Appendix C
Summary of the Chemical Weapons Workshop

To investigate the feasibility of developing alternative technologies and approaches to chemical weapons (CW) destruction, OTA conducted a l-day workshop on February 24, 1992. The workshop explored approaches to implementing such a development program if that policy was adopted. The participants were selected from private and public institutions with background and experience in research, development, and demonstration of innovative technologies in the fields of both waste treatment and chemical processing. The agenda was set to first give some history of the current program, to discuss the key obstacles to implementing the technology now under test, and then to discuss ideas for the creation of an alternative, and possibly concurrent, plan.

It was noted that public acceptance problems are seriously affecting the U.S. Government's ability to efficiently and effectively establish incineration facilities at the eight sites and successfully destroy the stockpile of obsolete weapons as directed by treaties and domestic laws. Until these problems are overcome, it is likely that delays will continue and added costs will mount. Some believe that the public acceptance problem, in particular, will prevent incineration facilities from being built and operated in the foreseeable future at some, if not most, of the depot locations.

OTA staff had concluded and the workshop participants agreed, that none of the alternatives to the current Army program, that have been proposed by various individuals or groups, could be expected to be available soon for destruction of the weapons stockpile. Rather, each is in some early stage of development where it must undergo substantial integration with a larger system and testing or field demonstrations before it could be considered acceptable. Further, the process for supporting the development and testing of alternative technologies and systems is limited. While some firms and individuals have proposed alternative technologies that are promising, none have been tested with actual chemical agent and most only address a part of the total weapons destruction system (usually the treatment of the agent itself) and thus must be considered as only part of the total solution.

Because any alternative technology would need to be further developed and tested, the workshop participants discussed how a development program should be structured, how certain promising technologies might be selected for further development, what criteria would be selected for judging the acceptability of new technologies, what other factors need to be considered, and what time and resources would be required. The following is a summary of the points made during these discussions.

An important conclusion of the workshop was that, even though a technology (namely, incineration) may be viewed by the government as the "technically best" or "most available" (or even, as in this case, the "only available' '), it may nonetheless be necessary to develop alternative technologies for possible use at some of the sites because some of the communities will not accept the chosen solution. Even though current deadlines established by law and government policy may, in principle, not allow enough time to develop alternatives, much more time is likely to be available when public opposition delays the implementation of the current technical approach. However, workshop participants noted, it's important that the government doesn't make the same mistakes in developing alternative technologies as it did in picking the current one. That is, it mustn't be done in a process closed to the stakeholders and interested parties. Thus the ***process*** of developing a possible alternative technology will be as important as the pure technical solution itself. The process must involve the public early and continuously and must provide for meaningful public input to the decisions that are made.

Congressional concerns about the current program and its chances for success were discussed by workshop participants. Four committees in Congress have authority over the Army's Chemical Demilitarization program: Senate and House Committees on Appropriations (Subcommittee on Defense), and the Senate and House Committees on Armed Services. These committees do not all agree about the proper direction of this program, but its cost is becoming an increasingly important issue to all. Some feel that the eight sites where incinerators are planned are somewhat politically isolated-' 'them against the world. '

Implementation of an alternative technology development program may require a new, neutral institution other than the Army to administer it. Some participants believed that a location should be designated, probably by Congress, where new, competing technologies could be tried. An example might be to use a portion of the Johnston Atoll chemical Agent Disposal System facilities at Johnston Island, although the possibility of site contamination with agent would have to be evaluated. This facility is already designed to handle the CW munitions and agents.

National Research Council (NRC) activity was also discussed at the workshop. The NRC has a Committee on Alternative Chemical Demilitarization Technologies, under the Board on Army Science and Technology, chaired by John Longwell (MIT) and Gene Dyer (Bechtel). The committee plans to review all proposals for alternative technologies and to identify the most promising ap-

preaches. It will ask the scientific and commercial community to come forward and present their ideas. The committee will characterize the alternatives, enumerating their strengths, weaknesses, potential advantages and disadvantages, and needed research. It is possible that these NRC committee activities will become beginning steps of new national alternatives for CW destruction program, even though this is not the intention now. The NRC expects to develop a data bank to which others will have access. The OTA workshop participants suggested that the NRC also deal with the key issues of public participation in its work. However, its position as a purely scientific body may make this difficult.

The NRC committee considers that an alternative technology must have application to one or more of the four process streams currently used to destroy agent and munitions. Considering the sites, and the nature of the chemical stockpile located therein, it's possible that one or more alternatives (in combination) could apply. Whatever the case, a total working system is required in the end, and the system eventually developed must be the result of a series of reevaluations and corrections. Workshop participants agreed that only after integration and conceptual system design is done will it be possible to compare the merits of alternatives to the current system. It is very difficult, as well, to compare technologies that are in early stages of development. Usually more design, testing, and evaluation work is needed before valid comparisons are made and NRC does not have the resources to do this.

During discussions of public participation and alternative technology criteria, workshop participants agreed that different solutions may be appropriate for different sites or different weapons. The Army and concerned citizens would need to work together on establishing site-specific solutions if that approach was followed. Such public participation is crucial to acceptance of a solution: merely an explanation of risk to the public is generally ineffective. Participants all stated that the development of a new technology is more than just a technical problem, and the nontechnical community must be involved in a successful program.

A common nontechnical community position is that the technical community does not have the right to impose any risks on the affected public. The problem is that the U.S. public is unwilling to accept any risk that they did not consent to. The criteria for a new technology are only partially technical, and also involve managerial, legal, and other nontechnical aspects that all must be addressed for a successful program. A critical point is that the developers of the new technology need a very clear concept of the needs and concerns of the people who will be affected by the new technology. Workshop participants felt the current Army program lacks this concept.

Workshop discussions led to the conclusion that without local involvement most projects involving 'waste disposal" are likely to be vehemently opposed. However, this may or may not change with community involvement. In addition, the agenda of national groups may be different than that of local groups and probably should be handled differently. With regard to the Army's CW destruction program, most believed that alternatives should be developed—the only question is how. The Nation's ability to carry this out will reflect on its ability to function as a technical society in the next century.

Workshop participants also discussed the role of contractors. Contractors are a key interested party that should be involved in planning the development of new technologies. Contractors also have their own agendas and preferences. The contractor community also needs to know, and factor in, the political realities, i.e., general unpopularity of incinerators. Although the CW disposal program will require oversight from government agencies, the design and implementation will probably come from private industry. The Environmental Protection Agency (EPA) is developing a computer database on available vendors and technology for alternative technology development in a number of waste treatment areas. Most believe that we need some model on how to commercialize a technology in order to move ahead in this field.

Some workshop discussion focused on the fact that good ideas from small companies often have a difficult time penetrating the Federal procurement system. These companies will need assistance to do this effectively. The small developers of new technologies typically have annual revenues of a few million dollars and are not capable of financing major development and testing. Small companies are often willing to try new solutions for relatively very small amounts of money. However, small companies often lack a necessary understanding of the whole system. A second concern of small companies is their need to protect ownership of new, innovative ideas that they consider proprietary.

A suggested model by some workshop participants was to offer a national prize for the best solution to this problem. This would not necessarily be to invent a totally new process but rather to work out the technical details of currently available techniques. It could have the effect of turning loose competent engineers to work on the problem. Possibly it could be a joint project with unemployed Soviet scientists. A disadvantage to this idea is that small companies may not be able to participate as well as large ones.

The university consortia concept was another suggestion discussed as a mechanism to develop alternatives. EPA has developed such consortia with five universities receiving $5 million over 5 years. EPA feels that the

universities are bringing new ideas to the stage of bench-scale testing in about 3 years.

Workshop discussion of regulatory issues affecting the implementation of a new technology concluded that these issues should be anticipated at the earliest stage, rather than waiting until the last minute to worry about them. Many development programs do not include regulatory issues until they are ready for field trials, and then projects are surprised by the delays they encountered. Some regulations are developed purely as a means to thwart an unpopular technology. It would be worthwhile to learn from the Army's experience about the regulatory issues it has had to deal with in its current program. In the end, regulatory issues can make or break a technology.

A key criterion for the development of new technologies is meeting appropriate standards. This will apply to levels in air, liquids, and solids. Different alternative technologies will require different disposal criteria. For example, certain processes may provide less decontamination for CW containers and it will be necessary to understand how to integrate regulatory standards early in the development process.

Substantial workshop discussion focused on time constraints for the Army's Chemical Weapons Demilitarization Program. The time issue is critical in alternative technology development planning. One approach to an alternative program could be to try and find mid-term corrections for the Army's current system, e.g., replacing some or all of the incinerators with some other method but keeping everything else. Another would be to start over with an entirely new system. The impact on the Army's current program clearly will be quite different with these two approaches. A sense of time constraints will also dictate where a new program can begin. For example, if lots of time is available then a new program could afford to begin in the laboratory; if less time is available then a new program would probably be forced to consider only existing bench-scale technologies or technologies already tested in related areas. In addition, it maybe premature to try and be definitive in estimating the time required for successful completion of the Army's current program. Technical and regulatory hurdles faced by the program may delay it more than what has been estimated. Replacing incineration with some other CW agent treatment technology at this point could be considered by some a ''mid-term' modification.

Most workshop participants agreed that a clear analysis of time constraints is required. This should include an analysis of the costs of delay, the risks of delaying, the degree of uncertainty and other factors, and how to evaluate them.

Workshop discussions explored examples of analogous alternative technology programs. After the *Valdez* oil spill in Alaska, bioremediation companies saw the situation as a golden opportunity. One workshop participant explained the recent experience of the National Environmental Technology Applications Corp. (NETAC, see box l-D), which served as an evaluator for EPA and also put together a national committee that established technical and nontechnical criteria to evaluate hundreds of suggestions. This process narrowed the field to two alternatives that were eventually tested in the field. The tests involved importation of bacteria not indigenous to Alaska, despite the concerns of Alaska citizens. This was accomplished by incorporating public participation in the decisionmaking process and explaining the relevant technology to the public. A key to the success of this program was to initially develop a set of seven key criteria with public involvement for the evaluation of suggested technologies.

Another example given by a workshop participant was the alternative fuels development program, e.g., oil shale conversion. This is an example of a new technology that started from scratch. The Synthetic Fuels Demonstration program eventually produced six major demonstration projects, but the program eventually failed for financial reasons when the price of oil went down. Shale oil would have been competitive only if oil prices continued to go up, which they didn't. The lesson of this example is that a powerful national interest can significantly accelerate a program.

Discussions also included some history of incineration in the United States. Incineration was initially perceived as a panacea for waste treatment. As instrumentation got better and real experience was gained, unanticipated problems with incineration were discovered. A similar progression may be occurring today with bioremediation, which initially looked as a promising, benign method for handling waste. Today, people are beginning to ask about potential hazards from intermediates and byproducts of bioremediation processes.

Even though most believed that it is desirable and even essential to sponsor an alternative technology development program, workshop participants felt it important to understand the risks of such an effort. The prospects for success of an alternative program are not assured. There could always be a number of technical problems and delays associated with any development program. Failure of a technology or approach in a full-scale test is always possible. After even the best efforts to develop new technologies, it is possible that the results could be no better or even worse than the current system.

Therefore, if an alternative development program was supported it would not necessarily follow that the current program should be stopped. It may be possible to combine the best features of both programs in the future or it may be that current technologies will be superior to any alternatives in the end.

Workshop participants agreed that it is not clear whether future degradation of the weapons in the stockpile poses a significant threat and, thus, how this would affect decisions about time available for initiating destruction. An important issue, therefore, is a continuing program to evaluate stockpile condition and predict any future problems.