BIOPESTICIDES REGISTRATION ACTION DOCUMENT

Pasteuria nishizawae – Pn1

Pesticide Chemical (PC) Code: 016455

U.S. Environmental Protection Agency
Office of Pesticide Programs
Biopesticides and Pollution Prevention Division

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I. EXECUTIVE SUMMARY

Background

In July and August 2010, Pasteuria Bioscience, Inc. submitted applications for a manufacturing-use pesticide product, Soyacyst Tech (EPA File Symbol 85004-A), and two end-use pesticide products, Soyacyst Tech+ (EPA File Symbol 85004-T) and Soyacyst LF (EPA File Symbol 85004-O), to the United States Environmental Protection Agency (EPA) under section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Concurrently with these applications, Pasteuria Bioscience, Inc. filed a petition for a tolerance exemption for residues of *Pasteuria nishizawae* – Pn1, the new active ingredient contained in all three proposed pesticide products.

Pasteuria, a genus of bacteria, includes several species that have shown potential in controlling plant-parasitic nematodes that attack and cause significant damage to many valuable agricultural crops (see, e.g., the Federal Register of December 28, 1994 (59 Federal Register (FR) 66740) and June 30, 2010 (75 FR 37734) for Final Rules that established tolerance exemptions for residues of the nematicides, *Pasteuria penetrans* (40 Code of Federal Regulations (CFR) 180.1135) and *Pasteuria usgae* (40 CFR 180.1290), respectively). These gram-positive, mycelial, endospore-forming bacteria are obligate parasites (i.e., organisms that depend on particular hosts to complete their own life cycle) of nematodes and water fleas.[1] *Pasteuria* species are ubiquitous in most environments and are found in nematodes in at least 80 countries on 5 continents, as well as on islands in the Atlantic, Pacific, and Indian Oceans. Higher population densities often occur in areas where there is an ample supply of nematode hosts (e.g., where crops susceptible to nematodes are cultivated) (Centitas and Dickson 2004; Noel 2008; Tain *et al*. 2007). *Pasteuria nishizawae* – Pn1 was specifically isolated from an Illinois soybean field in the mid-2000s.

Although endospores of *Pasteuria nishizawae* have been observed to attach to the cuticle of three nematodes of the genus *Heterodera* and one nematode of the genus *Globodera*, it is known only to infect and complete its life cycle within the female soybean cyst nematode (*Heterodera glycines*). In the following manner, *Pasteuria nishizawae* – Pn1 exerts a pesticidal effect on the soybean cyst nematode through parasitism that ultimately results in the death of infected females:

(1) Endospores attach to the cuticle of a juvenile soybean cyst nematode female.
(2) Once a soybean cyst nematode female invades soybean roots, *Pasteuria nishizawae* – Pn1 produces a germ tube that penetrates the body of the nematode.
(3) Primary and secondary microcolonies of *Pasteuria nishizawae* – Pn1 develop and proliferate within the body of the nematode, causing its death.

In light of the demonstrated nematicidal capabilities and host specificity of *Pasteuria nishizawae* – Pn1, Pasteuria Bioscience, Inc. proposed to register several pesticide products that could be applied to soybean or its seed to control the soybean cyst nematode.

EPA scientists reviewed product analysis, toxicology, and nontarget organism data and information (40 CFR §§ 158.2120, 158.2140, and 158.2150, respectively) submitted to support the registration of the three proposed *Pasteuria nishizawae* – Pn1 pesticide products. Overall,

[1] *Pasteuria ramosa* is the only *Pasteuria* species that is known to parasitize water fleas.

such data and information are adequate for risk assessment purposes, fulfill the current microbial pesticide data requirements, and allow for registration under FIFRA section 3(c)(5).

Product Analysis
The product analysis data requirements for *Pasteuria nishizawae* – Pn1, including product chemistry and composition, analysis of samples, and physical and chemical characteristics, were fulfilled by acceptable guideline studies.

Toxicology
Adequate mammalian toxicology data and information were submitted to support the *Pasteuria nishizawae* – Pn1 pesticide products. Acute oral, pulmonary, and injection toxicity/pathogenicity studies showed that, at a single high dose, *Pasteuria nishizawae* – Pn1 is not toxic and/or pathogenic via these routes of exposure. Moreover, the applicant reported that no hypersensitivity incidents occurred during research, development, or testing of *Pasteuria nishizawae* – Pn1. In light of the results of the acute toxicity/pathogenicity data and the absence of hypersensitivity incidents, testing at higher tiers (i.e., Tiers II and III) was not required.

Tolerance Exemption
EPA concludes that there is a reasonable certainty that no harm will result to the U.S. population, including infants and children, from aggregate exposure to residues of *Pasteuria nishizawae* – Pn1. No dietary risks are expected from use of *Pasteuria nishizawae* – Pn1 as an active ingredient in pesticide products. Significant exposure to *Pasteuria nishizawae* – Pn1 through food and drinking water is not anticipated due to: (1) the proposed application methods of the end-use pesticide products (soil directed, soil incorporated, and/or seed directed; no aquatic applications); (2) the filtering effect of many particulate soil types; and (3) the conditions (e.g., filtration and pH adjustments) water is subjected to in wastewater treatment systems and drinking water facilities. Should *Pasteuria nishizawae* – Pn1 be present on food or in drinking water, its specificity for the soybean cyst nematode and supporting acute oral toxicity and pathogenicity data indicate that human exposure to this bacterium is not likely to be a concern.

Occupational Exposure
Despite the low toxicological profile of *Pasteuria nishizawae* – Pn1, baseline personal protective equipment (PPE) is required for handlers that may be exposed to the active ingredient, due to their occupation, for prolonged periods or numerous times. Handlers working with *Pasteuria nishizawae* – Pn1 in agricultural settings are directed to wear a long-sleeved shirt, long pants, socks, shoes, and a dust/mist filtering respirator meeting National Institute for Occupational Safety and Health (NIOSH) standards of at least N-95, R-95, or P-95. EPA may require additional PPE (e.g., protective eyewear), other than the standard described above, on a product-specific basis.

Nontarget Organisms
Data and other information (e.g., scientific literature) submitted by the applicant to support requests to waive nontarget organism testing for *Pasteuria nishizawae* – Pn1 are sufficient to fulfill the relevant microbial pesticide data requirements and for risk assessment purposes. Further testing of nontarget organisms at higher tier levels (i.e., Tiers II, III, and IV) is not required. EPA performed an environmental risk assessment based on data and other information provided by the applicant, and determined that adverse effects to nontarget organisms are not anticipated from the proposed pesticidal uses of *Pasteuria nishizawae* – Pn1. Moreover, EPA

made a "No Effect" determination for direct and indirect effects to listed species and their designated critical habitats resulting from these same proposed pesticidal uses.

Public Participation
On October 1, 2009, EPA announced a new policy to provide a more meaningful opportunity for the public to participate in major registration decisions before they occur. According to this policy, EPA intends to provide a public comment period prior to making a registration decision for, at minimum, the following types of applications: new active ingredients; first food uses; first outdoor uses; first residential uses; or any other registration actions for which EPA believes there may be significant public interest.

Consistent with the policy of making registration actions more transparent, the proposed pesticide products containing *Pasteuria nishizawae* – Pn1, a new active ingredient, and allowing for this active ingredient's first outdoor and food uses were subject to a 30-day comment period. During this comment period, no comments were received on EPA's preliminary decision to register the *Pasteuria nishizawae* – Pn1 pesticide products, Soyacyst Tech, Soyacyst Tech+, and Soyacyst LF. Therefore, EPA maintained that, based upon the risk assessment and information submitted in support of registration of such pesticide products, it was appropriate to issue the Soyacyst Tech, Soyacyst Tech+, and Soyacyst LF registrations under FIFRA section 3(c)(5). The basis for this decision can be found in the risk assessment for *Pasteuria nishizawae* – Pn1, which is characterized throughout this Biopesticides Registration Action Document (BRAD).

II. ACTIVE INGREDIENT OVERVIEW

Biological Name:	*Pasteuria nishizawae* – Pn1
Culture Deposit:	American Type Culture Collection in Manassas, Virginia under Accession Number SD-5833
OPP Chemical Code:	016455
Type of Pesticide:	Microbial Pesticide – Nematicide See Appendix B for specific information (e.g., use sites, application rates, methods of application, formulation types, and target pests) regarding the registered pesticide products containing this active ingredient.

III. REGULATORY BACKGROUND

A. Applications for Pesticide Product Registration

In July and August 2010, MacIntosh and Associates, Inc. (address: 1203 Hartford Avenue; Saint Paul, Minnesota 55116-1622), on behalf of Pasteuria Bioscience, Inc. (address: 12085 Research Drive, Suite 185; Alachua, Florida 32615), submitted applications to register a manufacturing-

use pesticide product, Soyacyst Tech (EPA File Symbol 85004-A), and two end-use pesticide products, Soyacyst Tech+ (EPA File Symbol 85004-T) and Soyacyst LF (EPA File Symbol 85004-O), under FIFRA section 3. On November 24, 2010 (75 FR 71697) and February 2, 2011 (76 FR 5805), EPA announced receipt of these applications to register pesticide products containing a new active ingredient and opened a 30-day public comment period pursuant to the provisions of FIFRA section 3(c)(4). No comments were received following these publications.

B. Food Tolerance Exemption

Concurrent with its registration applications and under Federal Food, Drug, and Cosmetic Act (FFDCA) section 408(d), Pasteuria Bioscience, Inc. submitted a petition to establish an exemption from the requirement of a tolerance for *Pasteuria nishizawae* – Pn1 (Pesticide Petition (PP) 0F7749). In the Federal Register of February 4, 2011 (76 FR 6465), EPA announced that Pasteuria Bioscience, Inc. proposed to establish an exemption from the requirement of a tolerance for residues of the microbial pesticide, *Pasteuria nishizawae* – Pn1, in or on all raw agricultural crops and opened a 30-day comment period. Two comments were received following this publication and are addressed in the preamble to the Final Rule.

On February 15, 2012, EPA established an exemption from the requirement of a tolerance for residues of *Pasteuria nishizawae* – Pn1 in or on all food commodities when applied as a nematicide and used in accordance with good agricultural practices (40 CFR § 180.1311; 77 FR 8736).

IV. RISK ASSESSMENT

In the Federal Register of October 26, 2007, EPA issued a Final Rule on the data requirements to support registration of microbial pesticides and updated the definition for microbial pesticides (72 FR 61002). The rule became effective on December 26, 2007. The data and information evaluated for this BRAD were considered in light of these requirements.

The classifications that are found for each data submission are assigned by EPA science reviewers and are an indication of the usefulness of the information contained in the documents for risk assessment. A rating of “acceptable” indicates the study is scientifically sound and is useful for risk assessment. A “supplemental” rating indicates the data provide some information that can be useful for risk assessment. The studies may have certain aspects determined not to be scientifically acceptable (“supplemental: upgradeable”). If a study is rated as “supplemental: upgradeable,” EPA always provides an indication of what is lacking or what can be provided to change the rating to “acceptable.” If there is simply a “supplemental” rating, the reviewer will often state that the study is not required by 40 CFR Part 158. Both “acceptable” and “supplemental” studies may be used in the risk assessment process as appropriate. An “unacceptable” rating indicates that new data must be submitted.

For the acute toxicity data requirements, Toxicity Categories are assigned based on the hazard(s) identified from studies and/or other information submitted to EPA in support of a pesticide registration. The active ingredient or particular product is classified into Toxicity Category I, II, III, or IV, where Toxicity Category I indicates the highest toxicity and Toxicity Category IV indicates the lowest toxicity (see 40 CFR § 156.62).

A. Product Analysis Assessment (40 CFR § 158.2120)

All product analysis data requirements for *Pasteuria nishizawae* – Pn1 have been fulfilled. Refer to Tables 1, 2, 3, and 4 in Appendix A for a summary of the data requirements, including both generic and product-specific information.

B. Human Health Assessment (40 CFR § 158.2140)

1. Toxicity

All toxicology data requirements for *Pasteuria nishizawae* – Pn1 have been fulfilled. Acceptable Tier I mammalian toxicology data and information support registration of the *Pasteuria nishizawae* – Pn1 pesticide products. Furthermore, Tier II and Tier III studies were not required for *Pasteuria nishizawae* – Pn1, based on the lack of acute toxicity/pathogenicity in the Tier I studies.

For a summary of the generic toxicology data requirements described in sections IV(B)(1)(a) and IV(B)(1)(b), as well as additional product-specific data submitted to support the individual registrations, refer to Tables 5 and 6 in Appendix A.

a. Acute Toxicity/Pathogenicity – Tier I

Acute Oral Toxicity/Pathogenicity – Rat (Harmonized Guideline 885.3050; Master Record Identification Number (MRID No.) 481517-09): Groups of rats were treated with live test substance at 1.6 x 10^9 spores/rat, were treated with killed (autoclaved) test substance, or were in 1 of 2 untreated control groups. No adverse clinical signs were observed in any test animals. At necropsy, no treatment-related gross observations were noted. Organ weights primarily did not differ, though in male rats treated with live test substance, brain weights on days 7, 14, and 21 and spleen weight on day 21 were slightly but significantly decreased. In female rats from the same group, the only statistically significant difference was heavier stomach/small intestine weight on day 7. No evidence of pathogenicity or toxicity was found from oral administration of *Pasteuria nishizawae* – Pn1 to rats. Although clearance and infectivity were not measured, EPA believes these endpoints are not a concern given *Pasteuria nishizawae* – Pn1's well-established host specificity for the soybean cyst nematode. This study was rated supplemental.

Acute Pulmonary Toxicity/Pathogenicity – Rat (Harmonized Guideline 885.3150; MRID No. 481517-10): Groups of rats were treated with live test substance at 1.6 x 10^8 spores/rat, were treated with killed (autoclaved) test substance, or were untreated controls. No adverse clinical signs were observed in any test animals. At necropsy, no treatment-related gross observations were noted. Organ weights primarily did not differ, though in male rats treated with live test substance, brain weights on days 7, 14, and 21 and liver weight on day 21 were slightly but significantly decreased. In female rats from the same group, there were no statistically significant differences in organ weights. No evidence of pathogenicity or toxicity was found from pulmonary administration of *Pasteuria nishizawae* – Pn1 to rats. Although clearance and infectivity were not measured, EPA believes these endpoints are not a concern given *Pasteuria nishizawae* – Pn1's well-established host specificity for the soybean cyst nematode. This study was rated supplemental.

Acute Injection Toxicity/Pathogenicity (Intravenous) – Rat (Harmonized Guideline 885.3200; MRID No. 481517-11): Groups of rats were treated with live test substance at 1.0 x 10^9 spores/rat, were treated with killed (autoclaved) test substance, or were untreated controls. No adverse clinical signs were observed in any test animals. At necropsy, no treatment-related gross observations were noted. Organ weights primarily did not differ, though in males rats treated with live test substance, spleen weights on days 14 and 21 and liver weight on day 21 were slightly but significantly decreased. In female rats from the same group, there were no statistically significant differences in organ weights. No evidence of pathogenicity or toxicity was found from intravenous administration of *Pasteuria nishizawae* – Pn1 to rats. Although clearance and infectivity were not measured, EPA believes these endpoints are not a concern given *Pasteuria nishizawae* – Pn1's well-established host specificity for the soybean cyst nematode. This study was rated supplemental.

Hypersensitivity Incidents (Harmonized Guideline 885.3400; MRID No. 481517-12): The applicant reported that no hypersensitivity incidents, including immediate-type or delayed-type reactions of humans and domestic animals, occurred during research, development, or testing of *Pasteuria nishizawae* – Pn1. Any future hypersensitivity incidents must be reported to EPA (refer to test note #3 of 40 CFR § 158.2140(d)).

Cell Culture (Harmonized Guideline 885.3500): This study is not required because *Pasteuria nishizawae* – Pn1 is not a virus (refer to test note #4 of 40 CFR § 158.2140(d)).

b. Acute Toxicology and Subchronic Toxicity/Pathogenicity – Tier II; Reproductive Fertility Effects, Carcinogenicity, Immunotoxicity, and Infectivity/Pathogenicity Analysis – Tier III

Tier II and Tier III studies were not required for *Pasteuria nishizawae* – Pn1, based on the lack of acute toxicity/pathogenicity in the Tier I studies.

c. Endocrine Disruptors

As required under FFDCA section 408(p), EPA has developed the Endocrine Disruptor Screening Program (EDSP) to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans or wildlife similar to an effect produced by a "naturally occurring estrogen, or other such endocrine effects as the Administrator may designate." The EDSP employs a two-tiered approach to making the statutorily required determinations. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid (E, A, or T) hormonal systems. Chemicals that go through Tier 1 screening and are found to have the potential to interact with E, A, or T hormonal systems will proceed to the next stage of the EDSP where EPA will determine which, if any, of the Tier 2 tests are necessary based on the available data. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance, and establish a quantitative relationship between the dose and the E, A, or T effect.

Between October 2009 and February 2010, EPA issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. This list of chemicals was selected based on the potential for human exposure through pathways such as

food and water, residential activity, and certain post-application agricultural scenarios. This list should not be construed as a list of known or likely endocrine disruptors.

Pasteuria nishizawae – Pn1 is not among the group of 58 pesticide active ingredients on the initial list to be screened under the EDSP. Under FFDCA section 408(p), EPA must screen all pesticide chemicals. Accordingly, EPA anticipates issuing future EDSP orders/data call-ins for all pesticide active ingredients.

For further information on the status of the EDSP, the policies and procedures, the list of 67 chemicals, the test guidelines and the Tier 1 screening battery, please visit our website: *http://www.epa.gov/endo/*.

2. Federal Food, Drug, and Cosmetic Act (FFDCA) Considerations

Section 408(c)(2)(A)(i) of FFDCA allows EPA to establish an exemption from the requirement for a tolerance (the legal limit for a pesticide chemical residue in or on a food) only if EPA determines that the exemption is "safe." Section 408(c)(2)(A)(ii) of FFDCA defines "safe" to mean 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." This includes exposure through drinking water and in residential settings, but does not include occupational exposure. Pursuant to section 408(c)(2)(B) of FFDCA, in establishing or maintaining in effect an exemption from the requirement of a tolerance, EPA must take into account the factors set forth in section 408(b)(2)(C) of FFDCA, which require EPA to give special consideration to exposure of infants and children to the pesticide chemical residue in establishing a tolerance exemption, and to "ensure that there is a reasonable certainty that no harm will result to infants and children from aggregate exposure to the pesticide chemical residue...." Additionally, section 408(b)(2)(D) of FFDCA requires that EPA consider "available information concerning the cumulative effects of [a particular pesticide's] . . . residues and other substances that have a common mechanism of toxicity."

EPA performs a number of analyses to determine the risks from aggregate exposure to pesticide residues. First, EPA determines the toxicity of pesticides. Second, EPA examines exposure to the pesticide through food, drinking water, and through other exposures that occur as a result of pesticide use in residential settings.

Consistent with section 408(b)(2)(D) of FFDCA, EPA has reviewed the available scientific data and other relevant information, and considered its validity, completeness, and reliability and the relationship of this information to human risk. EPA has also considered available information concerning the variability of the sensitivities of major identifiable subgroups of consumers, including infants and children.

Based on the acute toxicity/pathogenicity data and information discussed previously and presented in Tables 5 and 6 in Appendix A, the data required for a FFDCA risk assessment for *Pasteuria nishizawae* – Pn1 have been fulfilled.

a. Aggregate Exposure

In examining aggregate exposure, section 408 of FFDCA directs EPA to consider available information concerning exposures from the pesticide residue in food and all other nonoccupational exposures, including drinking water from ground water or surface water and exposure through pesticide use in gardens, lawns, or buildings (residential and other indoor uses).

Food Exposure and Risk Characterization: Dietary exposure to *Pasteuria nishizawae* – Pn1, a naturally occurring soil bacterium (Atibalentja *et al*. 2004; Noel *et al*. 2005; Sayre *et al*. 1991), is anticipated to be negligible. For optimal control of the target pest, soybean cyst nematode (*Heterodera glycines*), *Pasteuria nishizawae* – Pn1 is applied in a manner that facilitates spore movement into or spore placement near the root zone of potentially affected plants. This requires that end users take certain actions, depending on the treatment type, that would inevitably minimize the amount of *Pasteuria nishizawae* – Pn1 residues on above-ground food commodities. That is, although *Pasteuria nishizawae* – Pn1 can be applied to soil, plants, or seeds, some seeds are incorporated into the soil immediately after treatment (at-planting, hopper box, planter box, or slurry box seed treatments), and pesticide applications made to plants or the soil are always followed by irrigation to incorporate *Pasteuria nishizawae* – Pn1 into the soil. In instances where food commodities develop underground or where treated seed is diverted for food or feed purposes or to process into oil, exposure to *Pasteuria nishizawae* – Pn1 residues is a more likely scenario. Regardless of the situation, should *Pasteuria nishizawae* – Pn1 be present on food, its specificity for the soybean cyst nematode and available data indicate no toxicity, pathogenicity, and/or infectivity is likely to occur with any dietary exposure that results from pesticide applications made in accordance with good agricultural practices (see section IV(B)(1)(a) and Tables 5 and 6 in Appendix A).

Drinking Water Exposure and Risk Characterization: Exposure to residues of *Pasteuria nishizawae* – Pn1 in consumed drinking water is possible but not likely. The proposed use patterns for *Pasteuria nishizawae* – Pn1 are soil directed, soil incorporated, and/or seed directed, thereby limiting contact with surface water by drift and runoff. Furthermore, ground water is not expected to have significant exposure to *Pasteuria nishizawae* – Pn1 since, like other microorganisms, this microbial pesticide would likely be filtered out by the particulate nature of many soil types (Aislabie *et al*. 2001; DeFelice *et al*. 1993; Pang *et al*. 2008). If *Pasteuria nishizawae* – Pn1 were to be transferred to surface or ground waters (e.g., through spray drift or runoff) that are intended for eventual human consumption and directed to wastewater treatment systems or drinking water facilities, it may not survive some of the conditions water is subjected to in such systems or facilities, including chlorination, pH adjustments, and filtration (Centers for Disease Control and Prevention 2009; U.S. EPA 2004). In the remote likelihood that *Pasteuria nishizawae* – Pn1 is present in drinking water (e.g., water not subject to treatment systems or facilities), its specificity for the soybean cyst nematode and available data indicate no toxicity, pathogenicity, and/or infectivity is likely to occur with any drinking water exposure that results from pesticide applications made in accordance with good agricultural practices (see section IV(B)(1)(a) and Tables 5 and 6 in Appendix A).

Non-occupational, Residential Risk Characterization: Given *Pasteuria nishizawae*'s natural occurrence in soil (Atibalentja *et al*. 2004; Noel *et al*. 2005; Sayre *et al*. 1991), non-occupational exposure to the bacterium is likely already occurring. Additional exposure to *Pasteuria nishizawae* – Pn1 due to pesticidal applications is not expected because all proposed pesticide

end-use products are labeled for use in distinct agricultural settings. Even if non-occupational exposures were to occur (e.g., eventual expansion of use sites), such exposures would not exceed EPA's level of concern in light of *Pasteuria nishizawae* – Pn1's specificity for the soybean cyst nematode and test results that indicated *Pasteuria nishizawae* – Pn1 is not toxic (acute dermal toxicity and acute pulmonary toxicity/pathogenicity), is essentially non-irritating (primary dermal irritation), and is not pathogenic (acute pulmonary toxicity/pathogenicity) (see section IV(B)(1)(a) and Tables 5 and 6 in Appendix A).

b. Cumulative Effects from Substances with a Common Mechanism of Toxicity

Section 408(b)(2)(D)(v) of FFDCA requires that, when considering whether to establish, modify, or revoke a tolerance exemption, EPA consider "available information concerning the cumulative effects of [a particular pesticide's] . . . residues and other substances that have a common mechanism of toxicity."

No mechanism of toxicity in mammals has been identified for *Pasteuria nishizawae* – Pn1, and *Pasteuria nishizawae* – Pn1 does not appear to produce a toxic metabolite against the target pest. For the purposes of the tolerance action, EPA has assumed that *Pasteuria nishizawae* – Pn1 does not have a common mechanism of toxicity with other substances. Therefore, section 408(b)(2)(D)(v) of FFDCA does not apply. For information regarding EPA's efforts to determine which chemicals have a common mechanism of toxicity and to evaluate the cumulative effects of such chemicals, see EPA's website at *http://www.epa.gov/pesticides/cumulative*.

c. Determination of Safety for the U.S. Population, Infants and Children

FFDCA section 408(b)(2)(C) provides that, in considering the establishment of a tolerance or tolerance exemption for a pesticide chemical residue, EPA shall assess the available information about consumption patterns among infants and children, special susceptibility of infants and children to pesticide chemical residues, and the cumulative effects on infants and children of the residues and other substances with a common mechanism of toxicity. In addition, FFDCA section 408(b)(2)(C) provides that EPA shall apply an additional tenfold (10X) margin of exposure (safety) for infants and children in the case of threshold effects to account for prenatal and postnatal toxicity and the completeness of the database on toxicity and exposure unless EPA determines that a different margin of exposure (safety) will be safe for infants and children. This additional margin of exposure (safety) is commonly referred to as the Food Quality Protection Act Safety Factor. In applying this provision, EPA either retains the default value of 10X or uses a different additional safety factor when reliable data available to EPA support the choice of a different factor.

Based on the acute toxicity and pathogenicity data discussed in section IV(B)(1)(a) and Tables 5 and 6 in Appendix A, as well as *Pasteuria nishizawae* – Pn1's host specificity for the soybean cyst nematode, EPA concludes that there are no threshold effects of concern to infants, children, or adults when *Pasteuria nishizawae* – Pn1 is used as labeled in accordance with good agricultural practices. As a result, EPA concludes that no additional margin of exposure (safety) is necessary to protect infants and children and that not adding any additional margin of exposure (safety) will be safe for infants and children.

Moreover, based on the same data and EPA analysis as presented directly above, the Agency is

able to conclude that there is a reasonable certainty that no harm will result to the U.S. population, including infants and children, from aggregate exposure to the residues of *Pasteuria nishizawae* – Pn1 when it is used as labeled and in accordance with good agricultural practices as a nematicide. Such exposure includes all anticipated dietary exposures and all other exposures for which there is reliable information. EPA has arrived at this conclusion because, considered collectively, the data and information available on *Pasteuria nishizawae* – Pn1 do not demonstrate toxic, pathogenic, and/or infective potential to mammals, including infants and children.

3. Occupational Exposure and Risk Characterization

Handler exposure to *Pasteuria nishizawae* – Pn1 is not expected to pose any undue risk. Regardless, appropriate personal protective equipment and precautionary statements are required on pesticide product labels to mitigate any potential risks to pesticide handlers due to prolonged or numerous exposures. Handlers applying *Pasteuria nishizawae* – Pn1 end-use pesticide products in agricultural settings must wear a long-sleeved shirt, long pants, socks, shoes, and a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Additional PPE (e.g., protective eyewear), other than the standard described above, may be required on a product-specific basis.

4. Human Health Risk Characterization

EPA considered human exposure to *Pasteuria nishizawae* – Pn1 in light of the standard for registration in FIFRA and the relevant safety factors in FFDCA. A determination has been made that no unreasonable adverse effects to the U.S. population in general, and to infants and children in particular, will result when *Pasteuria nishizawae* – Pn1 pesticide products are used in accordance with EPA-approved labeling.

C. Environmental Assessment (40 CFR § 158.2150)

Data and other information (e.g., scientific literature) submitted by the applicant to support requests to waive nontarget organism testing for *Pasteuria nishizawae* – Pn1 are sufficient to fulfill the relevant microbial pesticide data requirements and for risk assessment purposes. Further testing of nontarget organisms at higher tier levels (i.e., Tiers II, III, and IV) is not required. EPA performed an environmental risk assessment based on data and other information provided by the applicant, and determined that adverse effects to nontarget organisms are not anticipated from the proposed pesticidal uses of *Pasteuria nishizawae* – Pn1. Moreover, EPA made a “No Effect” determination for direct and indirect effects to listed species and their designated critical habitats resulting from these same proposed pesticidal uses.

For a summary of the generic data requirements described in sections IV(C)(1), refer to Table 7 in Appendix A.

1. Ecological Exposure and Risk Characterization

a. Terrestrial Animals and Plants

Birds (Harmonized Guideline 885.4050), Wild Mammals (Harmonized Guideline 885.4150), Nontarget Plants (Harmonized Guideline 885.4300), Nontarget Insects (Harmonized Guideline 885.4340), and Honey Bees (Harmonized Guideline 885.4380) (MRID No. 481517-17): The proposed end-use pesticide products are for use on soybeans. The liquid formulation end-use pesticide product may be applied by soil-directed spray or chemigation, including both soil-directed and foliage-directed (e.g., overhead sprinkler) chemigation. Applications are to be followed with a sufficient amount of water to move the *Pasteuria nishizawae* – Pn1 spores into the root zone. Therefore, both formulations will primarily deposit *Pasteuria nishizawae* – Pn1 into the soil. While this type of application reduces the potential for exposure to many nontarget species, exposure to nontarget species consuming, contacting, or living in the soil will not necessarily be eliminated.

Data and other information submitted by Pasteuria Bioscience, Inc. to support its waiver requests provides sufficient information to conclude that adverse effects are not expected in birds, nontarget insects, and honey bees as a result of exposure to *Pasteuria nishizawae* – Pn1. *Pasteuria* spp. are widespread in their distribution throughout the world. They are known only as parasites of plant-parasitic nematodes, with the exception of *Pasteuria ramosa* that is known only to parasitize *Daphnia* spp. (Atibalentja *et al*. 2004; Chen and Dickson 1998; Sayre *et al*. 1991). *Pasteuria nishizawae* is considered to be an obligate parasite of *Heterodera glycines* and is known only to infect and complete its life cycle within females of *Heterodera glycines* (Noel *et al*. 2005; Sayre *et al*. 1991). Therefore, *Pasteuria nishizawae* – Pn1 is not expected to be toxic or pathogenic to birds, nontarget insects, or honey bees if they are exposed as a result of the proposed pesticidal applications.

An acute oral toxicity/pathogenicity study with laboratory rats (MRID No. 481517-09) and an acute oral toxicity study (MRID No. 481517-13) are available to evaluate the potential effects of *Pasteuria nishizawae* – Pn1 on wild mammals. In the acute oral toxicity/pathogenicity study, laboratory rats were dosed with approximately 1.6×10^9 spores/animal and were observed for 21 days. No signs of toxic or pathogenic effects were found as a result of the exposure. This study was determined to be supplemental because clearance and infectivity were not observed. The acute oral toxicity study showed no evidence of toxicity in rats dosed with 5,000 milligrams per kilogram bodyweight, and this study was determined to be acceptable. These studies show that toxicity/pathogenicity of *Pasteuria nishizawae* – Pn1 to laboratory rats is not expected. There is no reason that the test animals in these studies would not be adequate models with which to determine potential effects to wild mammals, so adverse effects to wild mammals are not expected as a result of the proposed pesticidal applications of *Pasteuria nishizawae* – Pn1.

Nontarget plant testing is not required because *Pasteuria nishizawae* is not related to any known plant pathogen. Adverse effects on plants are not expected to result from the proposed pesticidal applications of *Pasteuria nishizawae* – Pn1.

Additionally, there are no reports of toxicity or pathogenicity of *Pasteuria nishizawae* to nontarget terrestrial animals or plants. To support its data waiver rationale, the applicant

performed a search within the Agricola and PubMed databases, along with several biological journals (i.e., Journal of Bacteriology, Applied and Environmental Microbiology, FEMS Microbiology Ecology, Soil Biology and Biochemistry) for the period of 1980–2010. The search was conducted using "*Pasteuria*" as the search word, and returned no reports of acute toxicity data on birds, freshwater fish, freshwater invertebrates, nontarget insects, and honey bees. The Biopesticides and Pollution Prevention Division also conducted a search within the Environmental Information Database that is available to EPA. This database simultaneously searches the Agricola, Biosis Previews, CAB Abstracts, Energy Science and Technology, General Science Abstracts, and the National Technical Information Service literature search databases. The search was performed with the term "*Pasteuria*" coupled with each of the search terms of "bird," "mammal," "invertebrate," "arthropod," "insect," "honey bee," and "plant" for all of the years available (1926–present). The search was also performed with the search term "*Pasteuria nishizawae*." No unanticipated reports of adverse effects of *Pasteuria nishizawae* or other *Pasteuria* species in nontarget organisms were found in any of these searches.[2] Any reports of effects to nontarget organisms related to *Pasteuria nishizawae* that are found in the future may trigger the need for testing; however, given the specificity of *Pasteuria* spp. for their hosts as is currently understood, such reports are not expected.

Based on the information above and available data, adverse effects are not expected to occur to terrestrial animals or plants as a result of the proposed pesticidal applications of *Pasteuria nishizawae* – Pn1.

b. Aquatic Animals and Plants

Freshwater Fish (Harmonized Guideline 885.4200), Freshwater Invertebrates (Harmonized Guideline 885.4240), Estuarine/Marine Fish and Invertebrates (Harmonized Guideline 885.4280), and Nontarget Plants (Harmonized Guideline 885.4300) (MRID No. 481517-17): Since the proposed applications are intended to deposit *Pasteuria nishizawae* – Pn1 in the soil, some runoff of the active ingredient to freshwater and marine/estuarine environments is expected. Applications of the liquid formulation and seed treatment, however, are intended primarily to put *Pasteuria nishizawae* – Pn1 in the root zone of the treated plants, so these amounts are not likely to be significant. *Pasteuria nishizawae* and other *Pasteuria* spp. are naturally found in soil, so some natural presence of *Pasteuria nishizawae* in surface waters is expected. To date, no information is available on the size of naturally occurring populations of *Pasteuria nishizawae*.

Data waiver rationale was submitted to fulfill data requirements for and support effects conclusions for freshwater aquatic organisms. The rationale provides sufficient information to conclude that adverse effects are not expected in freshwater fish or freshwater invertebrates as a result of exposure to *Pasteuria nishizawae* – Pn1. The rationale was similar to that presented for terrestrial organisms in that *Pasteuria* spp. are found in soils worldwide, and *Pasteuria nishizawae* is known only to parasitize females of *Heterodera glycines*. *Pasteuria ramosa* is a closely related species that parasitizes *Daphnia magna* and other *Daphnia* spp. (Ebert *et al*. 1996); however, it is widely understood that all other known *Pasteuria* spp. are obligate parasites of soil-dwelling nematodes (Atibalentja *et al*. 2004; Chen and Dickson 1998; Sayre *et al*. 1991).

[2] *Pasteuria ramosa* is already recognized as parasitizing water fleas and is not considered an "unanticipated" report.

There are no available reports in the literature documenting pathogenicity or toxicity to freshwater fish or invertebrates as a result of exposure to *Pasteuria nishizawae*. A search, similar to the one described for terrestrial animals and plants, was performed for aquatic animals and plants. In addition to the search terms used for terrestrial animals and plants, the terms "fish," "aquatic," "freshwater," "estuarine," and "marine" were also searched. No reports of adverse effects of *Pasteuria nishizawae* – Pn1 in aquatic nontarget organisms were found in any of these searches. As noted above, reports of adverse effects that may be found in the future may trigger the need for testing; however, none are anticipated due to the specificity of *Pasteuria* spp. for their nematode hosts.

Based on the information submitted, adverse effects to freshwater and marine/estuarine fish, invertebrates, and plants are not expected as a result of exposure to proposed pesticidal applications of *Pasteuria nishizawae* – Pn1.

2. Environmental Fate Data

As the data and information provided are sufficient to fulfill the Tier I nontarget organism data requirements and allow for nontarget organism risk assessment for *Pasteuria nishizawae* – Pn1, further testing at higher tier levels (i.e., Tiers II, III, and IV) is not required.

3. Threatened and Endangered Species Assessment

Since EPA has determined that no effects are anticipated for any nontarget species exposed to *Pasteuria nishizawae* – Pn1 as a result of the proposed applications, effects to threatened and endangered species and their designated critical habitats are also not expected. Therefore, a "No Effect" determination is made for direct and indirect effects to listed species and their designated critical habitats resulting from the proposed pesticidal uses of *Pasteuria nishizawae* – Pn1, as labeled.

V. ENVIRONMENTAL JUSTICE

EPA seeks to achieve environmental justice—the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income—with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal environmental programs and policies. Meaningful involvement means that (1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; (2) the public's contribution can influence the regulatory agency's decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the decision-makers seek out and facilitate the involvement of those potentially affected. EPA has this goal for all communities and persons across the United States.

To help address potential environmental justice issues, during the 30-day public participation comment period, EPA sought information on any groups or segments of the population who, as a

result their location, cultural practices, or other factors, may have atypical, unusually high exposure to *Pasteuria nishizawae* – Pn1, compared to the general population. No public comments were received on this particular matter.

For additional information regarding environmental justice issues, please visit EPA's web site at *http://www.epa.gov/compliance/environmentaljustice/index.html*.

VI. RISK MANAGEMENT DECISION

Section 3(c)(5) of FIFRA permits for the registration of a pesticide provided that all the following determinations are made:

(1) Its composition is such as to warrant the proposed claims for it;
(2) Its labeling and other material required to be submitted comply with the requirements of FIFRA;
(3) It will perform its intended function without unreasonable adverse effects on the environment; AND
(4) When used in accordance with widespread and commonly recognized practice, it will not generally cause unreasonable adverse effects on the environment.

To satisfy criterion 1, the *Pasteuria nishizawae* – Pn1 pesticide products have well-known properties. EPA has no knowledge that would contradict the claims made on the Soyacyst Tech, Soyacyst Tech+, and Soyacyst LF labels, and such pesticide products are not expected to cause unreasonable adverse effects on the environment when used according to their respective label instructions. Criterion 2 is satisfied by the current product labels, as well as the data and information presented in this document. It is believed that the *Pasteuria nishizawae* – Pn1 pesticide products will not cause any unreasonable adverse effects on the environment, and Soyacyst Tech+ and Soyacyst LF (end-use pesticide products), in particular, are likely to provide protection against soybean cyst nematode as claimed, satisfying criterion 3. Criterion 4 is satisfied in that the *Pasteuria nishizawae* – Pn1 pesticide products are not expected to cause unreasonable adverse effects when used according to label instructions. Therefore, Soyacyst Tech, Soyacyst Tech+, and Soyacyst LF, containing *Pasteuria nishizawae* – Pn1 as a new active ingredient, are eligible for registration under FIFRA section 3(c)(5) for the labeled uses.

VII. ACTIONS REQUIRED OF THE REGISTRANT

A. Final Printed Labeling

Before releasing pesticide products containing *Pasteuria nishizawae* – Pn1 for shipment, the registrant is required to provide appropriate final printed labeling to EPA.

B. Terms of Registration

No additional data are being required as terms of registration.

C. Reporting of Adverse Effects and Hypersensitivity Incidents

Notwithstanding the information stated in the previous sections, it should be clearly understood that certain specific data are required to be reported to EPA as a requirement for maintaining the federal registration for a pesticide product. A brief summary of these types of data are described below.

Reports of all incidents of adverse effects to the environment must be submitted to EPA under the provisions stated in FIFRA section 6(a)(2). Additionally, all incidents of hypersensitivity (including both suspected and confirmed incidents) must be reported to EPA under the provisions of 40 CFR § 158.2140(d).

VIII. GLOSSARY OF ACRONYMS AND ABBREVIATIONS

BRAD	Biopesticides Registration Action Document
CFR	Code of Federal Regulations
cSt	centistokes
EDSP	Endocrine Disruptor Screening Program
EP	end-use pesticide product
EPA	United States Environmental Protection Agency (the "Agency")
FFDCA	Federal Food, Drug, and Cosmetic Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
g/mL	grams per milliliter
lb/gal	pounds per gallon
LD_{50}	median lethal dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral, dermal, or inhalation). It is expressed as a weight of substance per unit weight of animal (e.g., mg/kg).
mg/kg	milligrams per kilogram
MP	manufacturing-use pesticide product
MRID No.	Master Record Identification Number
NIOSH	National Institute for Occupational Safety and Health
OPP	Office of Pesticide Programs
PC Code	Pesticide Chemical Code
PP	Pesticide Petition
PPE	personal protective equipment
TGAI	technical grade of the active ingredient
U.S.	United States
w/w	weight to weight

IX. BIBLIOGRAPHY

A. Studies Submitted to Support the *Pasteuria nishizawae* – Pn1 Pesticide Product Registrations

MRID No.	Study Information
481517-01	MacIntosh S, Smith K. 2010. Product Identity: *Pasteuria nishizawae* – Pn1. Project Number: PBI/2010/001. Unpublished study prepared by MacIntosh & Associates, Inc. and Pasteuria Bioscience, Inc., 90 pages.
481517-02	Smith K. 2010. Manufacturing Process for *Pasteuria nishizawae* – Pn1. Project Number: PBI/2010/002. Unpublished study prepared by Pasteuria Bioscience, Inc., 36 pages.
481517-03	MacIntosh S. 2010. Discussion of Formation of Unintentional Ingredients: *Pasteuria nishizawae* – Pn1. Project Number: 14060/10. Unpublished study prepared by MacIntosh & Associates, Inc., 29 pages.
481517-04	Smith K. 2010. Analysis of Samples/Enforcement Methods for *Pasteuria nishizawae* – Pn1. Unpublished study prepared by Pasteuria Bioscience, Inc., 62 pages.
481517-05	Smith K. 2010. Certification of Limits for *Pasteuria nishizawae* – Pn1. Project Number: PBI/2010/004. Unpublished study prepared by Pasteuria Bioscience, Inc., 8 pages.
481517-06	Kaminsky M. 2010. *Pasteuria nishizawae* – Pn1 Product Chemistry: Final Report. Project Number: 13885/10. Unpublished study prepared by Stillmeadow, Inc., 16 pages.
481517-07	Smith K. 2010. Product Stability to Elevated Temperatures: *Pasteuria nishizawae* – Pn1. Project Number: 115/54. PBI/2010/005. Unpublished study prepared by Pasteuria Bioscience, Inc., 8 pages.
481517-08	Smith K. 2010. Storage Stability & Corrosion Characteristics for *Pasteuria nishizawae*. Project Number: 13886/10, PBI/2010/002. Unpublished study prepared by Pasteuria Bioscience, Inc., 16 pages.
481517-09	Gingras B. 2010. Toxicity/Pathogenicity Testing of *Pasteuria nishizawae* – Pn1 Following Acute Oral Challenge in Rats. Project Number: 2262/SN4. Unpublished study prepared by IIT Research Institute, 58 pages.
481517-10	Gingras B. 2010. Toxicity/Pathogenicity Testing of *Pasteuria nishizawae* – Pn1 Following Acute Intratracheal Challenge in Rats – Final Report. Project Number: 2262/SN5. Unpublished study prepared by IIT Research Institute, 53 pages.

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481517-12	MacIntosh S. 2010. Hypersensitivity Incidents: *Pasteuria nishizawae* – Pn1. Project Number: PBI/2010/007. Unpublished study prepared by MacIntosh & Associates, Inc., 7 pages.
481517-13	Sullivan D. 2010. Acute Oral Toxicity Study of *Pasteuria nishizawae* – Pn1 in Rats. Project Number: 2262/SN11. Unpublished study prepared by IIT Research Institute, 28 pages.
481517-14	Sullivan D. 2010. Acute Dermal Toxicity Study of *Pasteuria nishizawae* – Pn1 in Rabbits. Project Number: 2262/SN12. Unpublished study prepared by IIT Research Institute, 30 pages.
481517-15	Sullivan D. 2010. Acute Eye Irritation Study of *Pasteuria nishizawae* – Pn1 in Rabbits. Project Number: 2262/SN13. Unpublished study prepared by IIT Research Institute, 25 pages.
481517-16	Sullivan D. 2010. Acute Dermal Irritation Study of *Pasteuria nishizawae* – Pn1 in Rabbits. Project Number: 2262/SN14. Unpublished study prepared by IIT Research Institute, 24 pages.
481517-17	MacIntosh S, Smith K, Hewlett T. 2010. Request for Waiver from the Requirement to Conduct Guideline Studies (Avian Oral Toxicity, Freshwater Fish Toxicity/Pathogenicity, Freshwater Invertebrate Toxicity/Pathogenicity, Non-Target Insect Testing, and Honey Bee Testing) for *Pasteuria nishizawae* – Pn1. Project Number: PBI/2010/014. Unpublished study prepared by MacIntosh & Associates, Inc., 29 pages.
482103-01	MacIntosh S, Smith K. 2010. Product Identity and Manufacturing Process: *Pasteuria nishizawae* – Pn1 (Liquid Formulation; End Product). Project Number: PBI/2010/020. Unpublished study prepared by Pasteuria Bioscience, Inc. and MacIntosh & Associates, Inc., 17 pages.
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482103-03	Smith K. 2010. Analysis of Samples/Enforcement Methods for *Pasteuria nishizawae* – Pn1 (Liquid Formulation; End Product). Unpublished study prepared by Pasteuria Bioscience, Inc., 20 pages.

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482103-04	Smith K. 2010. Certification of Limits for *Pasteuria nishizawae* – Pn1 (Liquid Formulation; End Product). Project Number: PBI/2010/022. Unpublished study prepared by Pasteuria Bioscience, Inc., 8 pages.
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482103-06	Smith K. 2010. Storage Stability: Interim Report *Pasteuria nishizawae* – Pn1 (Liquid Formulation; End Product). Project Number: PBI/2010/023. Unpublished study prepared by Pasteuria Bioscience, Inc., 8 pages.
482103-07	Smith K. 2010. Corrosion Characteristics for *Pasteuria nishizawae* – Pn1 (Liquid Formulation; End Product). Project Number: PBI/2010/024. Unpublished study prepared by Pasteuria Bioscience, Inc., 11 pages.
482103-08	MacIntosh S. 2010. Hypersensitivity Incidents: *Pasteuria nishizawae* – Pn1 (Liquid Formulation; End Product). Project Number: PBI/2010/024. Unpublished study prepared by MacIntosh & Associates, Inc., 11 pages.
482103-09	Sullivan D. 2010. Acute Oral Toxicity Study of *Pasteuria nishizawae* – Pn1 (End Product) in Rats. Project Number: 2262/SN15. Unpublished study prepared by IIT Research Institute, 28 pages.
482103-10	Sullivan D. 2010. Acute Dermal Toxicity Study of *Pasteuria nishizawae* – Pn1 (End Product) in Rabbits. Project Number: 2262/SN20. Unpublished study prepared by IIT Research Institute, 28 pages.
482103-11	Sullivan D. 2010. Acute Eye Irritation Study of *Pasteuria nishizawae* – Pn1 (End Product) in Rabbits. Project Number: 2262/SN21. Unpublished study prepared by IIT Research Institute, 22 pages.
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486461-01	Smith K. 2011. New Sources of Inert Ingredients *Pasteuria nishizawae* – Pn1 (TGAI/MP) and *Pasteuria nishizawae* – Seed Treatment (EP). Unpublished study prepared by Pasteuria Bioscience, Inc., 51 pages.
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APPENDIX A. MICROBIAL PESTICIDES DATA REQUIREMENTS (40 CFR PART 158 – SUBPART V)

TABLE 1. Product Analysis Data Requirements for the Technical Grade of the Active Ingredient (TGAI), *Pasteuria nishizawae* – Pn1, and the Manufacturing-Use Pesticide Product (MP), Soyacyst Tech (40 CFR § 158.2120)

Harmonized Guideline Number	Data Requirement	Results		MRID No.
		***Pasteuria nishizawae* – Pn1**	**Soyacyst Tech**	
885.1100	Product Identity	N/A	Submitted data fulfill the requirement for product identity. Soyacyst Tech contains 99.88% by weight *Pasteuria nishizawae* – Pn1 (contains at least 1 x 10^8 spores per gram).	481517-01 485915-01 486461-01
885.1200	Manufacturing Process	Submitted data fulfill the requirement for manufacturing process.		481517-02 485915-02
N/A	Deposition of a Sample in a Nationally Recognized Culture Collection	*Pasteuria nishizawae* – Pn1 is on deposit with the American Type Culture Collection in Manassas, Virginia under Accession Number SD-5833.	N/A	481517-01 485915-01
885.1300	Discussion of Formation of Unintentional Ingredients	Submitted data fulfill the requirement for discussion of formation of unintentional ingredients.		481517-03 485915-03
885.1400	Analysis of Samples	Submitted data fulfill the requirement for analysis of samples.		481517-04 485915-04
885.1500	Certification of Limits	N/A	Limits listed on the confidential statement of formula are adequate/acceptable.	481517-05

TABLE 2. Product Analysis Data Requirements for the End-Use Pesticide Product (EPs), Soyacyst Tech+ and Soyacyst LF (40 CFR § 158.2120)

Harmonized Guideline Number	Data Requirement	Results		MRID No.
		Soyacyst Tech+*	Soyacyst LF**	
885.1100	Product Identity	Submitted data fulfill the requirement for product identity. Soyacyst Tech+ contains 99.88% by weight *Pasteuria nishizawae* – Pn1 (contains at least 1 x 10^8 spores per gram).	Submitted data fulfill the requirement for product identity. Soyacyst LF contains 33.29% by weight *Pasteuria nishizawae* – Pn1 (contains at least 1.3 x 10^7 spores per gram).	481517-01* 485915-01* 486461-01* 482103-01** 486461-02**
885.1200	Manufacturing Process	Submitted data fulfill the requirement for manufacturing process.		481517-02* 485915-02* 482103-01**
N/A	Deposition of a Sample in a Nationally Recognized Culture Collection	N/A		N/A
885.1300	Discussion of Formation of Unintentional Ingredients	Submitted data fulfill the requirement for discussion of formation of unintentional ingredients.		481517-03* 485915-03* 482103-02**
885.1400	Analysis of Samples	Submitted data fulfill the requirement for analysis of samples.		481517-04* 485915-04* 482103-03**
885.1500	Certification of Limits	Limits listed on the confidential statement of formula are adequate/acceptable.		481517-05* 482103-04**

TABLE 3. Physical and Chemical Characteristics for the Technical Grade of the Active Ingredient (TGAI), *Pasteuria nishizawae* – Pn1, and the Manufacturing-Use Pesticide Product (MP), Soyacyst Tech (40 CFR § 158.2120)

Harmonized Guideline Number	Data Requirement	Results		MRID No.
		***Pasteuria nishizawae* – Pn1**	**Soyacyst Tech**	
830.6302[1]	Color	Light brown/caramel brown		481517-06
830.6303[1]	Physical State	Liquid		
830.6304[1]	Odor	Faint odor/similar to dog food		
830.6313[1]	Stability to Normal and Elevated Temperatures, Metals, and Metal Ions	Stable up to 14 days at 54°C without loss of viability		481517-07
830.6317	Storage Stability	Stable for one year when stored at 4°C		481517-08 485915-05
830.6319	Miscibility	N/A	Not required because Soyacyst Tech is not an emulsifiable liquid form of a microbial pesticide (refer to test note #2 of 40 CFR § 158.2120(d)).	N/A
830.6320	Corrosion Characteristics	N/A	Not corrosive to packaging materials in a one-year study.	481517-08 485915-06
830.7000[1]	pH	4.69–5.21 (1% w/w)		481517-06
830.7100	Viscosity	N/A	1.570 cSt (20°C) 1.046 cSt (40°C)	482744-02
830.7300[1]	Density/Relative Density/Bulk Density (Specific Gravity)	1.04 g/mL (or 1.04 g/cm^3)		481517-06

[1] According to 40 CFR § 158.2120, these data are only required for the technical grade of the active ingredient. Since Pasteuria Bioscience, Inc. included this information with its application for Soyacyst Tech, it is summarized appropriately in this table.

TABLE 4. Physical and Chemical Characteristics for the End-Use Pesticide Products (EPs), Soyacyst Tech+ and Soyacyst LF (40 CFR § 158.2120)

Harmonized Guideline Number	Data Requirement	Results		MRID No.
		Soyacyst Tech+*	Soyacyst LF**	
830.6302[1]	Color	Light brown/caramel brown	N/A	481517-06
830.6303[1]	Physical State	Liquid	N/A	481517-06
830.6304[1]	Odor	Faint odor/similar to dog food	N/A	481517-06
830.6313[1]	Stability to Normal and Elevated Temperatures, Metals, and Metal Ions	Stable up to 14 days at 54°C without loss of viability	N/A	481517-07
830.6317	Storage Stability	Stable for one year when stored at 4°C		481517-08* 485915-05* 482103-06** 486052-01**
830.6319	Miscibility	Not required because the end-use pesticide products, Soyacyst Tech+ and Soyacyst LF, are not emulsifiable liquid forms of microbial pesticides (refer to test note #2 of 40 CFR § 158.2120(d)).		N/A
830.6320	Corrosion Characteristics	Not corrosive to packaging materials in a one-year study.		481517-08* 485915-06* 482103-07** 486052-02**
830.7000	pH	4.69–5.21 (1% w/w)[1]	3.5–4.5[2]	481517-06*
830.7100	Viscosity	1.570 cSt (20°C) 1.046 cSt (40°C)	318.2 cSt (20°C) 255.15 cSt (40°C)	482744-02* 482103-05**
830.7300	Density/Relative Density/Bulk Density (Specific Gravity)	1.04 g/mL (or 1.04 g/cm^3)[1]	8.5 lb/gal[2]	481517-06*

[1] According to 40 CFR § 158.2120, these data are only required for the technical grade of the active ingredient. Since Pasteuria Bioscience, Inc. included this information with its applications for Soyacyst Tech+, it is summarized appropriately in this table.
[2] Obtained from the confidential statement of formula for the end-use pesticide product.

TABLE 5. Toxicology Data Requirements for the Technical Grade of the Active Ingredient (TGAI), *Pasteuria nishizawae* – Pn1, and the Manufacturing-Use Pesticide Product (MP), Soyacyst Tech (40 CFR § 158.2140)

Harmonized Guideline Number	Data Requirement	Results		MRID No.
		***Pasteuria nishizawae* – Pn1**	**Soyacyst Tech**	
		Tier I		
885.3050	Acute Oral Toxicity/Pathogenicity	Not toxic and/or pathogenic to rats when administered by oral gavage in a single dose of 1.6×10^9 spores per animal. Although clearance and infectivity were not measured, EPA believes these endpoints are not a concern given *Pasteuria nishizawae* – Pn1's well-established host specificity for the soybean cyst nematode. **Classification: Supplemental**	N/A	481517-09
885.3150	Acute Pulmonary Toxicity/Pathogenicity	Not toxic and/or pathogenic to rats when administered by intratracheal instillation in a single dose of 1.6×10^8 spores per animal. Although clearance and infectivity were not measured, EPA believes these endpoints are not a concern given *Pasteuria nishizawae* – Pn1's well-established host specificity for the soybean cyst nematode. **Classification: Supplemental**	N/A	481517-10
885.3200	Acute Injection Toxicity/Pathogenicity (Intraperitoneal)	Not toxic and/or pathogenic to rats when administered intravenously in a single dose of 1.0×10^9 spores per animal. Although clearance and infectivity were not measured, EPA believes these endpoints are not a concern given *Pasteuria nishizawae* – Pn1's well-established host specificity for the soybean cyst nematode. **Classification: Supplemental**	N/A	481517-11
885.3400	Hypersensitivity Incidents	The applicant reported that no hypersensitivity incidents, including immediate-type or delayed-type reactions of humans and domestic animals, occurred during research, development, or testing of the TGAI or MP. Any future hypersensitivity incidents must be reported to EPA (refer to test note #3 of 40 CFR § 158.2140(d)).		481517-12
885.3500	Cell Culture	Not required because *Pasteuria nishizawae* – Pn1 is not a virus (refer to test note #4 of 40 CFR § 158.2140(d)).	N/A	N/A
870.1100	Acute Oral Toxicity	N/A	Oral LD_{50} combined (male and female rats) > 5,000 mg/kg **Classification: Acceptable TOXICITY CATEGORY IV**	481517-13
870.1200	Acute Dermal Toxicity	N/A	Dermal LD_{50} combined (male and female rabbits) > 2,000 mg/kg **Classification: Acceptable TOXICITY CATEGORY IV**	481517-14

TABLE 5. Toxicology Data Requirements for the Technical Grade of the Active Ingredient (TGAI), *Pasteuria nishizawae* – Pn1, and the Manufacturing-Use Pesticide Product (MP), Soyacyst Tech (40 CFR § 158.2140)				
Harmonized Guideline Number	**Data Requirement**	**Results**		**MRID No.**
		***Pasteuria nishizawae* – Pn1**	**Soyacyst Tech**	
870.1300	Acute Inhalation Toxicity	N/A	Waived based on the results of MRID No. 481517-10 and because this formulation contains inert ingredients that are not expected to be of toxicological concern (refer to test note #5 of 40 CFR § 158.2140(d)). **Classification: Acceptable TOXICITY CATEGORY III**	482744-05
870.2400	Acute Eye Irritation	N/A	Soyacyst Tech was essentially non-irritating to the eyes of rabbits. **Classification: Acceptable TOXICITY CATEGORY IV**	481517-15
870.2500	Primary Dermal Irritation	N/A	Soyacyst Tech was essentially non-irritating to the skin of rabbits. **Classification: Acceptable TOXICITY CATEGORY IV**	481517-16
Tiers II and III				
Not required for *Pasteuria nishizawae* – Pn1 based on the lack of acute toxicity/pathogenicity in the Tier I studies.				

TABLE 6. Toxicology Data Requirements for the End-Use Pesticide Products (EPs), Soyacyst Tech+ and Soyacyst LF (40 CFR § 158.2140)				
Harmonized Guideline Number	**Data Requirement**	**Results**		**MRID No.**
		Soyacyst Tech+*	**Soyacyst LF****	
885.3050	Acute Oral Toxicity/Pathogenicity	N/A		N/A
885.3150	Acute Pulmonary Toxicity/Pathogenicity	N/A		N/A
885.3200	Acute Injection Toxicity/Pathogenicity	N/A		N/A
885.3400	Hypersensitivity Incidents	The applicant reported than no hypersensitivity incidents, including immediate-type or delayed-type reactions of humans and domestic animals, occurred during research, development, or testing of the EPs. Any future hypersensitivity incidents must be reported to EPA (refer to test note #3 of 40 CFR § 158.2140(d)).		481517-12* 482103-08**
885.3500	Cell Culture	N/A		N/A
870.1100	Acute Oral Toxicity	Oral LD_{50} combined (male and female rats) > 5,000 mg/kg **Classification: Acceptable TOXICITY CATEGORY IV**		481517-13* 482103-09**
870.1200	Acute Dermal Toxicity	Dermal LD_{50} combined (male and female rabbits) > 2,000 mg/kg **Classification: Acceptable TOXICITY CATEGORY IV**		481517-14* 482103-10**

TABLE 6. Toxicology Data Requirements for the End-Use Pesticide Products (EPs), Soyacyst Tech+ and Soyacyst LF (40 CFR § 158.2140)				
Harmonized Guideline Number	**Data Requirement**	**Results**		**MRID No.**
		Soyacyst Tech+*	**Soyacyst LF****	
870.1300	Acute Inhalation Toxicity	Waived based on the results of MRID No. 481517-10 and because these formulations contain inert ingredients that are not expected to be of toxicological concern (refer to test note #5 of 40 CFR § 158.2140(d)). **Classification: Acceptable** **TOXICITY CATEGORY III**		482744-05* 482744-06**
870.2400	Acute Eye Irritation	The EP test substances were essentially non-irritating to the eyes of rabbits. **Classification: Acceptable** **TOXICITY CATEGORY IV**		481517-15* 482103-11**
870.2500	Primary Dermal Irritation	The EP test substances were essentially non-irritating to the skin of rabbits. **Classification: Acceptable** **TOXICITY CATEGORY IV**		481517-16* 482103-12**

TABLE 7. Nontarget Organism Toxicity and Environmental Fate Data Requirements for the Technical Grade of the Active Ingredient (TGAI), *Pasteuria nishizawae* – Pn1 (40 CFR § 158.2150)			
Harmonized Guideline Number	**Data Requirement**	**Results**	**MRID No.**
Tier I			
885.4050	Avian Oral Toxicity	Data and other information provide sufficient information to determine that toxicity/pathogenicity to avian wildlife is not expected as a result of the proposed pesticidal uses. **Classification: Acceptable**	481517-17
885.4100	Avian Inhalation Toxicity/Pathogenicity	Not required as the nature of the microbial pesticide does not indicate potential pathogenicity to birds or relatedness to any known bird pathogens (refer to test note #3 of 40 CFR § 158.2150(e)).	N/A
885.4150	Wild Mammal Toxicity/Pathogenicity	Tests required by 40 CFR § 158.2140 are adequate and appropriate for assessment of hazards to wild mammals. Studies submitted with laboratory rats indicate no adverse effects due to oral exposure. **Classification: Acceptable for wild mammal risk assessment**	N/A
885.4200	Freshwater Fish Toxicity/Pathogenicity	Data and other information provide sufficient information to determine that toxicity/pathogenicity to freshwater fish and invertebrates is not expected as a result of the proposed pesticidal uses. **Classification: Acceptable**	481517-17
885.4240	Freshwater Invertebrate Toxicity/Pathogenicity		
885.4280	Estuarine/Marine Fish and Invertebrate Testing	Not required as the microbial pesticide will not be applied directly to water and is not expected to enter marine/estuarine environments in amounts that would result in significant concentrations (refer to test note #6 of 40 CFR § 158.2150(e)).	N/A
885.4300	Nontarget Plant Testing	Not required as the microbial pesticide is not taxonomically related to any known plant pathogens (refer to test note #7 of 40 CFR § 158.2150(e)).	N/A

TABLE 7. Nontarget Organism Toxicity and Environmental Fate Data Requirements for the Technical Grade of the Active Ingredient (TGAI), *Pasteuria nishizawae* – Pn1 (40 CFR § 158.2150)			
Harmonized Guideline Number	**Data Requirement**	**Results**	**MRID No.**
885.4340	Nontarget Insect Testing	Data and other information provide sufficient information to determine that toxicity/pathogenicity to honey bees and nontarget insects is not expected as a result of the proposed pesticidal uses. **Classification: Acceptable**	481517-17
885.4380	Honey Bee Testing		
Tiers II, III, and IV			
Not required for *Pasteuria nishizawae* – Pn1 based on the acceptability of the data and other information provided for Tier I.			

APPENDIX B. PESTICIDE PRODUCTS

EPA Registration Number	Registration Name	Percentage Active Ingredient	Formulation Type	Use Site(s)	Method(s) of Application	Application Rate(s)	Target Pest
85004-6	Soyacyst Tech	99.88%	Technical	N/A	N/A	N/A	N/A
85004-7	Soyacyst Tech+	99.88%	End Use – Liquid	Soybean	Seed Treatment (Preplant or Commercial)	2–5 fluid ounces of Soyacyst Tech+ per 100 pounds of soybean seed	Soybean cyst nematode (*Heterodera glycines*)
85004-9	Soyacyst LF	33.29%	End Use – Liquid	Soybean	Seed Treatment (Preplant or Commercial)	2–5 fluid ounces of Soyacyst LF per 100 pounds of soybean seed	Soybean cyst nematode (*Heterodera glycines*)
					Ground application equipment or chemigation	1.3–64 fluid ounces of Soyacyst LF per 1,000 square feet of soybean	