BINARY CHEMICAL WEAPONS

HEARINGS

BEFORE THE

COMMITTEE ON APPROPRIATIONS
UNITED STATES SENATE

NINETY-SEVENTH CONGRESS

SECOND SESSION

Printed for the use of the Committee on Appropriations

SPECIAL HEARING

Department of Defense
Department of State
Nondepartmental Witnesses

U.S. GOVERNMENT PRINTING OFFICE
93-757 O WASHINGTON : 1983

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NONDEPARTMENTAL WITNESSES

THURSDAY, MAY 6, 1982

HARVARD UNIVERSITY AND UNIVERSITY OF SUSSEX, ENGLAND

STATEMENTS OF:
MATTHEW MESELSON, THOMAS DUDLEY CABOT PROFESSOR OF THE NATURAL SCIENCES AT HARVARD UNIVERSITY
JULIAN PERRY ROBINSON, SENIOR FELLOW WITH THE SCIENCE POLICY RESEARCH UNIT OF THE UNIVERSITY OF SUSSEX, ENGLAND

INTRODUCTION OF WITNESSES

Chairman HATFIELD. I would like to now invite Prof. Matthew Meselson and Dr. Julian Perry Robinson to come to the table.

Prof. Matthew Meselson is Thomas Dudley Cabot Professor of the Natural Sciences at Harvard University. He is generally credited with having played a key role in the political process which led to the signing of the Biological Weapons Convention in 1972.

Dr. Julian Perry Robinson is a senior fellow with the Science Policy Research Unit of the University of Sussex, England. He is a specialist on military technology and arms control. Before joining the faculty at Sussex in 1971, he was head of the project on the limitation of biological and chemical arms at the Stockholm International Peace Research Institute.

Gentlemen, we have your full statements, which will be made a part of the record. If you would care to highlight or brief it, we would be very happy to hear from you. First Professor Meselson.

ADMINISTRATION POLICIES ON CHEMICAL WEAPONS

Mr. MESELSON. It is a privilege to be here today in connection with your consideration of the administration's request for funds to begin production of certain binary chemical munitions. This is a subject which I think needs a considerable amount of clarification and information.

I must say that I thought Senator Garn's statement about the so-called hazards of our current stockpile was the most concise, informative statement I have ever heard on the subject. Men who work in the sheds containing our stockpile weapons do not routinely wear gas masks. And as the Senator said, there has never been a serious accident resulting from storing, production, or movement of those weapons.

ADMINISTRATION POLICY

I agree with the policy of this and previous administrations in two important regards. I disagree with the policy of this administration in a third.

I agree with this and previous administrations on the necessity of assuming the existence of a substantial Soviet chemical threat. But we should deplore the common practice of putting forth to the Congress and the public worst-case interpretations for which the evidence is flimsy or even misrepresented. The reason we should deplore this is the departure from the highest standards of evidence and interpretation in any kind of intelligence work eventually can only harm our own interests. The fact is that we don't know whether the Soviets have or have

not significantly added to their stockpile of lethal chemical weapons in the last dozen years since we stopped. Maybe they have; maybe they haven't. We just don't know.

Similarly, estimates of the size and composition of Soviet chemical stocks are extremely variable and uncertain. Indeed, we don't know whether the Soviet stockpile of chemical weapons is larger or smaller than that of the United States. It could be bigger. It could be smaller. It is not definite knowledge about any of these things, and I am glad to see some indications that some administration spokesmen are beginning to speak in this language instead of the exaggerated language of recent months. It is prudence, not definite knowledge, that requires that we assume the existence of a substantial Soviet chemical weapons capability.

But that doesn't help us decide on specific procurement issues. To decide whether to buy this or that weapon requires a detailed understanding of what is the purpose of the weapon, the missions for which it is intended to be used, the effectiveness in those missions, the effectiveness of competitor weapons, plus a variety of political considerations that are less technical. But I do agree we must assume the existence of a substantial Soviet chemical weapons capability.

I also agree with the determination of this administration and its predecessor that increased effort must be given to equipping and training U.S. forces to protect themselves against the effects of chemical weapons.

ADMINISTRATION PLANS FOR NEW GENERATION OF CHEMICAL WEAPONS

However, I begin to disagree seriously when it comes to the plans of the current administration to go forward with major outlays for a new generation of nerve gas weapons.

The administration has requested in this coming fiscal year, fiscal 1983, $54 million for initial production costs of two new chemical weapons. One is the artillery projectile and the other is a bomb. The Bigeye bomb cannot be certified as ready for production until fiscal 1984 or later—probably later. There has been delay in its development and testing. This delay and serious unresolved doubts about the deliverability and effectiveness of the Bigeye bomb argue, I would say, that we shouldn't consider the issue of Bigeye funding in fiscal 1983, that the consideration of it should be deferred to fiscal 1984 when the studies are farther along and when the possibility of its certification for production is more near to the horizon.

That is all I plan to say about the Bigeye bomb. I think it should be discussed carefully, but I don't see any need to go into it in this fiscal year.

ARTILLERY PROJECTILE

Regarding the artillery projectile, it is certified ready for production. We could begin producing it. We could begin spending money to produce it. But I must say that I believe that production of this particular chemical munition would not contribute significantly to U.S. defense.

The initial cost isn't much, but as you go to the outyears, you are talking about spending several hundreds of millions of dollars or possibly a billion, or $1.2 billion, depending on how many you buy, and, of course, depending on whether there are or are not any cost overruns beyond the present scheduled price of about $550 per projectile.

The reasons I think the projectile would not add to our defense are as follows:

First of all, existing stocks of 8-inch and 155mm chemical weapons are substantial enough for us to have a 30-day, full-scale war in Europe. Now it is true, as Senator Garn quite correctly pointed out, there are munitions—it is not a matter of classified information so I am free to talk about this. I should add, I have served as a consultant on chemical weapons matters to this administration and, I think, to all administrations starting with that of President Kennedy. But it is not a matter of classified information that the U.S. Army has withdrawn its multiple-rocket launchers, and this means that whether or not the chemical rockets we have are deteriorating, that it is irrelevant because there is nothing to launch them with.

It is also true the Army is retiring the 105mm canon. It remains, and will remain, a standard weapon for the Marine Corps but not for the Army.

HEAVY ARTILLERY

But I am not talking about rockets and I am not talking about light artillery. I am talking about heavy artillery, 155mm and 8-inch.

It was once thought—and it was a common misconception often repeated—that those artillery projectiles were becoming obsolete due to range restrictions. That is not at all true. No one will tell you that anymore. It is just not true. The existing stockpile of 155mm and 8-inch is not becoming obsolete and it is not significantly deteriorating.

This is a photograph of some stocks, in fact in Senator Garn's State, in Tooele's Army Depot in Utah, of the 8-inch artillery projectiles containing GB's. Those were made at the Rocky Mountain Arsenal, I think, in 1966.

There are large, either serviceable or to be made serviceable, stocks of 8-inch nerve gas and 155mm nerve gas artillery projectiles. With proper maintenance, these munitions should be serviceable for many years to come. Indeed, the proposed binaries have a certified shelf life requirement of 20 years. I think it altogether possible that our existing rugged, simply designed chemical munitions will outlast the binaries. That is an altogether possible prospect.

I am also concerned that the M687, which is the proposed artillery projectile, has not been adequately tested. There has not been a single field test of that weapon in its actual configuration. There have been many tests with simulants. Those are recorded by numerous individuals who have been associated with this program both as advisors and full-time employees as inadequate.

Finally, a different sort of consideration, not a technical one, but it would seem that the allies of the United States in Europe are very unlikely to accept any prepositioning of additional U.S. chemical weapons.

And that, of course, greatly limits the utility of making any more, though I don't think—I mean that is a subsequent limitation. The key point I would make is we already have adequate quantities.

Beyond these specific somewhat technical issues bearing on the proposed 155 binary projectile, I believe that the underlying assumptions of the administration's chemical weapons program are highly questionable. I believe they are based on wholly inadequate analyses of the characteristics of chemical weapons. I believe that this lack of adequate analysis and coherent planning seriously risks disastrous consequences to the United States and its allies should we become involved in chemical war.

CURRENT CHEMICAL WEAPON STOCKS SATISFACTORY

Let me explain very briefly why I come to the conclusion we have enough chemical artillery shells at present. The objective of using chemical artillery, according to present doctrine, is not essentially to get casualties. The reason is, if you put men in modern protective equipment they are invulnerable to modern chemical weapons, for all intents and purposes.

Highly controversial and very important, but the tempo of their operation can be slowed. The object is to put gas on to the point their commanders command them to put on their protective equipment. You can calculate how much is needed for that purpose in various ways. One way is to ask how much more effective is a chemical projectile than a regular high explosive one if men aren't wearing protective equipment. You can average this over ICM's and over regular emissions and men attacking and dug in and so on, different conditions. You come up with a ratio of 10 or 20. That means if people don't put on their protective equipment, and for each let's say 20 or near rounds you shoot, you shoot even 1 chemical round, if they don't put on their equipment, they are, in effect, granting to your side a 50 percent or even 100 percent increase in your artillery power against them, which is something that it would be unreasonable for any enemy commander to grant to our side. Therefore, something like 5 percent of our total fire is certainly adequate. And I have heard Chemical Corps officers say less would be enough recently. They may not say that in public, but I have heard them say it in technical discussions in which I have been involved.

At that figure we can calculate how many we need. In 30 days in Europe, U.S. forces might shoot for four or five artillery shells. That means we might need a couple hundred thousand, 250,000 chemical artillery shells if we want to meet that 5-percent requirement. It has been estimated from unclassified sources to be more than that.

We shouldn't forget that the United States maintains a large number of 155mm mustard rounds, and it is wrong to think of these as obsolete. Nor does the Army do so, because the current Army plan for maintenance of munitions, which I have here, an unclassified plan, projects the bringing up to ready-to-issue status of our 155 and 105 caliber mustard rounds. Mustards, indeed, would be superior in the role of forcing enemy personnel into a protective posture under certain im-

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portant conditions. So that I would say that the requirements that one can justify rationally are more than met in present stocks.

WEAPON DETERIORATION

As to the problem of deterioration, I think Senator Garn, as I mentioned earlier, has made extremely well the point the leakage problem is sheer politics. But beyond that it is not the question of leakage but whether the agent is deteriorating and getting to be ineffective.

There was a surveillance done on each lot of nerve gas and mustard we have. There are four code categories. A means serviceable with no restrictions as to time. B means serviceable with certain restrictions. C means serviceable with other restrictions. H means no good; you have to demilitarize it.

Every single lot of nerve gas, both VX and GB, in 155 and 8-inch, is code category A, not even B or C. Some of the 105's are B and C. But the ones we are talking about here, the heavy ones, the ones that would be presumably added to, supplemented or replaced by binaries are all containing agents in category A. There is no evidence of which I am aware that the existing stockpile of those munitions, if properly maintained, cannot be kept in serviceable condition for many, many years into the future.

Regarding this question of field testing——

Senator GARN. Excuse me. Could I interrupt there and ask one question.

REPLACEMENT WITH BINARY WEAPONS

I am a little bit puzzled because I don't know of anybody who is advocating this in addition to what we have. I don't disagree with anything you have said so far. Sure, there is plenty. I am not advocating we increase the stockpile. I believe that we ought to build binaries as a replacement so that we can totally detoxify all of the present stockpile that we have, not because we can't store it safely, but because when you start to try and transport it—and again I may or may not be talking about classified things; I just don't want to take the chance of going too far. I think you know what I am talking about—the ability to move to a theater, the ability to have a delivery system as a credible deterrent and all of that.

I just want to make it clear, I don't disagree with you. There is far more than enough in our present stockpile. I look at binary as a replacement because of the transportation and delivery problems.

Mr. MESELSON. Yes; I tried to address some comments to that.

I think that regarding our artillery shells that binaries are likely to be inferior to single field in some of those artilleries and certainly not superior enough even given the best of assumptions showing the $1 or $2 billion it would take to replace it.

First of all, there is no intention at present to replace that stockpile of artillery stockpiles. The Army plans until 1988 to bring into serviceable condition all of the existing artillery projectiles. Nor would it make any sense to destroy those projectiles. It would cost $20 to $30 each to bring them into serviceable condition. It would cost at least $550 each

for the others. There is no reason at all to spend 10 or 20 times the cost.

DISADVANTAGES OF BINARY WEAPONS

The binary is three or four times bulkier to store. That is not so important because bulk is not the key thing in shipment; weight is. But it is not an advantage when you have to take that much more real estate, especially if it is in Europe where they don't like giving up very much real estate.

Second, it is heavier to ship. The Army, in response to some questions from the Senate a few weeks ago, responded that each binary projectile in 155 would entail 60 pounds of shipping capacity. They later admitted they had done the numbers wrong. That is not something you should have wrong numbers on at this late stage.

Per round it is more weighty. That is not a big factor. The problem is the existing one and the binaries are both awfully heavy to ship. But the binary weighs more.

In the peacetime political problem, the one you were referring to, which we created by exaggerating it wildly—but I presume we have enough sense never to do it again——

Senator GARN. There will always be politicians around to exaggerate the problem. [Laughter.]

Mr. MESELSON. I am lost for words. You derailed my train of thought, Senator.

Senator GARN. I apologize.

Mr. MESELSON. You actually did.

The binaries, unfield-tested, more expensive, bulkier to ship, it seems to me offer no great advantage; and in the political domain, if I could venture a millimeter into it, making them, I think, promises to stir up strong movement in Europe to make us bring home the existing one and only stockpile that we have in Europe, which is in Germany.

As you may know, Chancellor Schmidt's party congress a few days ago, in fact on the anniversary of the first use of gas in World War I, April 22, resolved to ask their Government to have all the stocks that are there taken home. I am not talking about other possible binary modes. I haven't looked into them enough, and in most cases the configuration isn't even well enough determined. But when it comes to artillery shells, it seems there are disadvantages.

What I was going to say when you made that comment, is that the purpose of the binary is to me a peacetime political problem which I hope won't come back as strong, at least as it was once. When the war starts, the binary advantages all go away. You have to assemble them in the field. I know you can assemble them under perfect conditions in 2 minutes each. But what commander wants to have to go through the procedure of opening up the box with the cannisters, taking out the cannister, keeping everything clean, unscrewing the base plate of the projectile, taking out the spacer, putting in the cannister, screwing it back up again, making sure it is tight and won't leak. It is not impossible. Men will gladly do it if commanded to do so. But why add complexity when we have already a very simple, rugged system. So I don't think it has

been looked at carefully enough why we should go into binaries with artillery projectiles.

BINARY WEAPON DEPLOYMENT

Now, the problem of deploying them is complicated by civilian concern regarding civilian casualties. It is the unique characteristic of chemical weapons that you can protect soldiers against them and the soldiers can still fight. If you protect soldiers against high explosives, you have to put them in a hole or behind a lot of metal or concrete and they can't fight very much. To protect soldiers against flames you have the same problem. To protect them against nuclear weapons, you can't. But to protect them against chemical weapons requires chemical clothing and masks, and it can be done. The problem is the civilians.

These represent some calculations Dr. Robinson and I made, but they are typical calculations made by people in this field of the downwind hazard of several very limited chemical attacks superimposed on the map of West Germany. This darkest zone, which corresponds to an area of 45 square kilometers with the most present meteorological conditions in Europe, is the zone where people would exceed 50 milligrams per minute per cubic meter. That is the total of a lethal dosage. People there would either be killed or brought to the brink of death in spasms, uncontrolled breathing, asphyxiation, involuntary—all kinds of medical things I won't go into. This larger area would have severe symptoms but, except for infants and infirm people, a low death rate. In this large area you would have mild symptoms.

Now, you can calculate under different assumptions regarding the distribution of attacks how many square kilometers would be made lethal at this high concentration of 50, and it depends on the exact pattern of the distribution. According to my calculations, the answer under the standards, so-called D-meteorological conditions in Europe, comes out to be somewhere between 2 and 20 square kilometers would be made lethal for each ton of nerve agent you use.

CHEMICAL USE IN EUROPE

The amount of chemicals we might use in Europe—I think there are some additional charts here—is subject to serious discussion and debate. The highest figure I have seen is the figure attributed to the Joint Chiefs in Senate testimony last year of 19,000 agent tonnage in stockpile required for Europe. What fraction of that 19,000 tons you might put into artillery projectiles is a question I want to touch on in a minute.

If we take a number like 19,000 tons, that would correspond to between 40,000 and 400,000 square kilometers becoming lethal if that were used. Now, within that 40,000 to 400,000 square kilometers, one of three things has to happen about the people there. They could be protected. They could be given gas masks and doctrine for using them and collective shelters and so on. This is a massive undertaking. It would require discipline. It would require provisions for all kinds of people, infants, the infirm, and so on. It is physically, in principle, impossible.

The second thing that could happen is to move them out. That also is a massive undertaking because you are talking about, if you have a population density—if you remove the major cities from Europe, from the population map of Europe, on the assumption that gas would not be used there by armed forces, and then recalculate the population density, you get something like 100 people per square kilometer. That means we are talking between 4 million and 40 million deaths or exposures to lethal conditions. To move anything like that many people in the course of battle would be a gigantic undertaking.

The third possibility is they stay there without protection. This is a massive problem, and I presume this is why the Europeans are very reluctant to have a doctrine of heavy chemical retaliation brought into NATO planning.

ARTILLERY PROJECTILES

Now, as to artillery projectiles, with this requirement, if we were to put, say, half of it into artillery projectiles, which historically is not an unreasonable practice, we could calculate how many million pounds that would be in an average of 10 pounds per round to get this 10,000, which is to me the most reasonable projection, of 2 million. That would be enough firing in 5 percent of all of our fire for 270 days of continual chemical warfare in Europe, 10-plus divisions, 1,500 guns.

If we were to share our chemical munitions with all of NATO—and there is not much indication that all of NATO or even much of it would agree to use them—but if we should, since we cover about a third of the total NATO front and have about a third of all the canon, it would be enough for 90 days of chemical warfare with everybody shooting chemicals at 5 percent without interruption from start to end.

So I must say that, in my opinion, this enormous stockpile has no justification whatever. I would see no justification for such a big stockpile, unless one is planning on a very long war and a war in which all of our allies are simultaneously using our chemical munitions, something for which, as far as I know, there is no agreement whatsoever on their part. So I must say I see no reason either to replace our existing stockpile with binaries, nor am I aware of any plans to do so actually, only to add on the binaries; nor do I see any reason for adding additional numbers.

There are some other points I wanted to touch on, including the problem of airlifting these materials to Europe. I think because of the lateness of the time and in order that my colleague be able to say a few words, I should at this point stop.

Chairman HATFIELD. Thank you very much, Dr. Meselson.

[The statement follows:]

PREPARED STATEMENT OF DR. MATTHEW MESELSON

PROFESSOR OF BIOCHEMISTRY

HARVARD UNIVERSITY

It is indeed a privilege to appear before this Committee. I have served as a consultant on chemical warfare matters to a number of administrations, including the present one,and I welcome this opportunity to appear today in connection with your consideration of the Administration's request for funds for production of certain binary nerve gas weapons.

I agree with this and previous Administrations on the necessity of assuming the existence of a substantial Soviet chemical threat. We should deplore, however, the practice of putting forth to the Congress and the public worst-case interpretations for which the evidence is highly questionable or misrepresented. The departure from high standards of evidence and interpretation which is frequent in this field can, over time, only harm US interests. The fact is that we do not know whether the Soviets have or have not significantly added to their stockpile of lethal chemical munitions during the 12 years since we last produced such weapons. Similarly, estimates of the size and composition of Soviet chemical stocks are extremely variable and uncertain. Indeed, we do not know whether the Soviet stockpile of chemical weapons is larger or smaller than that of the US. It is prudence, not definite knowledge, which requires that we assume the existence of a substantial Soviet chemical weapons capability.

I also agree with the determination of this Administration and its predecessor that increased effort should be given to equipping and training US forces to protect themselves against chemical weapons.

It is a unique attribute of chemical weapons, in contrast to conventional weapons, that it is possible and practical to provide military personnel with a high degree of protection. A soldier wearing modern protective clothing is nearly invulnerable to chemical weapons at practical field concentrations. Against a soldier wearing modern protective equipment, chemicals are far less effective in producing casualties than are conventional weapons. Thus, a good defense accomplishes two important objectives. First, it greatly reduces the incentive an adversary may see in attacking with chemicals. Second, if this disincentive fails, a good defense greatly reduces the effect of a chemical attack. We already have effective equipment for chemical defense but important improvements are possible. With continued support and good management,

they will be forthcoming. The other key element in chemical defense is good training. More time is spent on training programs than in earlier years but I believe the prevailing evaluation is correct that both the practice of chemical protection and the concepts underlying it could be considerably improved.

Where I begin to disagree seriously with the plans of the current Administration is in its program for major outlays for a new generation of nerve gas weapons.

For Fiscal Year 1983, the Administration has requested funds for production of two new chemical weapons: the M687 GB 155mm binary nerve gas artillery projectile and the Bigeye binary VX nerve gas bomb. It is only the artillery projectile, however, which is certified as ready for production. As for the Bigeye bomb, its developer, the Navy, now states that the need for further development and testing will postpone the first possible production to FY84 or beyond. In view of the fact that budgetary authority is at an especially high premium for FY83 and in view of serious doubts regarding the deliverability and the effectiveness of Bigeye, it would seem wise to defer consideration of the authorization of production funds for the Bigeye to next year when the as yet incomplete DoD studies of its utility are farther along. Therefore, I shall focus this part of my testimony on the issues raised by the request for funds to begin production of the M687 artillery projectile.

I question the need and military utility of additional nerve gas artillery ammunition. US forces already have considerably more than enough nerve gas artillery projectiles for a 30 day full-scale war in Europe, even under the assumption that chemical weapons are in use from the start of hostilities.

Let me explain. For causing casualties to well-trained, well-protected troops, as the Soviets certainly are, chemical artillery fire will generally be much less effective than conventional high explosive artillery fire. By forcing troops into protective posture, however, chemicals will degrade mission performance and slow the tempo of enemy operations to an extent which is uncertain but could be substantial under some conditions.

Since firing more chemical rounds means firing fewer conventional rounds, there will be an optimum ratio, depending upon the amount required to force the other side into protective posture. Firing more chemical rounds than this optiumum will reduce, not increase, US combat effectiveness. Thus, as stated in a recent DoD report to the Congress, the objective of US retaliatory use of chemicals would generally not be to obtain casualties but rather to force the

other side into protective posture. Avoiding additional casualties to unprotected civilians downwind is a further reason for not exceeding the optimum.

Calculations based on munitions effectiveness data show that the inclusion of just a few percent chemical rounds in total artillery fire would provide opposing forces with a powerful incentive to assume a high degree of chemical protection. The number of chemical artillery rounds needed to comprise five percent of all rounds fired by the US during 30 days of all-out war in Europe would be about 200,000. Essentially the same estimate can be reached by a different approach, namely, detailed target analysis.

It may be estimated from unclassified sources that the existing stockpile of M121 and M426 nerve gas artillery projectiles is substantially greater than this requirement.

Also, it should not be forgotten that the US maintains a large number of 155mm mustard rounds designated M110, which, for creating a persistent vapor hazard to the lungs, eyes and skin can be superior to rounds containing nerve agents GB and VX. Indeed, the Army is planning to upgrade the M110 stockpile, very substantially increasing the number of ready-to-issue rounds. In addition, there are large stocks of 105mm GB nerve gas artillery projectiles, the M360 and 105mm mustard artillery projectiles, the M60. Although the Army is phasing the 105mm howitzer out of Europe, it will remain a standard artillery system for the Marine Corps. The Army's upgrading program also includes these 105mm nerve gas and mustard munitions.

I would like to emphasize that stocks of serviceable 155mm and 8-inch nerve gas artillery projectiles are not significantly deteriorating. Tests done several years ago were mistakenly interpreted to suggest deterioration of nerve agent in US artillery munitions. The tests were later found to have been done incorrectly. Subsequent tests showed no deterioration. On the basis of still more recent tests, the Army has assigned all lots of nerve agent in its 155mm and 8-inch artillery projectiles to Condition Code A, defined as "Serviceable - fully meets all military characteristics. Issuable without limit or restriction." The same holds true for all lots of mustard gas in M110 155mm projectiles and in M60 105mm projectiles.

As of last summer only 33 of the very large number of stockpiled M121 and M426 projectiles were classified as leakers. The leaks are minuscule. They present no real hazard. In past years some of the stocks were not adequately maintained. Also, burster charges were not available for many of the rounds.

Due to improved burstering and maintenance programs, the stockpile of serviceable chemical artillery munitions will substantially increase over the next

several years. On the basis of all available evidence, it is reasonable to expect that the bulk of the serviceable stockpile of 8-inch and 155mm chemical artillery munitions will, with proper maintenance, remain fully serviceable for many years.

A further point to consider is that the proposed binary projectile has not been adequately field tested. In contrast, the presently stockpiled US nerve gas artillery projectiles have been extensively field tested.

Due to restrictions on field testing enacted by Congress, the M687 binary projectile has never been field tested in its actual configuration. In spite of extensive field tests with simulated agents, and a single test shot with a live round of a binary munition of significantly different design, field testing with live rounds of the M687 has yet to be done.

In addition to revealing possible unsuspected design faults, field testing is needed in order to develop munitions effectiveness tables which presently do not exist for the M687 binary. Only such testing can provide fully dependable information as to whether the M687 is reliable and equal in effectiveness to the currently stockpiled M121 GB round.

In this regard the former Director of Development at the Army Chemical Systems Laboratory, Dr. Saul Hormats, has stated that, and I quote, "When I developed and introduced into production the presently stockpiled munitions I chose a straightforward approach and merely adapted and modified the designs of existing suitable munitions for which we had a very large number of static and then dynamic (field) trials. We had to make numerous design changes as these trials progressed and in some cases critically important changes they were. We would never have gone into production without all this engineering data, even on as simple an adaptation program as we could have devised. The proposed binary munitions are not a simple change from other rounds, but are an entirely new design. Their functioning will be entirely different from their predecessors. Engineering data must be obtained on cloud size and shape, rate of formation, yield droplet size distribution persistency, et cetera, et cetera, statically and dynamically and in statistically significant numbers. These must be with live, not simulant rounds. This is a large program. A few tests just will not do." In the same vein, the Army's Simulants/Simulation Advisory Panel in its 1974 report on the 155mm binary GB projectile stated that production without live agent field testing "...severely weakens the deterrent value of the munition and sets the precedent of stockpiling ordnance not fully field tested, and produces unnecessary uncertainty in Army planning."

Lastly, the main limitation of US chemical artillery capabilities is likely to be imposed by deployment difficulties, not by stockpile limitations. No NATO ally has indicated willingness to accept deployment of these munitions. The stated policy of the Federal Republic of Germany is not to train its troops in the use of chemicals "now or in the future." There is no evidence that the FRG will permit replacement of US chemical weapons already deployed there with binaries, let alone permit the deployment of increased quantities.

Indeed, there are recent indications that US production of short-range nerve gas weapons such as the M687 which are perceived as being most likely to be used on German soil could force the Government of the Federal Republic to request withdrawal of US stocks presently positioned on its territory. Less than two weeks ago, at its annual conference, Chancellor Schmidt's Party overwhelmingly passed a resolution requesting the Federal German Government to have removed from its soil all stocks of poison gas and to renounce any such deployment in future. This would leave the United States with no stocks whatever in Europe for prompt retaliation in case of chemical attack. Recently the Norwegian government precluded such deployment. So has the Dutch Government, which has also renounced all use of chemical weapons.

Much of the opposition to chemical weapons in European NATO countries is based on awareness that even a few weeks of major chemical war on their territory could cause tens of millions of civilian casualties, a catastrophe of strategic proportions for Western Europe.

In view of the lack of any substantial prospectof pre-positioning, it becomes important to consider the logistic problem of rapid deployment by airlift. In unclassified testimony to the Senate last year, the Joint Chiefs were represented as recommending a requirement of approximately 19,000 agent tons of chemical weapons for possible use in Europe. If we consider half or even a quarter of this to be in the form of ground-fired munitions such as 8-inch and 155mm artillery, the problem of airlift deployment is seen to be acute, requiring a large proportion of the total C141B airlift capability over a one-month period.
This may be seen in the following table:

MINIMUM REQUIREMENTS FOR AIRLIFT OF CHEMICAL ARTILLERY MUNITIONS TO EUROPE

agent tons (thousands)	artillery projectiles (millions)	C-141B** flights	Weeks using*** entire fleet
5	1	2100	2
10	2	4200	4
15	3	6300	6

* At 10 agent-lb/projectile, averaged for 8-inch and 155mm.

** At 150 lb/projectile, averaged for 8-inch and 155mm, including all projectile components. Aircraft loaded to maximum payload of 36 tons. Dover,Delaware, to Ramstein, West Germany.

*** At 1.5 days/sortie, 230 operational aircraft.

Note: The above estimates are minimal and would be somewhat greater for binaries or for less than maximum allowable aircraft loading.

Thus, even if one subscribes (as I do not) to the JCS view that currently serviceable US chemical artillery stocks are quantitatively inadequate, building additional supplies may do little or nothing to make such supplies available in the theatre.

The dollar cost of the artillery segment of the binary program will of course depend on the numbers and kinds of munitions to be procured. A current estimate of the cost of the M687 binary artillery projectile is $550 per round. The other binary artillery projectile now being developed, the 8-inch IVA (intermediate volatility agent) round might cost about 50 percent more, in 1982 dollars. In the same testimony to which I refered above, and on other occasions, it has been indicated that the total world-wide JCS requirement is a stockpile of 25-30,000 agent tons. If 5, 10, or 15 thousand agent tons of this total were to comprise 155mm and 8-inch binary artillery munitions in equal numbers, the estimated costs would be as follows.

COST OF BINARY ARTILLERY MUNITIONS

agent tons (thousands)	artillery projectile (millions)	cost (billions-1982 $)
5	1	0.7
10	2	1.4
15	3	2.1

(The above estimates are exclusive of the other currently envisaged binary nerve gas weapons: the Bigeye bomb, the Multiple-launch chemical rocket system, the chemical cruise missile and the chemical corps support missile. These weapons would cost considerably more than artillery munitions on an agent ton basis.)

In summary, I conclude that there is no significant need for binary artillery projectiles and that their production would, over the period of several years, waste several hundred million dollars without adding significantly to our defense capabilities.

STATEMENT OF JULIAN PERRY ROBINSON

EUROPEAN DIMENSION TO BINARY PROGRAM

Chairman HATFIELD. Dr. Robinson, if you could move those microphones over.

Mr. ROBINSON. Mr. Chairman, as a European, it is a special privilege to appear before you and your committee. I am very much honored by your invitation.

There is, as you know, a strong European dimension to the binary program. Many of us in Europe are concerned lest this dimension be ignored or belittled in the decisions that lie ahead for the Congress.

My understanding is that you want to know from me more about our European view of the binary program.

Chairman HATFIELD. Your entire statement will be placed as part of the record, but if you would comment more specifically on that point, it would be very helpful.

[The statement follows:]

zones, the concerns about poison gas casualties to civilians will not go away; they will increase. They will remain yet more sensitive perhaps as a source of European domestic opposition to the prepositioning of chemical weapons.

The second point is this: As time goes on, chemical weapons, whether they are binary or any other, are going to become harder to integrate into the NATO force posture. The trend in NATO armament is toward weapons of greater precision, greater single-round effectiveness, reduced collateral damage.

Against that background, against that trend, which is now beginning, which is gathering strength, chemical warfare forces must inevitably appear more and more archaic and obsolete. So the necessary political consensus that must be arrived at may then fail to capture not only popular opinion but military opinion as well.

So my conclusion is that Washington is very probably deluding itself if it thinks active European support for the binary program will materialize during the coming years. There is, as has been referred to earlier, indeed a risk at the moment that the binary program will eject stocks that are already there. That is a matter of concern to people who value their stocks as part of the deterrent against chemical warfare. There is surely no chance at all of European support while the chemical arms control negotiations are effectively in abeyance.

Those, Mr. Chairman, are the principal points I wanted to emphasize from my paper. Thank you.

Chairman HATFIELD. Thank you very much, Professor Robinson.

Senator Bumpers, do you have some questions?

PERCENTAGE OF CHEMICAL AGENTS IN USABLE FORM

Senator BUMPERS. Dr. Meselson, let me ask you just two or three general questions. And without getting into the classified quality of the number of tons of chemical agents the United States has in its arsenal, could you tell me what percentage, if you know—I don't think this is classified, Mr. Chairman; if it is, don't hesitate to call me down—what percentage of chemical agents in this country are presently in usable form?

Mr. MESELSON. Senator, the number is rather rapidly changing. I can tell you more effectively what percentage it will be at the conclusion of the current maintenance program. I can also talk about that more freely because that number has been published in Senate testimony. That number is 7,000 agent-tons. In other unclassified sources, the total amount of the stockpile has been referred to, including both bulk agent and weapons, as being in the range of 30,000 or so pounds, 30,000, 35,000. That would be a——

Senator BUMPERS. Has that been testified to here?

Mr. MESELSON. Yes. That has been testified to by—that number, I am not sure. I am certain it has, because it has been around for years. One reference to it is in the Marine Corps Gazette that I can think of offhand rather quickly. That would be a ratio of 1 to 5; in other words, 20 percent.

Senator BUMPERS. You mean 30,000 tons, do you not, not pounds?

Mr. MESELSON. Yes, tons. Did I say pounds?

Senator BUMPERS. I think you did.

Mr. MESELSON. Absolutely right; tons. In other words, 7,000 is about a fifth of 35,000. However, that 35,000 includes a great deal of bulk agent. If we were to consider only the weapons, then instead of 20 percent, I suppose it would go up to around 40 percent.

See, the bulk agent was made, in part, in case of extended chemical war. When it was first made, you could start filling munitions and supply the battlefield that way. That concept I think is greatly diminished now. But the reason we made so much bulk was connected with that.

So more than the percentage, it seems to me what is important is the numbers, the actual numbers. Are they even from the point of view of chemical retaliation? If that doctrine is correct, are they numerically adequate? Seven thousand agent tons is in terms of artillery—well, if it were all artillery, it would be about 1.4 million rounds.

Senator BUMPERS. Would that be 155's and 105's both?

Mr. MESELSON. No. The 105's would contribute a little, but not much. It would be mainly, as far as artillery goes, 155's and 8-inch.

Senator BUMPERS. We are phasing out our 105's. So whatever we had in our chemical weapons in 105's is virtually worthless to us, is it not?

Mr. MESELSON. Any Army man would agree with you. The Marines would flinch because the Marines depend on the 105's and will continue to do so. If there are any Marines in the room, they wouldn't agree with that. And also our allies maintain 105's. But you are right; the Army is withdrawing the 105's.

SOVIET ACTIVITY IN AFGHANISTAN

Senator BUMPERS. Dr. Meselson, aren't you a member of some organization that is officially sanctioned, or maybe financed by the Government, in determining the studies that have been ongoing both here and in the United Nations as to what the Soviets have actually done in Afghanistan? Are you privy to any of the information that the Soviets——

Mr. MESELSON. No. I served the Government in connection with the events in Sverdlovsk. Even with yellow rain or Afghanistan, no connection at all.

Senator BUMPERS. So you couldn't comment at all on what, if anything, the Soviets have done in Afghanistan?

Mr. MESELSON. Not knowledgeably.

Senator BUMPERS. Would you agree with me that if they have done something, if they have even used a nonlethal agent, is it your belief they would have done so if the Afghans had had a similar capability?

Mr. MESELSON. My belief is if the Afghans had had gas masks and if the Russians had done this, it would have been totally ineffective. Retaliation, I think, in that case isn't as relevant actually as protection. All of the both proven cases and alleged cases of the use of gas since World War II—there are about 20 of them—involve the use or alleged use against forces without gas masks, never against forces with gas masks.

Senator BUMPERS. What we want to do, Dr. Meselson, is make it so it isn't used by either side, but not be used by one side and hope the other side can defend against it, isn't it?

Mr. MESELSON. Yes. The argument is even if we maintain a chemical deterrent force, that will reduce the likelihood chemicals will ever be used. I think it is a two-edged sword. I don't know how to predict which way it would go. But I see the nightmare on the other side of that coin that is almost never discussed.

Chemical weapons in principle have, I would say, the two most threatening characteristics that a weapon can have. One, they threaten to cause immense civilian casualties, unlike conventional weapons at all, just totally different. But they also—and this is the point where there could be controversy—I believe it has not at all been established they are effective. I think it is quite possible they would be ineffective against defended sources.

Consider the following scenario: The Soviets and NATO are involved in a war. In a desperate moment of a breakthrough attempt, the Soviets decide to use chemicals. Whether or not that will help them will depend, I would say, almost totally on whether or not NATO forces are properly trained and warned.

Senator BUMPERS. And also which way the wind is blowing.

Mr. MESELSON. And which way the wind is blowing. But it is possible that that initial strike will be devastating in its consequences, particularly because the learning curve for chemical warfare is very steep. You could be caught by surprise. We might then, if we are relying on a doctrine of retaliation in kind, be tempted to fire back. Of course, we would if that was our doctrine.

Now if I am right, and 5 percent is enough chemicals for the basic load, which is a lowish amount, even with that lowish amount, after the hours of a first strike, you can be sure commanders are going to shoot back a lot more than 5 percent. One thing is sure. Each chemical round they fire is some other kind of round in some desperate moment they don't get to fire. Therefore, the effectiveness of conventional fire power will be reduced 15, 20, 30 percent with the chemicals you do fire.

Now, the Soviets are going to have warned their forces all up and down the front before they use chemical weapons, if indeed they do. Under that situation, the short-term impact of the chemical weapons on them, it seems to me, would be minimal. You have, therefore, the makings for the following situation. And I admit this is a worst-case scenario. But if we are going to get into worst-case scenarios on the other side, we had better look at this one.

It goes like this: After that event, the civilian populations of Europe are putting on their governments the most extraordinary political pressure either for surrender or for immediate escalation to the use of nuclear weapons. Meanwhile, we have put ourselves in a position where that breakthrough attempt may succeed because we have reduced our conventional fire power in those subsequent hours by a substantial percentage. Therefore, I am not at all sure that chemical weapons don't have the characteristics of bringing on the very thing they are intended

to avoid, not only the use of chemical weapons but possibly even the escalation to the use of nuclear weapons. Those things need to be looked at honestly.

The key question underlying it is, Is it really true that by forcing a Russian soldier into his gas mask and his poncho, protective equipment, that you are really going to slow him down? I just don't believe that. It certainly wasn't true; that kind of effect was not true in World War I. There were effects, but they were not massive. And since then the defenses have all become much better. And the competitor weapons, conventional weapons, have all become much better. But the chemical weapons haven't become all that much better. So from that broad point of view I would say that this is a very dangerous doctrine we are beginning to embrace, especially to go for it massively in the way the numbers here would indicate.

Senator BUMPERS. If we follow that logic to its ultimate conclusion, would that not mean that it would be preferable not only to go binary, but to destroy what we have?

Mr. MESELSON. That scenario I painted for you depends a great deal on the magnitude of our response. That is, the bigger our response, the more we rely on chemicals, the more massive retaliation we contemplate, the worse that scenario gets. So yes, it could be that there is a strong argument for not having any policy of retaliation in kind in Europe. The key uncertainty there is to what extent do chemical weapons have any military effect? We have no real studies of that. We have anecdotes. I am not being dogmatic about it either. I am saying from World War I, it looks to me the result would be they are not very effective. But we don't have more than that.

FAILURE OF GERMANY TO USE GASES IN WORLD WAR II

Senator BUMPERS. The Germans had a lot of chemical agents—mustard and other agents—which they never used in World War II. Would you venture a guess on what you read and study as to why they did not?

Mr. MESELSON. I would say two things. The kind of retaliatory policy we had was not a battlefield retaliatory policy. It was taken to mean the retaliation against cities, against citizens. That was the great fear in World War II.

Beyond that, I imagine the kinds of studies that were done by our military people were also done by the Germans. You heard Dr. Hormats talk about one of those. He understated it quite a bit. That was a very well-known group organized by Vanderbar Burke and James Conan from Military Operations Analysis under the National Defense Research Council. With that large staff of military people brought in fresh from the battlefield, they looked at scenario after scenario, where would chemical weapons help. They could simply find no important case.

So I would say there was both military—maybe they were wrong—but there was military disinclination and there was military threat against mainly civilians. So I don't think those conditions are transferable to the future.

Senator BUMPERS. You know, the Soviets—one of the things that has been disturbing me, I would divinely wish that all chemical warfare agents could be removed from the face of the Earth, just as I would wish the same thing about nuclear weapons. Unhappily, this is not a perfect world. The Soviets have refused—we have leveled accusations and allegations about what the Soviets have done in Afghanistan and they have violated Geneva by refusing to discuss it with us. Now, that doesn't bode very well for future negotiations in the whole field of chemical agents, does it?

Mr. MESELSON. These events in Afghanistan, reported from Afghanistan and Southeast Asia, are certainly very disturbing. The Geneva Protocol doesn't cover that. But I don't know our Government has tried——

Senator BUMPERS. The protocol did, did it not?

Mr. MESELSON. No. It just said the use of these is not prohibited, but it doesn't have any consolidated provision. That is probably one of its weaknesses.

Senator BUMPERS. It doesn't have any requirement that once an allegation is leveled, that you must discuss it.

Mr. MESELSON. Not the Geneva Protocol of 1925, which is the only agreement specifically about chemicals. But beyond that I am not convinced, Senator Bumpers, that our Government has really tried in a competent way to have those discussions.

Senator BUMPERS. I am not either.

Mr. MESELSON. I could tell you some reasons why I say that. Even with best intentions on both sides, it is possible to have lots of misconceptions and misinformation. But I am not sure, and I do believe that I have heard it said on several occasions by authoritative individuals in Geneva that in the context of those bilateral chemical weapons negotiations, that such talks about compliance issues would be possible. I think that it would be no cost to us to resume those talks that we are boycotting and see if we can do it.

Senator BUMPERS. I couldn't agree with you more on that.

Mr. MESELSON. But in any case, no matter how great the Soviet performance, if it is proven to be as bad as the worst case says it is, and that is conceivable, I don't see why we should get ourselves in a posture where we are wasting money on weapons that are not very effective, which can't be deployed, where we are not doing the kind of homework we need to do to find if even worst disasters might come about with a policy of reliance on large-scale chemical retaliation.

ON-SITE VERIFICATION

Senator BUMPERS. We can't have a treaty—I think you can have a nuclear arms treaty, but I do not believe you can have a chemical agent treaty without on-site verification. Would you agree with that?

Mr. MESELSON. Absolutely.

Senator BUMPERS. Is it your belt-buckle feel that the Soviet Union will or will not ever agree to such an on-site inspection?

Mr. MESELSON. I can't predict the future. I know they did agree, to the surprise of quite a few people, to the principle of international on-site inspection by challenge in connection with the Chemical Warfare Treaty. In July 1979, the joint communique from those talks stated that agreement. But we could never get them to tell us in detail under what conditions those on-site international inspections could be done.

Senator BUMPERS. That is right.

Mr. MESELSON. Now all I could say to your question—I wish I could say more—is if we want to find out, the only way to find out is to spend a few thousand dollars necessary to maintain the diplomats living and traveling to Geneva to talk to the Russians about that. We are not doing that. We have boycotted those talks.

Senator BUMPERS. I have taken too much time already, and I am sorry, Mr. Chairman. I have one more question.

If you had your choice between two things, not the ultimate, not the best of all worlds, not anything we have talked about here, but if you just had a choice between right now seeing everything we have, whatever it is, 30,000 tons or whatever, immediately disappear from the face of the Earth, to be replaced by binary, if we were going to have to have something, if we were going to have chemical agents and a chemical warfare capability, and you had a choice of all we presently have immediately disappearing from the Earth and being replaced by binary, would you accept that?

Mr. MESELSON. From a purely military and technical point of view, I would say absolutely not.

Senator BUMPERS. How about safety? Just safety to the civilian population right now.

Mr. MESELSON. The only real danger to the civilian population is if one shoots these in a war. There have been no civilian casualties, as Senator Garn pointed out, or even very serious accidents. As Senator Garn pointed out, the so-called danger of the existing single-filled stockpile has been wildly exaggerated of those leaking Weteye bombs. As he pointed out, the leaks are so minor that even if a person were inhabiting the air space between the bomb and protective cannisters and living there, he would not get a lethal dose.

Chairman HATFIELD. Senator Garn offered to go in the bunker where there was leakage occurring, Senator Bumpers. [Laughter.]

Senator BUMPERS. He may insist I go with him.

Mr. MESELSON. I would say from a military point of view it would be a foolish thing to do, because first of all, not even the one ready for production has ever been tested in live form, and the extra volume shipping requirements on binaries, I don't see why military commanders would welcome those features.

Chairman HATFIELD. May I invade, Senator Pryor, for just one question and then turn the gavel over to Senator Bumpers in that I must go to another hearing.

Senator PRYOR. I am about through, but go ahead.

Chairman HATFIELD. I just wanted to ask Dr. Robinson one question.

EFFECT OF BINARY PROGRAM ON SMALL WORLD POWERS

Dr. Robinson, if the super powers or the major powers determine this is a worthwhile weapons program to pursue, what impact do you see this having in terms of proliferation amongst the small powers of the world that are trying to imitate us in the nuclear arms area and/or the impact upon terrorist groups, that the proliferation of that type of weaponry might become available or they might have access to it? Would you like to briefly comment on that?

Mr. ROBINSON. On the second part of your question, sir, on the terrorists, I was trained as a chemist in my student days and indeed I was a rather enthusiastic chemist hobbyist. I used to make these things in the laboratory. From experience I can certainly say there is no particular technical difficulty in making both high explosives, the type that goes into boxes, and indeed some types of chemical warfare agents. For a person with training in comparative chemistry, these are not very serious problems. To conclude from that that it would be easy for terrorists to have access to chemical weapons, well, yes, it is quite tempting to conclude that. There are problems in a way which, perhaps, it is not all that proper one should discuss too much in public. But, yes, there does seem to be a real risk there.

I think you are absolutely right to relate it additionally to the wider proliferation question, proliferation at the national level rather than the subnational level. Proliferation is one of the very real worries we have in Europe. This is one of the things which is driving us to put pressure on for the chemical arms limitation agreement. Our fear is once the binary program gets underway, the path will have been set. The leader of the world in military technology will be seen to be taking an interest in poison gas, once again after a decade, decade and a half, of abstension. Governments that haven't been in the business before will start to question the reasons for not having done so.

The motives of proliferation reside partly in incentive, of course, but it is in technical accessibility. You have to have the industrial base to produce these things. This is a matter which has actually been studied under contract by the Research Institute for the U.S. Government—a good while ago, mind you, the late sixties, early seventies. They took a series of type countries to examine their industrial base, their ability to produce militarily significant supplies of nerve agents within a short space of time. And to illustrate something of the sensitivity of the problem in European eyes—and perhaps I should say more particularly British eyes—let me say the type country which they judged most capable of acquiring chemical weapons quickly was Argentina.

Chairman HATFIELD. Thank you very much. I want to thank each member of the panels who appeared here today for your contribution. The second session of this hearing will occur tomorrow afternoon at 2 p.m. when we will have representatives of the administration testifying.

I am delighted to invite Senator Pryor back and also at this time to turn the gavel over to him.

Senator PRYOR. I don't know whether I have the legal authority to preside over it.

Chairman HATFIELD. Let us momentarily grant that authority.

Senator PRYOR. I have two or three very quick questions just for the record.

Chairman HATFIELD. Please proceed.

Senator PRYOR [presiding]. Then we will adjourn the hearing.

AVAILABILITY OF BINARY PROGRAM TO THIRD WORLD COUNTRIES

First, Dr. Meselson, we have talked about how much safer to produce and to transport and easier, notwithstanding the weight problem, the binary system might be over the conventional or traditional. You stated, I think, that in 2 or 3 minutes on the battlefield the binary could be assembled, that the binary weapon could be assembled to become lethal. That in itself concerns me because I think we may be on the brink of creating sort of a "Saturday night special" of the chemical world because of its ease in handling and its capability, and I especially think about availability to Third World countries and peoples that we certainly would not want to see this weapon in their hand. Do you have any comments on that?

Mr. MESELSON. I think there is a lot to be said for that concern, Senator—not so much, however, in the battlefield use of the weapon but in the manufacture. The thing that is made greatly easier by the binary technology is the protection of the people who make them. Small countries, poor countries, dissident groups, nongovernmental groups, would find it very challenging to construct the kind of factory with very special valves, very special pumps, pipes within pipes, to avoid the workers getting killed by a leakage in accidents in the manufacture of regular nerve gas.

The thing about the binary concept is it does away with all that. Once it is in the field, I don't think it makes it easier. I think there it is about the same. It is really at the production where the Saturday night special characteristic might come in. So you might have more hands possessing binaries together with the factor to which Dr. Robinson referred; namely, that the keeping up with the military Joneses does have some impact. People want modern weapons. If the United States is going to lead the world into this new dimension, there will probably be others who would like to follow.

Senator PRYOR. Dr. Meselson, would you please evaluate for the committee the Chemical Corps record of success or failure in managing both the offensive and defensive chemical weapons programs that we have?

Mr. MESELSON. I think that in those areas what the Chemical Corps does—let's refer to it as the Chemical Corps—as based on daily experience, they have done an outstanding job. The maintenance of safety of the stockpile, which is based on daily hands-on experience, has been superb.

On the other hand, those things which depend on dealing with development of munitions, perhaps understandably because this is a field which is—these weapons haven't been used since World War I, to put it simply. That record has been poor.

None of the people involved in this are still in business, but we made 20,000 tons of an agent called Luicide. We decided it was a very good agent at the close of World War I and kept on thinking so to the eve of World War II when we made all of that, only to find out, only to realize a very simple thing that should have been realized before. It wasn't—that in human atmospheres, it is almost useless because the fine spray reacts with water.

We made large quantities of much more recent agents containing BZ, a psychochemical agent. We then abandoned the concept after making large quantities of the agent because we realized it might make enemy soldiers fanatically minded, and this would not be a good thing.

Quite recently the Israelis discovered in Egyptian vehicles that had been supplied to them by the Soviets an antidote for nerve agents called TAB. This was reported to General Abrams as a great advance over us, to indicate the Soviets had the intention of the use of chemical weapons. We carbon copied this material and issued it to our troops in Europe and airmen in Europe before doing proper tests. The Food and Drug Administration insisted each injector have the words on it, "Investigative drug use only." When the necessary investigations were done, after the men had been issued this instead of our standard antidote, which is Atropene, we found it causes extreme hallucinations. The Air Force instructed airmen if they should by accident get injected with this to bail out immediately. The Air Force and Army withdrew all of these carbon copies. Now they are going back to Atropene, the old one. And to add insult to injury, it appears this was never a Russian antidote. It appears the Egyptians purchased it, not from the Soviet Union, but from somewhere else.

Another great, I would say, defect has been the management of the stockpile which is now being improved greatly. But that, I think, was more reflective of the earlier Army view that these weapons weren't worth much. Even now I see evidence of lack of familiarity with the importance and I would say almost universally known practices of this warfare. I have seen over and over again statements on chemical weapons, including statements made only in the last few days, about the value of our stockpile of mustard munitions, the implication mustard is useless because it freezes at 57 or 58 degrees. That is an altogether new concept to me.

In the winter of 1917–18, which was largely well below 57, 58 degrees Fahrenheit, the U.S. expeditionary forces did not enjoy the pounding they received from German mustard. It is simply technically erroneous to believe that the vapor hazard from mustard does anything when it freezes.

Mothballs, if I could use a very homely analogy, are solid, like frozen. But that doesn't mean the vapor from them isn't an adequate agent for dealing with moths. This is technically incompetent.

There are many other indications that there is inadequate appreciation of the characteristics of chemical weapons on the part of those who are planning our chemical weapons policies.

Senator PRYOR. This is just as a trivial matter, but am I not correct in World War I, wasn't it, Cpl. Adolph Hitler was exposed to mustard gas or another form of poisonous gas?

Mr. MESELSON. He certainly was exposed to chemical agents. I am not certain whether it was mustard. I believe my colleague, Dr. Robinson, would know. He says it was mustard.

Senator PRYOR. You stated, Dr. Meselson, that the Army and the Chemical Corps, et cetera, in charge of storing and caring for, let's say playing nursemaid, to the existing stockpile, never gas chemical warfare agents, that they didn't put much value on the stockpile. Could that also be taken to mean that the same individuals or the same mentality or thinking feels that if this stockpile deteriorated, that then they could get a new supply? Did they discourage or did what they did by even inaction or negligence, contribute to its more rapid deterioration or head it toward obsolescence, if, in fact, it is obsolete or it has deteriorated?

Mr. MESELSON. I really don't know of any evidence that the stockpile was allowed to—it isn't deteriorated. It was allowed to become nonserviceable. Much of it can be made serviceable again. I don't know of any evidence that that was done in order to create a need for binaries. One of the main reasons for a great deal of it being unserviceable was simply that the explosive charges needed in the centers of the artillery projectiles were either cannibalized—that was removed for service in Vietnam for regular munitions—or never provided.

What I am concerned about mainly, though, is that the homework which is necessary in order to form a coherent and reliable policy in this area seems, at least in the past, not to have been done.

Senator PRYOR. I want to thank both of you. Senator Bumpers may have something here.

I would, Senator Bumpers, if I might, ask permission of the committee to put this in the record. I think this is a splendid New York Times interview with Dr. Meselson and General Fulwyler. It is dated May 2.

Senator BUMPERS. It will be admitted into the record.

[The information follows:]

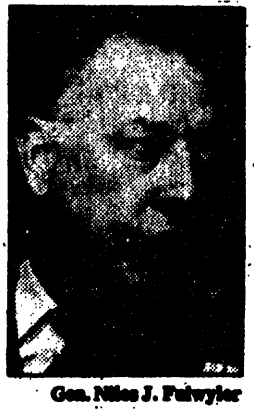
New York Times 5/2/82

A ROUNDTABLE: Binary Chemical Weapons

SHOULD the United States produce new binary chemical weapons? The question is scheduled for debate in the Senate this week when Senator Mark O. Hatfield, Republican of Oregon, holds hearings in the Appropriations Committee and amendments to the Pentagon's authorization bill are offered on the floor. The Administration would like a go-ahead, and has asked for $32 million to develop the new munitions, which consist of two nonlethal components that are packaged separately and combine to form a toxic agent only after a shell or bomb is in flight. The amount is relatively small as military budget/ go. But the question itself is highly charged. The Week in Review asked Maj. Gen. Niles J. Fulwyler, director of the Nuclear and Chemical Directorate, Department of the Army, and Matthew Meselson, professor of biochemistry at Harvard University, to talk about the pros and cons. Excerpts of their discussion with Richard Halloran, a correspondent in The Times's Washington bureau, and Caroline Rand Herron, an editor of The Review, follow.

Question. Do we need more, better or any chemical munitions, and why now?

Mr. Meselson. General Fulwyler and I agree we have to assume the Soviet Union poses a major chemical threat. Where we begin to disagree is in the response. In my opinion, the response which the Army has recommended and which the President has endorsed is dangerous and wrong.



Gen. Niles J. Fulwyler

This follows from a unique characteristic of chemical weapons. The military advantage against a sophisticated opponent is simply to force the other side into their protective equipment (and) decrease tempo. This has two important consequences. The munitions requirement is very small.

The other thing, though, about chemicals is that they selectively exterminate civilians. A civilian goes down into his cellar, the way civilians do to avoid high explosive fire — he's going down into his gas chamber. Quite aside from the moral implications of that, that means that if you're thinking about alliance warfare on somebody else's real estate, mainly Europe, those people aren't going to let their soldiers use chemical weapons in their defense.

General Fulwyler. Unfortunately, civilians have been subjected to the violence of war in every war we've ever had. Now that is not good, but it has occurred.

Mr. Meselson. We need to look at these things more quantitatively. You can calculate the ratio of military deaths to civilian deaths under various kinds of scenarios. With chemicals, you might end up killing 20 civilians for every soldier; with high explosives, far, far less. Even in tactical war in Europe, the ratio would be less.

General Fulwyler. The first reason that we want the retaliatory capability is, of course, to deter use. But, secondly, if the adversary uses chemical and forces us into protective clothing, if we do not have the capability to force him into protective clothing, then we're fighting with one or one and a half arms tied behind our backs.

Mr. Meselson. We already have many more than enough artillery shells (containing chemical weapons) to accomplish the objective which General Fulwyler and I have been discussing. They are not deteriorating, contrary to a myth that is prevalent; they are not obsolescing, contrary to a second myth.

General Fulwyler. Perhaps the agent deterioration itself is not all that great — except it does occur. (But) we have containerized today over a thousand different types of artillery munition that have been leaking.

There's another type of deterioration. The M-55 rocket, we don't have a delivery system for; the rocket launcher is no longer in inventory. We have a sizable part of our stockpile in the 105-millimeter howitzer, which is rapidly being phased out of the Army inventory.

Q. Are binaries the most efficient additions, in terms of storage, transport, battlefield use?

General Fulwyler. We believe so, particularly on production, storage and transport. We never join the second chemical precursor until in the operational site, which means that that round, for all practical purposes, is safe up until the time it is finally loaded. And those various compounds themselves are relatively non-toxic. The diflor that will be used in the 155, as an example, is not as toxic as tear gas. And we believe, based on over 2,500 test firings of the 155, that the binary concept will be just as effective as the current unitary rounds.

Mr. Meselson. There has never been a single test firing in the present configuration. You can't test one thing by testing another.

General Fulwyler. Well, the configuration wasn't that much different. (And) we do not need live testing because we can do all the necessary testing in a laboratory environment with modern technology.

Mr. Meselson. General, you know that we want to resume testing. I'm all for it, I think we should. To issue untested munitions to the troops is wrong.

But let me talk about the need for them, not whether they're any good. You are participating in the perpetuation of a harmful confusion. Do you know that all of our nerve gas (in) artillery ammunition is today classified Code A? Code A means, and I quote, that 'fully meet all military characteristics, issuable without limit or restriction.' The only way you could generate a bigger requirement would be to assume a long war in which all our allies are also using nerve agent at a high rate.

The Deterioration Factor

General Fulwyler. You do not have access to —

Mr. Meselson. Yes, I do. I've written a classified report on the stockpile (in January 1981). And it's gone up, not down, since then.

General Fulwyler. Still, I have concern about you making statements concerning the status of our stockpile, when I believe, Professor, you do not have timely information.

Mr. Meselson. Can you refer me — because names of documents are always unclassified as names — to a single existing document saying that the stockpile of munitions are deteriorating at such a rate that in a few years we won't have any?

General Fulwyler. I don't know if there's a study or not, but the information that I have would lead me to say unless we do something, by the end of this century we will have unilaterally disarmed.

Q. Mr. Meselson, what would be your formula for acquiring sufficient deterrent?

Mr. Meselson. There are two parts to that. The first is protection in defense. We have a good protective suit, and a better one is coming along. We have a mask which is somewhat maligned; whether a better one is coming along I don't know.

But where we fail is troop training, except for certain specialty units like the 82nd Airborne. I talked to a colonel from the 82nd Airborne; he says that his men relish the chemical suits. But most soldiers are not practiced in the equipment to the extent they should be.

As far as our deterrent stockpile is concerned, if we press ahead with what I consider to be these useless weap-

ons, which are complicated, almost four times bulkier to ship, 10 percent heavier to ship —

General Fulwyler. That's wrong! We can (ship) almost twice as many of the binary rounds as we can a unitary round.

Mr. Meselson. General, the numbers you're talking about refer to not having the fuse or the cannister (and packing materials).

General Fulwyler. That's correct, you're not shipping both at the same time. In the interests of safety, we would not plan to ship them on the same aircraft.

Mr. Meselson. Then there's not twice as many.

But my point is that if we overemphasize chemical weapons, which we are on the verge of doing, then two very bad things could happen.

First, there is already on the agenda of the German Social Democratic Party a resolution to withdraw the stocks there. They're the only stocks which are ready to use. This resolution is provoked by apprehension that we are going to overemphasize chemical weapons. The other great danger in overemphasizing the chemical weapons is that if they are ever used against us, our second strike by definition has got to be a lot less effective. Because anyone who would use them first against us is going to prewarn all their forces to protect themselves. Whereas the first strike on us has a chance of catching us by surprise.

Therefore, to the extent that we advertise that we're going to make very much more than we already have on hand, which is a lot, we risk propagating the view that we are unlikely to use our nuclear weapons ever. This undermines the deterrent to war itself.

General Fulwyler. Professor, I think you're really stretching the rationale on that one.

Let me hit just a couple of things.

We have done some tests last year with soldiers with the protective clothing on, for instance, in tanks, and the time by which we had to get them out of the suit or risk a health hazard to them was about 40 minutes.

About the overemphasis on chemical — well, on the defensive side we're paying the price for an underemphasis for a number of years. We can and must make improvements. Over and above that, though, I still maintain that the best way to deter the Soviets' use of chemical agent is for us to have a credible retaliatory capability. That means one in being, one that constitutes a threat and one that he knows that we can hold him at risk at. And the current stockpile does not offer that.

Matthew Meselson

Mr. Meselson. Even if the wearing of this equipment, which I believe has had its burden exaggerated, is a burden, that just means that the objective of having these munitions is to force the other side into such equipment. We have at present far more than enough to do that.

The intent to produce another type which is not needed and which has not been tested in live form in the field is likely to do more to enrage our allies — we're not doing us a particle of military good. Besides that, binary is complicated to assemble in the field.

General Fulwyler. That is not true, Professor! It's a very simple weapon to assemble in the field. Two to three minutes at the most.

Mr. Meselson. I agree that it can be assembled in the field, the piece time rate is probably an underestimate — but no commander prefers to have to do that.

Q. To close, let's talk about something that takes more than three minutes or 20 years, apparently, and that's the chemical warfare treaty, and the now apparently abandoned push for a total ban. How does our current posture help or hurt that endeavor?

General Fulwyler. Well, of course that's one of our points, too. We believe that what we're doing with the binary program is probably going to give us the best leverage at the negotiation table.

Incentives to Negotiation

We have been sitting at the table with the Russians since 1977, and during that time we have seen little or no progress at all. And at the same time, we believe that the Soviets have gone forward and continued to improve their posture. There has been no incentive for them to make any meaningful proposals or agreements.

Mr. Meselson. I can't evaluate that, because that is a psychological question. But I can say something about the negotiations. It depends on how you look at the record (as to) whether it represented progress. And I wouldn't dogmatically assert one or the other. We have agreed with the Soviets — and we announced in July three years ago in a joint communiqué with them — we agreed on the principle of on-site international challenge inspection. But that's not good enough for us.

We're the ones who cut off these talks. We should resume them. Whether or not we could get agreement on the kind of verification that's needed, I don't presume to know. We should just keep trying.

Quite aside from the fact that millions of Europeans are at risk of dying in any large-scale chemical war in Europe, the military implications of that have gone unappreciated. You cannot fight an alliance war with allies who won't use the weapon. It's dreaming to think that they will allow their troops to use it.

The Retaliation Boomerang

General Fulwyler. We got to live with the facts of the day, and the facts are that the Soviets are the best equipped nation in the world to wage chemical warfare. If the conflict is forced upon them, I would be willing to wager that anyone, including our allies, will be more than happy to accept that as part of the deterrent, if not to have it as a retaliatory capability if it is used on them.

Mr. Meselson. I strongly disagree. If we could imagine the war happening in New Jersey —

General Fulwyler. Do you think our allies would prefer for us to cross the nuclear threshold first as a counter to the Soviet use of chemical weapons?

Mr. Meselson. At the point where the Europeans see millions of their civilians dying that they would advocate that we not defend them anymore — which we hope they wouldn't do. That's exactly what chemicals might achieve, because it puts them in a position where the continuation of that war would involve a catastrophe of strategic proportions for them due to chemical losses.

General Fulwyler. If we cross the nuclear threshold, that is going to be a catastrophe of greater immensity.

Mr. Meselson. Yes, but I think that chemicals can bring that on.

PROJECTILE TESTING

Senator PRYOR. We thank both of you for coming here today.

Senator BUMPERS [presiding]. Dr. Meselson, the Army says on this business of whether or not this has been tested, that they tested 2,758 projectiles during the development program. This included extensive evaluation of the agent dissemination characteristics, flight performance, and hardware integrity. Other tests utilized simulants in lieu of binary precursor chemicals.

To insure the adequacy of the simulant testing, 17 simulants were evaluated and 82 firings were conducted to validate the simulant technology. To correlate the simulant testing and demonstrate the binary concept for GB nerve agent, 340 reactor tests of scaled-down 155mm projectiles and 43 full-scale tests were conducted in an environmental controlled chamber. Of these, 347 tests utilized the actual binary precursor chemicals to produce GB nerve agent. These tests demonstrated that formation of GB from binary precursor chemicals was highly reproduceable, predictable, and efficient. In addition, one full-up M687 round with actual binary components was fired, the results of which conclusively demonstrated that the simulant and other testing measures used accurately demonstrated the designed weapon results.

How would you comment on that?

Mr. MESELSON. I would say the Army has done almost as good a job as can be done in testing a weapon without field tests. That is using simulants. The adequacy of this test program has been reviewed by a panel, convened by the Army, made up of Dr. George Abrahamson of Stanford Research Institute, Dr. William Burke of Arizona State University, the world-famous chemist Dr. Henry Eyring, Dr. Max Garbuny of Westinghouse Research Laboratories, and Elihu Grossmann of Drexel University.

In their conclusions they state:

It should be realized that this alternative——

which means production without field testing—

Severely weakens the deterrent value of the munition and sets the precedent for stockpiling ordnances not fully field tested and it produces unnecessary uncertainty in army planning.

Further:

Field tests of the 687 with GB must be undertaken before it can be regarded as a proven round. Without such tests, serious questions on dissemination effectiveness and particularly on flashing characteristics will be unanswered. To be of greatest value to the 687 program, the field tests should be undertaken as early as possible.

And further:

No matter how similar simulants may be to GB in their physical characteristics, there can never be one-to-one correspondence of the chemical species presented at burst. Hence, without a statistically significant number of test firings, there cannot be absolute confidence in the performance of a round.

I do not have any information that would lead me to believe that any of the panel members reviewing the information have changed their views. I know that it is the Army's publicly stated view now that the

testing has been adequate. I do not, however, believe that even the current Army officials responsible for this program would deny the great value to the development of adequate information about this round of field testing. I am rather confident in predicting they will ask for such field testing. I doubt advisers who have advised them in the past about the necessity of doing and the desirability of doing it before making the rounds have changed their views, although I haven't corresponded with them in that regard.

M121/121A1 GB 155MM PROJECTILE

Senator BUMPERS. On the other side of the coin, let me ask you to comment on this statement. The Army does not have a high degree of confidence in the reliability and functioning of the current unitary M121/121A1 GB 155mm projectiles because they have not been test fired/certified since the 1960's. In this regard, the current surveillance program indicates that the agent is being degraded due to munition/agent age and the structural integrity of the metal bodies is questionable because of possible deterioration of the metal components.

Mr. MESELSON. There are two issues there. One is that with the binary we are talking not only about questions of purity and so on, we are talking about the actual concept of the weapons. The concept of the single-fill has been tested in thousands of test firings in the field. The concept worked. During those tests, I should say, there were many design changes, even though that concept is a very simple one. The binary is not a simple one.

Beyond that, the question of so-called deterioration—what you have just read to me I find very discouraging. I assume that the individual who wrote that knows full well that the evidence of deterioration he is talking about is not in the weapons at issue.

The Army has just completed a series of tests on all lots of nerve gas and mustard agent in the present stockpile. There are four code categories, A, B, C and H. H means a candidate for demilitarization. A means issuable without limit of time, without restrictions. Every single lot of VX and GB nerve agent and of mustard in 155 and 8-inch rounds, heavy artillery rounds, which is what we are talking about here, is not code category H, it is not even C or B; it is A. Now, there are some other kinds of munitions which are B and C which are still issuable. Category B and category C are still issuable. But it is not true of the munitions at issue.

There is over and over again, I find, a game being played here which is to confuse either out of ignorance or deliberately one thing with another. This is a perfect example of that kind of confusion.

Senator BUMPERS. I spent a day in Pine Bluff a couple of weeks ago and it was a very interesting briefing. It was a very interesting day. I don't have to tell you how concerned I am about this whole issue. But what you are saying and the information I have been getting from the Army is at considerable variance. You seem to have the best credentials on your side of the aisle on this issue.

I am going to ask the chairman if we might have a closed executive session here and let you and the Army just debate. Let them make their statement, you refute it, and vice versa. I would like to hear a good debate between you and possibly your colleague and the Army. I hope that can be arranged, because I would like to see a faceoff on the issue. We are obviously getting two different kinds of information.

Mr. MESELSON. I think that is a marvelous suggestion. I think it is the only way to resolve some of these questions.

COMMITTEE RECESS

Senator BUMPERS. With that, we will stand in recess until 2 tomorrow afternoon.

[Whereupon, at 4:40 p.m., Wednesday, May 5, the committee was recessed, to reconvene at 2 p.m., Thursday, May 6.]