Shows final revisions made during EO 12866 Review

All revisions were made at OMB's suggestion.

ECONOMIC ANALYSIS FOR PROPOSED EXEMPTION UNDER THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT FOR CERTAIN PLANT-INCORPORATED PROTECTANTS DERIVED FROM A PLANT VIRAL COAT PROTEIN GENE (PVCP-PIPs)

TABLE OF CONTENTS

LIST OF TABLES

List of Charts

EXECUTIVE SUMMARY

A plant-incorporated protectant (PIP) is defined as a pesticidal substance that is intended to be produced and used in a living plant, or in the produce thereof, and the genetic material necessary for production of such a pesticidal substance. The definition includes both active and inert ingredients. The U.S. Environmental Protection Agency (EPA, or the Agency) considers plant virus coat protein PIPs (PVCP-PIPs) to be those PIPs based on one or more genes that encode a coat protein of a virus that naturally infects plants. PVCP-PIPs are considered pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) because they meet the FIFRA definition of a pesticide, being intended for preventing, destroying, repelling, or mitigating a pest. EPA under the Federal Food, Drug, and Cosmetic Act (FFDCA) regulates residues of PVCP-PIPs in food.

EPA is proposing to exempt certain PVCP-PIPs from most FIFRA requirements. A PIP can be exempt from the requirements of FIFRA, other than the adverse effects reporting requirements of 40 CFR 174.71, if it meets all three of the requirements listed in 40 CFR 174.21. Section 174.21(a) requires that the PIP meet the criteria listed in at least one of the sections in §§ 174.25 through 174.50. Section 174.21(b) requires that when the PIP is intended to be produced and used in a crop used as food, the residues of the PIP are either exempted from the requirement of a tolerance under FFDCA or no tolerance would otherwise be required for the PIP. Section 174.21(c) requires that an exempt PIP must contain only those inert ingredient(s) included on the list codified at §§ 174.485 through 174.490.

The proposed rule would establish 40 CFR 174.27, which would contain three criteria that, when met, would allow PVCP-PIPs to meet the general requirement for exemption for all PIPs listed at 40 CFR 174.21(a). This economic analysis evaluates the effect of proposed § 174.27 by assuming that all PVCP-PIPs meet the existing requirements under § 174.21(b) and (c).

In developing this proposal, EPA evaluated PVCP-PIPs for risk based on an analysis of human experiences with the breeding and cultivation of agricultural plants as well as food preparation and consumption. EPA combined this long history of human experience with knowledge of plant genetics, plant physiology, phytopathology, microbial ecology, ecology, biochemistry, and plant breeding. Based on its evaluation, EPA currently believes that some PVCP-PIPs warrant exemption, i.e., those covered under Option 1 of this economic analysis (EA). This rule would benefit the industry by reducing the cost of regulation for some PVCP-PIPs and by removing regulatory uncertainty for this class of products. This rule would also benefit the public by appropriately allocating federal resources for risk evaluation and by ensuring that other, non-exempt PVCP-PIPs remain subject to FIFRA requirements in order to protect public health and the environment.

Under the proposed rule analyzed in this EA (Option 1), PVCP-PIPs meeting all of the following three criteria (a, b, and c) will meet the requirements of 40 CFR 174.21(a):

(a) Criterion a is satisfied if either paragraph 1 or paragraph 2 applies:

(1) The plant containing the PIP is one of the following: anthurium (*Anthurium* spp.), asparagus (*Asparagus officinale*), avocado (*Persea americana*), banana (*Musa acuminata*), barley (*Hordeum vulgare*), bean (*Phaseolus vulgaris*), cacao (*Theobroma*

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cacao), carnation (*Dianthus caryophyllus*), chickpea (*Cicer arietinum*), citrus (*Citrus* spp., e.g., *Citrus aurantifolia, Citrus limon, Citrus paradisii, Citrus sinensis*), coffee (*Coffea arabica* and *Coffea canephora*), corn (*Zea maize*), cowpea (*Vigna unguiculata*), cucumber (*Cucumis sativus*), gerbera (*Gerbera* spp.), gladiolus (*Gladiolus* spp.), lentil (*Lens culinaris*), mango (*Mangifera indica*), orchids (Orchidaceae), papaya (*Carica papaya*), pea (*Pisum sativum*), peanut (*Arachis hypogaea*), pineapple (*Ananas comosus*), potato (*Solanum tuberosum*), soybean (*Glycine max*), starfruit (*Averrhoa carambola*), sugarcane (*Saccharum officinarum*), or tulips (*Tulipa* spp.).

(2) The Agency determines after review that the plant containing the PIP:

(i) has no wild or weedy relatives in the United States with which it can form viable hybrids in nature, and

(ii) is not a weedy or invasive species outside of agricultural fields in the United States, and

(iii)is unlikely to establish weedy or invasive populations outside of agricultural fields in the United States even if the plant contains a PVCP-PIP.

(b) Criterion b is satisfied if either paragraph 1(i), paragraph 1(ii), or paragraph 2 applies:

(1) (i) The viral pathotype used to create the PVCP-PIP has naturally infected plants in the United States and naturally infects plants of the same species as those containing the PVCP-PIP, or (ii) the genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance is inserted only in an inverted repeat orientation or lacking an initiation codon for protein synthesis such that no PVC-protein is produced in the plant.

(2) The Agency determines after review that viruses that naturally infect the plant containing the PVCP-PIP are unlikely to acquire the coat protein sequence through recombination and produce a viable virus with significantly different properties than either parent virus.

(c) Criterion c is satisfied if either paragraph 1 or paragraph 2 applies:

(1) The genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance

(i) is inserted only in an inverted repeat orientation or lacking an initiation codon for protein synthesis such that no PVC-protein is produced in the plant, or

(ii) encodes only a single virtually unmodified viral coat protein. Multiple PVC-proteins could each separately meet this criterion. Chimeric PVC-proteins do not qualify.

(2) The Agency determines after review that the genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance

(i) encodes a protein that is minimally modified from a coat protein from a virus that naturally infects plants, or

(ii) produces no protein.

This EA estimates the projected compliance cost for the industry under the baseline of full registration for all PVCP-PIPs (Option 4) and compares that to the compliance cost for the potentially affected industry under the proposed rule in order to estimate the expected savings from the regulation relief. The steps used in this EA to obtain a cost estimate for the proposed rule are summarized below.

Since the nature and timing of future development of PVCP-PIPs are unknown, this EA begins by identifying nine case studies that represent the broadest range of PVCP-PIPs that the Agency anticipates could be developed in the future. After considering the characteristics of the products that have already been marketed, characteristics of the crop plants that have been the subject of field trials for PVCP-PIPs, and knowledge of the field of genetically engineered virus-resistant crops, EPA estimated the percentage of products projected to be characterized by each case study, i.e., the "prevalence" of the case study. The stated prevalence of each case study represents the best estimate of the expectation of a PVCP-PIP product like the one in a specific case study being developed in the future.

For each case study, a set of data would be required of a developer in order to register the PVCP-PIP. The cost and burden of potential data requirements for each case study under the baseline are compared with the potential data requirement costs and burden under the proposed option. Using the prevalence for each case study, we estimated the probability of developing a PVCP-PIP product like that examined in any of the case studies in any year, given that the Agency anticipates 1.5 – 2.5 PVCP-PIPs being developed each year over a 10-year period. These probabilities determine the frequency and timing of development and registration of PVCP-PIPs in a model we designed to compute compliance cost savings.

To estimated compliance cost savings in any year, the number of PVCP-PIPs like the one developed in a given case study was multiplied by the difference between cost and burden under the proposed rule and baseline. Since the model made use of probabilities, we computed the average of 5,000 simulations for each year to represent the annual compliance cost savings for the proposed rule. Using this procedure to estimate the annual impact, based on an average of high and low cost estimates (called hereafter the "average cost") per data requirement, the proposed rule is expected to result in a regulatory compliance cost reduction approximately within the range of $330,000 and $340,000 a year. Over a 10-year period, the annual average regulatory compliance cost reduction is expected to be approximately $330,000.

1. INTRODUCTION

EPA is proposing to exempt certain PVCP-PIPs from most FIFRA requirements. A PIP can be exempt from the requirements of FIFRA, other than the adverse effects reporting requirements of 40 CFR 174.71, if it meets all three of the requirements listed in 40 CFR 174.21. Section 174.21(a) requires that the PIP meet the criteria listed in at least one of the sections in §§ 174.25 through 174.50. Section 174.21(b) requires that when the PIP is intended to be produced and used in a crop used as food, the residues of the PIP are either exempted from the requirement of a tolerance under FFDCA or no tolerance would otherwise be required for the PIP. Section 174.21(c) requires that an exempt PIP must contain only those inert ingredient(s) included on the list codified at §§ 174.485 through 174.490.

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The remainder of this economic analysis contains seven additional sections. Section 2 contains a brief introduction, which includes a general background description and addresses the nature of PVCP-PIPs and their effects. Section 3 describes the regulatory options considered, including the proposed rule and two alternatives. Section 4 includes an industry profile of the anticipated PVCP-PIP pesticide registrant universe. Section 5 outlines the possible data requirements and method used to evaluate the cost impacts of the proposed rule and alternatives, and includes a quantitative assessment of the compliance costs. Section 6 presents a qualitative discussion of the benefits from the proposed rule. Section 7 illustrates the costs and benefits comparison between the proposed rule and the baseline. Section 8 discusses the rationale for proposing the preferred option (Option 1) rather than either of the two alternatives, and finally, Section 9 discusses other economic impact assessments associated with the proposed rule. ¶

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The proposed rule would establish 40 CFR 174.27, which would contain three criteria that, when met, would allow PVCP-PIPs to meet the general requirement for exemption for all PIPs listed at 40 CFR 174.21(a). This economic analysis evaluates the effect of proposed § 174.27 by assuming that all PVCP-PIPs meet the existing requirements under § 174.21(b) and (c).

This rule would benefit the industry by reducing the cost of regulation for some PVCP-PIPs and by removing regulatory uncertainty for this class of products. This rule would also benefit the public by appropriately allocating federal resources for risk evaluation and by ensuring that other, non-exempt PVCP-PIPs remain subject to FIFRA requirements in order to protect public health and the environment. Although the rule proposes to relax registration requirements for some types of PVCP-PIPs that EPA determined from experience to be safe for the public health and the environment, it will protect the public by ensuring regulatory control over PVCP-PIPs that EPA cannot *a priori* determine to be safe.

This report presents the results of an economic analysis (EA) evaluating the potential change in compliance costs of exempting (1) certain PVCP-PIPs from regulation under FIFRA and (2) the protein portion of certain PVCP-PIPs (termed the "PVC-protein") from the need for a tolerance under the Federal Food, Drug, and Cosmetic Act. The introductory chapter of this EA presents an overview and discussion of PCVP-PIPs in relation to human health, the environment, industry, and the public as a whole. The introduction also summarizes the statutory requirements that must be met for regulating pesticides and for exempting pesticides, the various statutes and executive orders requiring the analysis, and the scope of the analysis.

1.1. Overview of PVCP-PIPs and their Environmental Effects

A plant-incorporated protectant is defined as a pesticidal substance that is intended to be produced and used in a living plant, or in the produce thereof, and the genetic material necessary for production of such a pesticidal substance. The definition includes both active and inert ingredients.

EPA considers plant virus coat protein PIPs (PVCP-PIPs) to be those PIPs based on one or more genes that encode a coat protein of a virus that naturally infects plants. This includes plant-incorporated protectants derived from one or more plant viral coat protein genes that produce only RNA and no virus-related protein. PVCP-PIPs that produce no protein are PIPs because they consist of a pesticidal substance intended to be produced and used in a living plant (even though that substance may be non-proteinaceous) and the genetic material necessary for production of such a substance. Incorporation of plant viral coat protein gene sequences into plant genomes has been found to confer resistance to the virus from which the protein was derived, and often to related viruses (Gonsalves & Slightom 1993; OECD Environment Directorate 1996; Kaniewski & Lawson 1998).

PVCP-PIPs are pesticides under FIFRA because they meet the FIFRA definition of a pesticide, being intended for preventing, destroying, repelling, or mitigating a pest. EPA under the Federal Food, Drug, and Cosmetic Act (FFDCA) regulates residues of PVCP-PIPs in food.

1.2. Need for Regulation

In the mid-1980s, the Federal government examined existing laws and concluded that, for the most part, existing laws would adequately ensure the safety of products produced from the

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application of biotechnology. In 1986, the Federal government announced in the "Coordinated Framework for Regulation of Biotechnology" (51 FR 23302 June 26, 1986) that biotechnology products will be regulated in the United States as are products of other technologies; that is, by the various regulatory agencies on the basis of use. Thus, EPA, which is responsible for regulating the use of pesticides, would be responsible for products of biotechnology that are to be used as pesticides. The proposed rule is part of a program to implement fully the Coordinated Framework.

This section presents a discussion of the risks and concerns associated with PVCP-PIPs that would not be exempted by this proposed rule. Specifically discussed are concerns associated with human health and the environment and the concerns of industry and the public.

1.2.1. Human health concerns

Virus-infected plants have always been a part of the human and domestic animal food supply. Most crops are frequently infected with plant viruses, and food from these crops has been and is being consumed without adverse human or animal health effects. In addition, plant viruses are not infectious to humans, including children and infants, or to other mammals. Finally, plant virus coat proteins, while widespread in food, have not been associated with toxic effects to animals or humans. These conclusions are derived from a sufficient experience and information base to support this proposed exemption from the requirement of a tolerance for PVC-proteins that (1) are virtually unmodified when compared to natural plant viral coat proteins or (2) the Agency has determined are minimally modified from natural plant viral coat proteins, i.e., are substantially similar to and are as safe as natural plant viral coat proteins.

With the PVCP-PIPs not exempted by the proposed rule, there is a possibility of qualitatively different (i.e., new) dietary exposure. For example, a qualitatively different exposure could occur if the PVC-protein were significantly modified by the addition of amino acids that changed the overall protein structure from its natural state and modified the protein's allergenicity potential. Modern biological and genetic techniques enable developers to introduce substances significantly different from those historically consumed safely into foods. PVCP-PIPs for which there is no history of natural exposure and consumption would not fall within the record supporting exemption.

In addition, EPA evaluates under FIFRA not only potential human dietary risks, but also non-dietary risks such as may occur through occupational exposure. PVCP-PIPs not exempted by the rule are those that EPA cannot determine have a history of natural human exposure, and therefore EPA cannot conclude that there is no unreasonable occupational risk without the type of review provided by the registration process.

1.2.2. Environmental concerns

The underlying risk assessment paradigm for PVCP-PIPs is similar to that used for other types of PIPs, considering the potential for exposure to the pesticidal substance and its chemical and toxicological properties. For PVCP-PIPs, EPA has addressed the three relevant potential risks:

First, EPA considered whether the transfer of virus resistance through gene flow from a crop plant to a wild or weedy relative might affect the recipient's growth, survivorship, and/or reproduction. A related question is whether acquisition of virus resistance by individual plants

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Examples of PVCP-PIPs that would not be exempted by this proposed rule include those expressing a protein that is significantly different than those known to have a history of safe exposure. Such PVPC-PIPs would not be exempted, because the toxicity and allergenicity to humans and other organisms of such proteins is unknown and would not fall within the base of experience supporting the proposed exemption. Other PVCP-PIPs that would not be exempt are those found in plants that could transfer the PVCP-PIP to a wild or weedy relative whose growth and or reproduction is constrained by virus infection such that acquisition of virus resistance would be expected to alter the plant's weedy or invasive behavior. Specific use … [1]

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may subsequently affect population dynamics and change the natural plant community on which other organisms depend.

Second, EPA considered the potential for recombination between virus coat protein sequences of the PVCP-PIP and other viruses infecting the plant, a process that produces viruses that contain genetic material from both sources. Most such events are anticipated to be like those that occur naturally in mixed virus infections that are quite common in nature. However, for certain PVCP-PIPs, the recombinant produced may be unlike those that would be expected to result from a natural recombination event. For example, a PVCP-PIP could be introduced into a plant that is not naturally infected by the virus from which the PVCP-PIP was derived. Viruses that infect that plant may have had no previous opportunity to recombine with such viral sequences in nature. Potentially novel recombinants resulting from such interactions could have altered epidemiology and/or pathogenicity. Given the potential impact of virus infection, such changes might affect competitiveness of plant populations, thereby altering ecosystem dynamics, e.g., through changes in species composition of populations, resource utilization, or herbivory.

Third, EPA considered the potential for exposure of non-target organisms to a PVC-protein that is significantly different from any naturally occurring plant virus coat protein. Some PVC-proteins may be identical to those already naturally produced in virus-infected plants and to which organisms that interact with the plant are already exposed, e.g., herbivorous insects and animals. However, some modifications to the coat protein sequence in the PVCP-PIP could lead to PVC-proteins being produced that may be entirely new to the plant and thus present new exposures to organisms that associate with the plant. For instance, amino acids may be added to PVC-proteins that change the allergenicity or toxicity potential of the PVC-protein.

PVCP-PIPs not exempted by the proposed rule are those that EPA cannot determine pose low risk with respect to one or more of the concerns outlined above. The Agency would evaluate non-exempt PVCP-PIPs for these considerations during the registration process.

1.2.3. Industry concerns

EPA identified three primary concerns of the agricultural biotechnology industry:

First, although EPA proposed two options to exempt PVCP-PIPs from FIFRA registration in 1994, EPA has yet to finalize either exemption. Since 1994, several companies have developed and commercialized PVCP-PIP products. In addition, since 2000, at least 80 field trials have been conducted for at least 15 types of plants containing PVCP-PIPs. Until the Agency finalizes an exemption for PVCP-PIPs that clearly articulates which are exempt and which are not, companies will be uncertain whether their product would be exempt upon implementation of a final rule or whether the company would need to register the product.

Second, although the number of PVCP-PIPs subject to FIFRA requirements would be much reduced through issuance of the proposed rule, some companies are still likely to face costs for those products not exempted from registration. New plant varieties have historically had lower profit potentials than traditional chemical pesticides, and companies in the area of agricultural biotechnology often assume a greater market risk. Therefore, potential registrants of PVCP-PIPs are concerned about the costs associated with the data that EPA may require for the registration of these products.

Third, companies are also very concerned about expending considerable resources for product development that they may not be able to recoup because the public does not accept the

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products. Farmers may hesitate to purchase seed containing a PVCP-PIP if they were unsure of their ability to sell their harvest in international markets or for use as ingredients in processed food that may be exported. Importing countries want assurances that biotechnology products have undergone a thorough human health and environmental risk assessment. For example, the Cartagena Protocol on Biosafety requires that parties to the Protocol make available summaries of risk assessments or environmental reviews of living modified organisms generated by their regulatory processes. Although the United States is not a party to the Protocol, many of its trading partners are Parties and expect Non-Parties to follow the procedures called for therein.

1.2.4. Public concerns

EPA identified three public concerns associated with PVCP-PIPs.

One public concern is that firms may not adequately consider the consequences to the public at large of biotechnology products (The Pew Initiative on Food and Biotechnology 2004, 2005), or that without a regulatory framework, companies have little incentive to use potentially costly risk mitigation measures (Larson & Knudson 1991).

Two, many consumers are concerned about the safety of the food supply. Surveys of American consumers show that a majority are unaware of the existence of genetically engineered foods, but a sizeable minority of the population have expressed concern about their safety. Respondents also indicated that they know very little about the regulatory structure for genetically modified foods, although they support a strong regulatory system (The Pew Initiative on Food and Biotechnology 2004). Consumer opinion in international markets is also highly important because overall exports account for 28% of agricultural sales. However, consumers in many other countries remain skeptical of genetically modified foods (Gaskell 2000, Hogan 2004, and Asian Food Information Centre 2003).

Three, a major source of environmental concern is the possibility that transgenes could be transferred to wild or weedy relatives of the crop plant engineered to contain them (Daniell 1999). For example, concerns have been raised that if fitness-enhancing transgenes become established in natural populations, the population might become larger, more widespread, or more difficult to manage, depending on ecological factors that limit population growth (Snow et al. 2005). The potential for a plant or parts of a plant containing a PIP to adversely affect non-target organisms has also been the subject of public concern (GM Science Review Panel 2003).

1.3. Statutory Authority for the Proposed Rule

EPA regulates pesticides in the United States. The principal legal authority is established by FIFRA. This proposed rule is promulgated under the authority of FIFRA sections 3(a), 25(a), and 25(b) (7 U.S.C. §§ 136a(a), 136w(a), and 136w(b)).

FIFRA section 3(a) states that, except as provided by the Act, no person may distribute or sell in the United States any pesticide that is not registered under the Act (7 U.S.C. 136(a)). FIFRA section 2(u) defines "pesticide" as: "(1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant, and (3) any nitrogen stabilizer…" (7 U.S.C. 136(u)). Under FIFRA section 2(t), the term "pest" includes "(1) any insect, rodent, nematode, fungus, weed, or (2) any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other microorganism… which the Administrator declares to be a

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pest…" subject to certain exceptions (7 U.S.C. 136(t)).

Before EPA may register a pesticide under FIFRA, the applicant must show that the pesticide "when used in accordance with widespread and commonly recognized practice… will not generally cause unreasonable adverse effects on the environment" (7 U.S.C. 136a(c)(5)(D)). The term "environment" includes "water, air, land, and all plants and man and other animals living therein, and the interrelationships which exist among these" (7 U.S.C. 136(j)). FIFRA section 2(bb) defines the term "unreasonable adverse effects on the environment" to mean: "(1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide, or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under section 408 of the Federal Food, Drug, and Cosmetic Act" (7 U.S.C. 136(bb)).

Although FIFRA requires the registration of most pesticides, it also authorizes the regulation of unregistered pesticides. FIFRA section 3(a) provides that, to the extent necessary to prevent unreasonable adverse effects on the environment, the Administrator may limit the distribution, sale, or use of any pesticide that is not registered under section 3 of FIFRA, subject to an experimental use permit under section 5 of FIFRA, or subject to an emergency exemption under section 18 of FIFRA. Pesticides that are "not registered" include pesticides that are exempt from FIFRA requirements under section 25(b).

An unregistered pesticide may be distributed or sold if it is exempted by regulation under FIFRA section 25(b). Under FIFRA section 25(b)(2), the Agency can exempt pesticides from some or all of the requirements of FIFRA when the Agency determines that the pesticide is "of a character which is unnecessary to be subject to [FIFRA] in order to carry out the purposes of this Act" (7 U.S.C. 136w(b)(2)). EPA interprets section 25(b)(2) to authorize the Agency to exempt a pesticide or category of pesticides that EPA determines (1) poses a low probability of risk to the environment and (2) is not likely to cause unreasonable adverse effects to the environment even in the absence of regulatory oversight under FIFRA. This standard differs from the standard for registration which considers only whether the pesticide "when used in accordance with widespread and commonly recognized practice… will not generally cause unreasonable adverse effects on the environment" (7 U.S.C. 136a(c)(5)(D)).

In evaluating the first condition that must be met for the Agency to exempt a pesticide, i.e., whether use of the pesticide poses a low probability of risk to the environment, EPA considers the extent of the potential risks caused by use of the pesticide to the environment, including humans and other animals, plants, water, air and land. Potential risks to humans include dietary risks as well as non-dietary risks such as those resulting from occupational or residential exposure to the pesticide. EPA uses the FFDCA section 408 standard in evaluating dietary risks. Under FFDCA §408, any pesticide chemical residue in or on food shall be deemed unsafe unless a tolerance for such pesticide chemical residue in or on such food is in effect under this section, and the quantity of the residue is within the limits of the tolerance, or an exemption from the requirement of a tolerance is in effect for the pesticide chemical residue. The Agency may exempt a product from the requirement of a tolerance if the Agency determines that the exemption is "safe," i.e., if the Agency determines that "there is a reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue, including all

anticipated dietary exposures and all other exposures for which there is reliable information." EPA will not exempt pesticides unless they pose a low probability of risk to the environment.

In evaluating the second condition that must be met for the Agency to exempt a pesticide, i.e., whether the use of the pesticide is unlikely to cause unreasonable adverse effects on the environment even in the absence of regulatory oversight under FIFRA, EPA balances all the potential risks to human health, including dietary risks, and risks to the remainder of the environment from use of the pesticide against the potential benefits associated with its use. In balancing risks and benefits, EPA considers the economic, social, and environmental costs and benefits of the use of the pesticide. If the pesticide poses a low probability of risk to the environment and is not likely to cause unreasonable adverse effects to the environment even in the absence of regulatory oversight under FIFRA, EPA may exempt the pesticide from regulation under FIFRA.

See Unit VI. of the preamble to the proposed rule for a summary of EPA's statutory finding explaining how the proposed rules satisfies the above two conditions that must be met for the Agency to exempt a pesticide.

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1.4. Regulatory Assessment Requirements

This report is intended to meet the requirements of Executive Order 12866 on Regulatory Planning and Review, the Regulatory Flexibility Act as amended by the Small Businesses Regulatory Enforcement Fairness Act, the Unfunded Mandates Reform Act, Executive Order 12898 on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, and FIFRA §25. The remaining regulatory requirements (the Congressional Review Act, Executive Order 13045 on Protection of Children from Environmental Health Risks and Safety Risks, Executive Order 13175 on Consultation and Coordination with Indian Tribal Governments, and Executive Order 13132 on Federalism) are briefly addressed, but do not apply to the proposed rule because of the nature and low cost estimates of the proposed rule. This document also serves as input in preparing any analysis required under the Paperwork Reduction Act (44 U.S.C. § 3501-21).

Under Executive Order 12866, the Agency must determine whether a regulatory action is "significant" and therefore subject to review by the Office of Management and Budget (OMB). Pursuant to the terms of Executive Order 12866, it has been determined that the proposed rule is a "significant regulatory action" because it raises novel policy issues arising out of FIFRA legal mandates. As such, this proposed rule will be submitted to OMB for review, and any comments or changes made in response to OMB suggestions or recommendations will be documented in the public record.

The Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (5 U.S.C. 601 et seq.) requires that agencies take special note of the impact of regulations on small entities. Analysis requirements under the RFA are combined with the analysis required under Executive Order 12866.

FIFRA §25(a)(2)(b), requires that the Administrator of EPA consider such factors as "...the effect of the regulation on production and prices of agricultural commodities, retail food prices, and otherwise on the agricultural economy..." when issuing regulations under §25 (7 U.S.C. 136w(a)(2)(B)).

1.5. *Scope of Analysis*

This analysis examines the costs and benefits of exempting certain PVCP-PIPs from regulation under FIFRA. The potential direct compliance cost savings of exempting certain PVCP-PIPs from registration was estimated for three exemption options. The analysis estimates the potential direct compliance costs and benefits of the proposed rule relative to a baseline of registering all PVCP-PIPs.

Although this economic analysis focuses solely on the direct, quantifiable compliance costs and benefits of the rule, EPA recognizes that there are other, non-quantifiable benefits and costs to the rule. These include the benefits of ensuring protection of the environment, a more certain regulatory climate for industry, and reassurance to the public of the safety of these products. Indirect costs and benefits were not addressed in this analysis because of the absence of data. Indirect costs of the proposed rule include the one-time cost of time lost to companies that must familiarize themselves with a different regulatory scheme than is associated with other PIPs; and the time necessary for explaining a more complex regulatory structure to the U.S. trading partners that have developed laws specifically for genetically engineered products, unlike the United States, which relies on existing statutes. Indirect benefits considered include increased public confidence in a review process that regulates commensurate with risk, the channeling of research towards the developing and marketing of safer products, and a reduction in time to market a product due to fewer regulatory requirements for exempted products.

Primarily affected by this regulation will be those companies involved with agricultural biotechnology that may develop and market PVCP-PIPs. A majority of these include pesticide manufacturers and seed companies. Other potentially affected entities include land grant universities or colleges, the U.S. Department of Agriculture (USDA) Agricultural Research Service, non-government organizations that may manufacture and market PVCP-PIPs, and firms that perform research and development in the agricultural sciences.

2. ALTERNATIVE OPTIONS FOR THE PROPOSED RULE

Four options are examined in this EA: (1) an option representing the Agency's proposed regulatory scope based on the proposed exemption, (2) an option that exempts the same number of PVCP-PIPs as the proposed exemption but does so solely by Agency determination rather than partly by developer determination, (3) an option that exempts fewer PVCP-PIPs than either Option 1 or 2, and (4) an option that exempts no PVCP-PIPs and thus would require EPA to register all PVCP-PIPs.

2.1. *Option 1*

Option 1 represents EPA's proposed rule. Under Option 1, all PVCP-PIPs meeting all of the following criteria would be exempt from regulation:

(a) Criterion a is satisfied if either paragraph 1 or paragraph 2 applies:

(1) The plant containing the PIP is one of the following: anthurium (*Anthurium* spp.), asparagus (*Asparagus officinale*), avocado (*Persea americana*), banana (*Musa acuminata*), barley (*Hordeum vulgare*), bean (*Phaseolus vulgaris*), cacao (*Theobroma cacao*), carnation (*Dianthus caryophyllus*), chickpea (*Cicer arietinum*), citrus (*Citrus* spp., e.g., *Citrus aurantifolia, Citrus limon, Citrus paradisii, Citrus sinensis*), coffee

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(*Coffea arabica* and *Coffea canephora*), corn (*Zea maize*), cowpea (*Vigna unguiculata*), cucumber (*Cucumis sativus*), gerbera (*Gerbera* spp.), gladiolus (*Gladiolus* spp.), lentil (*Lens culinaris*), mango (*Mangifera indica*), orchids (Orchidaceae), papaya (*Carica papaya*), pea (*Pisum sativum*), peanut (*Arachis hypogaea*), pineapple (*Ananas comosus*), potato (*Solanum tuberosum*), soybean (*Glycine max*), starfruit (*Averrhoa carambola*), sugarcane (*Saccharum officinarum*), or tulips (*Tulipa* spp.).

(2) The Agency determines after review that the plant containing the PIP:

(i) has no wild or weedy relatives in the United States with which it can form viable hybrids in nature, and

(ii) is not a weedy or invasive species outside of agricultural fields in the United States, and

(iii) is unlikely to establish weedy or invasive populations outside of agricultural fields in the United States even if the plant contains a PVCP-PIP.

(b) Criterion b is satisfied if either paragraph 1(i), paragraph 1(ii), or paragraph 2 applies:

(1) The viral pathotype used to create the PVCP-PIP has naturally infected plants in the United States and naturally infects plants of the same species as those containing the PVCP-PIP, or (ii) the genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance is inserted only in an inverted repeat orientation or lacking an initiation codon for protein synthesis such that no PVC-protein is produced in the plant.

(2) The Agency determines after review that viruses that naturally infect the plant containing the PVCP-PIP are unlikely to acquire the coat protein sequence through recombination and produce a viable virus with significantly different properties than either parent virus.

(c) Criterion c is satisfied if either paragraph 1 or paragraph 2 applies:

(1) The genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance

(i) is inserted only in an inverted repeat orientation or lacking an initiation codon for protein synthesis such that no PVC-protein is produced in the plant, or

(ii) encodes only a single virtually unmodified viral coat protein. Multiple PVC-proteins could each separately meet this criterion. Chimeric PVC-proteins do not qualify.

(2) The Agency determines after review that the genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance

(i) encodes a protein that is minimally modified from a coat protein from a virus that naturally infects plants, or

(ii) produces no protein.

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2.2. Option 2

Option 2 exempts the same number of PVCP-PIPs as Option 1, but it eliminates the provision for a developer-determined exemption. The criteria for evaluation would be identical

to those in Option 1; the difference is that products could meet the criteria only upon satisfactory evaluation by the Agency.

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2.3. *Option 3*

Option 3 exempts fewer PVCP-PIPs than options 1 or 2. Under Option 3, the Agency-determined part of the exemption has been eliminated, and only PVCP-PIPs meeting all of the following criteria (a, b, and c) would be exempt from regulation:

(a) Criterion a is satisfied if the plant containing the PIP is one of the following: anthurium (*Anthurium* spp.), asparagus (*Asparagus officinale*), avocado (*Persea americana*), banana (*Musa acuminata*), barley (*Hordeum vulgare*), bean (*Phaseolus vulgaris*), cacao (*Theobroma cacao*), carnation (*Dianthus caryophyllus*), chickpea (*Cicer arietinum*), citrus (*Citrus* spp., e.g., *Citrus aurantifolia, Citrus limon, Citrus paradisii, Citrus sinensis*), coffee (*Coffea arabica* and *Coffea canephora*), corn (*Zea maize*), cowpea (*Vigna unguiculata*), cucumber (*Cucumis sativus*), gerbera (*Gerbera* spp.), gladiolus (*Gladiolus* spp.), lentil (*Lens culinaris*), mango (*Mangifera indica*), orchids (Orchidaceae), papaya (*Carica papaya*), pea (*Pisum sativum*), peanut (*Arachis hypogaea*), pineapple (*Ananas comosus*), potato (*Solanum tuberosum*), soybean (*Glycine max*), starfruit (*Averrhoa carambola*), sugarcane (*Saccharum officinarum*), or tulips (*Tulipa* spp.).

(b) Criterion b is satisfied if the viral pathotype used to create the PVCP-PIP has naturally infected plants in the United States and naturally infects plants of the same species as those containing the PVCP-PIP, or (ii) the genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance is inserted only in an inverted repeat orientation or lacking an initiation codon for protein synthesis such that no PVC-protein is produced in the plant.

(c) Criterion c is satisfied if the genetic material that encodes the pesticidal substance or leads to the production of the pesticidal substance (i) is inserted only in an inverted repeat orientation or lacking an initiation codon for protein synthesis such that no PVC-protein is produced in the plant, or (ii) encodes only a single virtually unmodified viral coat protein. Multiple PVC-proteins could each separately meet this criterion. Chimeric PVC-proteins do not qualify.

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2.4. *Option 4*

Option 4, also referred to as baseline or full registration, exempts no PVCP-PIPs from regulation. All would continue to be regulated under FIFRA, and registration would be required for all PVCP-PIPs.

The alternatives analyzed in the EA differ in the particular PVCP-PIPs that would be exempted from FIFRA regulation. They range from a broad scope that exempts the largest number of products meeting the definition of a PVCP-PIP and that meet the low-risk exemption criterion, to an alternative that exempts no PVCP-PIPs. EPA's proposed rule would exempt certain low-risk PVCP-PIPs from FIFRA; those PVCP-PIPs that may present a higher probability of risk to human health or the environment would remain subject to the statutory requirement to be registered before sale or distribution.

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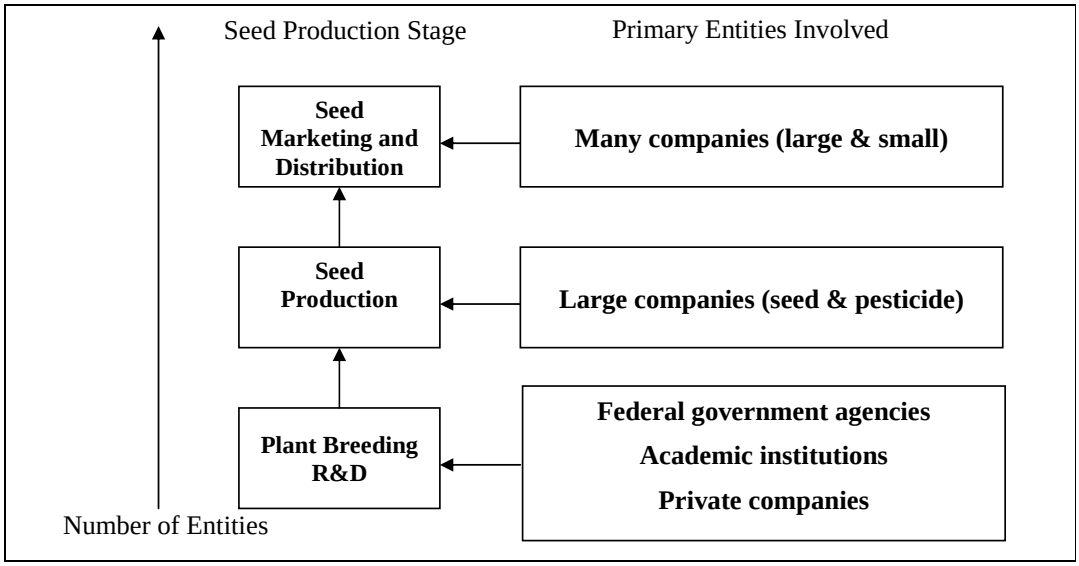
3. ECONOMIC PROFILE OF REGULATED INDUSTRY

According to the USDA, "[s]eeds embody the scientific knowledge needed to produce a new plant variety with desirable attributes, such as higher yield, greater disease resistance, or improved quality."[1] The U.S. seed industry is composed of three primary elements – plant breeding research and development (R&D), seed production, and seed marketing and distribution – historically undertaken by seed companies, pesticide manufacturers, land grand universities or colleges, the USDA, and non-governmental organizations, all of which may be potentially affected by the proposed rule.[2] Chart 1 provides a diagram depicting the U.S. seed industry in terms of the elements generally carried out by each potentially affected entity and the relative number of firms involved in each stage of the seed production process.

Chart 1: Primary Production Stages and Entities in the U.S. Seed Industry



As shown in Chart 1, the seed production process consists of three primary stages (plant breeding R&D, seed production, and seed marketing and distribution) conducted by a variety of entities. In general, the seed production process begins with plant breeding R&D. This stage involves basic research, applied research, and field trials, and it can be relatively lengthy. The primary entities involved in plant breeding R&D are small and large companies from the private

[1] United States Department of Agriculture, Economic Research Service, "The Seed Industry in U.S. Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development." Agriculture Information Bulletin Number 786, January 2004, page 18.

[2] Seed industry elements are taken from United States Department of Agriculture, Economic Research Service, "The Seed Industry in U.S. Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development." Agriculture Information Bulletin Number 786, January 2004. Detailed information characterizing each element is provided on pages 28 to 29 of this report. The report also includes seed conditioning as an element of the U.S. seed industry; however, due to the general nature of this industry overview, seed conditioning is not included in this section.

sector, Federal government agencies, and academic institutions. Upon successful development of the desired characteristics for a seed product, primarily large, private companies produce the seed for sale and distribution. Finally, many companies of various sizes usually undertake marketing and distribution of seeds, the last stage in the process. Overall, as the diagram shows, the number of entities involved in each stage increases as the process moves from R&D for a particular variety through marketing and distribution. Section 4.1 below provides additional information on the history and current characteristics of the seed production process in the United States.

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3.1. *Background on the U.S. Seed Industry*[3]

During the late 20th century, the seed industry in the United States underwent significant and rapid growth and consolidation – from small, family-owned enterprises engaged primarily in distribution of publicly developed seed materials to vertically integrated corporations engaged in all aspects of plant breeding and seed production, conditioning, marketing, and distribution. The change was due to a variety of regulatory incentives that stimulated private participation in the seed industry, such as the 1970 Plant Variety Protection Act (PVPA), and change was most concentrated after 1970. Large companies specializing in different but related industries, including chemical and pharmaceutical companies looking for profitable areas in which they could also create economies of scale, acquired previously independent seed companies.

The growth of biotechnology in the 1980s provided further impetus for private firms to invest in seeds by increasing their R&D efforts and seed production capabilities. Whereas the public sector in the United States comprised the majority of plant breeding efforts in the first half of the 20th century, private R&D expenditures on plant breeding increased 1,300 percent from 1960 to 1996, while real public R&D expenditures did not change significantly. The growth of private sector involvement in plant breeding R&D is no doubt also linked to the strengthening of intellectual property rights in the second half of the 20th century through the PVPA and other regulatory mechanisms.

Along with the entry of the private sector into the seed industry, the quantity and value of seed purchases and trade increased significantly in the last century, due in part to the availability of commercial seed sources. Up until the late 19th century, farmers relied on their previous year's crop for seeds, but with seed certification programs in the early 20th century, farmers began to purchase seeds from commercial sources, many of which were improved varieties demonstrating desirable properties such as increased yield potential. In fact, seed improvements effected by plant breeding innovations have been a major element in crop yield gains.

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3.2. *Identifying Potentially Impacted Entities in the U.S. Seed Industry*

This section details the methodology employed to identify potentially impacted entities within the U.S. seed industry and provides results for each industry sub-sector. A small number of firms have submitted PVCP-PIPs to USDA since 1994 for determination of non-regulated status (five firms), making extrapolation of historical industry impacts to all sub-sectors of the wider seed industry inappropriate. For this reason, and given data limitations discussed in the

[3] Unless otherwise noted, information presented in this section is taken from United States Department of Agriculture, Economic Research Service (2004).

following paragraphs, the analysis profiles relevant industry sub-sectors broadly rather than profiling individual entities. In order to identify potentially impacted industry sub-sectors in the U.S. seed industry, the analysis relies on North American Industrial Classification System (NAICS) codes. Accordingly, the NAICS codes and corresponding industry sub-sectors that may be impacted by the proposed rule are:

- **325320 Pesticide and Other Agricultural Chemical Manufacturing:** This industry comprises establishments primarily engaged in the formulation and preparation of agricultural and household pest control chemicals (except fertilizers).

- **111 Crop Production:** Industries in this sub-sector grow crops mainly for food and fiber. The sub-sector comprises establishments such as farms, orchards, groves, greenhouses, and nurseries, primarily engaged in growing crops, plants, vines, or trees and their seeds.

- **611310 Colleges, Universities, and Professional Schools:** This industry comprises establishments primarily engaged in furnishing academic courses and granting degrees at baccalaureate or graduate levels. The requirement for admission is at least a high school diploma or equivalent general academic training. Instruction may be provided in diverse settings, such as the establishment or client's training facilities, educational institutions, the workplace, or the home, and through correspondence, television, Internet, or other means.

- **54171: Research and Development in the Physical, Engineering, and Life Sciences:** This industry comprises establishments primarily engaged in conducting research and experimental development in the physical, engineering, or life sciences, such as agriculture, electronics, environmental, biology, botany, biotechnology, computers, chemistry, food, fisheries, forests, geology, health, mathematics, medicine, oceanography, pharmacy, physics, veterinary, and other allied subjects.

Because the data derived from the U.S. Census Bureau encompass a broad group of firms, most of which are not related to research, production, sale, and/or distribution of PVCP-PIPs, economic profile information was also sought from private organizations and industry associations that record relatively detailed financial information on private companies. Such sources are few and limited. The financial information available is based on the aggregate performance of the entire company and not on specific sectors that produce these products. Thus, specific standardized information on production, employment, trade, and research and development in the areas potentially affected by the proposed rule are not available for many of the companies. In addition, some large, highly diversified public corporations potentially affected by EPA's proposed rule may market their agricultural products through subsidiaries, and some large firms have pursued joint ventures. Most companies, as well as their subsidiaries, are developing and marketing a wide spectrum of commodities that are generally not of a nature to be subject to EPA authorities and thus are not affected by EPA's proposed rule. In addition, most information sources describe the global pesticide and seed markets rather than the U.S. markets. Therefore, any data used to profile these companies are based on the companies' aggregated profits, sales, number of employees, etc., in a global market setting.

Another factor limiting access to data is the nascence and development of a number of small privately held firms. The locations of many of the new firms indicate they may have been

formed by or with the cooperation of university researchers or possibly for-profit subsidiaries of universities. Little, if any, financial information is available on these firms.

The APHIS database offers some perspective on products in the early stages of research and development that USDA/APHIS has reviewed and the names of the entities pursuing testing and commercialization of products subject to USDA authorities under the Plant Protection Act. This broad range of entities includes pesticide-manufacturing companies, research firms, universities, and the USDA Agricultural Research Service. Since 1988, APHIS regulations have resulted in numerous submissions of applications for environmental release permits (ERPs) for field tests of genetically engineered plants. A recent review of the database listed 52 entities conducting field trials for virus resistant crops that may contain a PVCP-PIP. Detailed information about the product being field tested is not always disclosed because in some cases it is confidential business information. Thus, it is not always possible to determine from the database whether virus resistance is conferred through a PVCP-PIP. See Appendix A for a listing from the USDA database of entities conducting research and products under development.

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3.2.1. Pesticide manufacturers

The pesticide and other agricultural chemical manufacturing industry includes establishments primarily engaged in the formulation and preparation of agricultural and household pest control chemicals (except fertilizers). These companies frequently register products with EPA as required by FIFRA because PVCP-PIPs are considered pesticides. According to a 2005 analysis (U.S. EPA 2005), approximately 1,804 companies comprise the pesticide manufacturing universe that may be impacted by the proposed rule. This section describes the methodology and results of the 2005 analysis to identify the universe of potentially impacted companies within this industry sub-sector based on July 2002 pesticide registration information.

Under the assumption that all potentially impacted pesticide manufacturers have one or more registered pesticides, the total universe of affected pesticide manufacturers was derived based on the number of unique companies holding active Section 3 and/or Section 24(c) pesticide registrations. EPA queried the Pesticide Product Information System (PPIS) database in July 2002 and determined that 1,956 companies with unique EPA company numbers held more than 16,000 Section 3 and 24(c) pesticide registrations. The PPIS database, now a component of the Office of Pesticide Programs Information Network (OPPIN), contains information for all pesticide products registered in the United States, including registrant name and address, chemical ingredients, toxicity category, product names, distributor brand names, site/pest uses, pesticidal type, formulation code, and registration status.

If only parent companies and merged companies are counted, EPA's query results are reduced further. Specifically, parent and merged companies were identified following three steps:

1. Unique companies with EPA company numbers were matched to company information and financial data from the Dun & Bradstreet (D&B) database. The D&B data include information on number of employees, most recent sales and revenue, and primary business classifications (NAICS code and Standard Industrial Classification [SIC] code where possible). In order to link registrants in the PPIS sample data set with the D&B database, each company's Data Universal Numbering System (DUNS) number is

identified. The D&B DUNS number is a unique identifier for a single business entity, which also links together the corporate family structure. Using the corresponding DUNS numbers, companies were combined to the Global Ultimate DUNS number or "parent" level.

2. In some cases company information in D&B did not reflect recent mergers; therefore, the analysis consolidated the registrant universe manually by adjusting for known company mergers. For example, Bayer CropScience acquired Aventis CropScience in June 2002.
3. Finally, the analysis matched and consolidated company names for all EPA company numbers, based on the likelihood that the company numbers actually reflect one company and/or based on EPA recommendations.

Using the steps above, the set of 1,956 unique company numbers in EPA's 2002 PPIS database was reduced to 1,804 unique companies that represent the pesticide registrant universe that may be impacted by the proposed rule. Since 2002, some companies may have been formed and these companies would not be captured in the 1,804 unique companies identified here. However, we do not expect the new companies to be many, and the Agency assumes the current industry profile of the universe of pesticide manufacturers is relatively unchanged since 2002. Table 1 illustrates this process numerically.

Table 1: Estimated Number of Pesticide Registrants that May Be Affected by the Proposed Rule

Pesticide Registrants	Estimated Number of Entities
Number of unique companies in EPA's PPIS database holding Section 3 and/or Section 24(c) registration(s)	1,956 [a]
Total number of duplicate companies	243 [b]
Consolidated number of duplicate companies	91
Total	**1,804**

[a] As of July 2002.

[b] Number of all companies with unique EPA company numbers that were consolidated based on the following criteria: (1) matching of EPA company numbers with Dun & Bradstreet DUNS and Global Ultimate DUNS numbers; (2) consolidation as a result of recent mergers and acquisitions; or (3) matching of company names associated with unique EPA company numbers.

The eight most common six-digit NAICS codes designated in D&B for the set of registrants with sufficient data available are presented in Table 2. A total of 184 six-digit NAICS codes are associated with at least one of the 804 registrants. Also in Table 2 are the SBA thresholds that determine whether a firm with that NAICS code is considered "small."

Table 2: Most Common NAICS Codes Associated with Sample of 804 Pesticide Registrants

NAICS CODE	Count of NAICS Code	U.S. Industry Title	SBA Threshold
325320	88	Pesticide and Other Agricultural Chemical Manufacturing	500 employees
422690	84	1997 NAICS - Otr Chem & Allyd Prdct Whlslrs	100 employees
422910	65	1997 NAICS - Farm Supplies Wholesalers	100 employees
325612	62	Polish and Other Sanitation Good Manufacturing	500 employees
325998	30	All Other Miscellaneous Chemical Product and Preparation Manufacturing	500 employees
325188	27	All Other Basic Inorganic Chemical Manufacturing	1,000 employees
453998	22	All Other Miscellaneous Store Retailers (except Tobacco Stores)	$6 million in revenue
325412	21	Pharmaceutical Preparation Manufacturing	750 employees

In order to disaggregate the number of potentially impacted pesticide registrants into entity size categories as defined by Small Business Administration (SBA) (according to NAICS code), the analysis used information on the total number of employees and revenue information for each company. The entity size and average sales revenue of pesticide manufacturers used recently by the Agency (EPA 2005) are illustrated in Table 3.

Table 3: Economic Profile of Pesticide Registrants by Entity Size

Entity Size Category	Definition	PPIS Registrant Data [a]				Pesticide Registrants		
		Total Companies	Total Revenue for All Companies (million)	Average Revenue per Company (million)	Average Number of Employees per Company	Total Entities	Total Revenue for All Entities (million) [b]	Percentage of Total Revenue
SBA-Defined Sizes								
Large	501 or more employees	146	$1,075,106	$7,364	19,266	146	$1,075,106	98.6%
Small	500 or fewer employees	449 [c]	$4,239	$9.44	39	1,658	$15,651	1.4%
Total		NA [e]	NA [e]	NA [e]	NA [e]	1,804 [d]	$1,090,757	100.0%

Source: U.S. EPA 2005.

[a] Sufficient Dun & Bradstreet company information and financial data were assumed to be available for all SBA-defined large pesticide registrants, based on the set of 1,804 unique pesticide registrants identified as having one or more Section 3 or Section 24(c) pesticide registrations. The total number of pesticide registrants that met these criteria and were considered to be large companies was 146. For SBA-defined small businesses, a random sample of 1,000 unique pesticide registrants was used to develop the economic profile. A total of 565 unique parent companies were identified as having sufficient financial information at the Global Ultimate DUNS number level to be included in the analysis, of which 449 or 79 percent were considered small businesses by SBA definitions.

[b] Calculated as the average revenue per company multiplied by the total number of entities for the respective size category.

[c] SBA-defined small businesses identified from a random sample of 1,000 unique companies with one or more active Section 3 or Section 24(c) registrations.

[d] Number of all companies with unique EPA company numbers that were consolidated based on the following criteria: (1) matching of EPA company numbers with D&B DUNS and Global Ultimate DUNS numbers; (2) as a result of recent mergers and acquisitions; (3) matching of company names associated with unique EPA company numbers; or (4) recommended by EPA to be consolidated based on nearly identical name matching and/or prior knowledge.

[e] Since only 1,000 randomly selected unique pesticide registrants from the PPIS registrant database were used to develop the profile for small businesses, the total for this section does not reflect the actual total number of registrants. For that reason, these values are not reported.

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3.2.2. Crop production (including seed production)

Establishments are classified to the crop production sub-sector in the U.S. Census of Agriculture when crop production (i.e., value of crops for market) accounts for one-half or more of the establishment's total agricultural production. According to the Census, in 2002 there were 986,625 farms (NAICS 111) in the U.S. that produced crops valued at almost $90 billion. As noted in Section 4.1, seed purchases by U.S. farmers have grown significantly in the 20th century: in 1960, seed expenditures by U.S. farmers totaled approximately $500 million; by 1997, this figure had risen to $6.7 billion. According to the USDA, the primary factor behind this increase is an increase in commercial seed purchases by farmers, which is in turn driven by seed productivity increases made possible through scientific advancements in plant breeding.[4] Generally, however, only certain seed producers would be expected to develop, produce, sell, or distribute PVCP-PIPs and thus be affected by this proposed rule; most growers would not manufacture and market PVCP-PIPs, limiting the usefulness of Census data, which is highly aggregated. For this reason, the analysis focused on identifying data on seed producers that may engage in development, production, selling, or distribution of PVCP-PIPs.

A handful of life science companies and traditional pesticide manufacturers dominate the world seed trade. In 2005, seed companies faced further pressure towards consolidation as large multinational corporations sought to ensure a seed market for their genetic technologies under development (Mergermarket Limited 2005). In consolidating, a number of firms that in the past have been producers of conventional pesticides have entered the seed trade in a process of vertical integration of services. These firms have been purchasing outright or purchasing significant interests in seed companies, including the important seed distribution networks those companies have developed. For example, Monsanto has purchased Agracetus, Asgrow Seeds, DeKalb Genetics, Holden's Foundation Seed, Jacob Hartz Seed Company, and Calgene among others (Fernandez-Cornejo 2004). The trend towards consolidation of the industry is likely to continue as the industry restructures vertically. Due to vertical integration, half of the approximately $21 billion commercial seed trade is controlled by 10 companies, with genetically modified seeds accounting for one quarter of the total value of the commercial seed market worldwide (ETC Group Communique 2005).

Because traditional pesticide manufacturers are rapidly acquiring seed companies, the seed industry is the most difficult to describe and acquire data on. For example, there are 347 seed companies listed as subsidiaries or acquisitions of the parent companies that are listed in Table 4, which summarizes 2004 seed sales of the leading seed producing companies.[5] The U.S. Census Bureau classifies these new vertically integrated firms by their primary source of business, which most likely will not be seed production for a majority of them. Further, the dynamic restructuring of the seed industry makes it difficult to predict accurately either for the short- or long-term future how many small and medium size companies currently exist.

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[4] United States Department of Agriculture, Economic Research Service, "The Seed Industry in U.S. Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development." Agriculture Information Bulletin Number 786, January 2004.

[5] Appendix B provides a detailed chart of the parent companies and associated subsidiaries for the seed industry.

Table 4: Leading Seed Company 2004 Seed Revenues

COMPANY	2004 SEED SALES (MILLIONS)
Monsanto (U.S.) + Seminis (Monsanto acquisition 03/05)	$ 2,803
Dupont/Pioneer (U.S.)	$ 2,600
Syngenta (Switzerland)	$ 1,239
Groupe Limagrain (France)	$ 1,044
KWS AG (Germany)	$ 622
Land O' Lakes (U.S.)	$ 538
Sakata (Japan)	$ 416
Bayer Crop Science (Germany)	$ 387
Taikii (Japan)	$ 366
DLF-Trifolium (Denmark)	$ 320
Delta & Pine Land (U.S.)	$ 315
Royal Barenburg Group (Netherlands)	€ 160
Saaten-Union GmbH Ltd. (Germany)	€ 155
Svalöf Weibull AB (Sweden)	€ 116
Nidera Corporation (Netherlands)	$ 80
Landec Corp. (U.S.)	$ 34
BASF (Germany)	Unknown
Dow Chemical Co. (U.S.)	Unknown
Pannar Group (South Africa)	Unknown

Source: (ETC Group Communique 2005)

Given the character of the U.S. seed market, very few published data sources on this industry exist. Resources with published data are discussed below. Within these sources, very limited data were found on the size of the U.S. seed industry (i.e., the total production, size, and number of firms), because either the data are too aggregated or they include the international seed industry, and parsing data on the U.S. market in particular is not possible. One useful data source is a 2004 report on the U.S. seed industry published by USDA and referenced in Section 4.1. Table 5 reproduces information contained within this report on the distribution in 1997 of market share across seed-producing companies in the U.S. As shown, the industry is highly consolidated, with the top seven firms holding 68 percent market share in terms of U.S. seed sales.

Table 5: Estimated Seed Sales and Shares of U.S. Market for Major Field Crops, 1997

Company	Total Sales	Total Market Share	Corn Market Share	Soybean Market Share	Cotton Market Share
	($ millions)	Percent			
Pioneer Hi-Bred	1,178	33.6	42	19	0
Monsanto	541	15.4	14	19	11
Novartis	262	7.5	9	5	0
Delta & Pine Land	79	2.3	0	0	73
Dow Agrosciences / Mycogen	136	3.9	4	4	0
Golden Harvest	93	2.6	4	0	0
AgrEvo/Cargill	93	2.6	4	0	0
Others	1,121	32	23	53	16
Total	3,503	100	100	100	100

Source: United States Department of Agriculture, Economic Research Service, 2004

Another source of information on U.S. seed companies is the U.S.-based trade association for seed companies, the American Seed Trade Association (ASTA). ASTA's membership consists of roughly 850 companies involved in seed production and distribution, plant breeding, and related industries in North America. Some of these members fall into the list of parent seed companies above or are acquisitions of the larger companies in the first two tiers. Not all seed companies are members of ASTA. Additional information on the size or revenues of these companies is not publicly available; therefore, this data is unavailable for use in the analysis.

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3.2.3. Universities, colleges, and other entities

The Department of Education maintains information on universities and colleges in the United States. According to the U.S. Department of Education National Center for Education Statistics, in 2003-04 there were 634 public four-year institutions in the United States and 1,896 private four-year institutions (U. S. Department of Education National Center for Education Statistics 2004). Of the public four-year institutions, 446 award at least 20 masters' or doctoral degrees per year. Of the private institutions, 459 award at least 20 masters' or doctoral degrees per year. Other information available on universities such as the number of students, number of faculty and staff, and tuition was not useful for this analysis.

The Agency also searched the USDA/APHIS database for universities and colleges that may currently have environmental release permits for field research on virus-resistant plants that may contain a PVCP-PIP. Twenty such entities were found, almost all of which are public land grant universities (see Appendix A). Many universities that have the technology and resources to develop PVCP-PIPs may not manufacture and market these products. Rather, the universities

may sell or license the rights to any PVCP-PIPs to firms with the expertise to resolve intellectual property issues and to manufacture and market the products.

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3.2.4. *Research and development in the physical, engineering, and life sciences*

A portion of the industry potentially affected by this proposed rule includes firms solely involved in agricultural research, particularly if these firms have the expertise and resources to manufacture and market PVCP-PIPs. However, larger companies that have the expertise and financial resources to manufacture and market viable products would likely purchase most PVCP-PIPs produced by R&D firms. If a clearer regulatory environment and reduced regulatory costs encourage the development and/or marketing of more PVCP-PIPs, R&D firms may benefit from the proposed rule because the products of their research could become more valuable to other companies.

Published data on R&D firms are very limited and highly aggregated for all R&D in the life sciences area. For example, the Bureau of Census groups these firms in a broad industry category, establishments involved in research and development in the life sciences (NAICS 54171), which includes establishments primarily engaged in conducting research and experimental development in medicine, health, biology, botany, biotechnology, agricultural, fisheries, forests, pharmacy, and other life sciences. In 2002 there were 2,417 establishments conducting research and development in biotechnology and other biological sciences. Total revenues for these companies were over $16 billion. In 2000, R&D firms involved solely in agricultural biotechnology generated $2.3 billion in revenues (Ernst & Young Economics Consulting and Quantitative Analysis 2000). However, these data are too aggregated for the Agency to use for the analysis of R&D firms that may be involved in research on PVCP-PIPs. Moreover, those firms involved in agricultural biotechnology develop a broad category of products, most of which would not be PVCP-PIPs.

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4. COST IMPACTS ON DEVELOPERS DUE TO PROPOSED EXEMPTION FOR CERTAIN PVCP-PIPS

This chapter presents the potential data requirements and method used to quantitatively assess the incremental cost of compliance of the proposed rule for exempting certain types of PVCP-PIPs from FIFRA registration. Options 1 and 2 are the broadest possible exemptions for PVCP-PIPs, exempting all products that EPA can determine *a priori* meet the low risk criterion. Option 1 contains a provision allowing PVCP-PIP developers to determine in some cases whether a product meets the qualifications. Although Option 2 exempts as many PVCP-PIPs as Option 1, Option 2 specifies that only the Agency can determine whether a product is exempt. Option 3 exempts fewer PVCP-PIPs than Options 1 or 2 because it eliminates those criteria enabling qualification for exemption that the Agency must review. Option 4 exempts no PVCP-PIPs and thus would require EPA to register all PVCP-PIPs. The compliance costs of Options 1, 2, and 3 are compared to a baseline of regulating all PVCP-PIPs (Option 4).

This chapter is organized as follows: first, the general methodology used to estimate the compliance cost savings is outlined; second, the cost savings estimates are presented; and third, the limitations of the cost savings analysis are summarized.

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4.1. General Methodology

The analysis uses a partial-budgeting approach to estimate the potential cost savings associated with exempting certain categories of PVCP-PIPs over the next 10 years as described under the conditions of each regulatory option. The model is static; it does not account for changes in the economy, public acceptance, or other market factors, such as those affecting the industry's growth and the manufacturing of PVCP-PIP products over the next 10 years. EPA estimated the number of products commercialized over 10 years to be 15-25 and assumed the products would be equally distributed over that period. EPA believes a static model is preferable to a more complex model, as it is difficult if not impossible to predict the dynamics of PVCP-PIP development given the many variables that could affect the industry and an insufficient history with PVCP-PIPs on which to base more complex assumptions with any confidence. The USDA Advisory Committee on Biotechnology and 21st Century Agriculture was recently tasked by the Secretary of Agriculture with predicting the direction of biotechnology in the United States. This committee reported that a broad range of variables could affect the success or failure of biotechnology products over the next decade (USDA Advisory Committee on Biotechnology and 21st Century Agriculture 2005, 2006). The market could vary significantly for each crop, and there is little information to judge how the large number of variables could impact PVCP-PIPs. For example, genetically engineered, virus-resistant papaya has been widely adopted in the Hawaiian papaya industry, but genetically engineered, virus-resistant potatoes are no longer commercialized in the United States due to market variables. Given that numerous market trends could affect the number of PVCP-PIPs brought to market in the next decade, there is no strong support for assuming either that submissions would increase or would decrease or that some years may see more submissions than other years.

Costs quantified include the compliance cost savings associated with exempting various categories of PVCP-PIPs from FIFRA registration, as described by the options. The analysis projects the total number of PVCP-PIPs that may be exempted over the next 10 years under each option. The potential data requirements are assessed for each type of PVCP-PIP that would either be exempted or registered. Whenever the data requirements for registration are mentioned, this includes the data requirements for a FIFRA §3 license and a FIFRA §5 experimental use permit, as well as fees for registration imposed under the Pesticide Improvement Act of 2003 and registration maintenance fees. Then, the cost savings are calculated for each option by multiplying the total number of each type of PVCP-PIP that would be exempted under each option by the cost savings associated with reduced data requirements.

The compliance cost savings depend on the type and number of PVCP-PIPs developed, the data needed to register or exempt each particular type of PVCP-PIP, and the unit costs of performing the tests to acquire the data to be recorded or reported. Obtaining accurate information about these three factors presents difficulties due to the uncertainty of the rapidly evolving technology and the dramatically growing and vertically integrating industry. The technology used to create certain PVCP-PIPs is new and evolving, which makes it difficult to project the number and type of PVCP-PIPs that will be manufactured and marketed under the four options. This changing technology also affects EPA's ability to project the specific data needs for registration or exemption of particular PVCP-PIPs. Data needs will depend upon variables such as the viral source of the transgene, how the transgene is modified, whether the recipient crop is intended for human consumption, and whether the recipient crop has a strong propensity for ferality and/or wild or weedy relatives in the United States.

EPA created nine case studies of types of PVCP-PIPs to reflect these differences and represent the broad range of possible PVCP-PIPs that may be developed. The general approach for creating the case studies is described next. The relationship of the options to the case studies, the projections for the expected number of PVCP-PIP submissions in the next 10 years, and the potential data needs for each case study are also presented.

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4.1.1. Case studies

Nine case studies were created to represent the different types of PVCP-PIPs that may be marketed over the next 10 years. In developing these case studies, three main factors directly related to the considerations described in the criteria for Options 1 through 3 were used: the characteristics of the modified plant, characteristics of the virus from which the coat protein gene was derived, and characteristics of the PVC-protein.

With respect to the characteristics of the modified plant, four main categories were identified: (1) plants with low propensity to naturalize and no wild relatives in the United States with which the plant can form viable hybrids in nature; (2) plants with low propensity to naturalize and wild relatives that are not considered weedy; (3) plants that have a high propensity to naturalize or wild relatives that are considered weedy; and (4) plants for which little information about wild relatives is known.

With respect to the characteristics of the virus from which the coat protein was derived, three main categories were identified: (1) viruses isolated in the United States from the plant species transformed with the PVCP-PIP, (2) viruses isolated outside the United States that naturally infect the transformed plant species, and (3) viruses that do not naturally infect the transformed plant species, whether isolated in or outside of the United States.

With respect to the characteristics of the PVC-protein, five main categories were identified: (1) no PVC-protein produced, (2) unmodified PVC-protein produced, (3) minimally modified PVC-protein produced, (4) substantially modified protein produced in a product for food use, and (5) substantially modified protein produced in a product for nonfood use.

Case studies were then developed based on the various characteristics enumerated above for the three factors (the plant, the virus, and the PVC-protein). One case study represents a product with characteristics that would warrant the least data for a risk assessment (case study 2), and thus the lowest costs. One case study represents a product with characteristics that would warrant the most data, and thus the highest costs (case study 9). Additional case studies were developed to represent the middle of the cost spectrum by varying the characteristics of two of the factors against the characteristic most commonly expected for the third factor. These case studies represent the broadest range of PVCP-PIPs that the Agency anticipates would most likely be manufactured in the near future, in order to facilitate differentiating the costs of various regulatory options. The following is a description of each case study:

- Case study 1: The modified crop plant has a low propensity to naturalize in the United States, and has no wild or weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is produced, encoded by a single unmodified coat protein gene.

- Case study 2: The modified crop plant has a low propensity to naturalize in the United States and has no wild or weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is not produced in the plant because the coat protein gene was inserted in an inverted repeat orientation.

- Case study 3: The modified crop plant has a low propensity to naturalize in the United States. The plant has wild relatives in the United States with which it can form viable hybrids in nature, but these hybrids have very limited fertility and the wild relatives are not considered weedy in the United States. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is not produced in the plant because the coat protein gene was inserted in an inverted repeat orientation.

- Case study 4: The modified crop plant is an ornamental with low propensity to naturalize in the United States. Little information is known about whether wild relatives exist in the United States with which the plant can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is not produced in the plant because the coat protein gene was inserted in an inverted repeat orientation.

- Case study 5: The modified crop plant has a low propensity to naturalize in the United States, and has no wild or weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated outside the United States from the same species as the crop plant modified to contain the coat protein gene. The coat protein gene was modified to reduce the frequency of recombination. PVC-protein is not produced in the plant because the coat protein gene was inserted in an inverted repeat orientation.

- Case study 6: The modified crop plant has a low propensity to naturalize in the United States and has no wild or weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is produced, encoded by a single coat protein gene that has been minimally modified by both N-terminal and C-terminal truncations.

- Case study 7: The modified crop plant has a low propensity to naturalize in the United States, and has no wild or weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is produced, encoded by a single coat protein gene that has been substantially modified by the addition of nucleic acid derived from a non-viral source, which results in 35 additional amino acids in the protein. The crop plant has only non-food uses and is not able to form viable hybrids in nature with any food plants.

- Case study 8: The modified crop plant has weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States from the same species as the crop plant modified to contain the coat protein gene. PVC-protein is produced, encoded by a single coat protein gene that has been minimally modified by the addition of nucleic acid from a different virus coat protein gene that results in a few additional amino acids in the protein. The crop plant is used for food.

- Case study 9: The modified crop plant has weedy relatives in the United States with which it can form viable hybrids in nature. The virus used to create the PVCP-PIP was isolated in the United States, but does not naturally infect the crop plant modified to contain the coat protein gene. PVC-protein is produced, encoded by a single coat protein gene that has been substantially modified by the addition of nucleic acid derived from a non-viral source, which results in 35 additional amino acids in the protein. The crop plant is used for food.

The case studies do not represent all possible PVCP-PIPs that could be developed given the number of variables considered. However, the case studies cover the full spectrum of possible products from one that would require the least data (case study 2) to one that would require the most data (case study 9). Table 6 presents a summary of the nine case studies, with some indication of the expected prevalence of PVCP-PIPs like these case studies. After considering the characteristics of the products that have already been marketed, characteristics of the crop plants that have been the subject of field trials for PVCP-PIPs, and knowledge of the field of genetically engineered virus-resistant crops, EPA estimated the percentage of products projected to be characterized by each case study as the prevalence of the case study. Due to the inexact nature of predicting the future, several EPA staff members knowledgeable in this area and with expertise in the fields of molecular biology, ecology, and protein biochemistry independently estimated the percentage of products likely to be associated with each case study, by first considering the percentage of products likely to fall into each of the categories identified for the plant, the virus, and the protein. The characteristics of the plant, the virus, and the protein were considered to be independent variables such that the probability that a product would have any combination of the three could be found by multiplying the independent probabilities. The estimates of four EPA scientists were averaged to arrive at the numbers appearing in Table 6. There is necessarily a great deal of uncertainty associated with these predictions.

Table 6: Summary of Case Studies and Their Prevalence

Case Study	Plant	Virus	Protein	Prevalence
1	No wild relatives and low or no propensity to volunteer in the U.S.	Isolated from plants of the transformed species in the United States	Encoded by entire coat protein gene with no modifications	9%
2	No wild relatives and low or no propensity to volunteer in the U.S.	Isolated from plants of the transformed species in the United States	No protein produced	14%
3	Have wild relatives that are not considered weedy	Isolated from plants of the transformed species in the United States	No protein produced	13%
4	Little information about wild relatives is known	Isolated from plants of the transformed species in the United States	No protein produced	4%
5	No wild relatives and low or no propensity to volunteer in the U.S.	Isolated outside the U.S. and do infect the transformed plant species	No protein produced	1%
6	No wild relatives and low or no propensity to volunteer in the U.S.	Isolated from plants of the transformed species in the United States	Minimally modified protein	11%
7	No wild relatives and low or no propensity to volunteer in the U.S.	Isolated from plants of the transformed species in the United States	Substantially modified protein for nonfood use	1%
8	Wild relatives in the U.S. that are weedy or have high propensity to volunteer	Isolated from plants of the transformed species in the United States	Minimally modified protein	4%
9	Wild relatives in the U.S. that are weedy or have high propensity to volunteer	Does not naturally infect the transformed species	Substantially modified protein for food use	0.003%

4.1.2. Relationship of options to case studies

The Agency evaluated four regulatory options (see Chapter 3 of this EA for options). Table 7 illustrates the relationship of the scope of PVCP-PIPs to be exempted and regulated under each option with the different case studies that were developed.

Table 7: Analysis of Case Studies Exempted from Registration under Various Options

Option	Case studies exempted from registration	Case studies subject to registration
1	1, 2, 3, 4, 5, 6	7, 8, 9
2	1, 2, 3, 4, 5, 6	7, 8, 9
3	1, 2	3, 4, 5, 6, 7, 8, 9
4	None	All

PVCP-PIP products like case studies 7, 8, and 9 will be subject to registration under all four options, while products like case studies 1 and 2 will be exempted from registration under Options 1, 2, and 3. Products like case studies 3, 4, 5, and 6 will be subject to registration under Options 3 and 4, but exempted from registration under Options 1 and 2. As noted in Chapter 3, the difference between Option 1 and Option 2 is that under the latter, exemptions from registrations are determined by EPA upon satisfactory evaluation by the Agency.

4.1.3. Projections for the number of PVCP-PIP submissions

Assumptions of potential numbers of PVCP-PIPs likely to be developed in the next 10 years are based on the U.S. database of completed regulatory agency reviews (found at http://usbiotechreg.nbii.gov/database_pub.asp) and the USDA/APHIS database of small-scale field tests on transgenic plants (found at http://www.nbiap.vt.edu/cfdocs/fieldtests1.cfm).

EPA experience

Since 1994, the Agency has seen five PVCP-PIPs that would be regulated under Option 4 of this EA (Table 8) and that have been submitted to USDA for a determination of non-regulated status.

Table 8: Existing Crops Containing a PVCP-PIP

Crop	Current Owner	# Products	Current Status
Squash	Monsanto	2	Currently marketed
Papaya	Papaya Administrative Committee	1	Currently marketed
Potato	Monsanto	1	No longer marketed
Plum	USDA Agricultural Research Service	1	Not yet marketed

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USDA/APHIS database

The USDA/APHIS maintains a database of Environmental Release Permits (ERPs) and notifications of field tests for transgenic plants[6]. Several aspects of the database introduce uncertainty into this analysis to project the number of PVCP-PIPs likely to be commercialized in the next decade. First, for some types of virus-resistant plants, the database does not indicate whether the phenotype is conferred by a PVCP-PIP, as the donor gene is confidential business information. Second, a single product is likely subjected to multiple field tests that will each appear as separate listings. The database does not explicitly indicate when multiple listings actually cover the same product. Third, companies frequently test several different versions of a virus resistant plant with the intention of marketing only the best performing. The number of listings is therefore considerably higher than the number of products that are ultimately marketed.

To estimate the number of field trial applications that might result in a PVCP-PIP that would be seen by EPA, the Agency first screened each crop in the database to determine whether it was engineered to contain a virus resistance trait that might be based on a coat protein gene, i.e., either a coat protein gene was specified or the genotype was listed as confidential business information. Products that appeared to be similar based on their genotype and phenotype were grouped together to try to account for PVCP-PIPs that may have been modified through the course of research and/or PVCP-PIPs that underwent multiple field trials but would likely yield no more than a single commercial product. In addition, it was assumed that multiple entities would not market an identical product. EPA further evaluated how many of these unique PVCP-PIPs the Agency believed would be developed into commercial products, based on a number of factors including: a literature search to investigate the degree of viral resistance conferred by the PVCP-PIP, the length of time since the field trial permit was issued without subsequent activity, a search of field trials in other countries, and discussions with scientists knowledgeable in the field of genetic engineering.

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Projections for This EA

EPA primarily used the USDA/APHIS database as discussed above to estimate the projected number of PVCP-PIPs that would be ready for commercialization in the next 10 years. However, EPA also considered the U.S. database of completed regulatory agency reviews and EPA experience in this evaluation to account for the fact that the number of products marketed to date suggests that there are many products in the development pipeline that have not been brought to market, for a variety of reasons that would not be affected by EPA's issuance of this proposed rule. Thus, although the analysis of the USDA database suggested that as many as 80 or more products could conceivably be brought to market in the next 10 years, this was considered an unreasonably high estimate, given the fact that only five products have reached the commercialization stage in the last 10 years. The Agency assumes a uniform distribution in the number of products per year and estimates that 15-25 products could be ready for commercialization in this period, or 1.5-2.5 per year on average. The number of products expected over 10 years represented by each of the case studies (Table 9) can be determined based on their estimated prevalence found above in Table 6.

[6] found at http://www.nbiap.vt.edu/cfdocs/fieldtests1.cfm

Table 9: Number of PVCP-PIPs Expected Over 10 Years Like Each Case Study

Case Study	Number of PVCP-PIPs Expected Over 10 Years
1	1.4 – 2.3
2	2.1 – 3.5
3	2.0 – 3.3
4	0.6 – 1.0
5	0.2 – 0.3
6	1.7 – 2.8
7	0.2 – 0.3
8	0.6 – 1.0
9	0.0005 – 0.0008

4.1.4. Potential data needs for each case study

The Agency has not codified the data requirements specifically for PVCP-PIPs or for PIPs in general. However, for the purposes of this economic assessment, the Agency compiled a list of data/information needs that might reasonably be associated with each case study were it to be submitted to the Agency for a registration review. EPA staff familiar with information used to evaluate other types of PIPs and with expertise in ecology, molecular biology, virology, and protein biochemistry, estimated the types of data needed to evaluate each PVCP-PIP case study. They did this based on the content of USDA petitions for deregulation of PVCP-PIPs, current knowledge of the nature of PVCP-PIPs, EPA's expertise working with all types of biological pesticides, and the current data requirements at 40 CFR part 158. To date, EPA has relied on the microbial data requirements found at 40 CFR part 158 when evaluating PIPs because the existing PIPs have all come from microorganisms (bacteria or viruses). The Agency has used its authorities under FIFRA to require the generation of additional data when appropriate. Not all PVCP-PIPs meeting the description of any given case study would necessarily need all of the information to conduct a risk assessment. Tests were included if the information might reasonably be needed depending on the particular characteristics of the PVCP-PIP and potential routes of and levels of exposure. For this analysis, the characteristics of each case study drive the data needs. For example, if the plant has wild relatives in the United States with which it can form viable hybrids, it will be important to consider the effect that acquired virus resistance could have on the wild relatives. The Agency assumed it would use a "tiered" approach to data needs, as with other biological pesticides. Under a "tiered" approach, testing to meet the second or third tier data requirements is needed only if the results of the first tier testing indicate that additional data are needed to assess risk adequately. Some of the higher tiered tests may be needed for some PVCP-PIPs when the results from lower tiered tests indicate that more information is warranted to evaluate the potential risks from the pesticide to the environment or human health.

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Table 10: Information for Conducting a Risk Assessment for Each Case Study for FIFRA Registration Baseline

Case Study Plant relatives Virus Protein	**1** None Native Unmod.	**2** None Native None	**3** Non-weedy Native None	**4** No info. Native None	**5** None Exotic None	**6** None Native Min. mod.	**7** None Native Sub. mod. (non-food)	**8** Weedy Native Min. mod.	**9** Weedy Het. res. Sub. mod. (food)
Genetic construct ID & characterization [a]	X	X	X	X	X	X	X	X	X
Protein ID & characterization (plant expressed) [b]	X					X	X	X	X
Surrogate protein production [c]							X		X
Quantified concentration of protein produced [d]	X					X	X	X	X
Protein analytical detection method [e]	X					X		X	X
Plant identification [f]	X	X	X	X	X	X	X	X	X
Sexual compatibility testing [g]				X					
Viral pathotype characterization [h]					X				X
List of other viruses [i]									X
Outcrossing potential [j] & hybrid characterization [k]			X					X	X
Potential impact of introgression [l]								X	X
Exposure pattern changes [m]	X					X	X	X	X
Amino acid similarity studies [n]						X	X	X	X
In vitro digestibility [o]									X
Assessment of heat stability/lability									X
Acute oral toxicity [p]									X
Non-target effects [q]							X		X [r]
Benefit analysis [s]	X	X	X	X	X	X	X	X	X

Notes:

[a] Includes identification of the source of the genetic material, including identity of viral pathotype; a description of the development and production process (integration method and transformation system, including any modifications of sequence(s)); the genetic construct map (insert), including any modifications of the nucleic acid sequence; and characterization of the genetic insert to confirm expected identity, e.g., by restriction enzyme digestion and Southern blot analysis of the inserted DNA in the plant and/or PCR sequence analysis of the insert and flanking regions of genomic DNA.

[b] Includes the amino acid sequence of the coat protein or fragment thereof translated from the genetic insert; a comparison of the sequence with naturally occurring sequences, if modified; and characterization to identify/verify the expected product is produced (plant expressed), e.g., by

determining molecular weight by SDS-PAGE and/or western blot analysis, glycosylation analysis, N-terminal amino acid sequencing, and/or MALDI-TOF mass spectrometry.

[c] Includes (1) development of a non-plant protein expression system; (2) characterization of the protein to show equivalence with plant-expressed protein, e,g, by molecular weight by SDS-PAGE and/or western blot analysis, glycosylation analysis (if non-bacterial system utilized), N-terminal amino acid sequencing, and/or MALDI-TOF mass spectrometry; and (3) production of gram quantities of the protein for toxicity testing, e.g., medium-scale fermentation, extraction, and purification.

[d] In various tissues, e.g., leaf, seed, fruit, pollen, and whole plant by Western blot or ELISA.

[e] Validated analytical detection method in seed or grain, e.g., ELISA or lateral flow strip test (OPPTS guideline 860.1340), and submission of samples (OPPTS guideline 830.1900). The company must submit a method protocol and an "independent laboratory validation" study. EPA's Fort Meade lab uses the protocols to "validate" the method.

[f] Includes the common and scientific name, with variety (if known) of the modified crop plant; a list of known wild or weedy relatives in the United States with which the plant can form viable hybrids in nature, including information on their weedy or invasive potential and endangered/threatened species status; and a description of the propensity of the crop plant to naturalize, including the extent of existing feral populations. "United States" here and elsewhere in this table includes the Commonwealth of Puerto Rico, the Virgin Islands, Guam, the Trust Territory of the Pacific Islands, and American Samoa.

[g] To determine the ability to form a viable hybrid between the modified crop plant and wild or weedy relatives in the United States (e.g., by greenhouse tests). Testing would begin with the most closely related species in the same family that occur in the area of cultivation.

[h] Includes the geographical location where virus was isolated, information about the geographical distribution of the viral pathotype, including in particular whether it occurs in the United States; a list of which plant species in the United States have been or are naturally infected by the virus(es) used to construct the PVCP-PIP; and a list of plant species outside of these areas naturally infected by the virus(es).

[i] List of other virus(es) that are known to naturally infect the plant species that are naturally infected by the virus(es) used to construct the PVCP-PIP.

[j] Includes information on potential outcrossing with all wild or weedy relatives with which the modified plant can form viable hybrids in nature, e.g., degree of sexual compatibility, degree of overlap in the geographic distribution of relatives and crop cultivation areas, and/or phenology assessment.

[k] Characterization of crop-relative hybrid fitness (comparing hybrid and wild or weedy parent, virus free vs. virus-infected), including seedling emergence (germination rate), vegetative vigor (above and below-ground biomass), reproductive timing and output (seed set), and stability of the acquired transgene in the hybrid.

[l] For example, plant community dynamics modeling, growth chamber, mesocosm, and/or field studies.

[m] Discussion of any changes from previous human/environmental exposure patterns to the virus coat protein.

[n] Including bioinformatic amino acid sequence comparison of short contiguous amino acid segments using an allergen database to identify any allergens containing identical short sequences and bioinformatic amino acid sequence search for overall similarity with known toxins and allergens.

[o] In simulated gastric fluid and simulated intestinal fluid, e.g., following the procedure in Nat. Biotech. 14:1269-1973 or Reg. Tox. Pharm. 39:87-98.

[p] In mice (OPPTS guideline: 870.1100 – limit dose study).

[q] Includes honey bee testing; non-target insect testing, tier I (OPPTS guideline 885.4340); avian oral, tier I (OPPTS guideline 885.4050); wild mammal testing, tier I (OPPTS guideline 885.4150); estuarine and marine animal testing, tier 1: (OPPTS guideline 885.4280); freshwater fish testing, tier I: (OPPTS guideline 885.4200); and freshwater aquatic invertebrate testing, tier 1: (OPPTS validated test 885.4240).

[r] Wild mammal testing excluded.

[s] Under FIFRA 3(c)(7)(c).

This cost impact analysis was done in the following four steps:

Step 1. Determine the unit test costs of each data requirement and burden for each case study scenario.

Step 2. Determine the data requirements per case study.

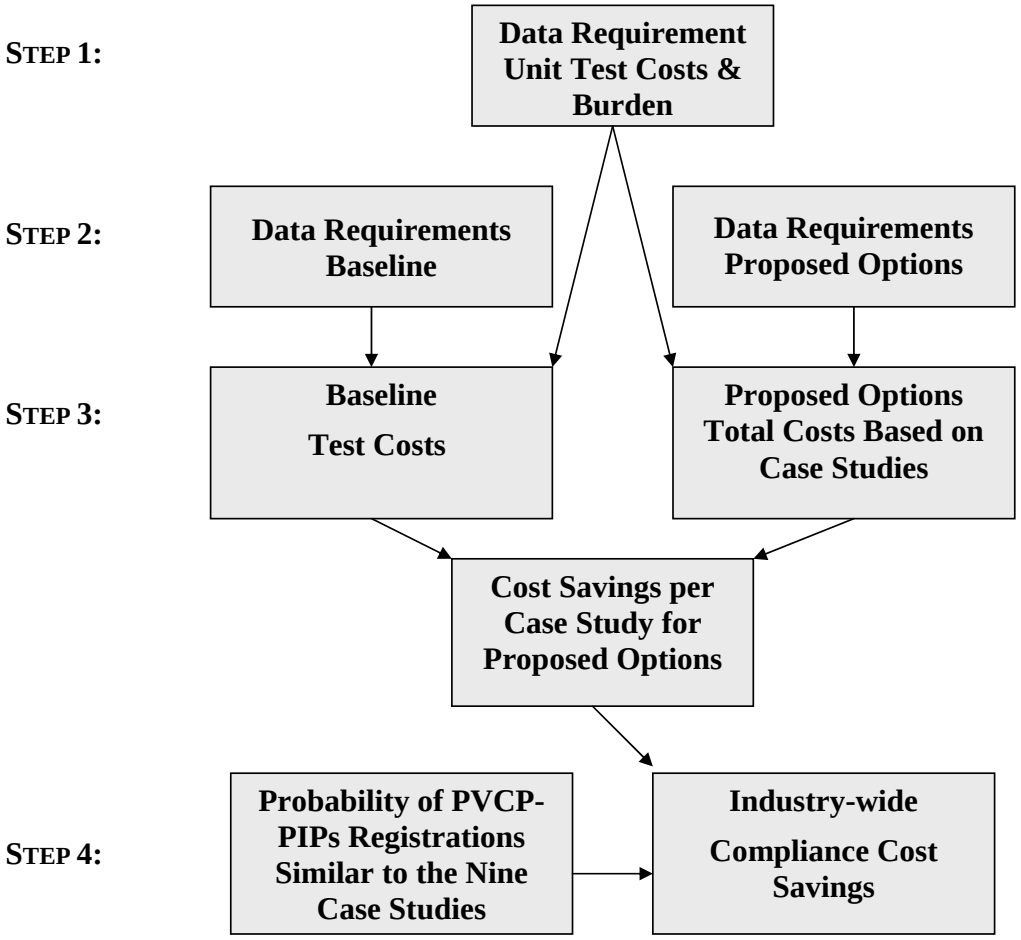
Step 3. Determine the cost savings per case study for each option.

Step 4. Determine the industry-wide impacts.

Chart 2 illustrates the methodology for estimating the change in compliance costs. First, for Step 1, the costs for the data requirements identified in Table 10 were estimated. Some of the

data requirements mainly involve gathering and reporting information by the PVCP-PIP developer to EPA. For these types of tasks, the burden – labor multiplied by hourly rates – for a technician to satisfy the requirements was also estimated. We estimate managerial review of the reporting tasks to be 20 percent of technical effort, with an additional 10 hours of clerical support required to complete the reporting tasks. The burden is specific to the case studies and differs among options. The unit test costs (from Step 1) are multiplied by the data requirements (Step 2) and added to the option-specific burden for both the baseline and proposed alternative options to estimate total cost per case study (Step 3). For any given year, the bundle of PVCP-PIP products that will be ready for commercialization will depend on the probability of a PCVP-PIP product like one of the nine case studies being developed. These probabilities may be defined by the range of number of PVCP-PIPs expected over 10 years in Table 9. The test costs saving per case study for Options 1, 2, and 3 is the difference in the total cost for exemptions and registrations between the baseline of registration and the proposed exemption options. For any year, the cost saving per case study for a proposed option was multiplied by the expected number of PVCP-PIPs like each case study developed that year to get the industry-wide cost impacts for each proposed option (Step 4).

Chart 2: Methodological Flowchart for Analyzing the Cost Impacts Associated with Proposed Changes to 40 CFR Part 174.27



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4.2. Unit Test Costs and Burden Estimates

In order to provide the data potentially required for a PVCP-PIP registration, registrants must submit or cite test results or other information to satisfy the possible data requirements. The test costs are the costs of complying with the specific data requirements, which depend on the type of product and use pattern. Burden estimates are generally synonymous with reporting- and recordkeeping-type requirements.

Several laboratories provided test cost data for different PVCP-PIP data requirements. Laboratories were asked to identify the method, range, analytical, and fixed cost for each

guideline based on a set of predetermined protocols. If for any test the component costs were not available, the laboratories were asked to provide a total. Understanding that the lab costs could vary considerably based on the study protocol chosen by the lab, high cost and low cost estimates were requested for each study protocol in order to bracket the costs. To establish the protocols, EPA initially identified the various study design options for each study based on the Office of Pesticide Prevention and Toxic Substances (OPPTS) guidelines. In cases where data requirements do not have predetermined OPPTS guidelines, the labs were asked to provide a range of costs based on their best professional judgments of the tasks involved to complete the required tests. Details on test cost data required for registering PVCP-PIPs that was used in this study are presented in Appendix C: Test Cost Data Used to Calculate Costs for 40 CFR Part 174.27. The estimated average costs of complying with individual OPPTS guidelines ranged from $495 (830.1900, Submission of samples) to $65,000 (885.4150, Wild mammal testing, Tier I.). The highest estimated average cost for all kinds of tests was $1,035,000, for studies to evaluate the potential impact of transgene introgression, which does not have an OPPTS guideline. In addition to tests costs and burden, for the baseline, a developer will have to pay a registration fee (about $249,000 in 2005) for registration of its product. Under the proposed regulation changes, the registration fee will be paid only when a product is registered. This results in a reduction in the compliance cost under the three alternative proposed options proportional to the number of products exempted from registration.

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4.3. Data Requirements per Registration or Exemption

The initial product analysis data needs for EPA registration of certain types of PVCP-PIPs are similar to the USDA/APHIS informational requirements for Environmental Release Permits (ERPs) or petitions for determination of non-regulated status. These data consist of basic information that is created as part of the research and development of these pesticides. The product analysis data needs for PVCP-PIPs are similar to those needed to meet USDA/APHIS requirements. Therefore, an application specifically for registration under FIFRA would not necessarily incur costs for such data that can be attributed to EPA. However, it is unclear whether costs should be assigned to EPA or USDA, particularly because USDA is currently rewriting regulations for all genetically engineered plants, including those containing a PVCP-PIP, and USDA data requirements could change. Given this uncertainty, EPA has chosen to include all costs incurred to register a PVCP-PIP in this analysis, whether or not such information may be needed for a review of the product at USDA. For information related to USDA/APHIS requirements, see Appendix D.

In addition to test costs, registrants are expected to report data that are readily available through the development of the PVCP-PIP, or through literature searches, public websites, and breeder records. These tasks involve only burden hours to comply with the registration process. The analysis grouped the burden activities for complying with data requirements for registration of PVCP-PIPs under FIFRA into eight categories, namely, read instructions, plan activities, create information, gather information, compile and review, complete paperwork, maintain and file, and additional activities. Technical hours for the baseline are estimates of the time needed by a developer to complete the required reporting tasks. The technical hours for the baseline in this EA are “loosely” based on the technical hours in an Information Collection Request (ICR)

for PIP Confidential Business Information (CBI) substantiation (with some minor adjustments to account for the different case studies and the special nature of these products).[8] (See Appendix E: Burden Hours and Estimates Used to Calculate Compliance Costs for 40 CFR part 174.27.) The burden hours for managerial review are estimated to be 20 percent burden hours for technical staff, and we project 10 hours of clerical support for each case study and for all options.

To obtain burden and cost estimates for the various options, the following rules were used. Since case studies 7, 8, and 9 are registered under all options, the data requirements for PVCP-PIP products should be the same under all options. However, under Option 3, case studies 1 and 2 would be exempt. The only information a developer would have to supply to the Agency is (1) a statement certifying that the product meets the conditions of the exemption, (2) the source of the genetic material, and (3) the name of the modified plant. Under Option 3, the other case studies would be registered and the burden would not change from Option 4 (full registration).

Under Option 1, case studies 1 and 2 would be exempt and the burden would be the same as under Option 3. Case studies 7, 8, and 9 would be registered and the burden would be the same as for Options 3 and 4. However, under Option 1, case studies 3, 4, 5, and 6 are also exempt. For case study 3, data would be needed on the genetic construct identification and characterization, but no benefit analysis would be required. Outcrossing potential and hybrid characterization may be needed for case study 3 products, depending on which alternative of the proposed rule is finalized.[9] Case studies 4, 5, and 6 would need to report the same data as though they were being registered, but a benefit analysis would not be required.

Under Option 2, case studies 3, 4, 5, and 6 are exempt and the burden is the same as for Option 1. Case studies 1 and 2 are exempt, but now the burden is the same as for registration (Option 4), excluding benefit analysis and the analytical detection method for case study 1. The registration cost estimates are summarized by case study in Table 11.

As discussed earlier, differences in the costs reflect the different data needs for different types of PVCP-PIPs. One factor affecting the data needed is the degree to which any PVC-protein produced has been modified from a natural plant viral coat protein. For example, case studies for which a history of safe exposure to the PVC-protein is not known to exist (e.g., case studies 7 and 9) would require more data on the human health effects and non-target organism effects than for case study 1 where there is a history of safe exposure. Another factor is the plant containing the PVCP-PIP. Case studies with plants that have wild relatives (e.g., case studies 8 and 9) would require additional testing to gather information on the biological fate of the PVCP-PIP in the environment. A range of cost estimates was calculated for each case study. The expected values were used to calculate the aggregate cost estimates and account for the probability that some tests may be required for only a portion of the time.

[8] The reference numbers for this ICR are EPA ICR #1693.04; OMB control #2070-0142 (August 2003).

[9] For this reason, we assume that outcrossing potential and hybrid characterization would be required for 50 percent of PVCP-PIPs like case study 3.

4.4. *Total Cost Savings per Option*

To estimate the compliance costs associated with each option, it is necessary to establish the data needed for review under each case study and estimate the cost to generate the data and submit the test results. The compliance cost savings from regulating only a subset of PVCP-PIPs (Options 1, 2, and 3) is then determined by comparing the compliance costs of each of these options with the compliance cost of registering all PVCP-PIPs (Option 4).

4.4.1. *Cost estimates for data submissions to the agency*

As shown in Table 10, the case studies were used to formulate potential PVCP-PIP data requirements. Low, high, and average cost estimates for collecting information and conducting individual tests were obtained from various sources including laboratories, EPA labor burden hour estimates, and best professional judgment estimates.

Table 11 presents the estimated compliance costs associated with each option. This is equivalent to the compliance cost for the four options per registration action if one PVCP-PIP of each of the nine case studies were ready for commercialization in any year. The test costs were obtained from a survey of laboratories that may have the experience of performing the tests required for registering a PVCP-PIP. Over 20 laboratories and companies were contacted, based in part on a National Pesticide Information Retrieval System (NPIRS – this is the subscription-based public version of EPA's Pesticide Data Management System (PDMS)) database search of laboratories and companies that had previously conducted and/or submitted data to EPA to support PIP registrations. Of the organizations contacted, only a few provided data used in this report. This may be primarily due to the relative novelty of the requirements and a lack of experience related to PVCP-PIPs.

The first column of numbers presents low and high estimates of the cost of tests that would be required by EPA for PVCP-PIPs like the respective case studies under the baseline (option 4). (The tests required for the respective case studies are summarized in Table 10.) The next four columns of numbers present the total compliance cost (unit test cost plus burden) for a PVCP-PIP like any of the nine case studies under the baseline and the three alternative options. These were the compliance cost estimates used to estimate expected industry compliance cost and regulatory relief from the regulatory options.

Again, as a result of the current uncertainty of the reporting requirement for outcrossing potential and hybrid characterization for case study 3 under Options 1 and 2, we estimated that 50 percent of PVCP-PIPs like case study 3 would have reporting requirements for outcrossing potential and hybrid characterization under Options 1 and 2.

In reality, EPA is not certain of how many products similar to the nine case studies would be registered or exempted over a 10-year period. However, as discussed in Section 5.1.3, the Agency projected these numbers based on the U.S. database of completed regulatory agency reviews and the USDA/APHIS database of small-scale field tests on transgenic plants. The section below discusses how these projections together with the information in Table 11 were used to obtain estimates of compliance cost for the four options over a 10-year period.

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Table 11: Compliance Costs for Four Alternative Options per Registration and/or Exemption.

	COSTS (thousands)				
	Test Costs (Baseline)	Average Burden and Test Costs			
	Range	Baseline (Registration)	Option 1	Option 2	Option 3
Case Study 1	$190 - $510	$350	$1	$80	$1
Case Study 2	$140 - $400	$270	$1	$20	$1
Case Study 3	$340 - $800	$570	$170	$170	$570
Case Study 4	$140 - $420	$280	$30	$30	$280
Case Study 5	$140 - $400	$270	$20	$20	$270
Case Study 6	$190 - $520	$360	$110	$110	$360
Case Study 7	$340 - $740	$540	$540	$540	$540
Case Study 8	$420 - $2,970	$1,700	$1,700	$1,700	$1,700
Case Study 9	$670 - $3,360	$2,020	$2,020	$2,020	$2,020

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4.4.2. Total compliance costs

The test costs and burden are incurred each time a developer requests a particular registration or exemption action. The Agency determined the expected number of PVCP-PIPs like the nine case studies to be developed over a 10-year period, and this is presented in Table 9 above. The eventual timing of the development of different types of PVCP-PIPs over 10 years is also not known at this time. In order to project the estimate of the expected compliance cost for registering PVCP-PIPs under the baseline and the regulatory relief under the three proposed options, we used the expected number of PVCP-PIPs like the nine case studies to be developed over a 10-year period in determining probability distributions for the likelihood of the development of PVCP-PIPs over a 10-year period. If an outcome is described as whether a PVCP-PIP is ready for commercialization or not, then a successful event is a PVCP-PIP similar to one of the case studies being ready for commercialization in a given year. For any case study, the assumed probability of a PVCP-PIP being ready for commercialization in any year within the 10-year period may be obtained from Table 9, with the following formula:

Expected number of PVCP-PIPs over 10 years / 10 = Number of PVCP-PIPs in a year

The results of the range of PVCP-PIPs expected over 10 years for each case study are expressed as percentages and presented in Table 12. Note that Table 12 is essentially a normalization of the case study prevalences from Table 6 into probabilities, based on the number of PVCP-PIPs expected over the next ten years. This is necessary because of the fact that not all possible PVCP-PIPs are characterized by the nine case studies, but compliance costs need to be estimated for all of the new products we expect. Although not all possible PVCP-PIPs are characterized by the nine case studies, the case studies do span the entire range of cost estimates. We expect some of the "missing" case studies would be registered under all four options. We

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also expect the compliance costs of "missing" cases studies that would be exempted from registration under the proposed options would fall within the range of costs identified in this EA. As a result, even though including the "missing" case studies would necessarily mean higher compliance costs than reported here, the estimates of compliance cost savings from the regulatory relief under the three proposed options would not change significantly.

Table 12: Probability of Registration Associated with Each Case Study

Case Study	Probability of PVCP-PIPs Developed in a Single Year Over the Next 10 Years
1	14 – 23%
2	21 – 35%
3	20 – 33%
4	6 – 10%
5	2 – 3%
6	17 – 28%
7	2 – 3%
8	6 – 10%
9	0.005 – 0.008%

The following experiment was conducted for each case study in order to determine if a PVCP-PIP is developed in any given year. A set of 10 random numbers is drawn from the uniform probability distribution ranging between 0 and 1. A successful outcome results (or a PVCP-PIP like that case study is assumed to be developed in that year) if the number drawn for any year falls within the appropriate range for that case study. Conducting this experiment for each case study, using a different set of 10 random numbers each time, yields a set of 10 outcomes for the nine case studies. The result of this is a set of results for the number of PVCP-PIPs like the nine case studies available for registration under the baseline and three alternative options over a 10-year period. The compliance cost savings for Options 1, 2, and 3 for the 10-year period are determined by comparing the compliance cost for this set of PVCP-PIPs to the compliance costs under the baseline (Option 4). By repeating the experiment 5,000 times, each time using different sets randomly drawn numbers, EPA estimated the compliance cost for all options by the average over the 5,000 sets of compliance costs.[10] The annual compliance costs are shown in Table 13 with an annual average over the 10 years.

The 10-year annualized average of total compliance cost for Option 4, the baseline of registration for all PVCP-PIPs, is about $550,000. The annual compliance cost for the baseline was between $540,000 and $560,000 without discounting. Option 1 has the lowest average annual compliance cost of $220,000 over a 10-year period. Average compliance costs are higher by about $20,000 with Option 2. Option 3 also has lower average compliance costs than Option 4 by about $140,000. Regulatory relief from the proposed options is evident by the lower total industry compliance costs for Options 1, 2, and 3. For each year in Table 13, the number of

[10] Even though we average compliance cost over a sample that was generated from 5,000 different sets of random draws, the cost estimates are stable well before the end of this sample.

PVCP-PIPs considered under the baseline and the options are the same, but developers experience lower compliance costs, since some of the PVCP-PIPs developed would be exempted from registration under the proposed options, with the associated lower test cost and burden.

Table 13: Average Total Compliance Cost[a]

Option	Total Compliance Costs (thousands)										
	Year										
	1	2	3	4	5	6	7	8	9	10	Average
Not Discounted											
Option 1	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	**$220**
Option 2	$240	$240	$240	$240	$240	$240	$240	$240	$240	$240	**$240**
Option 3	$410	$410	$410	$410	$410	$410	$410	$410	$410	$400	**$410**
Registration	$550	$550	$550	$550	$540	$550	$560	$550	$550	$550	**$550**

[a] The compliance costs in this table represent the costs for new products with an exemption or a new registration. There are other compliance costs that apply to registered products and that are not included in these estimates, e.g., costs associated with certain other requirements of registration.

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In order to obtain compliance cost savings from Options 1, 2, and 3, EPA subtracted the annualized compliance costs for these options from the compliance costs for the baseline (Option 4). Table 14 presents the compliance cost savings as a result of regulatory relief for Options 1, 2, and 3 over a 10-year period without discounting and with discounting at 3 percent and 7 percent. The average annual compliance cost savings for the preferred option was $330,000, and the annual compliance cost savings was between $140,000 and $330,000, in nominal terms. The preferred option results in the highest amount of regulatory relief. Option 2 results in regulatory relief of $310,000 a year on average, with a range of between $310,000 and $320,000. This is quite similar to the regulatory relief under the preferred option, since the same PVCP-PIPs are exempted from regulation. The main difference in compliance costs savings between the two options stem from slightly higher test costs and burden required under Option 2. Regulatory relief under Option 3 is less than half as much as Option 1 or Option 2. This is primarily a result of fewer PVCP-PIPs qualifying for registration exemption. Also shown in Table 14 are the present values of the cost savings for each of the options. At a 3% discount rate, the present value of the cost savings of the regulations over the first ten years ranges from about $1.2 million for Option 3 to about $2.8 million for Option 1. At a 7% discount rate, the present value of the cost savings over the next ten years ranges from about $1 million to about $2.3 million.

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Table 14: Total Compliance Cost Savings for a 10-Year Period with Discounting

Option	Total Compliance Cost Savings (thousands)										
	Year										
	1	2	3	4	5	6	7	8	9	10	Annual Average
No Discounting											
Option 1	$330	$330	$330	$330	$330	$340	$330	$330	$330	$330	**$330**
Option 2	$310	$310	$310	$310	$310	$320	$310	$310	$310	$310	**$310**
Option 3	$140	$140	$140	$140	$140	$140	$140	$140	$140	$140	**$140**
3% Discount											Present Value
Option 1	$320	$310	$300	$290	$280	$280	$270	$260	$250	$240	**$2,800**
Option 2	$300	$290	$280	$280	$260	$260	$250	$240	$240	$230	**$2,630**
Option 3	$130	$130	$130	$120	$120	$120	$110	$110	$110	$110	**$1,190**
7% Discount											Present Value
Option 1	$310	$290	$270	$250	$230	$220	$210	$190	$180	$170	**$2,320**
Option 2	$290	$270	$250	$240	$220	$210	$200	$180	$170	$160	**$2,190**
Option 3	$130	$120	$110	$110	$100	$90	$90	$80	$80	$70	**$980**

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4.5. Limitations of the Costs Analysis

The greatest cost savings from this rule are associated with the decreased cost of generating data in support of registrations of some types of PVCP-PIPs because of the inherently lower human health and ecological risks of these products. Estimating these cost factors is uncertain and complicated due to a number of variables.

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4.5.1. Unit costs

Most required studies and tests are quite specific to PIPs, and guidelines for these studies and tests have not been developed. As a result, most of the unit cost estimates are based on best professional judgment and estimates from a few laboratories. (See Appendix C: Test Cost Data Used to Calculate Costs for 40 CFR Part 174.27.) Compared to labs offering testing on conventional pesticides, relatively few labs offer some of the tests required for PVCP-PIP registration. For a number of studies there is a wide range of cost estimates. Although the Agency is not in a position to know the particular underlying reasons for this, presumably it is grounded in typical economic considerations, tempered by the particular experience that labs may have had with the study protocols.

4.5.2. Frequency of PVCP-PIP registration

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The analysis is limited by the uncertainty surrounding the dynamics of the industry producing PVCP-PIPs and the products that will be available in the future. The absence of published data on firms developing these products and the products themselves limited EPA from employing a dynamic model to evaluate the proposed rule. There is uncertainty in the projections of the number and types of PVCP-PIPs that may be developed in the future. For this EA, we have employed the use of a probability distribution to help account for the uncertainty of the dynamics of innovation and registration within the industry producing PVCP-PIPs.

The limited number of existing PVCP-PIPs provides limited information to allow for good projections for the expected number and timing of future registrations. The use of a probability distribution in the EA was intended to lessen the effects of the lack of information.

The effects that various novel PVCP-PIPs might have on the environment and human health will depend on a number of characteristics of the PVCP-PIP, including for example, the extent to which the PVC-protein is modified from a natural plant virus coat protein. The Agency has made every effort to include in the case studies cost estimates for those tests that are most likely to produce the information and data needed to make a determination that a particular PVCP-PIP will not cause "unreasonable adverse effects on the environment." It is conceivable that some of the data needs listed in the case studies will not be required for certain PVCP-PIP/crop combinations and/or that additional or entirely new data will be needed. It is possible that certain data needs will change as the Agency becomes more experienced with the data needed to review PVCP-PIPs.

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4.5.3. Case study prevalences

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The results are highly dependent on assumptions of the prevalences, much like the overall number of PVCP-PIPs that are commercialized in the next 10 years. For example, the benefits of the rule decrease as the prevalence of PVCP-PIPs like case studies 7, 8, and 9 increase because they would not be exempt under any of the exemption options and are therefore associated with no cost savings. These case studies were chosen to span the possible outcomes and were included even though they are unlikely events. Case studies representing PVCP-PIPs with the greatest potential risks are assumed to be rare based on the nature of existing PVCP-PIPs and the fact that most virus problems could be solved with relatively safe applications of PVCP-PIPs. In addition, the existence of an exemption for safer products is likely to further drive product development in such a direction.

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4.6. Existing Products

Although it is not possible to predict the exact form of the final rule and determine which existing products would qualify for exemption from FIFRA registration, EPA anticipates that some of the existing products may not qualify. Any PVCP-PIP not exempted from registration under FIFRA must be registered in order to be sold or distributed in commerce. The amount of data needed to register these products cannot be readily extrapolated from the data needs articulated in this document because most of this data has already been generated and exists in the public domain. EPA would also be able to rely in part on a history of safe use when evaluating these products for registration.

5. BENEFIT ANALYSIS

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Benefits of the alternative options over Option 4 (full registration) arise where Options 1, 2, and 3 generate different economic, environmental, and other conditions compared to the baseline option under which no PVCP-PIPs are exempted from regulation. Options 1 and 2 would provide exemption from regulation for similar PCVP-PIPs that meet certain criteria discussed in Chapter 3. These options, as compared to Option 4 under which no PVCP-PIPs are exempted, would reduce regulatory costs for industry and EPA, remove regulatory uncertainty for industry, provide important information regarding the safety of exempted PVCP-PIPs to the public, and may have certain environmental benefits. Option 3 would also exempt certain PVCP-PIPs from registration; however, it would exempt fewer PVCP-PIPs because it eliminates the Agency-determined part of the exemption process.

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Entities that may benefit from the proposed rule or alternate options are the public, companies that develop and market PVCP-PIPs (applicants and/or registrants), farmers, and the environment. However, potential future benefits to these entities are difficult to quantify due to data limitations and uncertain market conditions. In addition, considerable difficulty exists in quantitatively evaluating non-market benefits, such as environmental and human health risk reduction, consistency of regulation, reduced regulatory uncertainty, and improvements in public perception of biotechnology products. For this reason, this section discusses potential future benefits to each entity qualitatively, noting areas in which future benefits may be captured through changes in market transactions. Benefits are discussed for Option 1, the proposed rule, exclusively, because Options 2 and 3 are not expected to confer different types of benefits to each entity.

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5.1. Benefits to the Public

EPA is responsible for protecting human health by evaluating residues of pesticides in food and either establishing tolerances limiting the amount of pesticide residues that may be present in or on food or feed or establishing exemptions from the requirement of a tolerance for such residues. Those PVCP-PIPs not exempted by the proposed rule would be subject to health effects testing procedures and prescribed tolerance levels established since 1967 for pesticides. Because EPA is required to determine that it is safe to do so before exempting residues of pesticides from the requirement of a tolerance, the public can be assured that those residues of PVCP-PIPs that would be exempted by the proposed rule are safe. In addition, an exemption for certain PVCP-PIPs that are determined to be the safest is likely to drive development towards these safer products and away from riskier PVCP-PIPs, e.g., those producing proteins that have no known history of safe exposure. With increased development of safer products, the public would also benefit by having access to safer products on the market.

Public consumers of products containing PVCP-PIPs may indirectly benefit from the impact of PVCP-PIPs on crops. Where exempted PVCP-PIPs are used more extensively by farmers, crop losses due to viral diseases may be reduced, leading to cost savings to farmers. Consumers may benefit if farmers pass these cost savings on to them in the form of lower food prices.

5.2. *Benefits to Industry*

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Biotechnology firms face considerable economic risk when deciding whether to pursue R&D on a particular product, not least because R&D is significantly expensive. Regulatory uncertainty may create costs for industry where it impacts corporate decisions on timing of development and marketing. Some policy analysts refer to the risk incurred by biotechnology firms under regulatory uncertainty as a tax because it hinders product development. Establishing a clear regulatory policy is "one of the least expensive subsidies that government can provide to biotechnology development" (Hueth & Just 1987).

Because EPA proposed two alternatives in 1994, including a proposal to exempt a broad category of PVCP-PIPs from regulation, the status under FIFRA of certain PVCP-PIPs may be unclear to industry. Through implementation of the proposed rule, EPA could provide the regulated community with greater certainty regarding the regulatory status of PVCP-PIPs, either under consideration for development or under development. With a final rule in place, affected firms would no longer need to handle regulatory requirements on a case-by-case basis, and therefore should be better able to plan for timely product development and commercialization. In addition, regulatory costs of registering individual PVCP-PIPs would be reduced.

Industry may also benefit if the cost savings from the proposed exemption facilitate development and deployment of PVCP-PIPs that in some cases may be one of a very few or the only viable means of controlling viral diseases in a particular crop, either over the entire United States or in a particular region of the country. For example, the Hawaiian papaya industry was nearly devastated by papaya ringspot virus until a transgenic virus-resistant cultivar was developed (Fuchs et al. 1997). In these cases, PVCP-PIP products may be used in greater quantities, generating increased sales to PVCP-PIP registrants.

5.3. *Benefits to Farmers*

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Viral infection is a serious problem for agricultural production in the U.S. Virtually every plant species is susceptible to infection by at least one of more than 500 known plant viruses. Plant viruses create economic losses for a vast variety of crops by reducing yields and negatively affecting the quality of the crop, potentially even destroying an entire industry. In addition, farmers incur costs of either attempting to prevent infection or addressing a virus infection once it has started. Growers may use several control methods during a crop season in an attempt to prevent viral infection and dissemination. However, these methods are not always feasible or effective as a way to control virus transmission, and they can be harmful to the environment.

Exemptions of PVCP-PIPs under the proposed rule may bring a greater quantity of virus-resistant seeds to market for purchase by farmers. Farmers are likely to benefit from these seeds where they maintain or increase productivity on the farm and where they prevent viral disease and associated costly remediation methods.

5.4. *Benefits to the Environment*

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Under the proposed rule, certain PVCP-PIPs are exempted because sufficient information exists to demonstrate a low probability of risk to the environment. This lower probability of risk includes environmental risks posed by PVCP-PIPs as compared with other methods of viral control in plants. As stated in Section 7.3, in order to control economic losses presented by viral diseases (Tolin 1991), farmers may use several control methods during a crop season to prevent

viral infection and dissemination. For vector-transmitted viruses, control measures have often focused on chemical insecticides, fungicides, and nematicides to reduce the population of vectors that transmit viruses from plant to plant, all of which have harmful environmental impacts. By reducing or removing the need for these types of control methods, PVCP-PIPs have the potential to reduce the negative environmental impacts of existing virus control methods in U.S. agriculture. Benefits to the environment may include cleaner air and water and fewer pesticide and insecticide residues in food.

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6. ECONOMIC IMPACTS

This chapter discusses the potential economic impacts to the regulated community of the proposed rule exempting certain PVCP-PIPs from registration under FIFRA. Included are discussion of the total costs for each option and the potential impacts of the rule on the industry.

The proposed rule (Option 1) is expected to ease or eliminate compliance costs to the industry by exempting certain categories of PVCP-PIPs from FIFRA registration. The annual compliance costs savings of the proposed rule are estimated to be about $330,000 per year over the first ten years without discounting (Table 14). The Agency projected about 1.5-2.5 PVCP-PIPs would be developed annually and for that projection, about 0.3-2.4 per year would be exempted from regulation under FIFRA by this proposed rule.

Based on the Agency's current experience with companies registering PIPs and past experience with pesticide registrants, the Agency anticipates that many of the firms potentially affected by the proposed rule are pesticide manufacturers. It has already been discussed that pesticide manufactures have purchased seed companies and become vertically integrated. These new vertically integrated companies have the potential expertise in R&D, manufacturing, and marketing to produce PVCP-PIPs. If a company is involved in several different industry activities, a firm is classified under their primary source of business to avoid double counting. Other industries potentially affected include crop production establishments; colleges, universities, and professional schools; and research and development entities involved in agricultural biotechnology.

In 2002, 1,804 U.S. firms manufactured pesticides and other agricultural chemicals (see Table 1). The number of these firms that will be impacted by the proposed requirement changes is uncertain. The compliance cost savings of this rule was estimated to be between $330,000 and $340,000 per year. Since the proposed option results in regulatory relief with the associated compliance cost savings, we do not expect any negative economic impacts from the proposed option for any of the firms identified in Table 4.

The Agency assessed qualitatively the potential impacts on universities, colleges, and professional schools involved with agricultural biotechnology. The Agency reviewed the USDA/APHIS database for a list of such entities that may be researching and developing potential PVCP-PIPs. A number of universities are testing these types of pesticides (see Appendix A), but it is unclear whether the universities are developing potential PVCP-PIPs, testing PVCP-PIPs for potential registrants, or just engaged in research. Much of the research performed at universities, colleges, and professional schools is supported by private or public grants.

One university developed a virus-resistant papaya containing a PVCP-PIP. This university's efforts were complicated by having to negotiate six licensing agreements with

private firms (Smith, Ballenger, N., Day-Rubenstein, K., Heisey, P., and Klotz-Ingram, C. 1999). Because of the 1980 Diamond v. Chakrabarty Supreme Court decision, firms can receive utility patents for new types of plants and plant parts, including seeds, tissue cultures, and plant genes (Smith, Ballenger, N., Day-Rubenstein, K., Heisey, P., and Klotz-Ingram, C. 1999). It is now more difficult for those who perform research in the public sector to disseminate new technologies directly to growers, as they have typically done in the past, because private firms can financially benefit from the new technologies. Thus, there appears to be a need for public-private partnerships when products like PVCP-PIPs are developed using these technologies. Although universities may be developing PVCP-PIPs, it is unlikely that a university, college, or professional school would have the necessary expertise in manufacturing and marketing to bring a PVCP-PIP successfully to market, including experience with pesticide registration. If a university, college, or professional school develops a PIP, the school is more likely to establish an agreement with a private firm that has the necessary expertise and experience to market the product. As a result of the limited information available on the changes occurring within public and private sectors and the development of new genetically engineered crops, the Agency could not quantify the value of impacts of the proposed rule on universities, colleges, and professional schools.

Another industry potentially affected by this rule is R&D firms whose primary source of revenue is from agricultural research support. The Bureau of Census groups these firms in a broad industry category that includes establishments conducting research and development in biotechnology and other biological sciences. Unfortunately, this information is too general and broad for the Agency to determine the potential number and the revenues of R&D firms that may be performing research on potential PVCP-PIPs.

Because there is insufficient information to quantify impacts on R&D firms, the Agency also qualitatively assessed the potential impact of the proposed rule on R&D firms. Based on the available data, it is unclear how many, if any, R&D firms could potentially become PVCP-PIP registrants. Based on recent trends in the marketplace, smaller companies that develop marketable products are often purchased by larger firms that have the resources and marketing channels to bring the product to market. As a result, many smaller-sized R&D firms with specific expertise to perform R&D may ultimately rely on alliances with other firms with expertise in manufacturing and marketing to sell the product. The proposed rule would most significantly affect those who may produce, sell, and/or distribute PVCP-PIPs, although entities that conduct field trials might also benefit from the exemption if the field trials require an EPA experimental use permit. Overall, the Agency believes that the proposed rule will have minimal impacts on small R&D firms.

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7. RATIONALE FOR PROPOSING OPTION 1

The Agency chose to propose Option 1 rather than Option 2 or 3 because this option provides the relatively high level of human health and environmental protection that FIFRA requires, while at the same time exempting safe products from FIFRA registration. It may reassure the public that EPA is adequately regulating PVCP-PIPs, while providing quantifiable cost savings that are greater than the cost savings associated with Options 2 or 3.

7.1. *Protection of Human Health*

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The Agency examined the PVCP-PIPs in the various case studies under each of the proposed options in terms of potential effects on human health. In order to exempt a pesticide whose residues may be in food or feed from FIFRA requirements, EPA must, among other findings, conclude that "there is a reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue" (FIFRA §2(bb)(2)). A large base of information and experience exists for the PVCP-PIPs exempted under Option 1 that supports EPA's determination that they meet the FIFRA exemption standard. The information in EPA's possession is still too limited to support an *a priori* determination for PVCP-PIPs not exempted by Option 1 that "there is a reasonable certainty that no harm will result from aggregate exposure."

7.2. *Protection of the Environment*

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The Agency examined the PVCP-PIPs in the various case studies under each of the proposed options in terms of potential effects on the environment. In order to qualify for exemption from FIFRA requirements, a pesticide (for this EA specifically a PVCP-PIP) must pose a low probability of risk to the environment and not be likely to cause unreasonable adverse effects to the environment even in the absence of regulatory oversight under FIFRA. A large base of information and experience exists for the PVCP-PIPs exempted under Option 1 that supports EPA's determination that they meet the FIFRA exemption standard. The information in EPA's possession is still too limited to support an *a priori* determination for PVCP-PIPs not exempted by Option 1 that "there is a reasonable certainty that no harm will result from aggregate exposure."

8. OTHER ECONOMIC IMPACTS ASSESSMENTS

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This chapter presents the analysis used to evaluate the potential impacts of this rule on small entities in accordance with the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA). Several other regulatory assessment requirements (i.e., statutory requirements and executive orders) are also addressed in this chapter. These are: Executive Order 12898 (1994), Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations; the 1995 National Technology Transfer and Advancement Act; the 1995 Unfunded Mandates Reform Act; the 1966 Congressional Review Act; Executive Order 13045 (1997), Protection of Children from Environmental Heath Risks and Safety Risks; Executive Order 13084 (1998), Consultation and Coordination with Indian Tribal Governments; and Executive Order 13132 (1999), Federalism.

8.1. *Regulatory Flexibility Act (RFA) as Amended by the 1996 Small Business Regulatory Enforcement Fairness Act (SBREFA)*

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The President signed the Small Business Regulatory Enforcement Fairness Act (SBREFA) into law on March 29, 1996. SBREFA amended the Regulatory Flexibility Act (RFA) (5 U.S.C. 601 et seq.) to strengthen the RFA's analytical and procedural requirements. SBREFA also made other changes to agency regulatory practice as it affects small entities.

Since its enactment in 1980, the RFA has required every federal agency to prepare regulatory flexibility analyses for any notice-and-comment rule it issues, unless the agency

certifies that the rule "will not, if promulgated, have a significant economic impact on a substantial number of small entities." The purpose of the RFA is to ensure that in developing rules, agencies identify and consider ways of tailoring regulations to the size of the regulated entities to minimize any significant economic impact a rule may impose on a substantial number of small entities. The RFA does not require that an agency necessarily minimize a rule's impact on small entities if there are legal, policy, factual, or other reasons for not doing so. The RFA requires only that agencies determine, to the extent feasible, the rule's economic impact on small entities, explore regulatory options for reducing any significant economic impact on a substantial number of such entities, and explain its ultimate choice of regulatory approach.

The RFA defines small entities as including "small businesses," "small governments" and "small organizations." The RFA references the definition of "small business" found in the regulations issued by the SBA at 13 CFR 121.201. In general, the SBA defines small business by category of business using North American Industry Classification System (NAICS) codes, and in the case of manufacturing, generally defines small business as a business having 500 employees or less. In the case of agriculture, the SBA size standards generally define small business with respect to annual receipts (from $750,000 for crops). The RFA defines "small governmental jurisdiction" as the government of a city, county, town, school district, or special district with a population of less than 50,000, and defines "small organization" as any "not-for-profit enterprise which is independently owned and operated and is not dominant in its field."

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8.1.1. Affected small entities

A majority of the regulated industry potentially affected by this proposed rule are pesticide manufacturers and seed companies. As previously mentioned, pesticide manufacturers have recently purchased seed companies and become vertically integrated. These new vertically integrated companies have the expertise to develop and produce PIPs. Others potentially affected by the proposed rule include researchers at land grant universities, USDA, and non-government organizations that may develop PVCP-PIPs to manufacture and sell in the future. SBA size standards for "small" entities within the industries that are potentially affected by this rule are:

- Pesticides and Other Agricultural Chemical producers (NAICS 32532): fewer than 500 employees.
- Crop Production (NAICS 111): less than $750,000 in revenues.
- Universities, which includes colleges and professional schools (NAICS 611310): less than $6.5 million in revenues.
- Research and Development in the Physical, Engineering and Life Sciences (NAICS 54171): fewer than 500 employees.

The later two categories may include not-for-profit enterprises. For these entities, the SBA definition of small for "not-for-profit enterprises" is applicable. EPA's analysis presents only the estimated potential impacts on small businesses and small not-for-profit entities. EPA does not believe that small governments are likely to be impacted by the proposed rule because they would be extremely unlikely to sell, manufacture, or market PVCP-PIPs. The Agency reviewed data on entities that have consulted with the Agency on PVCP-PIPs. These businesses

involve six entities: Cornell University, Monsanto, Seminis Vegetable Seeds (now part of Monsanto), and USDA. None of these entities would qualify as a "small" business or university.

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8.1.2. Impacts on small businesses

Pesticide and other agricultural manufacturers

As shown in Table 3, 1,804 firms manufactured pesticides and other agricultural chemicals with the total value of shipments at $1,090,757 million in 2002. Table 3 also presents a further breakdown of this industry by size of firm using the value of shipments in 2002. Firms in this industry comprise establishments primarily engaged in the formulation and preparation of agricultural and household pest control chemicals (except fertilizers). Of these firms, 1,658 would be considered small, having fewer than 500 employees. Some of these 1,658 firms may produce, manufacture, and sell one or more PVCP-PIPs in the future, but it is unclear how many based on current information. The proposed rule should generate regulatory relief; therefore, the expected cost savings to revenue ratio for potentially affected pesticide and other agricultural manufacturers was not quantified.

Seed companies

The size and number of small businesses in the seed industry are the most difficult to quantify because of the rapid pace of acquisition by larger firms, the dynamic restructuring of the industry, and the absence of published data on the industry. Some of these producers fall into large and other-sized companies (see Table 4). A number of these firms have purchased total or partial interests in smaller firms, e.g., Monsanto purchased Seminis. Many of the smaller firms have developed expertise that the larger firms find more profitable to purchase rather than to develop themselves. Appendix B lists 347 seed companies as subsidiaries of the 19 parent companies that are listed in Table 4 (ETC Group Communique 2005).. None of these seed producers with revenues reported in Table 4 would qualify as a small business according to the SBA's standard of less than $0.75 million in revenues annually. For this analysis, the Agency assumed, on the basis of the published information available on the world seed industry, that the seed companies that may submit PVCP-PIPs for registration during the time period of this analysis would be represented by those vertically integrated pesticide and other large companies. For a more detailed discussion of the seed industry and companies, refer to the economic profile under Section 4.2 of this analysis. Again, the proposed rule should generate regulatory relief, and therefore the expected cost savings to revenue ratio for potentially affected seed companies was not quantified.

Universities, colleges, and professional schools

The Census Bureau does not cover universities, colleges, and professional schools. The Department of Education maintains some information on these NAICS codes. In 2003-04, there were 634 public and 1,896 private four-year institutions in the United States (U.S. Department of Education National Center for Education Statistics 2004). Of the public four-year institutions, 446 award at least 20 masters' or doctoral degrees per year. Of the private institutions, 459 award at least 20 masters' or doctoral degrees per year. Universities receiving federal funding such as land grant universities would not be considered "small."

The Agency also reviewed the USDA/APHIS database of entities testing genetically modified plants for a list of the universities, colleges, or professional schools that may be researching and developing potential PVCP-PIPs (Appendix A). The universities with release permits for PVCP-PIPs may be developing products, testing products for potential registrants, or just engaging in research. Cornell University has developed a product and submitted data for regulatory review. Thus, other universities may also be developing PVCP-PIPs that would fall under EPA's purview. All of the universities and colleges listed on the USDA/APHIS database would not qualify as "small" according to SBA's definition of small (i.e., $6.5 million in revenues). Research and land grant universities generally receive federal funding and/or private research grants in excess of $6.5 million. None of these types of universities would be considered "small."

Research and development in the physical, engineering and life sciences

The Agency anticipates that another industry potentially affected by this proposed rule includes those firms involved solely in agricultural research (i.e., their primary source of revenues is from agricultural research). The Bureau of Census groups these firms in a broad industry category that includes firms primarily engaged in conducting R&D in medicine, health, biology, botany, biotechnology, agricultural, fisheries, forests, pharmacy, and other life sciences including veterinary sciences. Therefore, it is impossible to use these data to identify specific information about agricultural R&D firms. The Agency has insufficient data on R&D firms that may be affected to evaluate the potential impact of this rule on this industry.

Because the available information is insufficient to quantify the impact, the Agency qualitatively assessed the potential impact of the proposed rule on R&D firms. Based on the available data, it is unclear how many, if any, R&D firms may become PVCP-PIP developers. Based on recent trends in the marketplace, smaller companies that develop marketable products are often bought out by larger firms that have the resources and marketing channels to bring the product to market. As a result, many smaller or medium-sized R&D firms with specific expertise to perform R&D may rely on alliances with other firms with expertise in manufacturing and marketing to sell the product. The Agency's proposed rule affects those who may produce, sell, and/or distribute PVCP-PIPs. For these reasons, it is unclear what impact the proposed rule will have on small R&D firms.

The proposed rule is expected to provide regulatory relief for small pesticide and other chemical manufacturers. Seed companies were not evaluated separately because the data available indicate that most seed companies have been purchased by larger, parent companies, many of which are pesticide manufacturers. The anticipated impact on universities, colleges, and professional schools cannot be determined. It appears that a majority of universities and colleges that would be expected to develop and research PVCP-PIPs would not be small. The impact this proposed rule would have on firms that solely perform R&D in agricultural biotechnology is not clear given the necessary expertise and resources needed to produce, sell, and manufacture PVCP-PIPs. The Agency anticipates that many of the R&D firms with specialized expertise in this area either will work with or be purchased by larger firms with the expertise and financial resources to produce, sell, and/or distribute viable PVCP-PIPs.

8.2. *Paperwork Reduction Act*

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The information collection requirements contained in the proposed rule have been submitted to OMB for review and approval under the Paperwork Reduction Act (PRA), 44 U.S.C. 3501 et seq., and in accordance with the procedures at 5 CFR 1320.11. The burden and costs related to the information collection requirements contained in this rule are described in an ICR, identified as EPA ICR No. 1693.03.

An Agency may not conduct or sponsor, and a person is not required to respond to, a collection of information that is subject to approval under the PRA, unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations, after appearing in the preamble of the Federal Register, are listed in 40 CFR part 9, and included on any related collection instrument.

As defined by the PRA and 5 CFR 1320.3(b), "burden" means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and use technology and systems for the purpose of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

This proposed rule contains some information collection activities that must first be approved by OMB under the PRA. In particular, developers availing themselves of the exemption will need to notify the Agency that they have a PVCP-PIP that qualifies for the exemption. The paperwork burden hours are provided for clerical, technical, and managerial personnel in the Information Collection Request.

The total annual burden for the information collection related activities associated with this action is estimated to average 24 hours per year for all respondents, i.e., including those that submit a PVCP-PIP for registration as well as those that submit a PVCP-PIP for exemption (see Appendix E). The burden per respondent submitting a PVCP-PIP for exemption is expected to average 22 hours per year. The total annual costs for the information collection related activities associated with this action is estimated to average $950 per year for all respondents.

8.3. *Unfunded Mandates Reform Act of 1995*

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Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) (P.L. 104-4) requires Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Title II became effective on the day the Act was signed, March 22, 1995, and a limited form of judicial review became available on October 1, 1995. In general, Title II mandates especially rigorous economic analysis for rules imposing high costs on either the public or the private sector, and it directs energetic consultation with small governments prior to actions that may significantly or uniquely affect them.

Under UMRA, an agency must generally prepare a written statement, including a benefit-cost analysis, for proposed and final rules with "Federal mandates" that may result in expenditures by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year. When, due to the anticipated cost of a rule, such a written

statement is warranted, the statute directs that an agency identify and consider a reasonable number of regulatory alternatives, and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objective of the rule. If an agency does not do so, the agency must explain why the agency did not do so. The requirement to consider alternatives and choose an option that meets one of the above criteria does not apply when it is inconsistent with applicable law. For rules with significant Federal intergovernmental mandates, the agency must have a process that permits elected officials of State, local, and tribal governments, or their designated, authorized employees, to provide meaningful and timely input in the development of the regulatory proposals.

Before EPA establishes any regulatory requirements that may "significantly or uniquely" affect small governments, including tribal governments, the agency must develop a Small Government Agency Plan. The plan must provide for notifying potentially affected small governments, giving them meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising them on compliance with the regulatory requirements.

The proposed rule exempts certain PVCP-PIPs from regulation under FIFRA, and provides annual cost savings estimated to be $330,000 on average over 10 years. Furthermore, the Regulatory Flexibility Analysis, performed within the same EA did not identify any significant costs to any of the affected parties of the proposed rulemaking. Therefore, the analysis concludes that this regulatory action does not contain a federal mandate that may result in expenditures of $100 million or more in any one year for State, local, and tribal governments in the aggregate, or for the private sector.

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8.4. Executive Order 12898

Pursuant to Executive Order 12898, entitled Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629, February 16, 1994), the Agency has considered environmental justice-related issues with regard to the potential impacts of this action on the environmental and health conditions in low-income and minority communities. EPA considered available information on the sensitivities of subgroups as pertains to the exemptions. EPA concluded that no subgroup would be differentially affected.

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8.5. FIFRA § 25(a)(2)(b)

FIFRA § 25(a)(2)(b), requires that the Administrator of EPA consider such factors as "…the effect of the regulation on production and prices of agricultural commodities, retail food prices, and otherwise on the agricultural economy…" when issuing regulations under §25 (7 U.S.C. I36w(a)(2)(B)). The total direct compliance costs savings for the proposed rule were estimated to be $330,000 in year 1 and year 10. The compliance costs savings of the proposed rule will affect those who plan to register, manufacture, or sell PVCP-PIPs. This proposed rule is expected to have a positive impact on pesticide and other chemical manufacturers who in turn will sell the PVCP-PIPs to agricultural producers. Factors other than this proposed rule that occur as a result of the production of genetically engineered plants—i.e., consumer acceptance and the international market desire to separately market genetically engineered products in the market—may affect agricultural producers and international markets. This proposed rule is also expected to benefit the agricultural industry by helping to assure the public of the safety of these products, thus positively affecting consumer acceptance.

8.6. Remaining Regulatory Assessment Requirements

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Because this action is not economically significant as defined by § 3(f) of Executive Order 12866, this action is not subject to Executive Order 13045, entitled Protection of Children from Environmental Health Risks and Safety Risks (62 FR 19885, April 23, 1997). In addition, this action does not significantly or uniquely affect the communities of tribal governments as specified by Executive Order 13084, entitled Consultation and Coordination with Indian Tribal Governments (63 FR'27655, May 10, 1998). This rule will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132, entitled Federalism (64 FR 43255, August 10, 1999).

This action does not involve any technical standards that require the Agency's consideration of voluntary consensus standards pursuant to §12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Pub. L. 104-113, §12(d) (15 U.S.C. 272 note).

In issuing this rule, EPA has taken the necessary steps to eliminate drafting errors and ambiguity, minimize potential litigation, and provide a clear legal standard for affected conduct, as required by §3 of Executive Order 12988, entitled Civil Justice Reform (61 FR 4729, February 7, 1996).

EPA has complied with Executive Order 12630, entitled Governmental Actions and Interference with Constitutionally Protected Property Rights (53 FR 8859, March 15, 1988), by examining the takings implications of this rule in accordance with the "Attorney General's Supplemental Guidelines for the Evaluation of Risk and Avoidance of Unanticipated Takings" issued under the Executive Order.

EPA will submit a report containing this proposed rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the Federal Register. This is not a "major rule" as defined by 5 U.S.C. 804(2).

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Appendix A: Entities Conducting Field Tests of Virus-Resistant Plants that May Contain a PVCP-PIP

Entity	Crop – Viral Resistance	Employees [a]	Industry Classification [a]
Advanta North America [b]	Sugarbeet – BNYVV	19,000	Large
Agdia	Tobacco – PPV	42	Small
Agracetus (now Monsanto)	Peanut – TSWV	22,000	Large
AgraTech Seeds [c]	Peanut – TSWV	1,250	Large
Agrigenetics [d]	Tobacco – AMV	42,413	Large
Agritope (now Exelixis)	Tobacco – Geminivirus Tomato – Geminivirus, BCTV	517	Large
AgriVitis [e]	Grape – Closterovirus, Nepovirus	5,100	Large
USDA Agricultural Research Service	Barley – BYDV Gladiolus – BYMV Papaya – PRSV Plum – PRV, PPV Potato PLRV, PVA, PVY Raspberry – RBDV, ToRSV Soybean – SMV Sugarcane – SCYLV, SRMV Tobacco – BCRV, TEV Tomato – CMV	99	
Asgrow [f]	Cucumber – CMV, PRSV, SMV, WMV2, ZYMV Melon – CMV, PRV, SMV, WMV2, ZYMV Squash – CMV, PRV, SMV, WMV2, ZYMV Tomato – Geminivirus, CMV, TSWV Watermelon – WMV2, ZYMV	22,000	Large
Betaseed [g]	Beet – BNYVV	2,336	Large
BHN Research	Tomato – CMV, PVY	6	Small
Calgene [f]	Potato – PLRV Tomato – CMV, PVY	22,000	Large

Entity	Crop – Viral Resistance	Employees [a]	Industry Classification [a]
Cornell University	Grape – Nepovirus, Closterovirus Melon – CMV, WMV2, ZYMV Papaya – PRSV Potato – PLRV Squash – CMV, SqMV WMV2, ZYMV Tobacco – TSWV	12,207	Large
Frito Lay [h]	Potato – PLRV, PVX, PVY	157,000	Large
GenApps [e]	Grape – Closterovirus, Nepovirus Tobacco – Potyvirus	5,100	Large
Harris Moran [i]	Melon – CMV, WMV2, ZYMV Tomato – CMV	6,769	Large
Hawaii Agriculture Research Center [j]	Papaya – PRSV	70	Small
Iowa State University	Soybean – SMV	8,533	Large
Michigan State University	Melon – ZYMV Potato - PVY	13,503	Large
Monsanto	Corn – CBI Potato – PLRV, PVX, PVY Sweet Potato – SPFMV Tobacco – TMV Tomato – TYLCV, CMV, TMV, ToMV Wheat – BYDV, WSMV	22,000	Large
Montana State University	Wheat – WSMV	2,500	Large
New York State Experimental Station [k]	Cucumber – CMV Melon – CMV, WMV2, ZYMV Squash – CMV, WMV2, ZYMV Tomato – CMV	12,207	Large
Noble Foundation	Tobacco – PSTV	261	Large
North Carolina Department of Agriculture	Tobacco – TSWV	90,333	Large
North Carolina State University	Tobacco – PVY, TEV, TMV, TSWV	7,588	Large
Northern Illinois University	Tobacco – BMV	4,000	Large
Northrup King [b]	Corn – MDMV	19,000	Large

Entity	Crop – Viral Resistance	Employees [a]	Industry Classification [a]
Novartis Seeds	Melon – PRSV, WMV2, ZYMV Squash – CMV, PRSV, WMV2, ZYMV Watermelon – CMV, WMV2	81,392	Large
Oklahoma State University	Tobacco – TMV	8,882	Large
Oregon State University	Potato – PVY	8,188	Large
PetoSeed [f]	Melon – CMV, WMV2 Squash – CMV, PRV, WMV2, ZYMV Tomato – CMV	22,000	Large
Pioneer	Alfalfa – AMV Corn – MCDV, MCMV, MDMV Soybean – SbMV Tobacco – AMV	60,000	Large
ProfiGen [e]	Grape – Closterovirus, Nepovirus	5,100	Large
Purdue University	Tobacco – AMV	17,812	Large
Rogers [b]	Corn – MDMV Tomato – ToMV, TSWV	19,000	Large
Sandoz [l]	Melon – CMV, WMV2	81,392	Large
Seminis Vegetable Seeds [f]	Cucumber – CMV, PRSV, WMV2, ZYMV Lettuce – LMV Melon – CMV, SqMV, WMV2, ZYMV Pepper – CMV, TEV Squash – CMV, PRSV, WMV2, ZYMV Tomato – Geminivirus, CMV, TSWV Watermelon – CMV, PRSV, WMV2, ZYMV	22,000	Large
Syngenta	Beet – BNYVV Melon – CMV, PRSV, WMV2, ZYMV Squash – CMV, PRSV, WMV2, ZYMV Sugarbeet – BNYVV Tomato – TLYCV Watermelon – PRSV, ZYMV	19,000	Large
Texas A&M	Grapefruit – Closterovirus Sugarcane – SrMV	22,000	Large
Tuskegee University	Sweet Potato - SPFMV	1,047	Large

Entity	Crop – Viral Resistance	Employees [a]	Industry Classification [a]
University of Arizona	Tobacco – BCTV	7,000	Large
University of California	Tomato – Geminivirus, ToMV Walnut – CLRV	121,726	Large
University of Florida	Cucumber – CMV, PRSV, WMV2, ZYMV Papaya – PRSV Peanut – TSWV Sugarcane – SCMV, SCYLV Tobacco – PVY , TEV, ToMoV Tomato – ToMoV	24,106	Large
University of Georgia	Peanut – GRAV, PStV, TSWV Tobacco – TSWV	17,800	Large
University of Hawaii	Papaya – PRSV Pineapple – PMWaV Banana – BBTV Dendrobium – CyMV Lettuce – TSWV Lime – CTV	12,000	Large
University of Idaho	Pea – BYMV, PSbMV, PEMV Potato – BYDV, PLRV, PVX, PVY, TRV. TVMV Wheat – BYDV, WSMV	4,200	Large
University of Kentucky	Soybean – BPMV Tobacco – AMV, PVY, TEV, TSWV, TVMV	12,503	Large
University of the Virgin Islands	Papaya – PRSV	625	Large
United States Sugar	Sugarcane – SCMV	2,500	Large
Upjohn [m]	Cucumber – CMV, PRV, SMV, WMV2, ZYMV Lettuce – TSWV Melon – CMV, PRV, SMV, WMV2, ZYMV, Squash – CMV, PRV, SMV, WMV2, ZYMV Tomato – CMV, TMV, ToMV, TSWV Watermelon – WMV2, ZYMV	115,000	Large
Virginia Tech	Potato – PVY	6,194	Large
Yoder Brothers	Chrysanthemum – TSWV	1,100	Large

Source: http://www.isb.vt.edu/cfdocs/fieldtests1.cfm

Notes.

[a] Unless otherwise stated, information for this column based on parent company level data available from the Duns & Bradstreet market spectrum database.

[b] Parent company is Syngenta.

[c] Parent company is Golden Peanut Company, LLC.

[d] Parent company is Dow Chemical.

[e] Parent company is U.S. Tobacco.

[f] Parent company is Monsanto.

[g] Parent company is KWS Saat AG.

[h] Parent company is Pepsico.

[i] Parent company is Limagrain.

[j] Information is from 2003 IRS form 990, obtained using GuideStar.org.

[k] Part of Cornell University.

[l] Parent company is Novartis AG.

[m] Parent company is Pfizer.

Abbreviations: AMV = alfalfa mosaic virus; BCRV = black currant reversion virus; BCTV = beet curly top virus; BMV = brome mosaic virus; BNYVV = beet necrotic yellow vein virus; BPMV = bean pod mottle virus; BYDV = barley yellow dwarf virus; BYMV = bean yellow mosaic virus; CLRV = cherry leafroll virus; CMV = cucumber mosaic virus; CTV = citrus tristeza virus; CyMV = cymbidium mosaic virus; GRAV = groundnut rosette assistor virus; MCDV = maize chlorotic dwarf virus; MCMV = maize chlorotic mottle virus; MDMV = maize dwarf mosaic virus; PEMV = pea enation mosaic virus; PLRV = potato leafroll virus; PMWaV = pineapple mealy bug wilt virus; PPV = plum pox virus; PRSV/PRV = papaya ringspot virus; PSTV = potato spindle tuber viroid; PVA = potato virus A; PVX = potato virus X; PVY = potato virus Y; RBDV = raspberry bushy dwarf virus; SbMV = southern bean mosaic virus; SCMV = sugarcane mosaic virus; SCYLV = sugarcane yellow leaf virus; SMV = soybean mosaic virus; SPFMV = sweet potato feathery mottle virus; SrMV = sorghum mosaic virus; SqMV = squash mosaic virus; SYLV = sugarcane yellow leaf virus; TEV = tobacco etch virus; TLYCV = tomato yellow leaf curl virus; TMV = tobacco mosaic virus; ToMoV = tomato mottle virus; ToMV = tomato mosaic virus; ToRSV = tomato ringspot virus; TRV = tobacco rattle virus; TSWV = tomato spotted wilt virus; TVMV = tobacco vein mottling virus; TYLCV = tomato yellow leaf curl virus; WMV2 = watermelon mosaic virus 2; WSMV = wheat streak mosaic virus; ZYMV = zucchini yellow mosaic virus.

Appendix B: List of Many of the World's Largest Seed Companies and Their Acquisitions and/or Subsidiaries

Seed Company	Subsidiaries/Acquisitions
Royal Barenburg Group (Netherlands)	• Barenbrug Belgium • Barenbrug China • Barenbrug France • Barenbrug Holland BV • Barenbrug Luxembourg • Barenbrug Polska • Barenbrug South East • Barenbrug UK • Barenbrug USA • Barenbrug Production • Heritage Seeds Pty (Australia) • Modern Forage Systems Inc • New Zealand Agriseeds • Palaversich y Cia (Argentina)
BASF (Germany)	• SunGene (Germany) • Metanomics • ExSeed Genetics LLC
Bayer (Germany) Subsidiary: Bayer CropScience	• Aventis CropScience (6/02) • AgrEvo • Plant Genetic Systems • Nunhems BV • Nunza BV • Sunseeds • Cannon Roth • Pioneer Vegetable Genetics • Dessert Seed • Leen de Mos (Neth. & Spain) • Castle Seed • Keystone Seed • Genex (Australia) • AgrEvo Cotton Seed Intl. (Australia) • Biogenetic Technologies • Sementes Ribeiral (Brazil) • Mitla Pesquisa Agricola (Brazil) • Sementes Fartura (Brazil) • Granja 4 Irmaos (Brazil) • Associated Farmers Delinting • Gustafson (3/04)

Seed Company	Subsidiaries/Acquisitions
DLF Trifolium (Denmark)	• DLF International Seeds (USA) • DLF-TRIFOLIUM Ltd. (UK) • Hladké Zlvotice s.r.o (Czek Rep.) • Top Green (France) • Prodana Seeds • DLF Group China • Danespo Holding A/S (50%) • DLF Seeds Ltd. (NZ) • DLF-TRIFOLIUM A/S, Moscow • DLF-TRIFOLIUM Deutschland • Cebeco Seeds Group (The Netherlands) • Cebeco Saaten GMBH • Cebeco Seeds S.R.O.
DLF Trifolium (continued)	• Cebeco-Verneuil GMBH & Co. KG • Cebeco Zaden B.V. • La Maison Des Gazons S.A. • N.V. Zaden Van Engelen S.A. • Oliver Seeds Ltd. • Proco Sem S.A. • Seed Innovations Ltd. • Wiboltt Fro A/S
Delta & Pine Land (USA)	• Ellis Brothers Seed • Arizona Processing • Mississippi Seed Co. • Hartz Cotton • Sure Grow Seeds • D&PL South Africa, Inc. • D&PL Semillas Ltda (Costa Rica) • Deltapine Australia Pty. Ltd. • Turk DeltaPine, Inc. (Turkey) • Deltapine India Seed Private Ltd. • D&M International, LLC: • D&PL China Pte Ltd. • Hebei Ji Dai Cottonseed Technology • Company Ltd. • CDM Mandiyu S.R.L. (Argentina) • MDM Sementes De Algodao, Ltda. (Brazil) • DeltaMax Cotton, LLC (50%)

Seed Company	Subsidiaries/Acquisitions
Dow Chemical Co. (USA) Subsidiary: Dow Agrosciences	• Mycogen • Agrigenetics • Cargill Hybrid Seeds • United Agriseeds • Morgan Seeds (Argentina) • Kelten & Lynks • Delta & Pine Land (corn & sorghum only) • Dinamilho Carol Productos (Brazil) • Hibridos Colorado Ltda. (Brazil) • FT Biogenetica de Milho (Brazil) • Phytogen (w/J.G. Boswell) • Empresa Brasileira de Sementes (Brazil)

Seed Company	Subsidiaries/Acquisitions
Dupont (USA)	• Pioneer Hi-Bred Intl. (USA) • Pioneer Argentina S.A. • Pioneer Hi-Bred Australia Pty Ltd • Pioneer Hi-Bred Services GmbH (Austria) • Pioneer Hi-Bred Northern Europe (Belgium) • Pioneer Sementes Ltda. (Brazil) • Pioneer Semena Bulgaria • Pioneer Hi-Bred Limited (Canada) • Semillas Pioneer Chile Ltda. • Shandong Denghai-PIONEER Seeds (China) • DuPont de Colombia S.A. • Pioneer Sjeme d.o.o. (Croatia) • Pineer Hi-Bred Services (Czech Rep.) • Misr Pioneer Seed Company (Egypt) • Pioneer Hi-Bred Seeds (Ethiopia) • Pioneer Semences SAS (France) • Pioneer Hi-Bred N. Europe (Germany • Pioneer Hi-Bred Hellas (Greece) • Pioneer Hi-Bred Magyarország Kft. (Hungary) • PHI Seeds Ltd. (India) • PT DuPont Indonesia • Pioneer Hi-Bred Italia • Pioneer Hi-Bred Japan • Farmchem Seedlinks Limited (Kenya) • Chemicals & Marketing Co. (Malawi) • PHI Mexico SA de CV • Pioneer Hi-Bred N. Europe (Neth.) • Genetic Technologies, Ltd. (New Zealand) • Pioneer Pakistan Seed Ltd • Melo & Cia, C.A. (Panama) • Pioneer Hi-Bred Philippines • Pioneer Hi-Bred Services GmbH (Poland) • Pioneer Hi-Bred Sementes de Portugal • Pioneer Hi-Bred Puerto Rico • Pioneer Hi-Bred Seeds Agro (Romania) • Pioneer Semena Holding GmbH (Russia) • Pioneer Hi-Bred Services (Serbia & Montenegro) • Pioneer Hi-Bred Slovensko (Slovakia) • Pioneer Hi-Bred Services (Slovenia) • Pioneer Hi-Bred RSA (South Africa) • South Korea O.M.C. • Pioneer Hi-Bred Spain SL • Bytrade Tanzania Limited • Pioneer Hi-Bred (Thailand) Co. • Pioneer Tohumculuk (Turkey) • Pioneer Nasinnya Ukraine, LLC • Pioneer Hi-Bred N. Europe (UK) • Agar Cross Uruguaya S.A • Semillas Pioneer de Venezuela • Farmchem Services Ltd. (Zambia) • Pioneer Hi-Bred Zimbabwe

Seed Company	Subsidiaries/Acquisitions
KWS AG (Germany)	• AgReliant (joint venture with Limagrain) • AgroMais • APZ • Betaseed • CPB Twyford • KWS ARGENTINA • KWS AUSTRIA SAAT GMBH • KWS BENELUX • KWS CHILE • KWS FRANCE • KWS ITALIA • KWS KLOSTERGUT • WIEBRECHTSHAUSEN • KWS MAIS FRANCE • KWS MAIS GMBH • KWS OSIVA s.r.o. • KWS POLSKA • KWS RAGT HYBRID KFT • KWS RUS • KWS SAAT AG • KWS SCANDINAVIA AB • KWS Semena Bulgaria EOOD • KWS Semena d.o.o. • KWS Semena s.r.o. • KWS SEME YU • KWS SEMILLAS IBERICA • KWS Sjeme d.o.o. • S.C. KWS Seminte S.R.L. • KWS TÜRK • KWS Ukraine T.O.W. • Lochow-Petkus GmbH • Lochow-Petkus Polska • MOMONT • Pan Tohum • PLANTA • Razés Hybrides • SAKA-RAGIS • Semena AG • ZKW • Producers Hybrid
Landec Corp. (USA)	• Landec Ag Inc. (USA) • Heartland Seed

Seed Company	Subsidiaries/Acquisitions
Land O Lakes (USA)	• Croplan Genetics • Hytest Seeds • Agriliance (joint venture with CHS, Inc.) • ABI Alfalfa • Seed Research of Oregon • Pickseed Companies Group • Seeds Ohio • Forage Genetics Inc.

Seed Company	Subsidiaries/Acquisitions
Groupe Limagrain (France)	• Vilmorin Clause & Cie • Advanta BV (European field crop division) • Force Limagrain (France) • Limagrain (Bulgaria) • Limagrain Cental Europe (France) • Limagrain Ceska Rep (Czech Rep.) • Limagrain Genetics (France) • Limagrain (Italia) • Limagrain Magyaroszag (Hungary) • Limagrain Moldova • Limagrain Nederland • Limagrain Nickerson GmbH (Germany) • Limagrain Polska (Poland) • Limagrain Romania • Limagrain Slovensko • Limagrain Verneuil Holding • Mais Angevin Nickerson (France) • Nickerson UK • Nickerson Intl. Research (France) • Nickerson Sur (Spain) • Soltis (France) • Alliance Semillas (Chile) • CHMT (South Africa) • Clause Tezier Italia • Clause Tezier do Brasil • Clause UK • Clause-Tezier Iberica (Spain) • Clause Tezier (France) • Clause • CNOS Vilmorin (Poland) • Ferry-Morse (US) • Flora-Fey (Germany) • Flora-Fey (Austria) • Harris Moran • Henderson • Kyowa • Marco Polo • Niagra • AgReliant Genetics (joint venture w/KWS) • AgReliant Genetics US (joint venture w/KWS) • Hazera Genetics • Producers Hybrids (acquired by AgReliant)

Seed Company	Subsidiaries/Acquisitions
Monsanto (USA)	• Seminis • Emergent Genetics • American Seeds Inc. • Channel Bio Corp. • Crow's Hybrid Corn • Midwest Seed Genetics • Wilson Seeds • NC+Hybrids • Advanta Canola Seeds • Interstate Canola Seeds • Asgrow (soybean & corn) • Holden's Foundation • Jacob Hartz • Hybritech • Calgene • Agracetus • Plant Genetics Inc. • Ameri-Can Pedigreed • Monsoy (Brazil) • First Line Seeds (Canada) • Plant Breeding Intl. (UK) • Agroceres (Brazil) • Cargill's intl. seed division • Dekalb Genetics (USA) • Custom Farm Seed • Sensako (South Africa)
Nidera Corporation (The Netherlands)	• Nidera Semillas (Argentina) • Nidera Sementes (Brazil)
Pannar Group (South Africa)	• Pau Seeds USA (formerly owned by Bayer) • Pannar Genetics, Inc. • Kaystar Seed • Pannar Seeds, Inc. (US) • Kombat (South Africa) • Starke Ayres (South Africa) • Mascor (South Africa) • Pannar Seed Kenya • Pannar Seed Lda (Mozambique) • Pannar Seed Z (Zambia) • Pannar Seed BV (The Netherlands)
Saaten-Union GmbH Ltd. (Germany)	• Subsidiary companies in UK, Poland, France, Romania. • Hybrinova (Dupont's hybrid wheat business) • Monsanto's hybrid wheat business

Seed Company	Subsidiaries/Acquisitions
Sakata (Japan)	• Sakata UK • Sakata Ornamentals UK • Sakata Holland • Sakata Ornamentals Europe (Denmark) • Frisa Planter (Denmark) • Sakata Polska (Poland) • Sakata Korea Co. • Sakata Seed (Suzhou) China • Sakata Siam Seed (Thailand) • Sakata Seed Oceania • Sakata Seed Corporation (India) • Sakata Vegetables Europe (France) • Sakata Middle East (Jordan) • MayFord Seeds (South Africa) • Sakata Vegenetics (South Africa) • Sakata Seed Iberica (Spain) • Alf Christianson Seed (USA) • Sakata Seed America (USA) • Sakata Seed de Mexico • Sakata Seed de Guatemala • Sakata Centroamerica (Costa Rica) • Sakata Seed Sudamerica (Brazil) • Sakata Seed Chile • Sakata Ornamentals (Chile)
Seminis (sold to Monsanto in 2005)	• Asgrow Seed Co. • Petoseed • Royal Sluis • Hungnong Seed Co. (S. Korea) • Ang Seed Co. (S. Korea) • Sementes Agroceres (vegetable seed division) • Barham Seed
Svalöf Weibull AB (Sweden)	• Danisko Seeds • SW Seed Canada • Newfield Seeds (Canada) • Riding Valley Agro (Canada) • Promark Seed (Canada) • Priority Lab Services (Canada) • Wheat City Seed (Canada)

Seed Company	Subsidiaries/Acquisitions
Syngenta	• Advanta BV (North American corn and soybean business – Garst brand) • Petoseed • Bruinsma • Northrup King (NK) • Asgrow Vegetable Seeds • Funk Seed Intl. • Rogers Bros. • Zaadunie BV (Neth.) • McNair Seed • Cokers Pedigreed • Fredonia • Hilleshog • Agritrading • CC Benoist • Maisadour Semences • Eridania Beghin-Soy • Golden Harvest (6/04) • Dia-Engei (Japan) 2/04 • CHS Research LLC (04) • GA21 (technology) (04)
Takii and Co., Ltd. (Japan)	• American Takii, Inc. • CTT Seed Co. (Thailand) • Qingdao Huang Long (China) • T.W. Company (Hong Kong) • Takii Chile • Takii Europe (Netherlands) • Takii France • Takii Korea Co. • Pahuja Takii Seed (India) • Takii do Brasil

Source: (ETC Group Communique 2005)

APPENDIX C: TEST COST DATA USED TO CALCULATE COSTS FOR 40 CFR PART 174.27

ACTIVITY NUMBER/DESCRIPTION	COSTS		
	Low	Average	High
Characterization of genetic insert to confirm expected identity	$1,060	$1,893	$2,725
Comparison of sequence with naturally occurring sequences, if modified; characterization to identify/verify expected product produced (plant expressed)	$7,420	$13,248	$19,075

ACTIVITY NUMBER/DESCRIPTION	COSTS		
	Low	**Average**	**High**
Surrogate protein production	$12,720	$22,710	$32,700
Quantified concentration of protein produced in various tissues, e.g., leaf, seed, fruit, pollen, and whole plant by Western blot or ELISA	$26,000	$50,875	$75,750
Validated analytical detection method in seed or grain, e.g., ELISA or lateral flow strip test	$19,000	$21,125	$23,250
Submission of samples	$330	$495	$660
Laboratory and/or greenhouse testing to determine sexual compatibility/ability to form a viable hybrid between the modified crop plant and wild or weedy relatives in the United States; testing would begin with the most closely related species in the same family that occur in the area of cultivation.	$5,000	$15,000	$25,000
Description of propensity of the crop plant to naturalize, including extent of existing feral populations (In most cases, sufficient information can be obtained from literature searches and/or consultations with breeders. Field surveys may be required in some instances.)	$5,000	$15,000	$25,000
Outcrossing potential – information on potential outcrossing with all wild or weedy relatives with which the transformed plant can form viable hybrids in nature, e.g., degree of sexual compatibility, degree of overlap in the geographic distribution of relatives and crop cultivation areas, phenology assessment. (Information can be based upon literature, field experts, breeders, etc.)	$50,000	$150,000	$250,000
Characterization of hybrids -- to determine the likelihood of introgression of the transgene -- characterization of crop-relative hybrid fitness (comparing hybrid and wild or weedy parent, virus free vrs. virus-infected), including: (a). Seedling emergence/germination rate (b). Vegetative vigor/above and below-ground biomass (c). Reproductive timing and output, e.g., timing of flowering and seed set and amount of seed produced; for root crops including also size, mass, and shape of tubers at harvest time (d). Stability of the acquired transgene in the hybrids and their progeny	$150,000	$152,500	$155,000
Studies to evaluate the potential impact of transgene introgression, for example: · plant community dynamics modeling (with hybrids and plants expected in the communities in which the hybrids exist) · plant competition growth chamber studies, e.g., series replacement under controlled conditions · plant competition mesocosm studies (with hybrids and plants expected in the communities in which the hybrids exist) · field studies, e.g., to investigate impact of virus infection on wild or weedy relatives of the modified plant	$30,000	$1,035,000	$2,040,000
Bioinformatic amino acid sequence comparison of short contiguous amino acid segments using an allergen database to identify any allergens containing identical short sequences	$1,700	$3,550	$5,400
Bioinformatic amino acid sequence search for overall similarity with known toxins and allergens	$1,700	$3,550	$5,400
In vitro digestibility in simulated gastric fluid and simulated intestinal fluid (as defined in the U.S. Pharmacopeia)	$30,000	$35,000	$40,000
Assessment of heat stability/lability	$15,000	$27,500	$40,000

ACTIVITY NUMBER/DESCRIPTION	COSTS		
	Low	**Average**	**High**
Acute oral toxicity study in mice	$2,932	$3,474	$4,015
Honey bee testing	$20,000	$24,250	$28,500
Non-target insect testing, Tier I	$7,000	$10,500	$14,000
Avian oral, Tier I	$12,000	$15,000	$18,000
Wild mammal testing, Tier I	$50,000	$65,000	$80,000
Estuarine and marine animal testing, Tier I	$32,000	$40,000	$48,000
Freshwater fish testing, Tier I	$30,000	$37,500	$45,000
Freshwater aquatic invertebrate testing, Tier I	$30,000	$37,500	$45,000
Registration Fee	$131,250	$249,375	$367,500

The following companies provided unit cost estimates included in this table: Biomatica, Inc., CA Agricultural research, Central California Research Laboratories, Inc. Central Science Laboratory, Central Science Laboratory, Huntingdon Research Centre Ltd., IIT Research Insitute, PTRL West, SafePharm Laboratories Ltd., Springborn Laboratories Inc., Stillmeadow Inc., WIL Research Laboratories Ind., Wildlife International Ltd., and other firms that requested anonymity. Best professional estimates from SciReg were used where test costs were not available from a laboratory.

Appendix D: USDA's Biotechnology Deregulation Process

The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS), through its Biotechnology Regulatory Services (BRS) program, is responsible for regulating the importation, movement, and field release of genetically engineered (GE) plants, insects, micro-organisms, and any other organism that is known to be, or could be, a plant pest.

APHIS's biotechnology regulations are designed to ensure that GE organisms, such as virus-resistant papayas, are just as safe for agriculture and the environment as traditionally bred crop varieties. In regulating biotechnology, BRS works in concert with the Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA), which also play important roles in protecting agriculture, food safety, and the environment. BRS involvement begins when a person or organization wishes to import, move interstate, or field-test a GE plant, which is done under the program's permitting and notification system.

After several years of field testing and data collection, a company or researcher may choose to begin preparing for commercialization. At this point, an applicant typically files a petition for the determination of non-regulated status with USDA, which means the applicant has gathered enough data to demonstrate that the new crop variety is not a plant pest, poses no threat to agriculture or the environment, and should no longer be regulated by USDA. Depending on the product, reviews by FDA and EPA may also be required.

The petition for deregulation must include:

- A description of the biology and taxonomy of the conventional plant variety that was used to produce the GE version.
- A detailed description of the differences in genotype between the GE plant and the original plant. The description must include all scientific, common, or trade names, and all designations necessary to identify the donor organism (where the new genetic material came from), the nature of the transformation system (how that genetic material was inserted), the inserted genetic material, and the GE plant. Information about the locations of the origin and processing of the plant, the donor organism, the original plant, vector organisms (if used), and any other regulated articles must be included.
- A detailed description of the phenotype of the GE plant. The description must cover known and potential differences from the original plant that would substantiate that the regulated article is unlikely to pose a greater plant pest risk than the original plant from which it was derived. This description may include plant pest risk characteristics, disease and pest susceptibilities, expression of the gene product, new enzymes or changes to plant metabolism, weediness of the GE plant, impact on the weediness of any other plant with which it can interbreed, agricultural or cultivation practices, effects of the regulated article on non-target organisms, indirect plant pest effects on other agricultural products, transfer of genetic information to organisms with which it cannot interbreed, and any other information that BRS requests. Any other information known to the petitioner that indicates that a GE plant may pose a greater plant pest risk than the original plant must also be included.
- Relevant experimental data and publications.

- Field-test reports for all trials conducted under permit or notification procedures involving the GE plant. These reports must include the methods of observation, resulting data, and analysis regarding all deleterious effects on plants, non-target organisms, and the environment.

APPENDIX E: BURDEN HOURS AND ESTIMATES USED TO CALCULATE COMPLIANCE COSTS FOR 40 CFR PART 174.27

PCVP-PIPs Burden Activities	Technical Burden Hours								
	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Case Study 5	Case Study 6	Case Study 7	Case Study 8	Case Study 9
OPTION 1									
1. Read instructions	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2. Plan activities	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.5	2.0
3. Create information	4.5	2.3	2.5	2.5	2.5	5.5	6.0	8.0	12.0
4. Gather information	2.3	1.5	1.5	1.5	1.5	3.5	4.0	4.0	4.0
5. Compile and review	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6. Complete paperwork	1.1	1.1	1.5	1.5	1.5	1.5	1.5	3.0	3.0
7. Maintain and file	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0
8. Additional activities	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total technical hours ($49.50/hr)[a]	12	8	9	9	9	15	16	20	25
Total managerial hours[b] ($57.35/hr)[a]	2	2	2	2	2	3	3	4	5
Total clerical hours[c] ($25.21/hr)[a]	10	10	10	10	10	10	10	10	10
UNIT BURDEN	24	20	21	21	21	28	29	34	40
COST BURDEN	$940	$770	$810	$810	$810	$1,140	$1,190	$1,470	$1,750

[a] Wage rates are U.S. Department of Labor's Employment reported employer costs per hour worked for employee compensation for private industries. The wage rates include wages and salaries, and benefit costs — including paid leave, supplemental pay, insurance, retirement and savings, legally required benefits, severance pay, and supplemental unemployment benefits. http://www.bls.gov/news.release/ecec.t11.htm. These wages are for the period ending December 2005 and were last updated in March 2006.

[b] EPA estimated the managerial labor burden to equal to 20 percent of the technical labor burden.

[c] EPA estimated the clerical labor burden to equal ten hours under each case study scenario.

PCVP-PIPs Burden Activities	Technical Burden Hours								
	Case Study 1	**Case Study 2**	**Case Study 3**	**Case Study 4**	**Case Study 5**	**Case Study 6**	**Case Study 7**	**Case Study 8**	**Case Study 9**
OPTION 2									
1. Read instructions	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2. Plan activities	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.5	2.0
3. Create information	5.5	2.5	2.5	2.5	2.5	5.5	6.0	8.0	12.0
4. Gather information	2.5	1.5	1.5	1.5	1.5	3.5	4.0	4.0	4.0
5. Compile and review	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6. Complete paperwork	1.5	1.5	1.5	1.5	1.5	1.5	1.5	3.0	3.0
7. Maintain and file	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0
8. Additional activities	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total technical hours ($49.50/hr)[a]	14	9	9	9	9	15	16	20	25
Total managerial hours[b] ($57.35/hr)[a]	3	2	2	2	2	3	3	4	5
Total clerical hours[c] ($25.21/hr)[a]	10	10	10	10	10	10	10	10	10
UNIT BURDEN	27	21	21	21	21	28	29	34	40
COST BURDEN	$1,090	$810	$810	$810	$810	$1,140	$1,190	$1,470	$1,750

[a] Wage rates are U.S. Department of Labor's Employment reported employer costs per hour worked for employee compensation for private industries. The wage rates include wages and salaries, and benefit costs — including paid leave, supplemental pay, insurance, retirement and savings, legally required benefits, severance pay, and supplemental unemployment benefits. http://www.bls.gov/news.release/ecec.t11.htm. These wages are for the period ending December 2005 and were last updated in March 2006.

[b] EPA estimated the managerial labor burden to equal to 20 percent of the technical labor burden.

[c] EPA estimated the clerical labor burden to equal 10 hours under each case study scenario.

PCVP-PIPs Burden Activities	Technical Burden Hours								
	Case Study 1	**Case Study 2**	**Case Study 3**	**Case Study 4**	**Case Study 5**	**Case Study 6**	**Case Study 7**	**Case Study 8**	**Case Study 9**
OPTION 3									
1. Read instructions	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2. Plan activities	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.5	2.0
3. Create information	4.5	2.3	3.0	3.0	3.0	6.0	6.0	8.0	12.0
4. Gather information	2.3	1.5	2.0	2.0	2.0	4.0	4.0	4.0	4.0
5. Compile and review	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6. Complete paperwork	1.1	1.1	1.5	1.5	1.5	1.5	1.5	3.0	3.0
7. Maintain and file	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0
8. Additional activities	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total technical hours ($49.50/hr)[a]	12	8	10	10	10	16	16	20	25
Total managerial hours[b] ($57.35/hr)[a]	2	2	2	2	2	3	3	4	5
Total clerical hours[c] ($25.21/hr)[a]	10	10	10	10	10	10	10	10	10
UNIT BURDEN	24	20	22	22	22	29	29	34	40
COST BURDEN	$940	$770	$860	$860	$860	$1,190	$1,190	$1,470	$1,750

[a] Wage rates are U.S. Department of Labor's Employment reported employer costs per hour worked for employee compensation for private industries. The wage rates include wages and salaries, and benefit costs — including paid leave, supplemental pay, insurance, retirement and savings, legally required benefits, severance pay, and supplemental unemployment benefits. http://www.bls.gov/news.release/ecec.t11.htm. These wages are for the period ending December 2005 and were last updated in March 2006.

[b] EPA estimated the managerial labor burden to equal to 20 percent of the technical labor burden.

[c] EPA estimated the clerical labor burden to equal ten hours under each case study scenario.

PCVP-PIPs Burden Activities	Technical Burden Hours								
	Case Study 1	**Case Study 2**	**Case Study 3**	**Case Study 4**	**Case Study 5**	**Case Study 6**	**Case Study 7**	**Case Study 8**	**Case Study 9**
OPTION 4									
1. Read instructions	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2. Plan activities	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.5	2.0
3. Create information	6.0	3.0	3.0	3.0	3.0	6.0	6.0	8.0	12.0
4. Gather information	3.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	4.0
5. Compile and review	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6. Complete paperwork	1.5	1.5	1.5	1.5	1.5	1.5	1.5	3.0	3.0
7. Maintain and file	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0
8. Additional activities	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total technical hours ($49.50/hr)[a]	15	10	10	10	10	16	16	20	25
Total managerial hours[b] ($57.35/hr)[a]	3	2	2	2	2	3	3	4	5
Total clerical hours[c] ($25.21/hr)[a]	10	10	10	10	10	10	10	10	10
UNIT BURDEN	28	22	22	22	22	29	29	34	40
COST BURDEN	$1,140	$860	$860	$860	$860	$1,190	$1,190	$1,470	$1,750

[a] Wage rates are U.S. Department of Labor's Employment reported employer costs per hour worked for employee compensation for private industries. The wage rates include wages and salaries, and benefit costs — including paid leave, supplemental pay, insurance, retirement and savings, legally required benefits, severance pay, and supplemental unemployment benefits. http://www.bls.gov/news.release/ecec.t11.htm. These wages are for the period ending December 2005 and were last updated in March 2006.

[b] EPA estimated the managerial labor burden to equal to 20 percent of the technical labor burden.

[c] EPA estimated the clerical labor burden to equal 10 hours under each case study scenario.

The following explains the tasks involved in the PVCP-PIP burden activities.

1. *Read Instructions.* This activity includes time spent:

(a) Reviewing the data needs for EPA registration for PVCP-PIPs to understand what data are to be submitted. EPA recognizes that time is required to review and understand the standard or test protocol under consideration, once the decision is made to submit a PVCP-PIP for registration. A company may need to receive clarification form EPA, which would also be considered part of this activity.

(b) Discussing the scope and test protocols of data requirements among staff within the company, and/or with EPA.

2. *Plan Activities*. Includes time spent to develop the company plan for data acquisition and submission.

3. *Create Information*. This activity includes time spent on conducting field surveys, administering tests, analyzing test data, performing laboratory analyses, and writing documents. Time spent in creating information during the course of PVCP-PIP product development is not included in burden hours, since time spent on these activities is not spent specifically to apply for registration under FIFRA. Information created by the company is considered a separate activity from gathering information from other sources (see next burden activity below).

4. *Gather Information*. Data required may be collected from various sources. Gathering information may include compiling information from web sites (e.g. USDA), literature searches, field surveys, and/or breeder records, such as, source of genetic material including viral pathotype, description of development and production process, and characterization of genetic inserts. All effort associated with searching for data that will satisfy PVCP-PIP data needs is considered part of this activity.

5. *Compile and Review*. Information that meets the requirements for PVCP-PIP data needs must be validated for accuracy before it is submitted to EPA. Given that the requested information may come from a variety of sources, such as web sites, literature searches, and breeder records and consultations, information must be assembled and evaluated based on the study methods used, test results obtained, and interpretation of that data.

6. *Complete Paperwork*. Time spent by managerial, technical, and clerical staff to complete forms, reports, and data submissions to comply with the PVCP-PIP data needs is considered part of this activity. Specifically, this includes recording, disclosing and/or displaying information, and preparing necessary correspondence, documents, and packages for submitting data to EPA.

7. *Maintain and File*. This activity describes the burden associated with filing and maintaining PVCP-PIP-related data requirements. Time spent to organize the data requirements information into a file system is also included as part of this activity.

8. *Additional Activities*. If additional activities are performed but are not addressed in the seven steps described above, time spent on these additional activities is included here.

APPENDIX F: HIGH AND LOW COMPLIANCE COST ESTIMATES FOR FOUR ALTERNATIVE OPTIONS PER REGISTRATION AND/OR EXEMPTION

	Range	COSTS (thousands)			
		Average Burden and Test Costs			
		Baseline (Registration)	Option 1	Option 2	Option 3
Case Study 1	Low	$190	$1	$40	$1
	High	$520	$1	$120	$1
Case Study 2	Low	$140	$1	$10	$1
	High	$400	$1	$30	$1
Case Study 3	Low	$340	$110	$110	$340
	High	$800	$230	$230	$800
Case Study 4	Low	$140	$10	$10	$140
	High	$420	$50	$50	$420
Case Study 5	Low	$140	$10	$10	$140
	High	$400	$30	$30	$400
Case Study 6	Low	$190	$60	$60	$190
	High	$530	$160	$160	$530
Case Study 7	Low	$340	$340	$340	$340
	High	$740	$740	$740	$740
Case Study 8	Low	$420	$420	$420	$420
	High	$2,970	$2,970	$2,970	$2,970
Case Study 9	Low	$670	$670	$670	$670
	High	$3,370	$3,370	$3,370	$3,370

Page 5: [1] Deleted **Melissa Kramer** **1/3/2007 2:12:00 PM**

In developing this proposal, EPA evaluated PVCP-PIPs for risk based on an analysis of human experiences with the breeding and cultivation of agricultural plants as well as food preparation and consumption. EPA combined this long history of human experience with knowledge of plant genetics, plant physiology, phytopathology, microbial ecology, ecology, biochemistry, and plant breeding. Based on its evaluation, EPA currently believes that some PVCP-PIPs warrant exemption, i.e., those covered under Option 1 of this EA.

Examples of PVCP-PIPs that would not be exempted by this proposed rule include those expressing a protein that is significantly different than those known to have a history of safe exposure. Such PVPC-PIPs would not be exempted, because the toxicity and allergenicity to humans and other organisms of such proteins is unknown and would not fall within the base of experience supporting the proposed exemption. Other PVCP-PIPs that would not be exempt are those found in plants that could transfer the PVCP-PIP to a wild or weedy relative whose growth and or reproduction is constrained by virus infection such that acquisition of virus resistance would be expected to alter the plant's weedy or invasive behavior. Specific use restrictions that are associated with registration may be needed to ensure the safe use of such PVCP-PIPs.

Page 5: [2] Deleted **Melissa Kramer** **1/3/2007 2:21:00 PM**

associated with these products: (1) gene flow leading to increased weediness or invasiveness of wild or weedy relatives of the plant containing the PVCP-PIP that could potentially affect either the agro-ecosystem or natural environment, (2) viruses with novel properties developing through recombination among virus sequences that do not have the opportunity to interact in nature, and (3) human or non-target organism exposure to proteins that have not previously existed in nature and could have potentially toxic or allergenic properties.

Page 6: [3] Deleted **Melissa Kramer** **1/3/2007 2:30:00 PM**

. The first option was a full categorical exemption based on the rationale that PVCP-PIPs generally pose a low probability of risk to human health and the environment. However, recognizing that other plants could acquire the virus resistance through gene flow from a transgenic plant, and that such events could affect population dynamics, an alternative to a full categorical exemption was also proposed. Under this alternative exemption option, the Agency defined a set of criteria to identify those PVCP-PIP/plant combinations with the lowest potential to confer selective advantage on wild or weedy plant relatives. Only those PVCP-PIPs that met the criteria would have been exempt from regulation.

Page 6: [4] Deleted **Melissa Kramer** **1/3/2007 3:11:00 PM**

for PVCP-PIPs, in part because recent information has raised questions about whether all PVCP-PIPs pose low risks, and EPA must be able to make such a finding in order to exempt all PVCP-PIPs under FIFRA

Page 6: [5] Deleted **Melissa Kramer** **1/3/2007 3:12:00 PM**

Because of uncertainty as to the future regulatory status, some companies may currently hesitate to commercialize products.

Page 6: [6] Deleted **Melissa Kramer** **1/3/2007 2:31:00 PM**

Costs of registration under FIFRA

This EA describes the costs of registering all the substances that meet the definition of a PVCP-PIP and the cost savings resulting from exempting certain PVCP-PIPs from certain FIFRA requirements. A

Page 6: [7] Deleted **Melissa Kramer** **1/3/2007 2:03:00 PM**

On the other hand, potential registrants of PVCP-PIPs can expend considerable resources on research and development of products that may not be commercially successful if the public does not accept them due to concerns about their safety or concerns that the government regulatory review process may be inadequate.

Page 6: [8] Deleted **Melissa Kramer** **1/3/2007 2:32:00 PM**

Uncertain business climate because of public concerns

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Page 7: [9] Deleted **Melissa Kramer** **1/3/2007 2:33:00 PM**

Inadequate consideration of public consequences

An overarching

Page 7: [10] Deleted **Melissa Kramer** **1/3/2007 2:58:00 PM**

into plants for research and development and product deployment

Page 7: [11] Deleted **Melissa Kramer** **1/3/2007 2:57:00 PM**

Thus, public concerns suggest that regulatory oversight is warranted to assure the public that the neither human health nor the environment will suffer undue consequences because of biotechnology products.

Page 7: [12] Deleted **Melissa Kramer** **1/3/2007 2:06:00 PM**

The proposed rule would exempt PVCP-PIPs that the Agency has carefully evaluated to ensure that they present a low probability of risk to human health and the environment even in the absence of regulatory oversight. EPA will evaluate those PVCP-PIPs not exempted through the registration process to ensure that under the conditions of use they will not present an unreasonable adverse effect to human health or the environment.

Safety of the food supply

As indicated above, the question of

Page 7: [13] Deleted **Melissa Kramer** **1/3/2007 2:34:00 PM**

is an important public issue that agricultural biotechnology faces

Page 7: [14] Deleted **Melissa Kramer** **1/3/2007 2:07:00 PM**

(The Pew Initiative on Food and Biotechnology 2004). However, as recently as 2004, 27% of consumers said that biotech foods are "basically unsafe," about equal to the number that said biotech foods are "basically safe." Thus, overall Americans have heard little about genetically modified foods

Page 7: [15] Deleted **Melissa Kramer** **1/3/2007 2:59:00 PM**

confusion and concern about existing regulatory requirements for biotech foods. Although consumers indicate

Page 7: [16] Deleted **Melissa Kramer** **1/3/2007 2:52:00 PM**

Given that the United States is a major exporter of agricultural commodities, consumer

Page 7: [17] Deleted **Melissa Kramer** **1/3/2007 2:37:00 PM**

. For example, European consumer acceptance of genetically engineered foods is generally low

Page 7: [18] Deleted **Melissa Kramer** **1/3/2007 2:38:00 PM**

), and a majority of Europeans do not support biotech foods (

Page 7: [19] Deleted **Melissa Kramer** **1/3/2007 2:38:00 PM**

). Likewise, Japanese and South Korean consumers are generally much more negative towards biotechnology than those in the United States (Hogan 2004). Consumers in China, Indonesia, and the Philippines are generally more favorable towards biotechnology, but a significant minority express reservations

Page 7: [20] Deleted **Melissa Kramer** **1/3/2007 2:08:00 PM**

Implementation of the proposed rule will help to reassure the public that EPA has carefully considered the safety of PVCP-PIPs in the diet.

Page 7: [21] Deleted **Melissa Kramer** **1/3/2007 2:53:00 PM**

Effects on the environment

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Page 7: [22] Deleted **Melissa Kramer** **1/3/2007 2:08:00 PM**

Implementation of the proposed rule will help to reassure the public that EPA has carefully evaluated the effect of PVCP-PIPs on the environment.