of the 2/1st Australian Chemical Warfare Laboratory drilling a 25-pounder chemical warfare shell, 3 May 1943.

A gutzeit arsenic determination in progress at the 2/1st Australian Chemical Warfare Laboratory, 3 May 1943.

A fume cupboard with chemical storage underneath. Broadmeadows, Victoria, 17 August 1943.

Personnel from the 1st Australian Field Trials Company RAE. Proserpine, Queensland.
Storage shed and the field laboratory for the Australian Chemical Warfare Research and Experimental Section at Innisfail. Circa December 1943.

Interior of the laboratory of the Australian Chemical Warfare Research and Experimental Section at Innisfail, 1944.

Aerial view of the military camp of the Australian Field Experimental Station at Proserpine, 30 January 1945.

Personnel quarters and office buildings at the Australian Field Experimental Station at Proserpine.

Group portrait of staff of the Australian Chemical Warfare Research and Experimental Section at Innisfail, 23 December 1943.

Chemistry laboratory staff of the 1st Australian Field Trials Company RAE at the Australian Field Experimental Station at Proserpine, Queensland.

A woman tests materials for gas respirator containers in the Munitions Supply Laboratory. Circa 1944.

A factory worker testing gas masks at the Munitions Supply Laboratory, October 1940.

A woman tests gas masks and respirator containers while wearing breathing equipment at the Commonwealth Munitions Supply Laboratories. Circa 1944.

A woman technician fitting buckles onto the head harness of a respirator at the Munitions Supply Laboratory, October 1940.

The only known photo taken from inside a chemical warfare storage tunnel, in this case Glenbrook.

A concrete igloo for storing phosgene-filled 250-lb bombs at the RAAF No. 19 Replenishing Centre, Talmoi, Queensland.

View of camp at ‘88 Mile’.


Eight servicemen at Forbes taking part in an experimental 25-pounder gas shell shoot, February 1943.

Sheds at Marrangaroo railway cutting housing 250-lb phosgene-filled bombs, mid-1943

West end of Glenbrook chemical warfare storage tunnel, mid-1943.

Glenbrook – Chemical Warfare Section headquarters, mid-1943.

Kitchen and airmen’s mess at the top secret camp at Glenbrook.

Locally built storeroom at Glenbrook camp, mid-1943.

View of Glenbrook camp area from the east end, mid-1943.

Chemical warfare armourer Mel Carney in the Glenbrook maintenance cutting.
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>83</td>
<td>View of Glenbrook camp area from the west end, mid-1943.</td>
</tr>
<tr>
<td>84</td>
<td>Anti-gas clothing store at the secret camp at Glenbrook, mid-1943.</td>
</tr>
<tr>
<td>85</td>
<td>Entrance to Marrangaroo tunnel, 1943 with Alsatian guard dog.</td>
</tr>
<tr>
<td>86</td>
<td>The ‘Angeline’ ballet from a ball at Dungowan Hall, Penrith, Sydney, in August 1943.</td>
</tr>
<tr>
<td>87</td>
<td>The Angeline ballet at Penrith.</td>
</tr>
<tr>
<td>88</td>
<td>Glenbrook camp masonite accommodation huts.</td>
</tr>
<tr>
<td>89</td>
<td>Hoax town at the administration and accommodation area at Marrangaroo.</td>
</tr>
<tr>
<td>90</td>
<td>Storage sheds in the Marrangaroo cutting, mid-1943.</td>
</tr>
<tr>
<td>91</td>
<td>Loading platform at one of the phosgene storage sheds at Marrangaroo railway cutting, mid-1943.</td>
</tr>
<tr>
<td>92</td>
<td>View of temporary ‘decontamination centre’ at Marrangaroo.</td>
</tr>
<tr>
<td>93</td>
<td>250-lb bombs passed from the Marrangaroo tunnel being cleaned by electric buffers, mid-1943.</td>
</tr>
<tr>
<td>94</td>
<td>Near the entrance to Picton tunnel where Smoke Curtain Installation mustard gas spray tanks were stored.</td>
</tr>
<tr>
<td>95</td>
<td>Smoke Curtain Installation mustard gas spray tanks in their crates await transfer to Rozelle wharf where they will be loaded on the Bantam, 1946.</td>
</tr>
<tr>
<td>96</td>
<td>Talmoi siding (railway platform).</td>
</tr>
<tr>
<td>97</td>
<td>Preparing for a turkey shoot at No. 19 Replenishing Centre, Talmoi, 1946.</td>
</tr>
<tr>
<td>98</td>
<td>After a scrub turkey shoot at No. 19 Replenishing Centre, Talmoi, 1944.</td>
</tr>
<tr>
<td>99</td>
<td>‘Mac’ (short for MacKenzie), the Scottish cook at Talmoi.</td>
</tr>
<tr>
<td>100</td>
<td>Corrugated iron shed at No. 19 Replenishing Centre, Talmoi.</td>
</tr>
<tr>
<td>101</td>
<td>Concrete igloo for storing 250-lb phosgene bombs at No. 19 Replenishing Centre, Talmoi.</td>
</tr>
<tr>
<td>102</td>
<td>View of 88 Mile camp in the Northern Territory.</td>
</tr>
<tr>
<td>103</td>
<td>88 Mile camp seen at night.</td>
</tr>
<tr>
<td>104</td>
<td>Alcohol, the universal entertainer. Frank Sutton at 88 Mile.</td>
</tr>
<tr>
<td>105</td>
<td>The Ghan train moving RAAF chemical warfare personnel to the newly established 88 Mile depot in the Northern Territory, 1944.</td>
</tr>
<tr>
<td>106</td>
<td>RAAF chemical warfare armourers at the combined mess kitchen/recreation hut at 88 Mile.</td>
</tr>
<tr>
<td>107</td>
<td>The decontamination centre of No. 3 sub-depot (chemical warfare ammunition storage area), 1st Base Ammunition Depot, Albury, 1 June 1944.</td>
</tr>
<tr>
<td>108</td>
<td>Tiny Waterman and Harry Dewhurst with ‘Leapin Lena’, the crane and bomb trolley at Glenbrook tunnel.</td>
</tr>
<tr>
<td>109</td>
<td>Aerial view of east cutting with covered maintenance area at Glenbrook tunnel, 1944.</td>
</tr>
</tbody>
</table>
110 The decanting shed at Glenbrook where leakers were handled. 196
111 View of the temporary shelter for maintenance operations at Marrangaroo during bad weather and for the painting of bombs. 250-lb bombs are seen upright and undercover, mid-1943. 198
112 Chemical warfare armourer Wally Garradd transporting a 250-lb light case bomb filled mustard gas at Marrangaroo, 1943. 199
113 Starboard bow view of the British passenger cargo steamer Idomeneus, the most infamous ship to import chemical warfare munitions from the UK to Australia, 14 December 1939. 201
114 250-lb light case bomb. 207
115/116 Chemical warfare armourer Les Parsons after mustard gas exposure on the Idomeneus. 211
117 A ship apparently delivering chemical weapons to 88 Mile, 1944. 221
118 RAAF chemical warfare armourers at Glenbrook railway siding. 222
119 Aerial view of North Brook Island – an aircraft has dropped a high explosive bomb. 236
120 Barges from Hinchinbrook Island bringing men and stores to North Brook Island, 3 March 1944. 238
121 Mr John Legge carrying out a post-mortem on a goat killed by mustard gas during the Brook Island trials. Circa 4 March 1944. 239
122 Flight Lieutenant Arthur Trewin (RAAF) taking samples. North Brook Island, 3 March 1944. 242
123 Volunteers wear full protective clothing and breathing apparatus. North Brook Island, March 1944. 246
124 RAAF chemical warfare armourers on parade on Hinchinbrook Island during the second Brook Island trial, March 1944. 247
125 An aircraft sprays unthickened American levinstein mustard gas on North Brook Island. 248
126 RAAF chemical warfare armourers clearing jungle near Innisfail. 252
127 RAAF chemical warfare armourers at Innisfail, 5 June 1944. 255
128 The headquarters of the Australian Chemical Warfare Research and Experimental Section at Innisfail in December 1943. 256
129 Staff of the physiology laboratory at the 1st Australian Field Trials Company RAE at Proserpine, Queensland. 257
130 Crew members boarding the ill-fated flight of a mustard-contaminated plane. 259
131 Blisters on Army volunteers caused by mustard gas exposure in human trials. 261
132 The first of seven obstacles on the assault course at the Innisfail showground, 1944. 264
133 Penis and scrotum of Army guinea pig burnt in a mustard gas trial, 15 February 1945. 266
134 The ‘annulus’ mustard gas experiment at Innisfail. 269
135 Two bare-chested members of the 2/2nd Field Regiment, Royal Australian Artillery. Singleton, January 1943. 271
136 Servicemen at Forbes following a 25-pounder gas shell experiment, February 1943. 272
137 Characteristic burns on the upper leg of a volunteer in a mustard gas trial at Innisfail. 272
138 ‘Members of the Chemical Defence Board ... demonstrate the effectiveness of a Japanese decontamination powder’, 1 June 1943. 275
139 Chemistry section equipment, bubblers and injectors set up on Mission Beach, Queensland, December 1944. 279
140 Surrounded by tropical bush, a volunteer wears full protective clothing, March 1944. 279
141 Frank Moran’s mustard gas-burnt foot with bandage. 282
142 Light anti-gas mask respirator, Australian Army issue. 285
143 Side view of RAAF ‘sniper’ crew disposing of phosgene at No. 19 Replenishing Centre. 287
144 Clean-up by RAAF armourers after a spill of mustard gas at Cairns airfield. 288
145 Unloading Smoke Curtain Installation spray tanks at Rozelle wharf, Sydney. 290
146 Low-level aerial view of North Brook Island with smoke rising from where an aircraft has dropped a mustard gas shell, 1944. 298
147 Len Rhody, having been burnt around the stomach by mustard gas, is covered with a bandage. 299
148 Layout of 60 mustard gas drums ready for an experimental burn at the Australian Field Experimental Station, Proserpine. 306
149 Horizontally placed 250-lb phosgene bombs venting to right after having been punctured by 0.303 rifle fire at No. 19 Replenishing Centre, Talmoi, January 1946. 307
150 Disposal of mustard gas supplies by fire at No. 19 Replenishing Centre, Talmoi. December 1945/January 1946. 309
151 Smoke Curtain Installation mustard gas spray tanks and 250-lb bombs await loading at Rozelle wharf onto the Bantam. 311
152 Newnes State Forest – aftermath of burn disposal, March 1946. 311
153 Clean-up of the former chemical weapons storage depot at Darra, Brisbane, in 1956. 314
154 Chemical warfare agents and equipment recovered in 1956. Darra, Brisbane. 315
155 6-lb training ground bomb filled with mustard gas, the contents of which killed a person 15 years after the war. 318
156 Unloading crates at Talmoi prior to a burn disposal of chemical weapons, December 1945/January 1946. 321
<table>
<thead>
<tr>
<th>Page</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>157</td>
<td>Talmoi mustard weapon burn disposal in December 1945.</td>
</tr>
<tr>
<td>158</td>
<td>Mustard gas bombs and drums burn fiercely at Talmoi in December 1945.</td>
</tr>
<tr>
<td>159</td>
<td>Trucks at Glenbrook moving stocks of chemical weapons to Newnes State Forest, February/March 1946.</td>
</tr>
<tr>
<td>160</td>
<td>Warning sign erected 11 January 1946 on entrance road to the 88 Mile burn disposal site.</td>
</tr>
<tr>
<td>161</td>
<td>Unloading of stocks in readiness for a burn disposal at 88 Mile.</td>
</tr>
<tr>
<td>162</td>
<td>Chemical Special No. 6 crates piled for burning of 88 Mile stocks.</td>
</tr>
<tr>
<td>163</td>
<td>Stocks of chemical weapons and fuel in the form of wood being piled for burning at either 88 Mile or Newnes State Forest.</td>
</tr>
<tr>
<td>164</td>
<td>The Bantam, laden with unused chemical warfare stocks from the storage tunnels near Sydney, September 1946.</td>
</tr>
<tr>
<td>165</td>
<td>Venting of 250-lb light case bombs filled phosgene at Fenton airfield near 88 Mile, Northern Territory.</td>
</tr>
<tr>
<td>166</td>
<td>The sea dumping of chemical waste recovered from the clean-up (Operation Thor) at the former chemical weapons storage depot at Darra, Brisbane.</td>
</tr>
<tr>
<td>167</td>
<td>A stack of 250-lb bombs from Marrangaroo storage depot on a copra barge (from Papua New Guinea).</td>
</tr>
<tr>
<td>168</td>
<td>View of the Bantam’s hold filled with crated Smoke Curtain Installation spray tanks from Picton tunnel.</td>
</tr>
<tr>
<td>169</td>
<td>Another view of the hold of the Bantam.</td>
</tr>
<tr>
<td>170</td>
<td>Looking down into the hold of the Bantam filled with crated Smoke Curtain Installation mustard gas spray tanks from Picton tunnel, 1946.</td>
</tr>
<tr>
<td>171</td>
<td>Smoke Curtain Installation spray tank crates at Rozelle wharf, Sydney.</td>
</tr>
<tr>
<td>172</td>
<td>RAAF chemical warfare armourers relax at Horse Shoe Bay near Bowen, Queensland.</td>
</tr>
<tr>
<td>173</td>
<td>Loading party sending chemical warfare stocks to the Bantam for scuttling.</td>
</tr>
<tr>
<td>174</td>
<td>RAAF chemical warfare armourers with ‘fig leaf’ apparel at Talmoi.</td>
</tr>
<tr>
<td>175</td>
<td>Talmoi transport section drivers with the wool scour left and back.</td>
</tr>
<tr>
<td>176</td>
<td>View of buildings at Talmoi.</td>
</tr>
<tr>
<td>177</td>
<td>88 Mile mess cookhouse and mess room.</td>
</tr>
<tr>
<td>178</td>
<td>65-lb LC bomb, manufactured in both the UK and Australia.</td>
</tr>
<tr>
<td>179</td>
<td>Types of gas shells used at the Singleton 25-pounder gas shell shoot, January 1943.</td>
</tr>
<tr>
<td>180</td>
<td>The 4.2-inch mortar bomb filled Y13 was used in trials near Innisfail.</td>
</tr>
<tr>
<td>182</td>
<td>Australian soldiers releasing phosgene gas from cylinders. Abasan el kebir, Palestine, circa 1917.</td>
</tr>
<tr>
<td>Number</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>183</td>
<td>B4 filled shell from Albury being examined by the 2/1st Australian Chemical Warfare Laboratory.</td>
</tr>
<tr>
<td>184</td>
<td>View of Talmoi chemical warfare storage facilities.</td>
</tr>
<tr>
<td>185</td>
<td>Gas cloud (presumably phosgene) in savannah near Proserpine.</td>
</tr>
<tr>
<td>186</td>
<td>Many 30-lb bombs charged Y3 arrived on the Nigerstrrom in August 1942.</td>
</tr>
<tr>
<td>188</td>
<td>US-manufactured rocket, 7.2-inch.</td>
</tr>
<tr>
<td>189</td>
<td>Size comparison of a number of UK-manufactured chemical weapon bombs held by the RAAF.</td>
</tr>
<tr>
<td>190</td>
<td>A 65-lb light case bomb outside wooden transportation crate.</td>
</tr>
<tr>
<td>191</td>
<td>View of the temporary shelter for maintenance operations during bad weather and for the painting of 250-lb bombs at Marrangaroo, mid-1943.</td>
</tr>
<tr>
<td>192</td>
<td>A 250-lb LC UK-manufactured chemical warfare bomb.</td>
</tr>
<tr>
<td>193</td>
<td>RAAF chemical warfare armourers in front of crates of 30-lb bombs (4 per box) at Marrangaroo, 1943.</td>
</tr>
<tr>
<td>194</td>
<td>The 30-lb light case Mark I bomb. Cut-out view below.</td>
</tr>
<tr>
<td>195</td>
<td>The 30-lb light case Mark II.</td>
</tr>
<tr>
<td>196</td>
<td>The 250-lb Smoke Curtain Installation mustard gas spray tank.</td>
</tr>
<tr>
<td>197</td>
<td>The 400-lb Smoke Curtain Installation mustard gas spray tank.</td>
</tr>
<tr>
<td>198</td>
<td>The 500-lb Smoke Curtain Installation mustard gas spray tank.</td>
</tr>
<tr>
<td>199</td>
<td>The 500-lb Mark II bomb, charged phosgene.</td>
</tr>
<tr>
<td>200</td>
<td>A line of 60 bulk storage drums destroyed at Proserpine, October 1945.</td>
</tr>
<tr>
<td>201</td>
<td>Mustard gas drums from the Australian Field Experimental Station burn at a disposal trial in October 1945.</td>
</tr>
<tr>
<td>202</td>
<td>The 5.5-inch Mark IV howitzer shell.</td>
</tr>
<tr>
<td>204</td>
<td>Close-up of a 25-pounder gas shell. Singleton, January 1943.</td>
</tr>
<tr>
<td>205</td>
<td>The 25-pounder base ejection shell with a cut-out view.</td>
</tr>
<tr>
<td>206</td>
<td>The 25-pounder, Mk I to III.</td>
</tr>
<tr>
<td>207</td>
<td>Gunners of the 2/2nd Field Regiment, Royal Australian Artillery, operating their 25-pounder guns at Singleton.</td>
</tr>
<tr>
<td>208</td>
<td>The 3-inch mortar bomb charged mustard or phosgene.</td>
</tr>
<tr>
<td>209</td>
<td>Second view of a 3-inch mortar bomb charged mustard or phosgene.</td>
</tr>
<tr>
<td>210</td>
<td>US M2A1 4.2-inch mortar.</td>
</tr>
<tr>
<td>211</td>
<td>The 4.2-inch mortar.</td>
</tr>
<tr>
<td>214</td>
<td>The 5-inch (U) rocket filled phosgene.</td>
</tr>
<tr>
<td>215</td>
<td>The 6-lb ground bomb.</td>
</tr>
</tbody>
</table>
Cut-out view of a 6-lb ground bomb.  
Chemical mine, manufactured in the UK.  
The 6-inch howitzer base ejection shell (quick firing variant).  
The 6-inch bursting howitzer shell (breech loading).  
The 6-inch base ejection howitzer shell (breech loading).  
The 1000-lb Mark I bomb.  
The 75 mm M64 shell.  
The 75 mm MKII shell.  
The 105 mm M60 shell.  
The 155 mm M110 shell.  
Method of handling a leaking M47A2 100-lb bomb at Charters Towers, mid-1943.  
The M78 (500-lb) bomb.  
The 1000-lb M79 bomb.  
The M20 Smoke Tank for spraying mustard.  
The M33 Smoke Tank for spraying mustard.  
Charged M10 Smoke Curtain Installation bombs at the US storage facility at Charters Towers, mid-1943.  
The M1A2 chemical portable cylinder.  
US chemical mine (M1).  
US M1 DM gas candle.  
No 20 Mark I Generator.  
No 2 Mark IV Generator.  
Spray or chemical projector bomb.  
An 8-inch Livens drum.  
Livens Projector and accessories.  
Typical smelling set.  
Servicemen taking part in the Townsville gas shell demonstration, November 1942.  
Close-up of a serviceman firing at a target following exposure to gas. Townsville, November 1942.  
An example of ‘very bad shooting’ by a serviceman exposed to the effects of gas. Townsville, November 1942.  
Using the directors and plotting table during fuze zone trials. Townsville, November 1942.  
A 25-pounder base ejection chemical shell bursting over a target. Townsville, November 1942.  
A serviceman in the 25-pounder gas shell trial at Townsville, November 1942.  
Inspecting the detector plates for degree of contamination. Townsville, November 1942.  
Inspecting the detector plates for degree of contamination. Townsville, November 1942.
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>249</td>
<td>Adjusting the vapour sampling apparatus at Singleton immediately prior to a 25-pounder gas shoot, January 1943.</td>
</tr>
<tr>
<td>250</td>
<td>Observers reading the detector plates (the white squares dotted about the range) at the Singleton 25-pounder trial in the target area, January 1943.</td>
</tr>
<tr>
<td>251</td>
<td>Captain W. N. K. King, Royal Engineers (UK). Singleton, January 1943.</td>
</tr>
<tr>
<td>252</td>
<td>Rear view of officers operating director instruments at the Singleton 25-pounder trial, January 1943.</td>
</tr>
<tr>
<td>253</td>
<td>Observers at Singleton compare results, January 1943.</td>
</tr>
<tr>
<td>254</td>
<td>Two vapour absorption bubblers. Singleton, January 1943.</td>
</tr>
<tr>
<td>255</td>
<td>Snap sampling apparatus. Singleton, January 1943.</td>
</tr>
<tr>
<td>256</td>
<td>Captain G.S. Compton examining respirators. Forbes, February 1943.</td>
</tr>
<tr>
<td>257</td>
<td>Swabbing off liquid contamination from the face-piece of a respirator. Forbes, February 1943.</td>
</tr>
<tr>
<td>258</td>
<td>Servicemen taking part in the 25-pounder gas shell Forbes trial, February 1943.</td>
</tr>
<tr>
<td>260</td>
<td>Placing clothing, contaminated by exposure to gas during the Forbes chemical shoot, February 1943.</td>
</tr>
<tr>
<td>261</td>
<td>Close-up of a detector worn on the shoulder of a serviceman. Forbes, February 1943.</td>
</tr>
<tr>
<td>262</td>
<td>Servicemen who participated in the Forbes 25-pounder gas shell experiment, February 1943.</td>
</tr>
<tr>
<td>263</td>
<td>Hanging out face-pieces of respirators to dry after decontamination at the Forbes trial, February 1943.</td>
</tr>
<tr>
<td>264</td>
<td>Spraying the decontamination area after its use to decontaminate clothing and equipment. Forbes, February 1943.</td>
</tr>
<tr>
<td>265</td>
<td>Lieutenant J.R.B. Neil, 2/1 Australian Chemical Warfare Laboratory, Royal Australian Engineers. Forbes, February 1943.</td>
</tr>
<tr>
<td>266</td>
<td>Swabbing off gross contamination on canisters of respirators. Forbes, February 1943.</td>
</tr>
<tr>
<td>267</td>
<td>Army personnel of the 1st Australian Division photographed at Lake Hiawatha. Grafton, April 1943.</td>
</tr>
<tr>
<td>268</td>
<td>Gas shells bursting near Lake Hiawatha during the Grafton gas shell trial, April 1943.</td>
</tr>
<tr>
<td>269</td>
<td>Inspection of the guns of 3 Battery at Grafton, April 1943.</td>
</tr>
<tr>
<td>270</td>
<td>Blisters sustained by Army personnel taking part in chemical warfare experiments near Lake Hiawatha. Grafton, April 1943.</td>
</tr>
<tr>
<td>271</td>
<td>A detector plate placed in the target area during the Grafton gas shell experimental shoot, April 1943.</td>
</tr>
</tbody>
</table>
Contamination detectors used in the Humpty Doo trial. 11 August 1943.

The 25-pounder MK VIII shell.

Hoax town at Marrangaroo with the dummy petrol station.

A chemical warfare semi-trailer truck at Marrangaroo.

Army and RAAF living quarters at Marrangaroo.

External view of the Army and RAAF living quarters at Marrangaroo.

Temporary storehouse ... Marrangaroo, mid-1943.

Distant view of the Army and RAAF living quarters at Marrangaroo.

Recently and locally built hut ... Glenbrook. Used as living quarters, mid-1943.

Looking over the transport section at Talmoi.

Talmoi artesian bore which supplied water to the swimming hole.

Talmoi transport section.

Talmoi transport section trucks.

Buildings at Talmoi, possibly for accommodation.

Sleeping quarters at 88 Mile as seen in November 1944.

Naval reserve depot, Sydney, October 1939.

Plant used to charge levinstein mustard into bombs at Charters Towers, mid-1943.

Dispersal of M47A2 crated bombs at Charters Towers, mid-1943.

M47A2 bomb – 15,540 were held at the US Kangaroo depot.

‘New’ method of storing M47A2 100-lb bombs at Charters Towers, mid-1943.

Sectioned 6-inch howitzer Y4 filled, Albury, August 1942.

M2 irritant toxic candle.

M10 mustard spray tank.

Composition exploding pellet with detonator attached to a mustard-filled drum. Proserpine burn disposal, October 1945.

Beginning of fire in which 60 drums were burned, October 1945.

Development of mustard gas fire disposal at Proserpine, October 1945.

Aftermath of the 60 burnt mustard gas drums at Proserpine, October 1945.

Showing 89 drums in line with trenches filled with wood. Proserpine, October 1945.

The trial fire at the AFES disposal, October 1945.

The development of the fire engulfing 89 drums at Proserpine, October 1945.

Showing the type of terrain in which the No. 6 drums were burned at Proserpine, October 1945.

Chemical Special No. 6 drums after burning at Proserpine in October 1945.

UK-manufactured mine.
305 Vertically placed 250-lb phosgene bombs venting at Talmoi. 612
306 The discarded 250-lb bombs used as an entrance marker at Talmoi. 614
307 A batch of 250-lb light case mustard bombs being destroyed at Molesworth Station, Talmoi, Queensland. 616
308 Vertically placed 250-lb phosgene bombs on Fenton airfield (near 88 Mile depot). 618
309 Unloading of crates of Chemical Special No. 6 mustard gas recharging drums (in crates) for the burn disposal near 88 Mile. 618
310 Stack of chemical weapons awaits disposal at Newnes State Forest. February/March 1946. 620
312 Stocks of mustard gas burn fiercely at Newnes State Forest, February/March 1946. 623
313 An hysterical panic-stricken girl being chased by an air raid precaution warden. Melbourne, 30 October 1943. 631
314 Pupils of the St Anthony’s Babies Home, Kew, Melbourne, 10 June 1942. 634
315 An instructor demonstrating the use of a soda-acid fire extinguisher, 3 June 1942. 636
316 A small boy helps display models of aircraft bombs. Elsternwick Park, Victoria, 7 April 1943. 639
317 An air raid precaution ‘Blitz Buggy’ designed by Mr A. K. Newell of Carnegie, Melbourne, 10 June 1942. 641
318 A captured Japanese respirator, type 93 no. 3. St. Lucia, Queensland, October 1942. 649
319 A captured Japanese toxic smoke generator activated in a controlled experiment, June 1945. 655
320 Type 136A Japanese DC/DA acid generator. 657
321 Type 1411A DC Japanese generator. 666
322 Cut-out view of Japanese HL filled shell. 675
323 Japanese 150 mm HCN shell. 678
324 Cut-out view of Japanese 150 mm HCN shell. 678
325 50 kg type 100 Japanese chemical bomb. 682
326 Japanese frangible grenades. 684
327 HCN Type 172 B-K Japanese frangible grenade. 685
328 Japanese HCN frangible grenade, copper stabilised type. 687
329 Container for a Japanese HCN frangible grenade. 687
330 Soldiers of the 45th Battalion wearing gas respirators in the Ypres Sector, 27 September 1917. 690
331 Two soldiers crouch in the entrance to a tunnel on the front line looking towards Turkish trenches. Anzac Cove, Gallipoli, 19 December 1915. 693
332 Three soldiers, probably members of the 4th Australian Field Ambulance, wearing gas helmets. Gallipoli. 1915. 693
An unidentified soldier at an Australian infantry company headquarters in the trenches. Circa June 1916. 697
An unidentified soldier with a gong. Circa June 1916. 699
Australian troops (wearing an early gas mask) with bayonets attached to their rifles in trenches, 1915. 701
A gas guard at the headquarters of the 3rd Battalion, Australian Imperial Forces, First World War, France. 705
Standing in a trench, an unidentified Australian soldier models the type of gas mask used in the trenches, 5 June 1916. 705

Maps
1 Chemical warfare training sites. 76
2 Location of chemical warfare establishments. 100
3 Australian-supervised chemical weapon storage depots. 139
4 Chemical weapons dump areas off Townsville. 337
5 Likely disposal area for 8000 tons of chemical weapons dumped off Brisbane. 337
6 Chemical weapons dump areas off Sydney. 342
7 Chemical weapons dump area off Victoria. 349
8 25-pounder trial locations. 517
9 US chemical warfare depots. 577

Figures
1 Australian Army chemical warfare structure. 62
2 Final proposed RAAF chemical warfare organisation. 67
3 Organisation of the Chemical Section, Headquarters, United States Army Services of Supply, South West Pacific Area, 1 June 1944. 74
4 Japanese DC generator (large type). 661
5 Japanese DC generator (small type). 661
6 Type 167K Japanese self-projecting toxic smoke generator. 663
7 Type 1612K Japanese self-projecting toxic smoke generator. 664
8 Schematic view of type 1411A DC Japanese generator. 666
9 Mark A (small type) tear gas Japanese generator. 668
10 Type 89 Mark A (large type) tear gas Japanese generator. 669
11 Type 162K Japanese lachrymatory generator. 670
12 Japanese 75 mm lewisite-filled shell. 674
13 Japanese 75 mm HL-filled shell. 675
14 Japanese 75 mm PS/stannic chloride shell. 676
15 90 mm Japanese mortar gas bomb. 679
16 Second view of Japanese 90 mm mortar gas bomb. 679
17 50 kg type 92 HL Japanese chemical bomb. 682
18 Diagram of Chibi Japanese AC gas grenade. 687
19 Type 89 Mark C tear gas grenade. 689
**ACRONYMS AND ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 BAD</td>
<td>1 Base Ammunition Depot (Albury)</td>
</tr>
<tr>
<td>AA</td>
<td>Australian Archives</td>
</tr>
<tr>
<td>ACT</td>
<td>Australian Capital Territory</td>
</tr>
<tr>
<td>AFES</td>
<td>Australian Field Experimental Station (Proserpine)</td>
</tr>
<tr>
<td>AIF</td>
<td>Australian Imperial Forces</td>
</tr>
<tr>
<td>AMF</td>
<td>Australian Military Forces (Army)</td>
</tr>
<tr>
<td>BBC</td>
<td>Bromobenzylcyanide (tear gas)</td>
</tr>
<tr>
<td>BE</td>
<td>base ejection (shell)</td>
</tr>
<tr>
<td>BL</td>
<td>breech loading</td>
</tr>
<tr>
<td>CD/CDB</td>
<td>Chemical Defence (Board Report)</td>
</tr>
<tr>
<td>CFLC</td>
<td>Chemical Field Laboratory Company (US)</td>
</tr>
<tr>
<td>CG</td>
<td>phosgene</td>
</tr>
<tr>
<td>CMF</td>
<td>Citizen Military Forces</td>
</tr>
<tr>
<td>coy</td>
<td>Army abbreviation for company</td>
</tr>
<tr>
<td>CO</td>
<td>Commanding Officer</td>
</tr>
<tr>
<td>CR</td>
<td>Central Reserve (RAAF)</td>
</tr>
<tr>
<td>CRU</td>
<td>Chemical Research Unit (Bowen), RAAF</td>
</tr>
<tr>
<td>CW</td>
<td>Chemical Warfare</td>
</tr>
<tr>
<td>CWC</td>
<td>Chemical Weapons Convention</td>
</tr>
<tr>
<td>CWP</td>
<td>Chemical Warfare Plan (SWPA)</td>
</tr>
<tr>
<td>CWSP</td>
<td>Chemical Warfare Service (US)</td>
</tr>
<tr>
<td>Cwt</td>
<td>one hundred weight (112-lbs or approx. 50 kilos)</td>
</tr>
<tr>
<td>DADOS</td>
<td>Deputy Assistant Director of Ordnance Services.</td>
</tr>
<tr>
<td>DC</td>
<td>Defence Committee</td>
</tr>
<tr>
<td>DM</td>
<td>adamsite</td>
</tr>
<tr>
<td>DRL</td>
<td>Defence Research Laboratories</td>
</tr>
<tr>
<td>EOD</td>
<td>explosive ordnance disposal</td>
</tr>
<tr>
<td>GHQ</td>
<td>general headquarters</td>
</tr>
<tr>
<td>HE</td>
<td>high explosive</td>
</tr>
<tr>
<td>HQ</td>
<td>headquarters</td>
</tr>
<tr>
<td>L</td>
<td>lewisite</td>
</tr>
<tr>
<td>L of C</td>
<td>lines of communication</td>
</tr>
<tr>
<td>lb/-lbs</td>
<td>pounds (Imperial weight measure) = 0.45 kilos</td>
</tr>
<tr>
<td>LC</td>
<td>light case (bomb)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>LHQ</td>
<td>Land Headquarters</td>
</tr>
<tr>
<td>MG</td>
<td>Maintenance Group (RAAF)</td>
</tr>
<tr>
<td>MK</td>
<td>Mark (bomb version)</td>
</tr>
<tr>
<td>MM</td>
<td>Methylmethacrylate (perspex)</td>
</tr>
<tr>
<td>MSL</td>
<td>Munitions Supply Laboratory</td>
</tr>
<tr>
<td>MSO</td>
<td>Movements &amp; Shipping Office (RAAF)</td>
</tr>
<tr>
<td>MV</td>
<td>motor vessel (ship)</td>
</tr>
<tr>
<td>NCO</td>
<td>non-commissioned officer</td>
</tr>
<tr>
<td>NEA</td>
<td>North East Area (RAAF)</td>
</tr>
<tr>
<td>No. 1 CR (1 CR)</td>
<td>No. 1 Central Reserve, Marrangaroo, NSW (RAAF)</td>
</tr>
<tr>
<td>19 RC</td>
<td>No. 19 Replenishing Centre (RAAF)</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>NT</td>
<td>Northern Territory</td>
</tr>
<tr>
<td>NWA</td>
<td>North West Area (RAAF)</td>
</tr>
<tr>
<td>ON</td>
<td>official number (ship)</td>
</tr>
<tr>
<td>oz</td>
<td>ounce (weight measure)</td>
</tr>
<tr>
<td>QLD</td>
<td>Queensland</td>
</tr>
<tr>
<td>RAAF</td>
<td>Royal Australian Air Force</td>
</tr>
<tr>
<td>RAF</td>
<td>Royal Air Force (UK)</td>
</tr>
<tr>
<td>RAN</td>
<td>Royal Australian Navy</td>
</tr>
<tr>
<td>RC</td>
<td>Replenishment Centre</td>
</tr>
<tr>
<td>SA</td>
<td>South Australia</td>
</tr>
<tr>
<td>SCI</td>
<td>smoke cloud installation (spray tank)</td>
</tr>
<tr>
<td>SWPA</td>
<td>South West Pacific Area</td>
</tr>
<tr>
<td>TAF</td>
<td>Tactical Air Force (RAAF)</td>
</tr>
<tr>
<td>TOET</td>
<td>Test of Elementary Training</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
</tr>
<tr>
<td>USAFIA</td>
<td>United States Army Forces in Australia</td>
</tr>
<tr>
<td>USASOS</td>
<td>United States Army Services of Supply</td>
</tr>
<tr>
<td>uwd</td>
<td>unit war diary</td>
</tr>
<tr>
<td>uxo</td>
<td>unexploded ordnance</td>
</tr>
<tr>
<td>VIC</td>
<td>Victoria</td>
</tr>
<tr>
<td>WA</td>
<td>Western Australia</td>
</tr>
<tr>
<td>we</td>
<td>war establishment</td>
</tr>
<tr>
<td>Y</td>
<td>mustard gas ‘yperite’</td>
</tr>
<tr>
<td>yard</td>
<td>0.91 metres</td>
</tr>
</tbody>
</table>

Where known, only the most commonly referred to chemical weapons are described here. Otherwise refer to Appendix B, Summary of Codes of Chemical Warfare Agents known to have been in Australia in World War II.
Source Notes:

Four types of files are referenced in this report. Files held at National Archives of Australia, Parkes, Canberra, ACT (Australian Capital Territory) are shown as [AA(ACT)], those held at National Archives of Australia, Melbourne Office as [AA(VIC)] and records based at the Australian War Memorial, Canberra, ACT are prefixed with [AWM]. The numbers following refer to the Series number and Item number respectively. The war diaries were day-to-day activity records of a unit during the war and are held in AWM series 52. Some of the AA(ACT) files are available for viewing (electronically) on the internet http://www.naa.gov.au and others can be requested.

The original source material has been liberally quoted in this report to reflect the language and motivations of those involved and to provide an understanding of the immediacy of the threat. A selective visual history of Australia’s chemical weapons involvement is available free of charge on the Australian War Memorial’s web site http://www.awm.gov.au (type the words ‘chemical warfare’ in the ‘collections database’). The collection includes photos not shown in this report. Another excellent series of photos of the experimental stations (Innisfail, Proserpine and accompanying trials) are also to be found on the personal records of Sylvia Stolz [Australian War Memorial PR01502 Stolz, Sylvia Wallet 2/2].
Chapter One

THE ARMOURERS REMEMBER:
GASSED WORLD WAR I DIGGERS

Most of the World War II RAAF chemical warfare armourers were born soon after the end of World War I. As schoolboys, they often met returned diggers who had suffered the effects of war gases in the trenches in Europe. These first-hand experiences left lasting memories on the men who would one day themselves handle the same chemical material. Their reminiscences go some way towards explaining the fear of chemical attack that pervaded all levels of society and which dominated government decisions concerning the use of chemical weapons in World War II.

Frank Burkin joined the RAAF at eighteen:

...so I was only a lad before that. Now my father had quite a few friends because two of his brothers served in the First World War, and some of those friends had been affected by mustard gas in Flanders. I was amazed. Most of them had bad chest problems. A lot of them couldn’t work. Some could work for a period of time then they’d have to rest up. They might rest for...probably a couple of months...before they could go back to work. And you know, it sort of really wrecked their lives and I just never, ever thought that it would be used again, it was such a terrible weapon.

Now, from seeing them and meeting them I knew it had been a deadly sort of stuff to play with. And my belief was that it had been outlawed, that never again would it be used. And it was [with] that concept that I joined the services. And I was much surprised of course when I found out that I’d suddenly been moved into a chemical warfare unit. And fortunately I think it’s probably helped me because knowing chaps that had been gassed, and some of them badly—and how they existed from then on through their lives, you know, it probably tended to make me a bit cautious...a little bit more wary of what could happen. But as far as the extent of its carcinogenic properties or anything like that was concerned, I just did not have a clue, none of us did. We were never sort of, informed of it. No. We didn’t have a clue [associating the mustard gas the diggers were exposed to with chemical warfare armourer work], at least I didn’t. Perhaps I was too dumb, but I didn’t twig that it was the same material. Had no idea, not until we were taken down to the tunnel and actually shown the containers there that had it in.
Chapter Two

Chemical Weapons Procurement: The Initial Debate

On 22 January 1930 Australia ratified the Geneva Protocol of 1925 which banned the use of asphyxiating, poisonous or other gases in time of war. Australia’s ratification was no doubt influenced to some degree by the World War I experience of Australian soldiers who suffered the deadly and debilitating effects of gas exposure. The establishment of the Chemical Warfare Board in 1924 constituted an early reaction to this recent wartime experience. Behind the Board’s foundation lay the belief that, as gas weapons had proved so effective in World War I, they would also play a significant role in any future conflict. The Board’s task was to provide advice to the Army, Royal Australian Navy (RAN), and Royal Australian Air Force (RAAF) on methods of defence against the use of chemical weapons.

At least as early as August 1937, some twenty-five months before the outbreak of World War II in Europe, Australia was giving preliminary consideration to the need for war gas procurement. The Department of Defence’s Controller-General of Munitions Supply published an article entitled: ‘Chlorine from the Aspect of

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1 This chapter is based on the following files: AA(ACT) A705 229/1/71, AA(ACT) A5954 243/23, AA(ACT) A816 9/301/89 and AA(VIC) MP729/6 9/401/132, AA(VIC) MP729/6 9/401/67, AA(VIC) MP1185/8 1830/2/146, AA(VIC) MP729/6 9/401/380.

2 The ‘Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare’ was signed on 17 June 1925 and banned the use of poisonous or other gases.

3 A series of anecdotes which describe Australia’s World War I chemical warfare experience is included in Appendix R.

4 The terms ‘chemical warfare agent’, ‘chemical weapon’, ‘war gas’ and ‘toxic gas’ or simply ‘gas’ (principally used by the Americans but also generally used in World War I) are used interchangeably throughout the source material. I have followed this convention. The Australian Army defined war gases as: ‘any substance whether solid liquid or vapour which is used for its physiological effects which may be poisonous, irritant and blistering.’ From ‘War Gases - Definitions and Classification’, Land Headquarters AAOC School, Ammunition Wing.

5 He was also referred to as the Controller-General of Munitions.
Chapter Three

CHEMICAL WEAPONS PROCUREMENT AND THEIR RETALIATORY USE: A NECESSARY INSURANCE POLICY

It was 1942 when the nagging question of Australia’s use of chemical warfare suddenly took centre stage. Singapore, a crucial physical and psychological barrier to the south-eastern surge of the Japanese forces towards the Australian continent, fell to the Japanese. The fall of Singapore was clearly the catalyst for Australia’s sudden move to formally request chemical warfare stocks from Britain. The debate over the acquisition of chemical stocks, either through manufacture or importation had, up to this point, lasted at least four years, while the war itself had been going on for two and a half years. On 16 March 1942, the day after Singapore fell, the Defence Committee argued that a formal arrangement should be made with Britain for the export of chemical weapons stocks to Australia. The request itself came three weeks later on 10 March 1942. Ironically, in March 1941, a report had been produced on the vulnerability of Singapore to attack by chemical warfare. The report noted that ‘intelligence reports have stated that the Japanese are familiar with chemical warfare methods so that the possibility of the use of gas by them cannot be ignored.’ Ultimately, however, the Japanese captured Singapore by conventional means.

The response from Britain was swift and reassuring. The Australian Prime Minister received news on 24 March 1942 that immediate action was being taken to supply Australia’s needs. The Australian Army would receive a six-month supply of 25-pounders, and shells for 4.5-inch howitzer and 6-inch howitzer artillery units.\(^{32}\) As soon as transport could be arranged, available supplies were to be dispatched.

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\(^{32}\) The British War Office was to base the Australian Army supply on standard British Army scales which included six-month usage (referred to as wastage) of 25-pounders, 4.5-inch howitzers and 6-inch howitzer artillery units. Although there is no evidence of 4.5-inch howitzer shells being delivered to Australia, 23,000 rounds (bursting type) were offered by the UK. AA(ACT) AA1981/405 4.
Chapter Five

Chemical Warfare Agents in Australia

The chemical weapons that found their way to Australian shores were imported from both the UK and US. The British stock was supervised and maintained by the RAAF, the Australian Army and a small amount by the RAN. The American forces based in Australia separately imported and managed stocks manufactured in the US. Mustard gas was the most important agent imported by the US and Australia, both in terms of quantity and in its tactical use. In comparative quantities, for example, by November 1943, 25-pounder shell stocks consisted of 75% mustard gas and 25% tear gas. Jim McAllester, reflecting on Army stocks, comments:

I don’t believe there was a very wide range [of chemical agents that were weaponised]. The only material we handled was artillery shell charged with bromobenzylcyanide, or BBC, which like mustard was mixed with thickening agents, chlorinated rubber and compounds like that, and the whole object of it was to increase the time during which it would lie in the operational area and so be able to disable enemy troops. I don’t recall phosgene being suitable for delivery by artillery shell. I thought the German use of it in France was achieved by cylinders of compressed phosgene being transported to the forward area and just an ordinary compressed gas valve opened and with the suitable meteorological advice, allowed to drift in the direction of the enemy.

In terms of tactical use, the first phase of the Chemical Warfare Plan called for an immediate punitive attack by air with a maximum weight of mustard gas bombs. The other agents were relegated to a secondary role in a number of defined phases. The tactical uses of mustard gas are described in a memorandum which stated:

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84 Many types of agents were imported into Australia and are detailed in Appendix A. The agents were given a code symbol and were also marked with a different code on the munition itself to prevent identification. These are tabulated in Appendix B.

85 The tear gas referred to here was Bromobenzylcyanide (BBC).

86 AA(ACT) A11093 471/1W Part 2.
Chapter Thirteen

The Armourers Remember:
Daily Routine at the Chemical Warfare Sites

Many of the chemical warfare armourers saw themselves as glorified ‘general hands’ and their daily routine among the chemical agents as extremely monotonous. Yet they never lost sight of the fact that they were dealing daily with deadly chemicals—proven killers from a previous war. By far the armourers’ most important daily task was to vent the mustard gas drums and bombs. An oily liquid, the mustard gas needed a regular and measured release to prevent a dangerous build-up of pressure. The drums and bombs were dragged from the tunnels to the ‘cutting’ maintenance areas, de-rusted, de-pressurised and coated with mustard gas detector paint on areas of possible leakage. Geoff Burn describes a typical day in the life of a chemical warfare armourer:

Well, yes, you’d be woken up at some ungodly hour of the morning, half past six or six o’clock or something like that, and you’d go to the ablution blocks and have your wash and have a shower if you wanted and had time and then you’d go to the dining area—the cookhouse—which was pretty rugged. It was a pretty rugged sort of a camp [Glenbrook], I can assure you. You know there wasn’t much there. I don’t know what we actually had—mainly porridge and stuff like that, rolled oats, probably dry bread, bit of cheese. I can’t remember really what the breakfasts were like, they were pretty mundane anyway. Then we had to go on parade, on the parade ground and we’d be read out the daily orders and what to do, what not to do and whatever was on the agenda. Then we’d go down into the tunnel—they had a little tractor type thing with a few trolleys on it and we’d go down and load the trolleys up with the gas that hadn’t had maintenance done on it at all. A lot of them were in crates and they all had to be taken out and examined and then re-crated and then restacked. The big drums were brought out in the same way and they had to be examined closely to see that there were no leakages and that’s how it went on—day in and day out. Some of us were sent hither and thither you know, to Marrangaroo or Picton to do the same thing.
THE GUINEA PIGS

Frank Burkin remembers the Army volunteers or ‘guinea pigs’ as they were officially known:

We were there when the guinea pigs came in because we were actually the guys working the sites. Our purpose in life was to provide the site, set up the trails through it, mark the site and set up the testing equipment—usually a vacuum-type thing. We’d set those all up, and then do whatever was necessary—if it was a bombing run the bombers would come over, bomb the site and then we would go back at a given period of time, depending on what it was—might be an hour, two hours, three hours, four hours, eight hours—depending on whatever the chemist wanted. We’d go back and we’d take out new vacuum flasks and bring out the old ones. And at a given time, which was probably a couple of days later, they’d have the guinea pigs go through there. Now, the ‘guinea pigs’—they virtually were ‘guinea pigs’ I suppose—were men who had volunteered to expose themselves to that risk in doing it. They were all volunteers. Some of them had fought through the Middle East. There was one chap in particular, whom I got to know fairly well. I said to him, ‘Why are you doing this? This is dangerous stuff.’ He said, ‘Look, if it’ll shorten the war, I’m doing it.’ Which he did. Some were desperate to get out of the Army, they were—and I quite honestly use this term—‘malingerers’. And they only did it because they saw a chance that they might be billeted out of the Army. Now they used to go through in groups of about five I think—five or six—and there’d be a chemical armourer leading, and one following, usually. And a lot of these bombs wouldn’t actually drop on the trails, but they’d drop nearby and they might be well away from it. But one incident in particular occurred on a particular day—there was a group going through—must have been round about ten o’clock in the morning I think—it was fairly late after the actual bombing had been done...a couple of days, perhaps. And on one particular trail the bomb had dropped against it or nearby it or within yards and, of course, these bombs have an explosive charge in them and when they fall and hit the ground, they burst and they don’t actually implode much into the ground—they were more of a spreading type of thing. So when this one had exploded it had thrown up the earth in a sort of a circular pattern around where it had hit, not very deep and these chaps obviously had it worked out between them, some of them anyway, as between the lot of them they created a diversion. And one chap, he raced over and he picked up a contaminated saw—you could see it was contaminated—it had an oily look to it. He picked this up and he rubbed it on his arms. Anyway, I wasn’t involved in that particular incident, but one of my mates was, so he told me what went on. Eventually they got moving and they did their run through the site and then this chap developed these burns. Well they had a ward in the Innisfail Hospital, top floor of the Innisfail Hospital, and they took him up there. And his burns—believe it or not, I think the films are still available today in the...
Chapter Eighteen

THE ARMOURERS REMEMBER: ACCIDENTS, INCIDENTS AND MEDICAL TREATMENT

Most armourers never lost sight of the ever-present danger of handling the chemical weapons. Those who became complacent or were the victim of accidents often suffered terrible burns and other injuries, the effects of which remained to dog their health, sometimes for years. Bill Boyd describes the effects of chemical injuries:

This is not just like a bullet, just doesn’t hit, you’ve got it for life. Those people who had tests up there in Queensland, some of them are scarred for life; they’ll never be any good ever. Once you’re damaged, it doesn’t heal. It’s a retentive sort of thing; it just reappears and reappears and reappears for years.

Frank Moran recalls a burn he suffered while working at Glenbrook:

There would be one man in the team who was in charge of cleaning the stuff and what have you and this particular day the fellow wearing these boots; instead of putting them in the dirty bin, just put them back in the racks. The next day I happened to take this pair of boots and put them on. It was morning job and I’d put them on and then taken them off at lunchtime. And while we were having lunch, I began to get a bit itchy on the right foot and I had a look and sure enough I had a burn on the inside of my right ankle. It was too late then, the damage had been done. They’d put ointment on, but next morning it was grown to a fair-size burn. And eventually I went to the doctor or the medical hand and he said, ‘Alright, we’ll see if we can stop it.’ So he put ointment on the burn and next morning it was just as bad, if not worse. So I said, ‘Well, I’m ready for some leave, how about giving me the leave and some dressings for my ankle?’ My home town was Rockhampton and there was a unit in Rockhampton that had an ambulance so they said, ‘Yeah, righto.’ So the next morning they took me to the local hospital and the nurse took the dressings off my foot and she said, ‘Doctor will have to have a look at this.’ So she went and got the doctor and the doctor said, ‘Oh what is it?’ I said, ‘It’s a burn.’ ‘What caused the burn?’ And in the end, I said, ‘Look, I’m sorry, I can’t tell you.’ And the doctor said, ‘What do you mean, you can’t tell me? I’m taking care of the medics in this; you tell me where you got the burn.’ I said, ‘Look you
Frank Moran’s mustard gas burnt foot with bandage. ‘There would be one man in the team [at Glenbrook] who was in charge of cleaning the [mustard contaminated] stuff and what have you and this particular day the fellow wearing these [contaminated] boots; instead of putting them in the dirty bin, just put them back in the racks. The next day I happened to take this pair of boots and put them on. It was morning job and I’d put them on and then taken them off at lunchtime. And while we were having lunch, I began to get a bit itchy on the right foot and I had a look and sure enough I had a burn on the inside of my right ankle. It was too late then, the damage had been done. They’d put ointment on, but next morning it was grown to a fair-size burn.’

© RAAF Chemical Warfare Armourers
A P P E N D I C E S

BLISTER AGENTS
Mustard Gas

**Sulphur Mustard**

*UK Mustard Gas Variants*
- H (Y0)
- HSV (Y2)
- HT (Y3)
- HTV or HTV CR (Y4)
- Y4a
- HTV (MM) (Y4b)
- HTV (CR) (MM) (Y4c)
- HM (Y5)
- HB (Y13)
- HBD (Y13a)
- H/B/gel I (Y18)
- H(SC) Grade I (Y25)

Mustard sulphoxide/ mustard chlorinated/ mustard sulphone/ mustard hydrochloride

*US Mustard Gas*
- H (HS)

**Nitrogen Mustard**

- T724 (T)
- Ethyl dichloroarsine (Ethyl Dick) (ED/DL)
- Phenyl dichloroarsine (PD)
- Mustard Gas/Lewisite mixture (HL)
- Lewisite (L)

BLOOD AGENTS

- Cyanogen Chloride (CK or CC)
- Hydrogen Cyanide (Prussic Acid) (AC)
- Magnesium arsenide

CHOKING AGENTS

- Phosgene (CG)
VOMITING AGENTS
  Adamsite (DM)
  Diphenylcyanoarsine (DC)
  DA (Diphenyl chlorarsine)

TEAR AGENTS
  Bromobenzylcyanide (BBC)
  Chloropicrin (PS)
  Chloroacetophenone CN (CAP)
  CNS
  KSK (B1)

The following chemical warfare agents and their variants are known to have existed in Australia during World War II. This list does not include captured Japanese chemical weapons which were brought back to Australia for analysis by the US 42nd Chemical Laboratory Company,\(^\text{15}\) 2/1st Australian Chemical Warfare Laboratory\(^\text{16}\) and the MSL. Reports by these bodies on captured munitions provide details of these weapons. Carter also notes that: ‘During the Salamaua, Lae, Finschhafen and Saidor [Papua New Guinea] operations, Australian and Allied Chemical Warfare Intelligence Teams, consisting each of one officer and one NCO, were employed in forward areas to obtain and send back enemy equipment and data of CW intelligence interest. The teams were replaced by FS [Field Security] (Enemy Equipment) Sections, whose specific responsibility was to collect and send back captured enemy equipment. Japanese CW munitions would have entered Australia during these operations.’\(^\text{17}\)

\(^{15}\) AWM 54 179/1/23 numerous parts, see Appendix Q.
\(^{16}\) AWM 54 179/5/6 numerous parts.
\(^{17}\) Major Jim McAllester comments that this was part of GSI (a) and operated by Lieutenant Frank Simpson. AWM 193 356 Part 6: ‘The establishment of CW intelligence teams to visit forward operational areas and collect CW intelligence data originated in the latter part of 1943 and the teams, each consisting of one officer and one OR, were sent to Lae and Salamaua in time to cover these campaigns. The chief assignments allotted to such Australian teams were (i) to obtain adequate supplies of captured enemy CW equipment (ii) to collect any other items of CW significance and (iii) to ensure that such equipment and information was sent back speedily to Force HQ.’ See ‘Report Covering Activities – Australian Chemical Warfare Intelligence Team Attached to Alamo Force from 27 December 1943 to 13 February 1944’ which noted that ‘from the CW point of view the mission was not not very successful...’ AA(VIC) MP 729/6 75/401/185.
The following variants are known to have been imported into Australia:

**H**\(^{27}\) (\textbf{Y0})

Pure mustard—This was not used as a UK bulk charging for weapons. More than 10 lbs were held by the MSL presumably for experimental/testing purposes.\(^{28}\) In September 1943 the MSL sent 2 oz to the 2/1st Chemical Warfare Laboratory.\(^{29}\)

**HSV**\(^{30}\) (\textbf{Y2})

Crude mustard gas—\(Y1\)\(^{31}\) rendered viscous with chlorinated rubber. A total of 1,150 \(Y2\) 250-lb bombs were moved to No. 19 RC in the second movement of stocks here (see Appendix C).

**HT** (\textbf{Y3})

This was standard British mustard gas containing 60% mustard (dichloro-diethyl sulphide) and 40% T724 prepared by the thiodiglycol process. It was classed as the most stable form of mustard gas. Owing to its stability \(Y3\) (and \(Y4\)) were charged into weapons in the pre-gas period (prior to use). T724 itself was a vesicant (see below) and was extremely persistent.\(^{32}\)

\(^{26}\) Major Keith Parker comments that there is some suggestion that 4.2-inch mortars, possibly charged \(Y15\), were fired at Mourilyan Harbour, although this has not been proven and \(Y15\) has not been included in this listing. \(Y1\) (15% CCL4 as diluent) is reported to have been used in RAAF training, but would only have been present in small quantities and has not been verified by the author.

\(^{27}\) \(Y\) stood for ‘Yperite’, derived from the Belgian town, Ypres, where mustard gas is said to have first been used in World War I. Prof. Julian Robinson comments: ‘My recollection is that the Royal Air Force used \(Y\) series designators for vesicant agent fills for their bombs and SCIs, while the producers and the developers of production methods used three- or four-letter codes that indicated agent, production method, solvent and any adjuvant such as thickener or freezing point depressant. Researchers used single letter symbols for the chemical species constituting the active principles of agents (H for mustard, Q and T for certain higher mustards, R and S for certain nitrogen mustards, L for lewisite etc.).

\(^{28}\) AA(VIC) B2037 40/44.

\(^{29}\) AA(VIC) B2037/1 40/147.

\(^{30}\) V=viscous.

\(^{31}\) Mustard gas prepared by the sulphur dichloride process, containing 15% carbon tetrachloride as diluent.

\(^{32}\) See Chapter 5 for more on persistence. Persistent gases are usually liquids, while non-persistent gases are gaseous at ‘normal temperatures’ and were compressed into liquid before charging into weapons. They are dispersed by wind currents and do not remain in toxic concentration for long periods. They leave no liquid contamination on the ground.
The following list describes chemical weapons and storage containers which were held in Australia during World War II. The weapons and containers are categorised by service. The Australian services stored British-manufactured items while material manufactured by the US was stored by American forces in Australia.

As well as having a code symbol on the weapon itself, chemical munitions were colour coded with grey for the UK material and blue/grey for the US. In addition, a colour band was added to denote the specific chemical fill: for the UK items mustard was yellow, phosgene green and BBC black; for the US, mustard and lewisite carried two green bands and phosgene one green band.

**RAAF MUNITIONS**

- 65-lb Light Case Bomb
- 250-lb Light Case Bomb
- 30-lb Light Case Bomb
- Smoke Curtain Installation (SCI) 250, 400 & 500 lbs

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273 A uniform system was adopted for marking all chemical weapons, including aircraft bombs. The system depended on three types of identification: (a) body paint—for gas the body paint was grey; (b) coloured bands—bands were painted 2 inches wide on weapons up to 3.7 inches calibre and 3 inches wide on larger weapons. Lachrymators (KSK, CAP, BBC) had black bands; toxic gases (CG, DM, DA, DC and PS) had green bands and vesicants yellow. In addition to these bands, coloured rings were added indicating the following: red ring meant ‘filled’; a brown ring meant ‘shell made of cast iron’; a red nose meant ‘shrapnel shell adapted to gas’ and a narrow white band meant that the charging had an arsine content, that is DM, DA, DC, Lewisite or HL. (c) code markings on the coloured bands—one inch high and painted in black on yellow or green bands and in white on black bands. Code markings indicated the nature of the charging and the date of charging was usually shown. The ‘shelf lives’ of the chemical weapons are covered in AWM193 354 Part 3.

274 Thickened mustard also had an additional red band. British chargings were as follows: yellow band—blister gas; green band—choking gases; and black band for tear gases. AA(ACT) A705 15/18/32.

275 Thickened BBC also had an additional red band.
500-lb A/c Light Case MK 2
Chemical Special No. 6 Drum
Storage Drums

ARMY MUNITIONS
25-lb Base Ejection Shell
3-inch Mortar Bomb
4.2-inch Mortar Bomb
Jets A/T MK1
5-inch U(P) Rocket
6-lb Ground Bomb
Chemical Mine

NAVY MUNITIONS
6-inch Shell
8-inch Bursting Shell MK VIII
4.7-inch Bursting Shell MK XII

US MUNITIONS
1000-lb Aircraft T2
75 mm Gun and Howitzer Shell
105 mm Howitzer Shell
155 mm Gun and Howitzer Shell
M47 & M47A2 Aircraft Bomb
M78 & M79 Aircraft Bomb
Spray Tank, M10, M20, M33 & M40
M1A2 Cylinder, Chemical Portable
Chemical land-mine
Candle
Grenade, Hand M6
Bulk mustard container, 1 ton

TRAINING ITEMS
Chemical Mine, training MK 1
DM Generators No. 20 and No. 21
DM Ampoules
Lachrymatory Generators No. 2 MK IV
Capsules Lachrymatory MK I, II & MK III
Projectors Chemical No. 13
Bombs Spray 1 litre, MK 1, GMT (Gas training Mixture) 3D
Livens Projector and Gas Cylinder
Sets, Smelling War Gases
Cylinders, CG

RAAF MUNITIONS

In response to the Department of Defence request to the High Commissioner in London (10 March 1942) for chemical weapons, the UK War Office proposed that the RAAF would be supplied (based on a six months reserve) with the following: (a) 24,000 Light Case 65-lbs HT (mustard); (b) 3,600 Light Case 250-lbs CG (phosgene); (c) 1,200 Light Case 250-lbs HT (mustard); (d) 850 Smoke Curtain Installation 500-lbs type S/G HTV (thickened mustard); (e) chemical special No. 6 drums—13,600 recharging drums, capacity approximately three gallons each, for two rechargings of SCI 500-lbs and (f) tactical reserve of 8,000 bombs 30-lb Light Case (mustard) for targets which required accurate aim and penetration. The total quantities of (b), (c) and (f) and 25% of (d) and (e) were

276 Not included in this list is the 1,000-lb AC LC experimental bomb (6 April 1945), samples of which were to be made available for trials in Australia. Copies of the design were "being forwarded to the RAAF". It was intended to introduce the bomb as a Y charged air burst bomb (exploding before it reached the ground) and a G1 ground burst bomb (which exploded on impact). The charged G1 bomb was approximately 650 lbs. It is not known if any arrived although the late date suggests they probably did not. Other weapons may have been present; for example, a number are mentioned in the future AFES programme 1944 to 1945 (from The Gillis Report) and included the Army 2-inch mortar charged with BBC and CN, CW grenades UK design and the US 7.2-in rocket [H or CG (although according to Jeff Osborne, there is no technical data indicating that this rocket was loaded with H)]. It is unclear whether these weapons were present in Australia and available for trialling.

277 On 24 March 1942.
278 See Appendix B for a description of the chemical agent symbology applicable to this and other terms in the list.

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US-manufactured rocket, 7.2-inch. They were included in a research program for the Australian Field Experimental Station but it is uncertain if any were delivered here.
tropical climates; for example, the contamination was too local and concentrated for certain tropical targets. Subsequently, it fell out of favour and was abandoned as a tactical weapon late in the war by the RAAF which declared it ‘operationally redundant’. Instead reliance (at least in theory) was placed on the equivalent US bomb, the M47A2.²⁹⁰

**250-LB LIGHT CASE BOMB²⁹¹**

The 250-lb Light Case Bomb was designated using the British ‘mark’ system.²⁹² Mark I and Mark II bombs will be described in this section. Mark II was designed to replace the Mark I. The primary role of the Mark I (mustard filled) was contamination of ground targets such as docks, camps, beaches, store dumps, aerodromes, defiles, supply depots, etc. Filled with phosgene it was used as an anti-personnel weapon only and preferred in areas of little air movement, e.g. woods and built-up areas. At great heights and on a soft ground target the bomb would bury with a loss of charge into the crater formed.

The bomb was designed on the tail ejection principle. After striking the target the liquid is ejected from the tail in the form of a spray that contaminated a belt downwind from the target. The body of the bomb consisted of a solid drawn, or jointed and welded, steel cylinder 0.25 inches thick, to one end of which was lightly welded a tail plate carrying a tapered charging hole and plug. To the other end of the cylinder a hemispherical steel nose about 0.5 inch thick was welded, in the centre of which was welded the burster container. The tail of the bomb, supplied separately, was of the snap-on variety and was assembled at the aerodrome just prior to use.²⁹³

²⁹⁰ However, from AWM193 356 Part 3 we have: ‘There seems no doubt that this bomb is in many respects an ideal weapon for delivery of mustard gas on to open or jungle covered target areas, provided means for economical stowage in aircraft are available. There remains, however, much uncertainty as to the scale and method of attack...’

²⁹¹ See also AA(VIC) B2037 40/673, ‘Metallurgical examination of bombs aircraft LC 250-lb MK II’ and AA(VIC) B3138 42/Z/29 ‘Charging of 250-lb bombs with CG in Australia’.

²⁹² British practice was to denote development changes as Mark One, Two etc, with such designations written as MK I, MK II, with Roman numerals. American practice was to use M1, M2, with Arabic numerals. From The Gillis Report.

²⁹³ The bombs were transported unboxed but without their tail units. A transit base was provided in the place of the tail units. Ideally, the bombs were stowed vertically (transit base downwards) but could be stowed horizontally if necessary (AAOC School Ammunition Wing, ‘Regulations for the Storage, Transport, Maintenance and Disposal of Chemical Weapons.’)
APPENDIX Q

JAPANESE CHEMICAL WARFARE MUNITIONS

A captured Japanese respirator, type 93 no. 3 which was returned to advanced Land Headquarters for examination. St. Lucia, Queensland. October 1942. There was considerable evidence that the Japanese were prepared for chemical warfare. © Australian War Memorial 069415

From AWM193 353 Part 1 ‘Notes on Japanese Chemical Warfare LHQ Technical Notes 7’ unless otherwise stated. The following caveat is from Jeff Osborne: ‘Research into pre-1946 chemical weapons of Japanese manufacture is characterised by a nearly complete lack of accurate available information. During the early years of WWII Japanese chemical warfare programs were run with a very high level of secrecy, and until late in the war very little information escaped. Intelligence documents produced during the war (on which this chapter is based) attempted to address the subject, but the information they provided was often conflicting, and of questionable accuracy. At the end of WWII most of the production sites and technical information was destroyed or removed by Allied forces, to prevent reuse and for intelligence value. Eventually many of the chemical weapons in China and Japan were buried as an attempted means of destruction. Due to postwar Allied downsizing and generally poor accountability of documents, little effort was spent analysing and examining the chemical weapons of a defeated enemy. As such, data was lost and little of the postwar information on these weapons may be found today.’ From ‘Introduction to Japanese CW: Handbook of pre-1946 Chemical Weapons. Organisation for the Prohibition of Chemical Weapons. Revision 1 January 2005’.
GENERAL OBSERVATIONS

Colour Markings

A list of the general Japanese markings on chemical munitions was obtained from several captured documents and many munitions were examined during the war. Despite this, the Allies were uncertain as to the significance of some of the chemical warfare colouration, as the following attests. A composite picture is presented below:

- Blue – lung/choking irritants – phosgene
- Green – lachrymators/tear – Chloracetophenone
- Red – sternutators/nose – Diphenylcyanarsine
- Yellow – vesicants (blister) – mustard gas (yperite), lewisite

Notes on the use of gas by the Japanese were received from the Chinese, with comments made by the latter. The notes were in brief tabular form and dealt mainly with tactics. The use of gas (termed ‘special smoke’) was to be concentrated on gases of immediate effectiveness used to lower enemy morale just before the Japanese infantry attacked. Any delay in launching such an attack was only permissible when preparations for the attack were incomplete. Deception by the use of screening smoke, either before use of the toxic smoke or mixed with it, was to be used, especially as the toxic smoke had a white colour which made its use alone in daylight inadvisable. The gas was to be concentrated on a narrow front; if it was necessary to release it over a long period, it was to be used intermittently. For methods of use, mortars and hand grenades were specially mentioned; aircraft spray, on the other hand, was much affected by the speed and direction of the wind. Effective concentration of gas from artillery shells could only be obtained by surprise shoots. It was, however, specially noted that gas should not be employed where it could not be followed up by a Japanese infantry charge, and that it was dependent on weather conditions; hence an alternative plan in case of unsuitable conditions was to be prepared. Each battalion was equipped with one set of meteorological equipment for use in forecasting. Finally, the necessity for thorough security measures was emphasised; before using these weapons the character ‘Aka’ which signified poison gas was to be removed from them, and ‘tubes’ and other traces destroyed after use. All enemy found suffering the effects of gas were to be killed and special care taken to protect orders for the use of gas. Practices involving the use of gas were to be kept secret by posting patrols around the area and gas was not to be used in areas where neutrals were living. These instructions appear to have been faithfully followed, as evidence of Japanese use of gas against the Chinese – perhaps also against the British in Malaya—was very difficult to obtain and especially to confirm.

Sometimes the colours were referred to as agents, e.g., blue agent, green agent etc.

Manufactured by the ‘thidioglycol’ process.
This general scheme applied to the bands with which the weapons were marked but not to the body colours which tended to vary. All chemical and HE shell bore a yellow and white band which reputedly indicated a ‘common explosive shell’, i.e., a shell constructed of forged steel containing an explosive charge. For artillery gas and mortar gas the following were reported: body colour: filled vesicant – grey; filled chloropicrin – scarlet black symbols. In terms of colour bands, all chemical and incendiary projectiles were believed to have had a red nose tip, with a blue band immediately beneath. The red tip was thought to indicate a filled shell and the blue band a chemical filling, thus conventional high explosive (HE) shells had a red tip without a blue band. Artillery shell filled with vesicant had a white band immediately above the driving band and a yellow band about one and three-quarter inches higher up. Those filled with DC/HE also had a white band immediately above the driving band, a red band (nose gas) one and three-quarter inches higher up and the yellow band just below the shoulder of the shell. It was not clear what the white and yellow bands denoted. All types of gas shell (except the scarlet-bodied chloropicrin shell which was probably obsolete) had these bands as did incendiary and HE. Apparently these did not therefore signify the nature of the filling. The only distinction between an HE and a vesicant shell was thought to be the presence of the blue nose band on the latter and possibly also the width and position of the yellow band.

Captured HCN grenades had outer containers coloured khaki or olive drab with a band variously described as red, maroon-red or maroon. Toxic generators (candles) were considered very important and numerous varieties were captured and described. They were described as having various body colours of dark green, brown, greenish-grey or brown and bluish-grey all with a red band (the latter accorded with the general classification above which shows red for nose gases). Certain heavy red-band generators captured in China (received in England in 1938), had a blue band in addition to the red band. The significance of this was not known. Specimens of the same type captured in the South West Pacific Area, which bore the date 1939, had no blue band. Self-propelling toxic generators had circles in black or navy blue on their lids. Since the circles have never been reported on other types, they presumably referred to the self-propelling generator.

The lachrymatory generators were described with either a green body or with green bands, again following the general classification above.

The following examples indicate the wide variety in markings: