

# Ethical Responsibilities in Military-Related Work: The Case of Napalm

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**Abstract:** Two case studies are presented illustrating how leaders of chemical enterprises addressed ethical questions posed by the incendiary napalm. The first one examines how the chemist Louis Fieser grappled with the ethical questions posed by his development of the napalm incendiaries used against military and civilian targets in the Second World War. The second involves the Dow Napalm Controversy, in which Dow Chemical engaged protests over its role as a supplier of napalm to the American military in Vietnam. Dow weighted the protesters' charges that napalm was being used indiscriminately on civilians against what it saw as an obligation to support the American government and soldiers in their aims of defending South Vietnam against a communist insurrection. Both cases are examined from a Just War viewpoint to illustrate chemists' responsibilities in the weapons development pipeline and the dilemmas that can arise in weapons development and over foreseeable misuses of chemical products.

**Keywords:** *ethics, military research, napalm, Just War theory.*

## 1. Introduction

The 20<sup>th</sup> century provides numerous examples of ethical questions associated with chemists' involvement in military work. Perhaps the most notable one is chemists' leadership in developing chemical weapons during the First World War. Even though poisoned projectiles were outlawed under the 1907 Hague convention, eminent chemists like Fritz Haber, Walter Nernst, Emil Fischer, and Carl Duisberg of Germany and William Ramsay of Great Britain promoted poison gas weapons (Haber 1986, Moy 1989, Stoltzenberg 2000, 2004). Of these Haber's efforts had the largest impact on the war and chemists' subsequent involvement in military research more generally. In addition to leading Germany's poison gas warfare program and advocating his ammonia synthesis process as a means of sustaining munitions production amidst the privations of blockade, Haber transformed his Kaiser Wilhelm Institute

for Physical Chemistry and Electrochemistry into the world's first large scale military research lab (Stoltzenberg 2004, Charles 2005).

Since then chemists have been involved in the development of numerous military technologies, including some which found wide use (Chemical Corps Association 1948, Cornwell 2003, Jeffreys 2008, Remers 2000). Of these the present paper examines jelled gasoline incendiaries, which arguably had the greatest impact on 20<sup>th</sup>-century warfare. During the Second World War a number of chemists and engineers in the United States and Great Britain pursued improved incendiaries for use in flamethrowers and bombs (Brophy *et al.* 1959, pp. 167-9; Neer 2013). Their discoveries led to one of chemistry's greatest military success stories, napalm, which was produced in large quantities by major chemical concerns and employed with devastating effectiveness on the battlefield. However, due to its potential to induce massive firestorms and cause particularly cruel wounds, napalm occasionally became the subject of public ethical scrutiny and reevaluation, in which chemists and chemical corporations had to consider what it means to develop and manufacture weapons responsibly. Thus the story of napalm provides an opportunity for chemists to consider the ethical issues associated with military work. This will be done using two case studies.

Our first case examines the organic chemist Louis Fieser's development of the incendiary napalm, particularly his decision to participate in incendiary research and his responsibility for the large-scale use of napalm against civilians during the closing stages of the war. Unlike the political and military leaders who have been the subject of intense scholarly and popular study,<sup>1</sup> Fieser neither ordered nor participated in the attacks. Any responsibility he bears is as napalm's inventor. The second case considers the responsibilities of chemical corporations engaged in the large-scale industrial manufacture of munitions. This issue rose to the fore when Dow Chemical faced protests over its manufacture of napalm for the American military during the Vietnam War. Unlike Fieser, Dow could not claim ignorance over how napalm *might* be used but instead wrestled with the relative harms and benefits of its napalm operations in the midst of questions about the merits of the war and uncertainty over whether napalm was *actually* being employed indiscriminately against civilians.

## 2. Ethical responsibility in military research

Arguments that scientists are not accountable for the outcomes of their work since they should be free to pursue any truth (Hoffmann 1975) or are mere functionaries<sup>2</sup> have been sharply criticized (Weeramantry 1987, pp. 157-166;

Ryberg 2003; Wolpe 2006). More helpful than are accounts that recognize scientists' ethical responsibilities (Brown 1971, Coulson 1966, Douglas 2003, Forge 2008, Hildebrand 1955, Hoffmann 1995, Jacob & Walter 2005, Kovac 2007/2013/2015, Lonsdale 1955, Mitcham & Siekevitz 1989, Fischhoff 2014, National Research Council 2014, Weeramantry 1987),<sup>3</sup> including those which address the synthesis of new compounds (Schummer 2001), the dissemination of results (Hoffman 2008), noting or failing to note hazards (Jacob & Walters 2005), and other consumer safety and environmental impacts of chemicals.<sup>4</sup>

Chemists and engineers are responsible for the outcomes of any work to which they in soundness of mind freely contribute, either as individuals or members of a larger organization. Nevertheless an individual's degree of responsibility might depend on how their actions or failure to act contributed to those outcomes. In general they would only be judged praiseworthy or blameworthy for expected or anticipatable outcomes of their actions or omissions and, in deontological ethical systems, whether they fulfilled or neglected their duties. This is illustrated by the post-World War II war crimes trials of chemist-managers at I.G. Farben and other concerns (DuBois 1952; Cornwell 2003, pp. 367-376; Hayes 2005; Jeffrey 2008). Consider the example of Bruno Tesch (Hayes 2005), who in the 1910s helped develop the Zyklon B delousing agent that the Nazis used to murder civilians in the gas chambers of the holocaust over twenty years later. Tesch is not considered morally blameworthy as Zyklon B's developer since its use in genocide was not foreseeable at the time. However, when Tesch later managed a firm that supplied Zyklon B to the death camps and learned that it was used in gasings, he had an opportunity to avoid further complicity. He neglected to do so and was later found responsible for the killings and sentenced to death by a postwar tribunal.

Because moral blame and praise is conditioned on individuals' choices and actions, our analysis of Dow's and Fieser's responsibilities will focus exclusively on whether they were or should have been aware of ethical issues associated with their work and whether they did or should have acted in their professional capacities to address those issues.<sup>5</sup> The issues themselves will be identified and examined using a Just War approach.<sup>6</sup>

### 3. Just War thinking

Just War thinking is the dominant framework currently used to consider the morality of military research. It forms the backdrop to international laws governing war; combines consequentialist and deontological criteria; and yet

can be appropriated by deontological, consequentialist, and virtue ethics frameworks. Here we outline its main features and illustrate how it might apply to chemists engaged in military work.<sup>7</sup>

Just War Theory envisions war as an unfortunate means of preventing harms, protecting social order, or appropriately chastising aggressors. It calls for right conduct in war and delimits when wars may be waged.<sup>8</sup> Specifically, its *Jus ad Bellum* provisions allow a *sovereign authority* to wage war in a *just cause* with *right intent* (i.e. it seeks a just resolution). Additional subordinate *prudential criteria* serve as criteria for overcoming a presumption against the use of force and hold that war should be a last resort, with a reasonable likelihood of success, and a favorable calculus of risks, benefits, and harms (*proportionality criterion*).

The *Jus ad Bellum* criteria typically apply to state actors but can also be interpreted to prohibit chemists' engagement in military work that supports war-related efforts of an entity that fails to meet them.<sup>9</sup> This judgement is reflected in the post-Second World War trials of I.G. Farben and Krupp managers (May 2008, pp. 185-206; Jeffreys 2008). However, the *Jus ad Bellum* criteria have also been employed to argue for military research on the grounds that new technology might enhance states' capabilities to protect the oppressed, promote global security, or achieve some overall noble aim (Dinegar 1989). For example, in the Cold War Western nuclear weapons research was justified as a means of forestalling the expansion of Soviet oppression. However, *Jus ad Bellum* arguments for and against military work require scientists to accurately assess their country's present and future war aims without succumbing to uncritical patriotism or overly optimistic ideas about technology's potential to deter wars or render them more humane. The fragility of scientists' judgments is illustrated by World War I era chemists' diverse and in hindsight dubious justifications for poison gas work. Fritz Haber justified it by appealing to the justice of Germany's cause and gas' potential to save lives by promoting a speedy end to the war.<sup>10</sup> American chemists talked about America's national security and chemical weapons' potential to deter conventional warfare (Whittemore 1975, p. 157).

Just war theory addresses right conduct in war through its *Jus in Bello* criteria of *discrimination* and *proportionality*. *Proportionality* holds that one's conduct should be commensurate with the justice of one's aims. Specifically, the means employed should not create greater evils than those the war is intended to avert and even then any harms inflicted should be necessary and kept to a reasonable level. *Proportionality* considerations feature in arguments against chemical weapons as unnecessarily cruel or as an unjustifiable existential threat to Western ideals of civilization<sup>11</sup> and in arguments against nuclear weapons as presenting an unjustifiable threat of nuclear annihilation.

The debates over napalm incendiaries involved the *discrimination* criterion and the closely-related concept of noncombatant immunity. The former holds that only the killing of enemy combatants (*i.e.* those actually contributing to the fighting) is morally justified while the latter stipulates that non-combatants may not be intentionally targeted. For absolutists noncombatant immunity it means that combatants must seek to avoid foreseeable harms to noncombatants.<sup>12</sup> Other Just War thinkers only hold that noncombatants may not be the primary target of attacks. For example, arguments for civilian bombing typically rely on the doctrine of double effect, which permits the killing of noncombatants as long as their deaths are a side effect of efforts to achieve an overall morally good end.<sup>13</sup>

Exactly what constitutes reasonable care and who is a noncombatant are matters of judgment. One complicating factor is the reliance of modern armies on technological expertise and civilian-manned industry located in or near cities – factors which tend to blur the combatant-noncombatant distinction and render the selective targeting of military enterprises more difficult. Thus the Second World War Allied civilian bombing campaigns avoided this difficulty by claiming civilians as legitimate targets by virtue of their supposed support for the Axis war effort and their complicity in upholding an immoral regime.<sup>14</sup> However, not all enemy civilians worked in arms factories or supported aggressive warfare and it was impossible for bombardiers to determine which civilians had been sufficiently militarized to constitute a legitimate target anyway. Thus proportionality and the doctrine of double effect were also employed to rationalize the bombings as a way of redressing the ‘supreme emergency’ which the Axis war effort posed to civilization;<sup>15</sup> and in the case of Japan, to avoid the casualties expected on ground invasion of the Japanese mainland.<sup>16</sup>

In principle, scientists can use the principle of discrimination to determine whether their work might result in unjustifiable foreseeable harms. However, this assumes they are able to accurately assess the relative justice of their nations’ war aims and the likelihood their discoveries may be inappropriately employed against civilians. That such judgments are far from simple and require constant reassessment is well illustrated by the contrast between the widespread approval of indiscriminate Allied civilian bombing during World War II and the storm of protest provoked by America’s relatively more discriminate use of napalm in Vietnam.

Scientists should also consider whether the weapons they are developing might be inherently discriminate. For example, nuclear weapons are regarded as indiscriminate due to their destructiveness and the lingering radiation they produce. In contrast smart munitions designed to deliver a measured explosive payload to within an accuracy of a few feet generally are not. Whether a weapon or strategy is regarded as discriminate depends on its social and tech-

nological context. For instance, America's Second World War precision bombing campaign was considered discriminate given the inaccurate bombing technology of the time but would be regarded as indiscriminate today.

## 4. Louis Fieser and the firebombing of cities

### 4.1 Historical description

By July 1940 Nazi Germany had overrun Poland and much of Western Europe.<sup>17</sup> Concerned that America itself might soon face an aggressive and capable foe, its leaders initiated a variety of military research projects under the auspices of a National Defense Research Committee (NDRC). Among the scientists it recruited was the Harvard organic chemist Louis Fieser. Originally assigned to work on explosives, Fieser's work on incendiaries began opportunistically. After learning of industrial explosions involving sticky divinylacetylene at a 1941 NDRC conference, Fieser judged his postdoctoral researcher Emanuel B. Hershberg "ideally qualified" to develop them as incendiaries (Fieser 1964, pp. 9-11).

Fieser and Hershberg soon found peroxidized divinylacetylene gels were not very shock sensitive, although they "burned with an impressive sputter" and retained a "viscous, sticky consistency" – ideal characteristics for "a bomb that would scatter large burning globs of sticky gel" (*ibid.*, p. 12). With support from the NDRC and British Air ministry they soon investigated related materials as incendiaries, including particularly effective rubber-benzene and rubber-gasoline gels. By November they were even testing prototype bombs at Harvard's stadium and demonstrating their effectiveness to military officials.<sup>18</sup> However, when the Japanese overran the Malaysian rubber plantations that December, Fieser's work on rubber-benzene bombs was suspended.

Undeterred, Fieser and his team investigated several alternatives, including metal salts of fatty acids which were used to thicken lubricating oil into greases. One such material, aluminum naphthenate, had earlier been investigated by another NDRC incendiary group and found to give suitable gels, but only after a heating step that was impractical for battlefield use. Fieser formulated mixtures of aluminum naphthenate and 'aluminum palmitate' which gelled when mixed with gasoline at room temperature, and named the resulting material 'napalm' after its components.<sup>19</sup>

Fieser and his group soon developed napalm bombs and designed a burster which scattered "large, burning, globs over a 50 yard radius" (*ibid.*, p. 36).

At various proving grounds these incinerated wooden buildings and proved stable to rough transport, demonstrating such effectiveness that Fieser proclaimed Japan's conquest of Malaysia "a blessing to the allied nations" (*ibid.*, p. 53).

Napalm-filled bombs and flamethrowers soon demonstrated their military utility; the latter proving especially useful for burning Japanese soldiers out of caves and other emplacements (*ibid.*, pp. 44, 52-53). Its most fateful use, however, was in the M-69 cluster bomb, an "aimable cluster" of 38 bomblets, each containing several pounds of napalm (Bess 2006, p. 98.) These were designed to ignite after they had penetrated the top floor of German and Japanese houses, whereupon they would eject a flaming stream of napalm with the intent of rapidly turning the structure into a raging inferno (Davis 1999a/b).

Napalm bombs proved extremely effective against German and Japanese cities, particularly when used in combination with high explosives that destroyed water mains and killed any firefighters who might extinguish blazes before they burned out of control. By the war's end, napalm and related incendiaries had burned away large swaths of many Axis cities. Particularly devastating were the firebombings of Dresden and Tokyo in 1945, in which massive incendiary-fueled firestorms generated tens of thousands of dead civilians (Crane 1993, pp. 113-119, 132-136). One incendiary raid on Tokyo was perhaps the single deadliest night in the history of warfare, in which the American General Curtis Le May claimed more people were "scorched and boiled and baked to death [...] than went up in vapor in Hiroshima and Nagasaki combined" (quoted in Grayling 2006, p. 147).

#### 4.2. Fieser's responsibility

Our consideration of Fieser's responsibility for the use of napalm against civilians examines whether he was or should have been aware napalm might be unjustifiably employed against civilians and, if so, could have acted to limit unjustifiable harms.

Fieser's own position thirty years later was that he did not foresee napalm's use against civilians and in any event was not responsible for how napalm was used. Specifically, he claimed to "certainly [have had] no thought about the use of napalm against non-military personnel" (Neilands 1971, p. 82) and disclaimed responsibility for such uses.

I discovered that a jelled fuel burns more efficiently than a free fuel [...]. I don't think I have to be ashamed of having made that discovery. And I would be the first to suggest that antipersonnel use be outlawed. But how in the world do you make the distinction? Why should the investigator be called on to rule on the uses? [Fieser quoted in Lemann 1973]

Fieser's repudiation of responsibility may be rejected as inconsistent with his role as developer of a weapon that might cause anticipatable harms. However, his claim of ignorance about the antipersonnel use of napalm is worthy of scrutiny.

Fieser could likely not have foreseen indiscriminate uses of napalm in postwar contexts<sup>20</sup> or even America's Second World War use of napalm against Axis civilians, at least not during most of 1941 when America had not yet entered the war and Britain was unable to prosecute a serious bombing campaign. The prospect of Allied civilian bombing also seemed precluded by American and British outrage over German bombing attacks on civilians early in the war and, later, by America's commitment to precision bombing. However, the use of napalm against noncombatants was anticipatable when Fieser began his work and grew increasingly likely as the war progressed. In fact, Germany had used incendiaries against Warsaw in 1939 and against residential areas of London from September 1940 onward while the British had been attacking German cities since the end of 1940. Perhaps because these employed conventional explosives, Fieser justified his work with the British Air ministry on the grounds he thought it unlikely the British would use napalm against civilians. If so, this might factor into whether his napalm work might be justified, but it does not absolve him of blame on the grounds that napalm attacks against civilians were unforeseeable. Such excuses would also certainly not apply to Fieser's mid-late war work, especially after a 1943 Hamburg raid in which British-dropped magnesium incendiaries fueled a firestorm that killed over 40,000 people (Neer 2013, p. 62).

Furthermore, whatever thoughts Fieser initially harbored about the potential uses of napalm, he did not long remain ignorant of its utility against civilian structures. While early tests on napalm were carried out on nondescript buildings, in his memoir *The Scientific Method* (1964) Fieser makes it clear that his napalm research envisioned the destruction of German and Japanese houses from the start. Perhaps he imagined these would be empty when the bombs fell, although this seems hard to reconcile with his knowledge of tests conducted at Dugway proving ground in Utah. There villages designed to model German and Japanese 'working-class housing'<sup>21</sup> were repeatedly bombed and rebuilt in an effort to determine optimal conditions for burning out Axis cities (Davis 1999a/b). Moreover, even if Fieser was unaware of the Dugway tests' civilian-oriented nature, he could hardly claim ignorance of America's abortive 'bat bomb' project, in which he personally served as a major driving force in developing incendiary-carrying bats designed to incinerate Japanese urban areas more effectively than ordinary napalm bombs (Couffer 1992).

The following spectrum of possible projects may help clarify Fieser's responsibility for the use of napalm against civilians:



1. Incendiaries for the safe burning of pathogen-contaminated dead livestock;<sup>22</sup>
2. Incendiaries discovered by accident or with no concern for their utility;
3. Incendiaries for a variety of military applications;
4. Incendiaries designed to make flamethrowers more effective against military emplacements (bunkers, machine gun nests, *etc.*);
5. Incendiary bombs for use against factory workers' housing;
6. Incendiary weapons designed to efficiently and indiscriminately destroy cities;
7. Incendiary bombs designed to spray incendiary at child height for maximal effectiveness against schools, playgrounds, and daycare centers.

Of these, case 1 is likely to be perceived as a positive benefit to mankind, whereas cases 5-7 target noncombatants, as either connected to the enemy's war effort (5) or indiscriminately (6), or selectively (7). No Second World War combatant deliberately aimed for the latter. However, throughout the war Fieser's work moved from predominately considering cases 3 and 4 (with cases 5 and 6 being foreseeable but unlikely) towards a preoccupation with realizing cases 5 and 6. Given this, we suggest that Fieser first failed to consider anticipatable Second World War anti-civilian uses of napalm and then later even promoted them.

### 4.3 Ethical analysis

Fieser's later strong disapproval of napalm's use against civilians<sup>23</sup> seems hard to reconcile with his wartime enthusiastic avowal of the bat bomb project<sup>24</sup> and the positive portrayal of napalm in his wartime memoirs. The latter depicts Fieser as a man involved in military research through a desire to help his country resist a potential aggressor, pursuing napalm as a morally preferable weapon compared to the "inhumane" vesicants which he had initially been assigned to develop (Fieser 1964, p. 14). Fieser's postwar disclosure in *Industrial and Engineering Chemistry* even presented napalm as a laudable contribution to America's war effort and, by implication, the welfare of mankind (Fieser *et al.* 1947).<sup>25</sup>

Nevertheless, because Fieser's moral judgments are somewhat opaque our analysis engages a speculative reconstruction of his moral reasoning, specifically one that merges Fieser's enthusiastic participation in incendiary work with popular American wartime sentiments that approved of the Allied civilian bombing campaign. In this respect it perhaps assesses the general merits of Second World War research on incendiaries designed for use against cities more than the actual views of Fieser himself.

First, it may be helpful to address some interpretations of the *Jus in Bello* principles which would forbid the development of incendiary weapons for use against civilian structures:<sup>26</sup>

1. Absolutist interpretations of the principle of discrimination which forbid any targeting of noncombatants;
2. Fieser's even more stringent 1973 interpretation of the principle of proportionality, which condemned all use of napalm against persons;
3. Ethical judgments reflected in the UN Convention on Certain Conventional Weapons, which prohibits the use of incendiaries against noncombatants in any form (United Nations 1980) and consequently has the potential to render chemists so engaged liable for war crimes.<sup>27</sup>

Each of these three interpretations depends on accepting particular judgments about the principle of discrimination. The first relies on an absolutist understanding of noncombatant immunity and the latter two judge the use of napalm in specific antipersonnel applications a great enough evil to *a priori* outweigh any good that might result. Moreover, interpretations two and three are historically-grounded in a retrospective awareness of the suffering caused by napalm's 'stickiness' when used as an antipersonnel weapon, something that was foreseeable but not as readily apparent at the time of Fieser's work as it would become later.

Thus it may be more interesting to consider whether Fieser's napalm work might be justifiable using interpretations of the *Jus in Bello* criteria that in principle allow for attacks against civilians. As explained in Section 3, the Allied civilian bombing was justified using a web of arguments based on proportionality, the doctrine of double effect, and the militarization of civilians. These rest on questionable assumptions and appear less compelling in view of the questions about their effectiveness and necessity which have arisen in hindsight. However, they were widely accepted by wartime Americans (Hopkins 1966) and remain a topic of considerable recent debate (Grayling 2006; Bess 2006, pp. 88-110). In short, Fieser's actions may be justifiable in principle, but involve abandoning previously-accepted norms concerning noncombatant immunity. At minimum the rejection of established norms represents poor practice, at least when done outside the scope of a sustained, professionally-informed, and appropriately public dialogue about the implications of such a move.<sup>28</sup>

## 5. The Dow Napalm Controversy

### 5.1 Historical description

In the 1960s and early 1970s the American and South Vietnamese effort to resist North Vietnamese aggression was beset by thorny problems. Unable to risk the expansion of Cold War hostilities that might attend invasion of the communist north, they faced an enemy who employed terror and anticolonial appeals to supplement their invasion of the South with a guerilla war. Moreover, the latter involved attacks on American forces by ununiformed Vietcong fighters who, after attacking from within or near a village, quickly blended back in with the local populace, who through a combination of terror, anticolonial patriotism, or simple lack of trust would often do nothing to help the offended Americans track down the offending Vietcong.

The specific strategies American military commanders employed to address this problem, their rationale, and precedents are described by Walzer (2006, pp. 186-196). The bottom line is that they adopted rules of engagement that militarized Vietnamese civilians who did not evacuate to designated strategic hamlets or actively seek to expel Vietcong fighters. The British had successfully employed a similar strategy to squelch an earlier communist insurgency in Malaya. Whatever its strategic value, the strategy effectively shifted responsibility for upholding the principle of noncombatant immunity from the combatants onto the Vietnamese civilians themselves.

As a result the strategy ended up rationalizing incidents like the attack on a “communist rest center” witnessed by Bernard Fall in 1965:

As we flew over the village it looked to me very much as any normal village would look [...] a peaceful scene. [...] I could see the napalm bombs dropping from the wings [...] an incredibly bright flash of fire. [...] The napalm was supposed to force the people – fearing the heat and the burning – out into the open. Then the second plane was to move in with heavy fragmentation bombs to hit whatever – or whomever – had rushed out into the open [Fall 1965, p. 25].

Fall’s account was reported in the New Leftist *Ramparts* magazine, along with his skepticism about whether any communists were actually in the village at the time (*ibid.*, p. 26). Additional accounts followed, some of which included graphic images of horrible napalm-produced wounds.<sup>29</sup> When coupled with popular unease over America’s involvement in Vietnam, these provoked a storm of protest that spread to napalm’s suppliers, including the United Aircraft Corporation, Witco Chemical, and Dow.

These protests soon centered on Dow and included calls for a boycott of its most popular product, the plastic ‘Saran Wrap’; vandalism; picketing; and over two hundred campus protests, some of which involved harassment of

Dow recruiters (Wells 1996, pp. 84-88). Featuring slogans like ‘Napalm Burns Babies, Dow Makes Money’ and ‘Nazi Ovens in 44, Napalm in 66’ the protests evoked images of industrial collusion in the holocaust and elicited much publicity (Whitehead 1968, p. 264; Brandt 1997, p. 353).

Dow was caught by surprise. When the protests started no member of Dow’s governing troika was even aware of its napalm operations, which involved only ten employees and accounted for a mere ~0.25% of its annual revenue.<sup>30</sup>

Despite the relative unimportance of its napalm operations, Dow refused to give in to the protester’s demands that it cease production. Through its chairman Carl Gerstacker it argued:

[...] we are a supplier of goods to the defense department and not a policy maker. We do not and should not try to decide military strategy or policy.

Simple good citizenship requires that we supply our government and our military with those goods which they feel they need whenever we have the technology and capability and have been chosen by the government as a supplier.

We will do our best, as we always have, to try to produce what our defense department and our soldiers need in any war situation. Purely aside from our duty to do this, we will feel deeply gratified if what we are able to provide helps to protect our fighting men or to speed the day when fighting will end. [Brandt 1997, p. 353; also in Brandt 2003, p. 95; Whitehead 1968, pp. 264-265]

This seemed to imply Dow was deflecting moral responsibility for the use of napalm wholly onto the US government, adopting a ‘Nuremberg defense’ like those deemed legally inadequate in post-Second World War trials of German industrial leaders. However, Dow’s President Ted Doan later clarified that Dow’s continued napalm operations reflected its judgment that America was fighting a just war:

All of the debate in the world about how we got [into the war] or how we get out [...] doesn’t change the fact that we are there nor the fact that our men are there and need weapons to defend themselves.

[...] We reject the validity of comparing our present form of government with Hitler’s Germany. In our mind our government is still representative of and responsive to the will of the people.

Further, we as a company have made a moral judgment on the long-range goals of our government and we support these. We may not agree as individuals with every decision of every military or government leader but we regard these leaders as men trying honestly and relentlessly to find the best possible solution to very, very complex international problems. As long as we so regard them, we would find it impossible not to support them. This is not saying as the critics imply that we will follow blindly and without fail no matter where our government leads. [...] Should despotic leaders attempt to lead our nation away from its historic national purposes, we would cease to support the government.

Our critics ask if we are willing to stand judgment for our choice to support our government if history should prove us wrong. Our answer is yes. [Doan 1967]

In short, Dow argued that the US effort in Vietnam met the *Jus ad Bellum* Just War criteria of sovereign authority and right intent and that consequently Dow had a duty to provide the American military with napalm needed to defend itself and achieve its aims.

However, Dow had not publicly addressed whether napalm was used indiscriminately, an issue with which it was in private deeply concerned. Its leaders spent two days of a 1967 board of directors meeting discussing the “moral and ethical considerations involved” (Brandt 1997, p. 360). Ultimately Dow decided to continue its napalm operations. They judged it had an obligation to support American soldiers and emphasized governmental assurances that reasonable precautions were taken to avoid hurting civilians as well as the findings of doctors who had reported few or no cases of napalm burn injuries in Vietnamese hospitals.<sup>31</sup>

Nevertheless, Dow president Ted Doan remained open to the possibility napalm was being used indiscriminately. Two years later he told protesters that “if they could prove to him that napalm was being used, intentionally or not, primarily on a civilian population, he would do all he could to get the company out of the contract” (Wells 1996, p. 295). Unfortunately the ensuing discussion produced an impasse, in which at least one antiwar demonstrator privately wondered exactly what evidence might convince Doan (*ibid.*). In turn the company’s own accounts betray that Dow’s otherwise sympathetic leaders had difficulty seeing past protesters’ rudeness and occasional incoherence (Brandt 1997/2003). When combined with the protesters’ all-or-nothing attitude towards the use of napalm in Vietnam, this effectively directed attention away from the rules of engagement which allowed attacks on questionable targets, and from the issue of whether napalm satisfied the principle of proportionality, both of which later became foci of postwar discussions about whether and how incendiaries might legitimately be employed (Lumsden 1975, International Committee of the Red Cross 1973, Björnerstedt 1973).

However, by then the issue had passed. Doan’s apparent skepticism notwithstanding, later that year Dow’s contract to supply napalm to the US military was not renewed. Rumors circulated that Dow had chosen not to bid competitively, although its official history provides no evidence that was the case (Brandt 1997).

## 5.2. Dow's responsibilities

To assess Dow's moral responsibilities it is helpful to first clarify what was at stake. The protesters argued:

1. America's involvement in Vietnam at minimum did not satisfy several *Jus ad Bellum* criteria.
2. Napalm was being used in ways that violated the *Jus in Bello* criteria of discrimination.
3. Napalm itself violated the *Jus in Bello* criteria of proportionality when used as an antipersonnel weapon.

If true, argument 1 meant that industrial concerns like Dow ought not to provide war-related goods at all, and arguments 2 and 3 that in supplying napalm Dow contributed to disproportionate warfare and unjustified attacks on noncombatants.

Dow understood its responsibility to address these charges. It also recognized that if they were true Dow would face a responsibility dilemma between its desire to avoid complicity in unjust warfare, on one hand, and both its contractual obligations to the government and its civic<sup>32</sup> and personal<sup>33</sup> duty to support American soldiers, who greatly valued napalm's effectiveness against attacking enemy troops, on the other. Thus, after an initial misstep in which Dow seemingly deflected responsibility onto the government, it addressed the *Jus ad Bellum* criteria directly. It took steps to assess whether it was indeed supplying napalm to parties who were misusing it to unjustly harm civilians. In this respect, it was unfair to compare Dow with holocaust-associated industrialists like the Zyklon B supplier Bruno Tesch, who deflected responsibility for genocide onto the state and offered that the killings would have been achieved by other means had he refused complicity.<sup>34</sup>

## 5.3 Ethical analysis

Dow ultimately decided the American war effort in Vietnam met the *Jus ad Bellum* criteria of legitimacy and right intent. Thus it did not view itself as supporting an unjust war of aggression or expansionist conquest but rather a defensive one aimed at preventing the spread of Soviet-style repression in Southeast Asia.<sup>35</sup> Dow refused to commit to a position on the more difficult issue to evaluate *Jus ad Bellum* proportionality and necessity criteria, however. It resolved any associated moral dilemmas in favor of acknowledging the reality of the fighting and consequently decided in favor of its contractual, civic, and personal obligations to support the American military engaged therein.

In continuing as a napalm supplier, Dow also accepted a responsibility to avoid contributing to unjustified attacks on noncombatants. However, it again weighted the potential misuse of napalm against the impact of its loss

on the ability of the largely conscript US forces to defend themselves in genuine combat situations. By all accounts napalm was very effective and fulfilled a vital role in such situations. In doing so Dow rejected claims that napalm is inherently disproportionate with respect to the *Jus ad Bellum* criteria. Instead it concluded napalm may be used to both advance just war aims and support combatants' in asserting a right of self-defense. Dow also shared the protesters' judgment that targeting noncombatants in napalm attacks was unjustified and sought assurances that napalm was being used discriminately in Vietnam. In this respect Dow was not so much adjudicating benefits and harms associated with napalm's intended use. Instead it weighted benefits associated with napalm's intended use against harms from its expected misuse, ultimately deciding in favor of the former.

However, in doing so Dow understood that it could still take steps to mitigate against misuse, although the strategy of warning, education, and restricting access that are commonly employed to limit the misuse of chemical products<sup>36</sup> might need to be modified in the case of a governmental user. Thus Dow sought assurance that its napalm would not be misused through a strategy that combined governmental assurances with eyewitness testimony and medical reports. When these were set against the easily-discounted assertions of the often incoherent protesters, Dow understandably concluded that napalm was largely used discriminately but remained open to reevaluating its conclusions in case of later changes.

However, because of its distrust of the protesters and its policy of non-interference in military affairs, Dow did not push the crucial questions about the US rules of engagement which governed how napalm could be used. These rules represented a case of moral slippage by redistributing the burden of discrimination onto the noncombatants themselves. This practice effectively served to minimize US casualties while giving the "appearance of attending to the combatant/noncombatant distinction" (Walzer 2006, p. 193).<sup>37</sup>

## 6. Conclusions and possible lessons

Taken together the cases of Louis Fieser and Dow Chemical illustrate how Just War Theory may be employed by chemists engaged in military work. They also suggest that it is important for chemists and managers engaged in the chemical enterprise to:

1. Accept responsibility for undertaking ethical reflection about both expected outcomes and foreseeable unintended harms and misuses.
2. Consider social context. Louis Fieser was not just developing napalm; he was developing napalm in a world experimenting with civilian bombing.

Dow was not just supplying napalm for self-defense purposes; it was supplying napalm to a military employing dubious rules of engagement.

3. Commit to a sustained and charitable ethical discussion in which no question is off-limits and where opposing arguments are strengthened before being addressed. Dow's engagement with the protesters helped it avoid several ethical pitfalls and produced a coherent justification for its napalm operations. However, had it undertaken a more charitable reconstruction of protesters' arguments, its executives might have better understood the systemic issues that at least allowed for napalm's misuse. So equipped, Dow might likely have been better able to exercise moral leadership in promoting the responsible use of its products.
4. Anticipate shifts in responsibility as projects evolve. Louis Fieser's early napalm work did not clearly violate Just War principles and we suspect that in 1941 he would have balked at the prospect of designing bombs for use against Japanese civilian housing. Yet later in the war he did just that.<sup>38</sup> It is not enough to consider ethical issues at the start of an enterprise. Ethical discussion should be made part of that enterprise and kept up to date.

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## Notes

- <sup>1</sup> See Schaeffer 1980, Crane 1993, Bess 2006, and Grayling 2006.
- <sup>2</sup> For example, the biochemist Harold Urey argued that scientists are first responsible to their governments (Chalk 1989).
- <sup>3</sup> Herein we limit ourselves primarily to English language sources.
- <sup>4</sup> See, for example, green chemistry as "an expression of environmental ethics" (George 2010).
- <sup>5</sup> We do not deny the existence of other responsibilities, but only limit our treatment to professional ones associated with anticipatable outcomes.
- <sup>6</sup> Other perspectives on the morality of war are pacifism and realism. Realism opposes moral restraint in war and by extension in military research. For pacifism and a pacifist perspective see Kovac 2013. Examples of chemists who refused to



conduct military research are Frederic Soddy (Anonymous 1921) and Kathleen Lonsdale (1964, p. 54).

- <sup>7</sup> For more comprehensive overviews of Just War Theory see Lazar 2016, Johnson 1999/2011, and Moseley (2004). On weapons and military research from Just War and related perspectives see Dinegar 1989, Fichtelberg 2006, Forge 2004, Malsch 2013, and O'Donovan 2003, pp. 78-94. For the relevant international law, its relationship to values, and some difficulties in applying it to specific weapons and situations see Greenwood 1998, Schmitt 2005, and Lietzau 2004.
- <sup>8</sup> Additional *Jus post Bellum* provisions address right postwar conduct and outcomes. These might restrain the use of chemical weapons and defoliants with persistent environmental or human health effects.
- <sup>9</sup> Or an industry that supplies such entities; see Fichtelberg 2014.
- <sup>10</sup> The colleagues Haber sought to convince included future Nobel laureates Hermann Staudinger (Weber & Deußing 2013), James Franck, and Otto Hahn (1970), the latter two of whom later publicly opposed atomic weapons. Other arguments Haber employed either addressed technicalities of international law or invoked Germany's "need and helplessness" (Cornwell 2003, p. 535) – an argument similar to the 'supreme emergency' used to justify the British Second World War civilian bombing campaign. Later, Haber and the biochemist J.B.S. Haldane would argue that Chemical weapons were preferred as being nonlethal relative to conventional weapons.
- <sup>11</sup> For example, the 'taboo' against chemical weapons is reflected in the 1907 Hague Convention's judgment that chemical weapons' barbarity constitutes an existential threat to civilized warfare (Price 1997).
- <sup>12</sup> For a critical review of arguments for absolute noncombatant immunity see Lazar 2014.
- <sup>13</sup> Other nonabsolutist understandings of noncombatant immunity tend to justify killing civilians from the standpoint of the morality of individual acts and cases rather than of the general conduct of states in war (Arneson 2006, McMahan 2011, Frowe 2014), a viewpoint difficult to reconcile with the way war is actually conducted (Lazar 2010, Strawser 2013).
- <sup>14</sup> For an example see Russell (2006, pp. 131-32).
- <sup>15</sup> By disrupting infrastructure and de-housing, displacing, and inconveniencing workers. See Walzer (2006, pp. 251-268).
- <sup>16</sup> Combatants' decision to pursue civilian bombing depended on whether they considered it necessity and effective. Americans objected to civilian bombing in Europe as ineffective and immoral (Crane 1993, Schaffer 1980). In the Pacific they considered the projected immense potential harms of a ground invasion to outweigh the harms of a devastatingly effective civilian bombing campaign. Nevertheless, even then they attempted to preserve noncombatant immunity by using warning leaflets (Crane 1993, pp. 133-35; Neer 2013, pp. 84-85).
- <sup>17</sup> For a comprehensive account of napalm and its development see Neer 2013. For an English-language account of the European bombing war see Overy 2013.
- <sup>18</sup> Hydrocarbon-based incendiaries like napalm still produce the most heat per gram (International Committee of the Red Cross 1973).
- <sup>19</sup> Fieser later discovered that his 'palmitate' was actually lauric acid and improved napalm's effectiveness by adding unsaturated oleic and linolenic acids to the mix.

- <sup>20</sup> Although this raises the issue of military researchers' responsibility for foreseeable impacts associated with proliferation.
- <sup>21</sup> They were complete with authentic furnishings including children's toys.
- <sup>22</sup> This is a use of napalm considered in anthrax and foot-and-mouth disease epidemics (Neer 2013, pp. 200-1)
- <sup>23</sup> That included urging Nixon to "promote an international agreement to outlaw further use of napalm or napalm-type munitions" (Lemann 1973).
- <sup>24</sup> As explained in Greenwood (1998, p. 226), the US Naval Commander's handbook on the laws of war includes Fieser's "bat bombs" in its list of weapons (along with German V-1 & V-2 Rockets, and Japanese "balloon bombs") that are forbidden as inherently indiscriminate (US Department of the Navy, 1997).
- <sup>25</sup> Though it is suggestive that Fieser emphasizes napalm's battlefield role over its use in the civilian bombing campaign.
- <sup>26</sup> That might reasonably be expected to contain noncombatants.
- <sup>27</sup> However, we are not sure American chemists could be charged, because the US did not sign the relevant portions of the convention (Neer 2013, pg. 192).
- <sup>28</sup> A recent NRC report on military research (2014) cites the public ethical debate over the human genome project as an example of fruitful dialogue. Review programs to assess weapons' legality like that advocated by Lawand (2006, International Committee of the Red Cross 2006) provide convenient opportunity for ethical discourse in military research, although in these cases care should be taken not to conflate legal and ethical considerations.
- <sup>29</sup> For examples see Pepper 1967 and Colaianni 1966.
- <sup>30</sup> Whitehead 1968, pg. 264; Brandt 1997, pg. 352. These figures perhaps understate napalm's contribution to Dow's profits (Friedman 1973, pg. 130).
- <sup>31</sup> Friedman 1973, pp. 127-29; Brandt 1997, pp. 357-8; Brandt 2003, p. 9. Defense secretary Robert MacNamara assured Doan that napalm was "a military necessity" used with precautions "as painstaking as we can make them without hamstringing our military operations" (Whitehead, 1968, p. 268), leading Doan to later claim "napalm is a good discriminate, strategic weapon" (Friedman 1973, p. 115).
- <sup>32</sup> For an argument that military research is a civic duty see Kemp 1994.
- <sup>33</sup> Here Dow leaders explicitly cited employees' family members engaged in the fighting.
- <sup>34</sup> Tesch's lawyer argued, "if Tesch did know the use to which the gas was being put, and had consented to [supplying Zyklon B for use in murder], this happened only under enormous pressure from the S.S. [and], had Tesch not co-operated, the S.S. would certainly have achieved their aims by other means." In fairness the comparison should not be pressed too far because Tesch argued after the fact and likely realized that the harms of genocide far outweigh the benefits of pest control. For details see the UN Commission on War Crimes Report (1997).
- <sup>35</sup> Albeit in the form of a Soviet-supported movement with its own anticolonial aims.
- <sup>36</sup> Examples include warning labels on environmentally-harmful pesticides and the criminalization of harmful drugs and their precursors.
- <sup>37</sup> General Telford Taylor, US chief counsel at Nuremburg, judged the types of attacks these rules permitted violations of the laws of war (1970, pp. 144-45).

- <sup>38</sup> For similar examples in computer science and ethics research see Singer 2010, pp. 304-306.

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