



**CITIZEN PETITION TO THE SECRETARY FOR HEALTH AND HUMAN SERVICES
AND TO THE SURGEON GENERAL**

Petition on Genetically Engineered Arthropod Vectors of Human Diseases

Submitted by: Center for Food Safety and the International Center for Technology Assessment

Date: November 26, 2001

EXECUTIVE SUMMARY

This Citizen Petition seeks comprehensive improvements in the way the United States Department of Health and Human Service (DHHS) regulates, analyzes, and funds the development of genetically engineered (GE) arthropods that are capable of vectoring human diseases. The Requested Actions include:

- The Surgeon General should promulgate robust, state-of-the-art regulations on the development and release of GE arthropods capable of vectoring human diseases; **currently no regulatory mechanism exists to govern such releases**. In addition, the Surgeon General should formally adopt a moratorium stating that permission to conduct limited or unlimited field releases of GE arthropods into the environment will not be granted until specific regulations are in place.
- The DHHS Public Health Service (PHS) should cooperate with the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) to draft parallel, coordinated regulations covering the development and release of GE arthropod vectors of animal diseases, such as mosquitos, which in many cases also are vectors of human diseases. APHIS should have primary regulatory responsibility for the animal health, environmental, and economic risks and PHS should have primary responsibility for human health risks and bioethics.
- The DHHS Secretary should require the Director of the National Institutes of Health (NIH) to promptly put a proposal before the NIH Recombinant DNA Advisory Committee to amend the NIH Guidelines to address foreseeably imminent field releases of GE arthropods, which prior to 1994 were governed by the Guidelines but now are not.
- PHS and NIH should strengthen compliance with the National Environmental Policy Act, including preparation of an Environmental Impact Statement prior to any field releases, as well as compliance with the Endangered Species Act, and Executive Order 13112 on Invasive Species.

If the DHHS continues its current *laissez-faire* approach, the potential for unfortunate mistakes by incautious investigators in the development and release of GE arthropods will be unacceptably high. **Indeed, lack of Federal oversight in this area translates into lack of knowledge to differentiate who is conducting legitimate work and who may be preparing for unregulated releases that pose potential bioterror threats in the form of more deadly vectors of human diseases.** The public safety, environmental, and ethical issues involved demand a prompt response. Further, significant support exists among the potentially regulated scientific community for the bulk of the changes requested herein.

Table of Contents

PETITIONERS.....2

BACKGROUND.....2

FIVE REQUESTED ACTIONS.....12

1. Adopt Robust Regulations for Genetic Engineering of Arthropods that are Potential Vectors of Human Diseases and Cooperate with USDA APHIS on Coordinated Regulations for GE Arthropod Vectors of Animal Diseases.....12

2. Amend the NIH Guidelines for Research Involving Recombinant DNA Molecules to Address Releases of GE Vectors of Human Diseases.....16

3. Commit to Enhanced National Environmental Policy Act Compliance for PHS and NIH Actions17

4. Commit to Formal Endangered Species Act Compliance for PHS and NIH Actions.....20

5. Comply with Executive Order 13112 on Invasive Species 22

APPENDICES..... 24

Appendix A - Hierarchy of Risks Associated with Release into the Environment of Genetically Engineered Animal Disease Vectors..... 24

Appendix B - Arthropods for which Transgenic Research has been Reported 24

Acronyms: genetically engineered arthropod vector of human disease = GEAVHD

genetically engineered arthropod vector of animal disease = GEAVAD

PETITIONERS

Petitioners are the *Center for Food Safety* (CFS) and the *International Center for Technology Assessment* (ICTA) and their undersigned individual members and officers. CFS and ICTA are non-profit, membership organizations located at 660 Pennsylvania Ave. SE, Suite 302, Washington, DC 20003. Petitioner CFS was established to address the increasing concerns about the impacts of our food production system on human health, animal welfare, and the environment. Petitioner ICTA is devoted to fully exploring the economic, environmental, health, ethical, social and political impacts that can result from the applications of technology.

Petitioners, together with their several thousand active members, have diverse economic, recreational, health, conservation, scientific, and aesthetic interests that will be negatively impacted if mistakes occur or unforeseen consequences result from the development and release of GE arthropods. Petitioners anticipate future co-sponsors for this Petition, who will be identified to the PHS subsequently.

BACKGROUND

Pursuant to the Right to Petition Government Clause in the First Amendment to the United States Constitution,⁽¹⁾ and the right to petition for new or amended regulations under the Administrative Procedure Act,⁽²⁾ the Petitioners respectfully submit this Petition to the Secretary for Health and Human Services and to the Surgeon General, seeking dramatic improvements in DHHS regulations, programs, and funding decisions related to GE arthropods.⁽³⁾

Arthropods constitute the most abundant group of multicellular organisms on earth - one of the oldest and the most diverse, with more than one million classified species.⁽⁴⁾ Arthropods are a leading cause of disease transmission to humans, domesticated and wild animals, and domesticated and wild plants. Mosquitos, in particular, transmit deadly diseases that kill more than 2 million people annually on the planet and sicken hundreds of millions more.⁽⁵⁾ Arthropods also cause massive crop and livestock damage, either directly or by acting as vectors for plant and animal pathogens.

On the positive side, arthropods constitute basic building blocks of natural food chains and are critical to many ecological processes, such as decomposition of organic matter, providing ecosystem services of incalculable value. Some, such as honeybees and other pollinators, are essential for agriculture and for wild plant pollination. Native arthropods also provide immense scientific, aesthetic, and recreational benefits. Unfortunately, at least 54 U.S. arthropods are listed as threatened or endangered under the Endangered Species Act.⁽⁶⁾ Many others are proposed or likely candidates for listing in the future.

Much current genetic engineering research focuses on altering harmful arthropods, especially mosquitos, to protect humans from diseases, such as malaria; other genetic engineering research seeks ways to protect domesticated plants and animals from damage caused directly by arthropods or by the pathogens that they vector.⁽⁷⁾ While these enterprises have laudable goals, responsible regulators must anticipate that some users of this technology may, in fact, have evil designs. No other known pathogen delivery system surpasses mosquitos. **Lack of Federal**

oversight has led to unnecessary ignorance regarding experiments that could create mosquitos genetically modified to be more, rather than less, effective vectors. The genetic transformations required likely are similar and the equipment and technical requirements are neither prohibitively sophisticated nor expensive. As the techniques are refined and explained through published literature, they become more accessible to potential bioterrorists.

Raising the bioterror/biotechnology link here is not meant to be opportunistic. The link was made clear in Sept. 5, 2001, Congressional testimony by one of the nation's leading bioterror expert to the United States Senate Committee on Foreign Relations. Donald A. Henderson, then the Director of the Center for Civilian Biodefense Studies at The Johns Hopkins University, stated, in pertinent part:

A key reason for being concerned about biological weapons is the remarkable progress now being made in biotechnology and genomics research.....But, as the understanding of molecular biology increases and as we develop the ability to manipulate cellular processes, we are also creating the tools and knowledge for building more powerful and more diverse weapons. When we discover why a particular virus or bacteria is especially virulent or why it has become resistant to antibiotics, we create an opening for building a new drug or a new vaccine. At the same time, we facilitate the creation of tools needed to build more virulent weapons.⁽⁸⁾

Dr. Henderson's quote above plainly calls for extra vigilance to ensure that biotechnology - such as fundamental engineering of disease vectors - is not converted to bioterror.⁽⁹⁾ Secretary Thompson recently named Dr. Henderson as the Director of the DHHS' new Office of Preparedness.

Extra vigilance is also needed for reasons originating on the other end of the spectrum, that is, to keep the enormous attractiveness of actually conquering the scourge of malaria - "Our Holy Grail" according to a prominent researcher - from blinding participants to the potential impacts of the technology.⁽¹⁰⁾ A race is underway with the lure of a Nobel Prize for Medicine to the winner. This pressure may cause shortcuts in safety and bioethics.

This Petition addresses a topic of intense public interest. The real prospect of deliberate or accidental releases of novel engineered mosquitos in a *laissez-faire* regulatory climate raises highly symbolic as well as practical issues. This would be the first U.S.-developed GE animal **of any kind** released into the wild, outside of a controlled agricultural setting. Major newspapers - the Wall Street Journal, USA Today, and the Washington Post - have published well-researched feature stories on the regulatory gaps detailed below.⁽¹¹⁾ In those articles, several scientists who themselves are developing GE arthropods went on record criticizing the lack of scrutiny by the Federal government.

Serious environmental and health risks are involved that must be formally analyzed.

It should be plain from the cautionary quotes from scientists throughout this Petition, that serious environmental and health risks may be associated with GE arthropod releases. In the words of the former leading APHIS scientist in this field, Dr. Orrey P. Young - who fully recognizes the potential benefits - this area is "*fraught with many dangers.*"⁽¹²⁾ Altering fundamental traits in

free-ranging insects such as fecundity, sex ratio, habitat preference, pesticide resistance, temperature tolerance, and vector competence may cause unforeseen, unintended, and undesirable consequences. Dr. Young created a draft hierarchy for APHIS of the potential risks of GE animal disease vectors, many of which also vector human diseases (attached hereto as Appendix A). The risk categories include, for example: "direct human impact," "spread of the engineered characteristics to species other than the target vector," and "alteration of ecological community."

Fully assessing such risks for particular proposals may require consideration of lengthy time periods - perhaps hundreds of arthropod generations during which evolutionary selection may occur - projected across a vast array of ecosystem and genetic contexts. A leading arthropod biotechnology researcher stated (emphasis added):

*Many questions need to be answered before we can safely release transgenic arthropods into the environment... What is the probability that the transgenic insects (released into the environment) will create future environmental problems? Will transgenes inserted into insects somehow be transferred horizontally through known or currently unknown mechanisms to other species to create new pests? Can we develop mitigation methods or techniques for retrieving transgenic insects from the environment after their release should they perform in unexpected ways? The issues surrounding potential risks **will require both researchers and regulatory agencies to accept new responsibilities....***⁽¹³⁾

The PHS cannot deny the serious potential human health risks at stake. Harvard epidemiologist Andrew Spielman and his colleagues, after a thorough review of the health-related ramifications, stated:

Although, clearly, the deliberate release of hematophagous arthropods into a site rife with vector-borne human infections would be designed to improve human health, such a release may also threaten well-being, both in the short and the long term. The released organisms or the first few generations of their descendants might themselves cause human annoyance or transmit agents of disease. More fundamentally, the disease burden might be exacerbated until the desired health effects were accomplished, but only temporarily. Another possible consequence is a resurgence of the disease should the manipulation not be sustained in the population.⁽¹⁴⁾

Another expert, Dr. Luke Alphey of Oxford University, stated that genetic engineering of a whole species of mosquito is too risky. He is on record as saying, "One of my concerns is that once you've let such a thing go, you can never recall it."⁽¹⁵⁾ In other words, this technology lacks the transitoriness of other technologies that pose environmental impact risks, such as chemical spills. Human-made biological pollution literally could become part of the landscape we pass on to our descendants.

Recent outbreaks such as the West Nile virus show that U.S. borders are porous to new mosquito-borne infectious diseases, which originate mostly from warm latitudes. Global warming likely is expanding the range of many dangerous mosquitos, such as the Asian tiger mosquito (*Aedes albopictus*), and has been identified as a new force in mosquito evolution.⁽¹⁶⁾

Making reliable long-term predictions of the potentially global range of human-released GE forms of such mosquitos will require very sophisticated analyses.

The National Institutes of Health are on record acknowledging unacceptable regulatory confusion.

The NIH is not a regulatory body. However, it has a well-known policy to deny grants to investigators, and their institutions, who do not follow the NIH Guidelines for Research Involving Recombinant DNA Molecules (Guidelines Sec. I-D). NIH is funding at least two GE mosquito research projects directly: 1) "Transgenic Engineering of Aedine Mosquitoes," NIAID/Univ. of Notre Dame (Malcom J. Fraser); and 2) "Novel Approaches for Malaria Control," NIAID/Univ. of Notre Dame (Marcos Jacobs-Lorena).⁽¹⁷⁾ Neither project proposes field releases *per se*, but the NIH abstracts for both do tout field releases for disease control as the ultimate end for the knowledge generated.

The NIH Guidelines state that once investigators have the necessary approvals from other Federal regulatory agencies "... the experiment may proceed without the necessity for NIH review or approval." (Guidelines Sec. I-A-1). Thus, in the event of a proposed field release, NIH officials would need to determine whether investigators are in fact so regulated and have the necessary "other agency" approval. The problem is that NIH officials are confused over what regulations other Federal agencies actually have in place. This is evident in direct quotes from internal documents obtained through the Freedom of Information Act (FOIA). Petitioners below excerpt and emphasize key statements in these NIH records.

On which agency has authority over what:

Kate Aultman, Program Officer, NIH, National Institute for Allergy and Infectious Diseases (NIAID):

It is my understanding that USDA APHIS already has regulatory jurisdiction over transgenic insect vectors of animal disease. They want to extend their authority to vectors of human diseases.....As I understand the Coordinated Framework document, the USDA APHIS regulates transgenic arthropods per se...⁽¹⁸⁾

Kate Aultman, Program Officer, NIH, NIAID:

Limited field releases are covered by various agencies, depending on several factors. While these regulations exist, there are gaps. The Office of Science and Technology Policy is addressing these, in the context of the Coordinated Framework.⁽¹⁹⁾

On whether regulatory coordination with USDA and other agencies has occurred:

Gene Rosenthal, NIH Office of the Director:

There was a meeting among NIAID, EPA, USDA, and others ?, but no one from this office (we were invited, but did not respond). Dr. Altman (sic) indicated the meeting was not very

productive.... [from attached earlier email:]Given the likelihood of field trials, however, the issue of what agencies have purview still needs to be addressed at some point.⁽²⁰⁾

These records demonstrate that key NIH officials assume that APHIS regulates GE arthropods "*per se*," when in fact, APHIS has no statutory authority to do so. The records also show that attempts in 1999 to coordinate with APHIS to clarify this situation were not "productive."

The statement in the second Aultman email (Mar. 30, 2001) that "while regulations exist, there are gaps" is flat wrong as to "regulations." The only APHIS regulations on GE arthropods address pests of plants.⁽²¹⁾ No regulations exist regarding GE disease vectors (animal or human), only "gaps." Further, the reliance in the second Aultman email on the White House Office of Science and Technology Policy (OSTP) to resolve the gaps is misplaced.⁽²²⁾ The OSTP Case Studies on Biotechnology Regulation she refers to was an initiative of the previous Administration that failed to reach fruition, has never led to any policy recommendations or changes, and appears to have been abandoned by the current Administration. The lengthy OSTP Case Studies only addressed GE arthropods in a half-page "sidebar" that was conclusory, lacking in rigor and comprehensiveness. That sidebar said nothing regarding Federal authority over GE arthropod vectors of human diseases (GEAVHDs). The sidebar did concur, however, in the lack of regulations to address GE arthropod vectors of animal diseases (GEAVADs). Ms. Aultman's statement that OSTP will resolve the gaps represents wishful thinking at best.⁽²³⁾

Recent statements from USDA APHIS indicate it lacks the statutory authority to regulate deliberate releases of GE arthropods.

As indicated, NIH has relied on APHIS' authority to address GE arthropod releases, eventually to be done through detailed regulations. Indeed, APHIS is clearly on record in the past as claiming to have such authority, at least with respect to GEAVADs. However, recent statements from APHIS indicate that it has now taken a cramped view of its own statutory authority (A. Morgan, Assoc. Dir., APHIS Vet. Services, pers. comm.).⁽²⁴⁾ This view is that APHIS' authority over GEAVADs (including those that are also GEAVHDs) is limited to international import and interstate transport. In other words, APHIS now denies authority to promulgate regulations for deliberate releases of any GE arthropods within one State.

Petitioners disagree with APHIS' newly stated view of its own authority limitation, and have separately petitioned APHIS to promulgate protective regulations for deliberate releases. If, however, APHIS continues to refuse to regulate such releases, the need for PHS to do so is even greater.

The NIH Guidelines for Research Involving Recombinant DNA Molecules are inadequate.

The NIH Guidelines are not regulations and do not apply broadly. Any private scientist or research institute working without Federal funding is free to ignore the NIH Guidelines. No other current PHS regulations apply to releasing GEAVHDs.

Further, the NIH Guidelines do not cover the potential health, environmental and other impacts associated with field releases. A search through the Guidelines reveals they are devoid of any

protocols for investigators to follow to assess and to minimize negative impacts of deliberate GEAVHD releases or to mitigate those impacts that cannot be minimized. This was acknowledged by NIH Biotechnology Program Advisor Thomas Shih, who stated:

I agree that the term 'deliberate release' was probably used in earlier versions of the NIH Guidelines when it still had the oversight over environmental release. Since EPA and USDA assumed the regulatory authority of environmental release of genetically modified organisms sections of the current NIH Guidelines pertaining to such issues were deleted, therefore no other sections of the current NIH Guidelines have such terminology.⁽²⁵⁾

Mr. Shih's justification for the elimination of the "deliberate release" category from the Guidelines is wrong and dangerous on two counts: 1) neither EPA nor USDA has regulatory authority in place that would govern proposed GEAVHD releases, and 2) USDA in particular is unqualified to assess the public health impacts or bioethics aspects of GEAVHD releases. The EPA may be better qualified than USDA, but EPA is simply not in the business of broadly regulating GEAVHDs. It has no statutory authority, no regulations, and no program to do so. Only the PHS has the statutory authority and the qualified personnel to implement enforceable public health protections in this area.

A key case study shows that the PHS has refused to exercise regulatory authority.

These matters came to a head in 1999, when Dr. David O'Brochta of the Biotechnology Institute at the Univ. of Maryland, in his own words, "tried hard" to get guidance from the two involved agencies regarding the interstate movement of GE mosquitos (*A. aegypti*) that he and his colleagues were developing (D. O'Brochta, pers. comm.). Neither APHIS nor PHS had a regulatory process in place, and neither agency could tell him what steps to comply with. While the PHS maintained its head-in-the-sand approach, abstaining from any regulatory action, APHIS eventually issued him an *ad hoc* courtesy permit for the movement. Internal communications by the lead APHIS scientist described the regulatory situation as "precarious" and admitted "we have no procedures in place to accomplish this."⁽²⁶⁾ Later, Dr. O'Brochta publicly stated:

It's time for the federal government to give us guidance, but no agency is willing to claim authority.⁽²⁷⁾

This authority has yet to be articulated by either agency almost three years later.

Proposals to release GE arthropod vectors of human diseases are foreseeably imminent.

A September, 2001, *Los Angeles Times* article on GE mosquitos includes claims by Univ. of California at Irvine geneticist Anthony James that he "is certain he and his competitors 'have all the pieces now'."⁽²⁸⁾ Dr. James is "driven by the competition to make the first, and then the best, new mosquito." According to the article, Dr. James' work "...should be finished in about a year...[then] a field test would be proposed immediately to determine whether the new mosquito could thrive in the wild." However, Dr. James has informed Petitioners that the article was incorrect and that actually three to five years of further lab work to meet risk assessment criteria

is expected (A. James, pers. comm.).⁽²⁹⁾ A different article quotes another vector biologist, Dr. Andrea Crisanti of London's Imperial College, to the effect that GM mosquito releases may occur soon. Commenting on whether proposed releases are expected within five years from 2001, as had earlier been claimed, Dr. Crisanti reportedly said: "Progress has been incredible in this field and probably it may take less time."⁽³⁰⁾

Whether one, three, or five years, the foreseeable problem again is that no Federal agency has a process in place under which such a GEAVHD release proposal would be governed or risk assessment criteria defined and enforced. No transparent process exists that is open to formalized expert and public comment and that requires decisions to be based on a reviewable record.

Appendix B, a document from APHIS' files, should dispel any notion that these concerns are limited to Dr. James' mosquitos. Entitled "Arthropods for which Transgenic Research has been Reported," it lists 32 individual species or larger taxa reported as of 1999. These include 15 direct plant pests, 4 indirect plant pests, 5 animal pests, 6 disease vectors, and 2 miscellaneous pests. The 6 human disease vectors are:

Mosquitos -*Anopheles gambiae*, *A. aegypti*, *A. triseriatus*

Ticks

Housefly - *Musca domestica*

Assassin bug - *Rhodnius prolixus*

Undoubtedly more GEAVHD development has occurred in the two years since APHIS compiled this list. The Petitioners have sought up-to-date information on this directly from the PHS through FOIA requests, but to date two of three PHS agencies have failed to produce any documents.⁽³¹⁾

Nothing can justify or excuse the failure to apply the highest standards of scientific scrutiny to novel arthropod development and release projects, which may affect not only public health, safety, economic, and bioethics interests, but also may alter basic ecosystem processes, indeed, may alter the course of millions of years of evolution. The DHHS, the responsible Federal department, simply cannot abstain from regulating imminent releases of this potential magnitude. For these reasons, **Petitioners request the PHS and NIH to promptly undertake the following five remedial actions**, each of which is reasonable, necessary, and carefully tailored to the problem.

FIVE REQUESTED ACTIONS

1. Adopt Robust Regulations for Genetic Engineering of Arthropods that are Potential Vectors of Human Diseases and Cooperate with USDA APHIS on Coordinated Regulations for GE Arthropod Vectors of Animal Diseases.

A. Statutory Authority

The Surgeon General has statutory authority over vectors of human diseases. 42 USC § 264(a) provides:

Sec. 264. Regulations to control communicable diseases

(a) Promulgation and enforcement by Surgeon General.

The Surgeon General, with the approval of the Secretary, is authorized to make and enforce such regulations as in his judgment are necessary to prevent the introduction, transmission, or spread of communicable diseases from foreign countries into the States or possessions, or from one State or possession into any other State or possession. For purposes of carrying out and enforcing such regulations, the Surgeon General may provide for such inspection, fumigation, disinfection, sanitation, pest extermination, destruction of animals or articles found to be so infected or contaminated as to be sources of dangerous infection to human beings, and other measures, as in his judgment may be necessary.

B. Argument: Promulgate Regulations Under the Surgeon General's Statutory Authority, in Coordination with USDA APHIS.

The Surgeon General's statutory authority is broad enough to cover not only international imports and deliberate interstate movements of disease vectors, but also intrastate actions such as deliberate releases. Legal, epidemiological, and ecological knowledge developed over the last 100 years makes clear that responsible regulators can and should treat the deliberate release of a vector of a communicable disease in one State as potentially affecting other States and interstate commerce. Unconfined arthropods and pathogens do not respect State lines. In the key legal case on this point, the human disease risks posed by the intrastate activities of a pet turtle dealer were ruled by the Court to be subject to regulation under 42 USC § 264(a) due to the causal connection between the intrastate activity and interstate commerce.⁽³²⁾

The Surgeon General has failed to act under his authority in the manner called for both by agency scientists and numerous outside experts, that is, to: 1) issue appropriate regulations on the development and release of GEAVHDs; and 2) cooperate with USDA APHIS on closely coordinated regulations for GEAVADs. No PHS or APHIS regulation mentions GEAVHDs or GEAVADs. Put simply, the Surgeon General has not taken steps needed to prevent GEAVHD release experiments from "backfiring," leading to potentially worse communicable disease outbreaks or other problems. Further, he has neglected to monitor a potential bioterror risk.

Neither NIH funded nor non-NIH funded developers of GEAVHDs have any guidance from PHS as to what is required to conduct field releases. **Indeed, no Federal legal barrier exists to keep them from conducting completely unregulated releases into the wild in the United**

States. The public, law enforcement officials, and the scientific community have no trustworthy way to be informed about what is happening. They are deprived of knowledge required to differentiate who is conducting legitimate research and who may be conducting experiments that pose serious disease threats.

Petitioners already submitted a separate Petition, dated September 26, 2001, to USDA APHIS seeking issuance of new parallel regulations and other related actions for GEAVADs.⁽³³⁾ These changes must occur in coordination with the PHS actions petitioned for here for GEAVHDs, as in many cases they will need to address the identical GE arthropods and the same potential public health, environmental, and economic risks. If PHS approves release of a GEAVHD, it may also be a GEAVAD that by all logic should also have APHIS approval, and vice versa. In 1999, APHIS made some, admittedly "unproductive," attempts to coordinate with PHS and other agencies on needed regulations. This effort needs to be completed. APHIS should have primary regulatory responsibility for the animal health, environmental, and economic risks. The PHS should have primary responsibility for human health risks and bioethics issues. Dividing regulatory responsibility is common among Federal agencies. Protracted "turf battles" such as have occurred in the past are indefensible now in a "post-September 11" environment.

Responsible members of the potentially regulated scientific community - including PHS scientists - have been on record for several years supporting the need for a well thought-out regulatory scheme. Dr. Charles Beard of the CDC and his collaborators, who are developing GE and paratransgenic vectors of human diseases, wrote in 1998 (emphasis added):

*[T]he scientist developing a new agent must make an honest, imaginative leap into the future and try to predict any possible dangerous consequences - the responsibility for risk assessment must be shouldered by the scientist, together with the appropriate regulatory agencies....As the tools and methods that allow broader applications of this approach are developed, and actual products arrive at the point of field testing, **permitting and regulation will be required.***⁽³⁴⁾

A resolution of the American Mosquito Control Association, the leading organization of academic and regulatory mosquito experts, urges Federal agencies to develop guidelines for the release of GE forms. The resolution states:

[V]ector-borne diseases are complex natural systems in which the environmental, ecological, and genetic interactions that influence transmission dynamics are not completely understood....[R]esearch projects that involve releasing...genetically engineered vector strains...may also alter [disease] transmission dynamics in ways that are unanticipated and unpredictable.⁽³⁵⁾

Marjorie Hoy of the Univ. of Florida, who was the first U.S. scientist to field test a GE arthropod (an agricultural pest), stated that there are "gaps" in the system.⁽³⁶⁾ Dr. Hoy eloquently expressed the biological doubts that compel tighter Federal oversight:

At this stage, people are more focused on how to transform the genomes than they are on assessing the risks. The issues of concern have to do with the unknown properties of the organisms and the genes. The release of transgenic arthropods is risky unless we know more

about the basic biology, ecology, and behavior than we know today. What are the long-term effects? What are the effects on non-target insects? How will beneficial or endangered species be affected?⁽³⁷⁾

The responsible scientific community fears the public and media perception that proposed GE arthropod releases lack governmental oversight. They also fear this omission could lead to poorly-conceived releases by short-sighted or incautious investigators, ultimately resulting in backlashes against future releases in the form of litigation or drastic legislative reaction.

Based on all of the above points, little doubt exists that PHS must promptly act. Given that the Surgeon General's statutory duty to issue protective regulations, his failure to do so here would be arbitrary and capricious and an abuse of his discretion, in violation of the Administrative Procedure Act.⁽³⁸⁾

Finally, under 42 USC § 264(a) the Surgeon General also possesses the broad authority to take "*other measures, as in his judgment may be necessary.*" This would include imposing a moratorium on unregulated field releases pending adoption of detailed regulations.

Requested Action:

- i.** Adopt comprehensive regulations for the development and release of GEAVHDs. The new regulations should mandate a permit process incorporating state-of-the-art public health, environmental, and economic impact analyses, require independent bioethics reviews, and should provide for public meetings, including notice and comment periods, prior to permit decisions.
- ii.** Formally adopt a moratorium for GEAVHDs stating that permission to conduct limited field trials or unlimited releases into the environment will not be granted until specific regulations are in place. This is allowed under the statutory authority to take such "other measures" as are needed.
- iii.** Work with APHIS on closely coordinated, parallel regulations for both GEAVADs and GEAVHDs, which in many cases will be the identical organisms. APHIS should have primary regulatory responsibility for the animal health, environmental, and economic risks, and the PHS should have primary regulatory responsibility for human health risks and bioethics issues.
- iv.** Exhibit a high degree of public openness, including extensive outreach and information efforts, both for projects that PHS and NIH conduct and fund, and for those projects over the PHS has regulatory authority. Maintain a comprehensive website that documents all GEAVHD projects the PHS and NIH are involved in or fund, and all regulatory applications and actions.⁽³⁹⁾
- v.** Appoint an expert group to advise PHS on scientific issues related to the broad regulation of the development, release, and potential impacts of GEAVHDs.

2. Amend the NIH Guidelines for Research Involving Recombinant DNA Molecules to Address Releases of GE Vectors of Human Diseases.

The NIH Guidelines formerly addressed "deliberate releases," requiring review and approval by the relevant Institutional Biosafety Committee, the Recombinant DNA Advisory Committee (RAC), and the NIH Director. They were amended in 1994 to essentially drop all coverage of such releases.⁽⁴⁰⁾ As indicated in the Background section, above, the former Guidelines sections were dropped on the mistaken assumption that other agencies had authority in place to address releases. With respect to GEAVHDs, other agencies do not. Until coordinated APHIS/PHS regulations can be promulgated (which may take years), some requirements must be imposed on NIH funded researchers to mandate peer oversight, to ensure that bioethics guidelines are met, and to prevent potentially serious mistakes.

The other need for this requested amendment is geographic. Even if PHS and APHIS adopt regulations governing activities in the United States and its territories, they could not be enforced abroad. Then, NIH funded investigators and their institutions would have strong incentives to field test GEAVHDs in countries where regulatory oversight is non-existent or minimal. It would be wrong for NIH to allow projects to proceed under such conditions. No enforceable guidelines exist now to deter this "forum shopping" phenomenon.⁽⁴¹⁾

Requested Action:

i. NIH should promptly put before the Recombinant DNA Advisory Committee (RAC) the proposal to amend the Guidelines for Research Involving Recombinant DNA Molecules to address deliberate GEAVHD releases, citing the absence of regulation by other agencies. The amendment should mandate state-of-the-art public health, environmental, and economic impact analyses, and independent bioethics reviews, before any releases occur, whether in the United States or abroad.⁽⁴²⁾ The amendment also should reinstate the former requirement of review and approval by the Institutional Biosafety Committee, the RAC, and the NIH Director.

3. Commit to Enhanced National Environmental Policy Act Compliance for PHS and NIH Actions.

The National Environmental Policy Act (NEPA) is the cross-cutting statute that requires environmental impact assessment for all discretionary, non-excluded Federal agency actions.⁽⁴³⁾ Such actions include, but are not limited to, actions carried out directly by the agency, funding decisions by the agency, and regulatory decisions the agency makes.⁽⁴⁴⁾ Actions may be project-specific or programmatic in nature.

All Federal agencies are required to prepare a "detailed statement" (or EIS) regarding all "major federal actions significantly affecting the quality of the human environment . . ." ⁽⁴⁵⁾ To determine whether an EIS is required, Federal agencies generally must first prepare an Environmental Assessment (EA), that provides evidence and analysis to support the agency's determination on whether the impacts are potentially "significant." The Council on Environmental Quality (CEQ), which oversees NEPA implementation by Federal agencies, has

adopted regulations listing factors for determining the significance of an action. Those factors most applicable to novel GEAVHD proposals include:

- *the degree to which the proposed action affects public health or safety,*
- *the degree to which the effects on the quality of the human environment are likely to be highly controversial,*
- *the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks,*
- *the degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*⁽⁴⁶⁾

According to Court decisions, the "presence of one or more of these factors should result in an agency decision to prepare an EIS."⁽⁴⁷⁾ The PHS and NIH actions of funding, carrying out, or approving a proposed field release of a GEAVHD would invoke each of the listed factors and should compel the scrutiny of a full EIS. A recent rule provides promise that DHHS generally recognizes the potential impact of releases of new species. The Department's revised NEPA implementing regulations state that the following factor is to be considered in the process of deciding whether to prepare a full EIS:

The establishment of a species in or removal of a species from an environment may be significant.⁽⁴⁸⁾

Release and establishment of an arthropod species engineered to outcompete, replace, or otherwise broadly affect its non-engineered counterparts falls squarely under this statement.

If, as indicated previously in this Petition, no other Federal agency has regulatory jurisdiction over intrastate GEAVHD releases in the United States, then no other agency will have the obligation to conduct NEPA compliance. It will fall to the PHS and NIH through their oversight and funding nexuses.

Similar issues arose in the early 1980s in NEPA litigation over the initial NIH oversight and funding of releases of other GE organisms. In the seminal case, Foundation on Economic Trends et al. v. Heckler et al., the Court found NIH had failed to comply with NEPA, stating:

...NIH should give greater consideration to the broad environmental issues attendant on deliberate use of organisms containing recombinant DNA, and to its own responsibility for approving these deliberate release experiments.⁽⁴⁹⁾

Petitioners urge PHS and NIH to avoid a repeat of those legal difficulties by way of a formal commitment to taking the required "hard look" in a full EIS at the full scope of the potential impacts.⁽⁵⁰⁾

Finally, former Department of Interior Science Advisor William Brown recently criticized the minimal NEPA review of GE organism releases by Federal agencies generally, stating:

Review of environmental effects must be open to public scrutiny and comment. To do less flies in the face of public expectation for access and the fundamental precept of NEPA to provide public review of the environmental impacts of Federal actions.⁽⁵¹⁾

Dr. Brown also stated that the agencies that do not specialize in environmental matters - such as PHS and NIH - need to consult with the key conservation agencies on GE releases whenever such releases pose risks to native species. (This concern is not limited to listed threatened and endangered species, discussed in the next section of this Petition, rather, it includes impacts on biological diversity generally.) In particular, Dr. Brown called for "a memorandum of understanding or joint rulemaking" (and ultimately new legislation) to ensure the involvement of the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, as appropriate, in all such releases

Requested Action:

- i.** The PHS and NIH should commit to conducting NEPA compliance in the form of a full EIS prior to carrying out, funding, or approving a proposed field release of a GEAVHD, including maximum opportunities for input from independent experts and the public. This commitment should occur initially by formal policy directive and subsequently through a revision of the DHHS NEPA implementing regulations
- ii.** The PHS and NIH should pursue a memorandum of understanding (MOU) or joint rulemaking to ensure the involvement of the U.S. Fish and Wildlife Service or the National Marine Fisheries Service with respect to environmental impact and conservation issues (not limited to the Endangered Species Act) presented by GE arthropod releases.

4. Commit to Formal Endangered Species Act Compliance for PHS and NIH Actions.

Under the Endangered Species Act (ESA), all Federal agencies have the duty to avoid actions that may jeopardize threatened and endangered (T/E) species of wildlife. Sec. 7 of the ESA (below, in pertinent part) formalizes this duty:

Interagency cooperation.

(a) Federal agency actions and consultations.... (2) Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical.... In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available. (3)... a Federal agency shall consult with the Secretary on any prospective agency action at the request of, and in cooperation with, the prospective permit or

license applicant if the applicant has reason to believe that an endangered species or a threatened species may be present in the area affected by his project and that implementation of such action will likely affect such species. (4) Each Federal agency shall confer with the Secretary on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under section 1533 of this title or result in the destruction or adverse modification of critical habitat proposed to be designated for such species....

Parallel to the duty to comply with NEPA, PHS and NIH have a duty to consult and confer with the U.S. Fish and Wildlife Service (USFWS) under Sec. 7 with respect to T/E species that applies not only to individual projects that it may carry out, fund, or approve, but also to the programmatic actions they undertake.⁽⁵²⁾

If an agency action may affect listed T/E species or their critical habitats, then the agency must engage in a formal consultation and obtain a biological opinion, typically from the USFWS.⁽⁵³⁾ To adequately review the effects of the action, the agency must first provide the USFWS with "the best scientific and commercial data available" regarding the T/E species that may be impacted.⁽⁵⁴⁾ The USFWS must review this information, evaluate the status of impacted species, and then determine the direct, indirect, and cumulative effects of the action. If the action is likely to jeopardize a T/E species or adversely modify designated critical habitat, then the USFWS biological opinion must seek to identify reasonable and prudent alternatives.⁽⁵⁵⁾

Petitioners note again that at least 54 native U.S. arthropods are listed already as T/E species.⁽⁵⁶⁾ Also, at least four arthropods in foreign countries are listed under the ESA; actions carried out, funded, or approved by U.S. agencies that affect these foreign species also must be considered under Sec. 7. Further, almost 500 other U.S. animals and more than 735 U.S. plants, and more than 550 other foreign animals and three foreign plants are listed as T/E species. Many more species of all groups are proposed or likely candidates for future listing.

As a general matter, arthropods play vital roles in the food chains and habitats upon which T/E species depend. A commitment by PHS and NIH to undertake formal Sec. 7 consultation for all of their regulatory, funding, and programmatic actions with respect to GE arthropods will greatly increase the confidence of the scientific and conservation communities that potential impacts are not overlooked.

Requested Action:

i. Issue a policy directive committing PHS and NIH to consult formally with USFWS, or the National Marine Fisheries Service (NMFS) as appropriate, under ESA Sec. 7 for each proposed GEAVHD release regarding the potential effect on T/E species and their critical habitat. Prepare a MOU with the USFWS and NMFS on implementation of this commitment.

5. Comply with Executive Order 13112 on Invasive Species.

Leading GE arthropod investigator Marjorie Hoy, former Department of Interior Science Advisor William Brown, and many others have identified the potential invasiveness of GE arthropods and other GE animals released from confinement as a key concern.⁽⁵⁷⁾ Mosquitos are

well-know and dangerous invasives, various species of which in recent years have been transported to new habitats around the world, causing major public health and environmental impacts. An example: the Asian tiger mosquito (*A. albopictus*), an effective vector of several deadly viral diseases, was brought into Houston, Texas, in 1985 in imports of used tires and has broadened its range since to more than 22 States.⁽⁵⁸⁾

An important obligation rests on Federal agencies to take careful steps to avoid the introduction of harmful invasives (whether GE or non-GE), under Executive Order (EO)13112 of February 3, 1999 on Invasive Species. This EO, still in effect, provides in pertinent part:

Section 2. Federal Agency Duties.

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species;....

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

If any of the Federal agencies "authorize, fund, or carry out actions" that may create new GE invasive species, then they must adopt appropriate guidelines addressing the benefits and harms and laying out ways to minimize the harms. Virtually by definition all proposed GEAVHDs are intended to be successful invaders to accomplish their aim, that is, to invading populations and habitats of a wild disease vector, such as a mosquito, to alter the virulence of a pathogen it carries. Non-GE mosquitos already are high-impact invasive species; their genetic alteration obviously "may affect their status" under the terms of Section 2.a, above. Thus, the EO is invoked and PHS and NIH must comply with it.⁽⁵⁹⁾

Requested Action:

i. Comply with Sec. 2 of EO 13112 by adopting appropriate guidelines addressing the benefits and harms, and ways to minimize the risks, for all PHS and NIH actions that "authorize, fund, or carry out actions" that may create new invasive pests or that "may affect the status" of existing invasive pests. These new Guidelines should be coordinated with the amendment to the NIH Guidelines for deliberate releases of GEAVHDs, called for in Requested Action 2, above.

In closing, we observe that this issue is remarkable for the general consensus among outside observers and the potentially regulated scientific community that the Federal government needs

to make progress on regulatory and program improvements. We look forward to your earliest formal responses to each Requested Action in this Petition, and we ask to meet with you to discuss these issues personally.

Please promptly publish notice of this Petition in the Federal Register and create a formal open docket for it, or otherwise assign an identification number to it and communicate that to us, as we anticipate submitting future endorsements and supporting comments from other organizations and individuals. For further information, please contact Peter T. Jenkins, CFS/ICTA Attorney/Policy Analyst, at (202) 547-9359 ext. 13, or email: peterjenkins@icta.org.

Respectfully submitted,

Andrew Kimbrell

Executive Director

Joseph Mendelson, III

Legal Director

Peter T. Jenkins

Attorney/Policy Analyst

Center for Food Safety

&

International Center for Technology Assessment

660 Pennsylvania Ave. SE, Suite 302

Washington, DC 20003

APPENDICES

Appendix A - Hierarchy of Risks Associated with Release into the Environment of Genetically Engineered Animal Disease Vectors

Appendix B - Arthropods for which Transgenic Research has been Reported

1. "Congress shall make no law ... abridging ... the right of the people ... to petition Government for a redress of grievances." U.S. Const., amend. I. The right to petition for redress of grievances is among the most precious of the liberties safeguarded by the Bill of Rights. United Mine Workers of America, Dist. 12 v. Illinois State Bar Ass'n, 389 U.S. 217, 222 (1967). The Supreme Court has recognized that the right to petition is logically implicit in, and fundamental to, a republican form of government. United States v. Cruikshank, 92 U.S. (2 Otto) 542, 552 (1875).

Note that the two originals of this Petition have copies attached of pertinent publications and other documents cited in the footnotes herein, exclusive of regulations, statutes, and case law opinions.

2. 5 USC § 553(e).

3. Arthropods are invertebrate animals, such as insects, with jointed limbs and a segmented body with an exoskeleton made of chitin.

4. Marshall, A. 1998. The insects are coming. *Nature Biotechnology* 16:530-33.

5. O'Brochta, D.A., and P.W. Atkinson. 1998. Building the better bug. *Scientific American*, Dec., pp. 90-95.

6. Listed at 50 CFR § 17.11; for totals, see U.S. Fish and Wildlife Service. 2001. *Endangered Species Bulletin* vol. XXVI, no.1, p. 40.

7. See generally, Handler, A.M., and A.A. James (ed.s). 1999. *Insect Transgenesis - Methods and Applications*, CRC Press, Boca Raton, FL.

8. Testimony at Hearing on the Threat of Bioterrorism and the Spread of Infectious Diseases, available online at: www.hopkins-biodefense.org/pages/library/spread.html.

9. These points are reinforced in Fraser, C.M., and M.R. Dando. 2001. Genomics and future biological weapons: the need for preventive action by the biomedical community. *Nature Genetics* 29:253 - 256. The authors state: "There is an increasing concern within both the scientific and security communities that the ongoing revolution in biology has great potential to be misused in offensive biological weapons programs....In light of the September 11th tragedy, we can no longer afford to be complacent...."

10. A. Crisanti, Imperial College of Science, Technology, and Medicine, London, quoted in D'Antonio, M. 2001. Building a better mosquito. *Los Angeles Times Magazine*, Sept. 2.

11. Kilman, S. 2001. Buzz bomb: Bioengineered bugs stir scientific dreams, but will they fly? *Wall Street Journal*, Jan. 26, p. A1; Yaukey, J. 1999. Designer insects could boost (or sting) research. *USA Today*, Feb. 1, p. 6D; Kaufman, M. 2001. A glowing achievement, or a can of worms? Proposed field test of gene-altered cotton pest debated, *Washington Post*, Apr. 25, p. A1.
12. Orrey P. Young, former Team Leader - Arthropods, Biotechnology Section, USDA APHIS, memorandum to Terry Medley, USDA APHIS, dated March 10, 1998, obtained from APHIS files.
13. Hoy, M.A. 1999. Deploying transgenic arthropods in pest management programs: Risks and realities. In A.M. Handler and A.A. James, ed.s, *Insect Transgenesis - Methods and Applications*, CRC Press, Boca Raton, FL, at pp. 336-37.
14. Spielman, A., J.C. Beier, and A.E. Kiszewski. 2001. Ecological and community considerations in engineering arthropods to suppress vector-borne disease. In D.K. Letourneau and B.E. Burrows, ed.s, *Genetically Engineered Organisms: Assessing Environmental and Human Health Effects*, CRC Press, Boca Raton, FL, p. 316.
15. Quoted in Meek, J. 2001. Scientists to fight malaria with GM mosquitos. *Manchester Guardian Weekly*, Sept. 12, p. 3.
16. Alto, B.W., and S.A. Juliano. 2001. Temperature effects on the dynamics of *Aedes albopictus* (Diptera: Culicidae) populations in the laboratory. *Journal of Medical Entomology* 38:548-556; Bradshaw, W.E., and C.M. Holzapfel. 2001. Genetic shift in photoperiodic response correlated with global warming. *Proc. Natl. Acad. Sci.*, Nov. 6; [epublication ahead of print, online at <http://www.pnas.org/>.]; for a news report on that study, see, Recer, P. 2001. Scientists find that a mosquito has adapted to global warming. *Philadelphia Inquirer*, Tues., Nov. 6.
17. NIH grants No.s 1R01AI048561-01A1 and 5P01AI045123-030002, respectively. Petitioners believe that NIH-funded investigators and institutions also are conducting many more such GE arthropod studies but have not received requested information on them (see footnote 31 below).
18. Kate Aultman email to Debra Knorr, dated June 17, 1999, subject: request for meeting assistance, obtained from NIH files under FOIA.
19. Kate Aultman email to Aaron Zitner, dated Mar. 30, 2001, subject: GM arthropods, obtained from NIH files under FOIA.
20. Gene Rosenthal email to Amy Patterson et al., dated Jan. 24, 2001, subject: transgenic mosquitos, obtained from NIH files under FOIA.
21. 7 CFR § 340 - "Introduction of Organisms and Products Altered or Produced Through Genetic Engineering Which Are Plant Pests or Which There is Reason To Believe Are Plant Pests."

22. 2000-2001 OSTP/Council on Environmental Quality Case Studies of Environmental Regulation for Biotechnology (online at <http://www.ostp.gov/html/012201.html>).

23. OSTP is not a regulatory body, has no authority over Federal agencies, and has not committed to do further studies in this "gaps" area. Further, the staff member responsible for the Case Studies, Sharon Friedman, Ph.D., has since left OSTP.

24. The statute at issue is: 21 USC

§ 111 - Regulations to Prevent Contagious Diseases.

25. Tom Shih email to Gene Rosenthal and Debra Knorr, dated March 19, 1999, subject: Aultman - Tom, obtained from NIH files under FOIA.

26. Orrey P. Young, former Team Leader - Arthropods, Biotechnology Section, USDA APHIS, email to Craig A. Reed, Administrator, USDA APHIS, dated Apr. 1, 1999; subject: Animal Disease Vectors, obtained from APHIS files.

27. Quoted in Kilman. 2001, *Wall Street Journal* article cited above.

28. D'Antonio, M. 2001. Building a better mosquito. *Los Angeles Times Magazine*, Sept. 2.

29. The author of the L.A. Times article recently told Petitioners directly that the relevant portion of the magazine article was accurate, that no retractions or corrections had been sought, and that the article had been carefully fact-checked. (M. D'Antonio, pers. comm.)

30. Smith, J. 2001. "World's worst diseases face new foe: biotechnology," Reuters story of Nov. 12 on Environmental News Network, online at:

http://www.enn.com/news/wire-stories/2001/11/11122001/reu_disease_45542.asp.

31. Petitioners request immediate responses and fee waivers for Petitioners' FOIA requests to the Centers for Disease Control and Prevention (CDC), dated June 20, 2001, amended Aug. 22 (CDC reference No. 01-0753), and to NIAID, dated Aug. 14, 2001, amended Aug. 22. Petitioners have only received a limited response from the NIH Office of Biotechnology Activities in response to their request to NIH, dated June 20, 2001, amended June 29, 2001.

32. State of Louisiana et al. v Mathews et al., 427 F. Supp. 174 (E.D. Louis.1977).

33. Petitioners previously delivered a courtesy copy of that USDA APHIS Petition to the Assistant Secretary for Health/Surgeon General. (It is available online at: www.centerforfoodsafety.org under Latest Actions, under the link in the Press Release.) Also, Petitioners are submitting a courtesy copy of this Petition to the Acting Administrator, USDA APHIS, who Petitioners assert has authority to issue protective regulations for GEAVADs under 21 USC

§ 111.

34. Beard, C.B., R.V. Durvasula, and F.F. Richards. 1998. Bacterial symbiosis in arthropods and the control of disease transmission. *Emerging Infectious Diseases*, vol. 4, no. 4, Oct. - Dec., pp. 581-88.

35. Letter to Dr. Lonnie J. King, Administrator, USDA APHIS, and attached resolution from Robert Graham, AMCA Executive Director, dated July 16, 1996.

36. Quoted in M. Kaufman. 2001. *Washington Post* article cited above.

37. Hoy interview of Feb. 12, 2001, with Eli Sarnat of CFS.

38. 5 USC § 551 *et seq.*; on the enforceability of the duty of Federal agencies to adopt appropriate protective regulations, see American Horse Protection Association, Inc. v. Lyng, 812 F.2d 1 (DC Cir. 1987).

39. For an example of an informative website, see the former USDA APHIS site, "The Regulation of Transgenic Arthropods," as of 1999, still online at <http://www.aphis.usda.gov/biotech/arthropod/>. Unfortunately, this site has not been adequately maintained or updated since then.

40. DHHS, PHS, NIH, "Notice of actions under the NIH Guidelines for Research Involving Recombinant DNA Molecules" *Fed. Reg.* vol. 59, no. 150, Fri., Aug. 5, 1994, pp. 40170-40174, deleting former Section III-A-2 and former Appendix L.

41. Executive Order 12114 on Environmental Effects Abroad of Major Federal Actions, issued by President Jimmy Carter in 1979, which applies to certain U.S. government activities in other countries, is neither comprehensive nor enforceable.

42. For a model of a detailed protocol for reviewing proposed releases of GE plant pests, which may also be largely applicable to the environmental review of a proposed GEAVHD release, see, Young, O.P., S.P. Ingebritsen, and A.S. Foudin. 1999. Regulation of transgenic arthropods and other invertebrates in the United States. In A.M. Handler and A.A. James, ed.s, *Insect Transgenesis - Methods and Applications*, CRC Press, Boca Raton, FL

43. 42 USC §

4321 *et seq.*

44. 40 CFR § 1508.18(a).

45. 42 USC § 4332(C).

46. 40 CFR § 1508.27(b)(2),-(4), -(5), -(6), and -(9). The Supreme Court has held that the CEQ regulations are entitled to substantial deference. Andrus v. Sierra Club, 442 U.S. 347, 348 (1979); Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 372 (1989).

47. Public Service Co. of Colo. v. Andrus, 825 F. Supp. 1483, 1495 (D. Idaho 1993); see Friends of the Earth, Inc. v. U.S. Army Corp of Eng'rs, 2000 U.S. Dist. LEXIS 11755 (D.D.C. 2000).

48. DHHS. Final notice of revision of HHS NEPA procedures. *Fed. Reg.* vol. 65, no. 38, Feb. 25, 2000, pp.10229-10284, at p. 10255.

49. 756 F.2d 143, 146 (DC Cir. 1985).

50. Kleppe v Sierra Club, 427 US 390, 410 n.21 (1976).

51. Brown, W.Y. 2001. Promise and peril. *The Environmental Forum* (Environmental Law Inst.), vol. 18, no. 5, Sept.-Oct., pp. 30-38.

52. On the duty to conduct programmatic Sec. 7 compliance, see Pacific Rivers Council v. Thomas, 30 F.3rd 1050 (9th Cir. 1994).

53. 16 USC § 1536(b).

54. 50 CFR § 402.14(d).

55. 16 USC § 1536(b)(3)(A).

56. USFWS. 2001. *Endangered Species Bulletin* vol. XXVI, no.1, p. 40.

57. Hoy. 1999, cited above; Brown. 2001, cited above; U.S. Congress, Office of Technology Assessment. 1993. *Harmful Non-Indigenous Species in the United States*. U.S. Government Printing Office; Washington, DC. Online at: www.wws.princeton.edu/~ota/disk1/1993/9325.

Chapter 9 covers GE organisms as a special case of invasive species.

58.

U.S. Congress, Office of Technology Assessment. 1993, cited above.

59. An EO adopted pursuant to statutory or constitutional authority, as EO 13112 was, has the force and effect of law for Federal agencies. Legal Aid Society of Alameda County vs. Brenner, 381 FS 125 (DC Cal. 1975).