Heptyl Butyrate
PC Code 100247

Interim Registration Review Decision
Case Number 6305

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I. Introduction

This document is the Environmental Protection Agency's (EPA or the Agency) Interim Registration Review Decision for heptyl butyrate (Case 6305) and is being issued pursuant to 40 CFR §§ 155.50 and 155.58. A registration review decision is the Agency's determination whether a pesticide meets, or does not meet, the standard for registration in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The Agency may issue, when it determines it to be appropriate, an interim registration review decision before completing a registration review. Among other things, the interim registration review decision may: 1) require new risk mitigation measures; 2) impose interim risk mitigation measures; 3) identify data or information required to complete the review; and 4) establish schedules for submitting the required data, conducting the new risk assessment, and completing the registration review.

FIFRA, as amended by the Food Quality Protection Act (FQPA) of 1996, mandates the continuous review of existing pesticides. All pesticides distributed or sold in the United States generally must be registered by the Agency based on scientific data showing that they will not cause unreasonable adverse effects to human health or to the environment when used as directed on product labeling. The registration review program is intended to ensure that, as the ability to assess and reduce risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects. Changes in science, public policy, and pesticide use practices will occur over time. Through the registration review program, the Agency periodically re-evaluates pesticides to ensure that as these changes occur, products in the marketplace can continue to be used safely. Information on this program is provided at www.epa.gov/pesticide-reevaluation. In 2006, the Agency implemented the registration review program pursuant to FIFRA § 3(g). The Agency will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration.

The regulations governing registration review are provided in 40 CFR part 155, subpart C. The public phase of registration review begins when the initial docket is opened for the case. The docket is the Agency's opportunity to inform the public what it knows about heptyl butyrate and what additional risk analyses and data or information, if any, it believes are needed to make a registration review decision on heptyl butyrate. Additional information on heptyl butyrate can be found in the Agency's public docket (EPA-HQ-OPP-2022-0402) at www.regulations.gov.

This document is organized into five sections: the *Introduction*, which includes this summary and the heptyl butyrate case overview; *Use Information*, which describes how and why heptyl butyrate is used and summarizes data on its use, and associated pesticide products; *Scientific Assessments*, which summarizes the Agency's risk assessments, any revisions, and risk conclusions; *Interim Registration Review Decision*, which describes the regulatory rationale for the Agency's interim registration review decision; and, lastly, the *Next Steps* and *Timeline* provides an anticipated timeline for completion of this registration review case.

Heptyl Butyrate Registration Review Case Overview

Pursuant to 40 CFR § 155.50, the Agency formally initiated registration review for heptyl butyrate (Case 6305). The following list highlights significant events that have occurred during the current cycle of registration review for this case. Documentation of these events can be found in the Agency's public docket for this registration review case in docket EPA-HQ-OPP-2022-0402 available at www.regulations.gov.

- July 2022 – Publication of the *Heptyl Butyrate Combined Preliminary Work Plan and Proposed Interim Registration Review Decision* (PWP PID) for a 60-day public comment period. The

Agency received one relevant public comment, from the United States Department of Agriculture. This comment was in support of the Agency's PWP PID for heptyl butyrate.

- December 2022 – The Agency is now publishing the *Heptyl Butyrate Interim Registration Review Decision*.

II. Use Information

The first pesticide products containing heptyl butyrate as an active ingredient were registered by the Agency in 2009. Currently, there are four registered end-use products containing heptyl butyrate, ranging from 18.9%-99.8% active ingredient.

Heptyl butyrate is a colorless, liquid ester that is found naturally in fresh apples and plums. Humans are regularly exposed to heptyl butyrate through consumption of these fruits (U.S. EPA, 2009a). The currently registered pesticide products contain synthetic heptyl butyrate, but the synthetic form is identical to naturally existing heptyl butyrate. As a pesticide, heptyl butyrate is intended for use in traps to attract several species of yellowjackets by mimicking the smell of fruit (U.S. EPA, 2009a). The four registered products containing heptyl butyrate are classified as biochemical pesticide products due to the natural occurrence of heptyl butyrate in the environment, its nontoxic mode of action to the pests, and the history of its exposure to humans and the environment demonstrating minimal toxicity (U.S. EPA, 2009b).

Table 1. Heptyl Butyrate Use Information

Ingredient Name	Heptyl butyrate
PC Code	100247
CAS Number	5870-93-9
Pesticide Classification	Insect attractant
Use Site Locations	Residential (outdoor), agricultural (outdoor), recreational/schools/institutional/retail (outdoor), and occupational/manufacturing/processing/industrial (outdoor)
Application Types	Bait treatment
No. of Registrations	4 FIFRA Section 3 products[1]
Physical Forms	Solution

III. Scientific Assessments

A summary of the Agency's human health and ecological risk assessments for heptyl butyrate is presented below. Refer to the Appendices for a listing of product analysis, human health assessment, and nontarget organism data that support the scientific assessments for this registration review. For further information on the human health and environmental risk assessments, including a summary of data and literature search findings, please see Appendices B and C.

A. Human Health Assessment

Hazard Characterization

The toxicological database is considered complete for characterizing hazard and assessing risk from the active ingredient in this case. Heptyl butyrate can be classified as Toxicity Category IV for acute oral toxicity, acute dermal toxicity, and primary eye irritation. Based on dermal irritation data derived from six compounds with similar chemical structures to that of heptyl butyrate, the Agency classified heptyl butyrate as a mild (Category III) dermal irritant. Local Lymph Node Assay (LLNA) and *in vitro* studies

[1] FIFRA labels can be obtained from the Pesticide Product Label System (ordspub.epa.gov/ords/pesticides/f?p=PPLS:1)

from the scientific literature indicate that heptyl butyrate is not a dermal sensitizer (Cottrez et al., 2016). Acute inhalation toxicity data requirements were satisfied through waiver rationales based on heptyl butyrate's low acute oral and dermal toxicity, low use rate (1.4 ounces heptyl butyrate/acre/week), application method (traps and lures), high dissipation rate when released outdoors as a vapor from traps due to its volatility, and its slow release as a vapor from traps or lures over an extended period of time (approximately two to three weeks). For additional data, see Table 4 in Appendix B below. The Agency does not anticipate the need for additional studies for this registration review. All data requirements, per 40 CFR § 158.2050, have been fulfilled for heptyl butyrate.

Dietary Exposure and Risk Characterization

There is no anticipated food or drinking water exposure to heptyl butyrate based on the labeled use pattern; therefore, a dietary risk assessment is not required. Regarding any incidental exposure, all routes of exposure associated with the use of heptyl butyrate as an attractant are negligible. Additionally, heptyl butyrate occurs naturally in fruit (apples and plums), is an ester with a nontoxic mode of action (attractant) and is regularly consumed in human diets. Finally, the acute toxicity information on file indicates that the risks associated with even incidental exposures would be negligible.

Food Tolerances

No food tolerances have been proposed or established for heptyl butyrate because there are no intended food uses for pesticide products containing heptyl butyrate.

Residential and Non-Occupational Exposure and Risk Characterization

Based on the use patterns of products containing heptyl butyrate as an active ingredient, anticipated residential and non-occupational exposure is not likely to result in unreasonable risk. All currently registered products containing heptyl butyrate are for use in outdoor residential, commercial, and agricultural settings, i.e., as an attractant in traps for wasps, hornets, and yellowjackets. Due to the utilization of heptyl butyrate as an internal attractant in a trap, no repeat or prolonged oral, dermal, or inhalation exposures are expected during the use and disposal of registered products containing heptyl butyrate. Potential exposure is only expected during trap set-up whereby the most likely route of exposure is dermal, in the event of spillage, as well as the possibility of incidental inhalation, oral, and ocular exposure. Due to heptyl butyrate's low toxicity profile (Appendix B), natural occurrence in foods (apples and plums), and nontoxic mode of action (attractant), the risks associated with incidental dermal, inhalation, oral, and ocular exposures are negligible.

Hazard and exposure data, Agency risk assessments, and other information on heptyl butyrate were evaluated against standards established by FIFRA and the Agency's regulations and scientific policies. No risks of concern have been identified.

Occupational Exposure and Risk Characterization

Based on the use patterns of products containing heptyl butyrate as an active ingredient, anticipated occupational exposure is not likely to result in unreasonable risk. No repeat or prolonged oral, dermal, or inhalation exposures are expected during the use and disposal of registered products containing heptyl butyrate due to its application method (traps/lures). The most likely route of exposure is dermal, in the event of spillage, as well as the possibility of incidental inhalation, oral, and ocular exposure. Heptyl butyrate has a low toxicity profile (Appendix B), naturally occurs in foods, and has a nontoxic mode of action (attractant). Therefore, the risks associated with incidental dermal, inhalation, oral, and ocular exposures are negligible.

Human Incidents

A search of the Office of Pesticide Programs' (OPP) Incident Data System (version 2.1.1) conducted on April 19, 2022, revealed no reported incidents associated with heptyl butyrate. This database contains information dating back to the 1970s and is continuously updated as incidents are reported.

B. Environmental Risk Assessment

All nontarget organism and environmental fate data necessary to meet the standard for heptyl butyrate were satisfied through the acceptance of waiver rationales based on lack of exposure to the active ingredient and its non-toxic mode of action. Heptyl butyrate is contained in traps and has no direct or significant contact with birds, mammals, fish, or surrounding vegetation. Moreover, heptyl butyrate occurs naturally in fruit, and no evidence of ecotoxicity was found in a search of the open literature (Appendix C) and OPP's Environmental Incident Information System. Risk to insect pollinators and other nontarget insects is not expected as a result of the pesticidal use of heptyl butyrate because field evaluations demonstrated that, with the exception of one individual wasp, only target insects (yellowjackets) were caught in traps containing heptyl butyrate (U.S. EPA, 2009a).

Ecological Incidents

A search of OPP's Incident Data System conducted on April 19, 2022, revealed no reported incidents associated with heptyl butyrate. This database contains information dating back to the 1970s and is continuously updated as incidents are reported.

Endangered Species Assessment

There is no reasonable expectation for any registered use of heptyl butyrate to cause direct or indirect discernible effects to threatened and endangered species or their designated critical habitat. This conclusion is based on a lack of anticipated exposure to nontarget organisms because of the Agency's understanding of heptyl butyrate's use pattern (insect traps) and specificity to the target organism, and heptyl butyrate's non-toxic mode of action (attractant) and natural environmental occurrence. Therefore, EPA has made a "No Effect" determination under the Endangered Species Act (ESA) for all listed species and designated critical habitat for such species and has therefore concluded that consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service under ESA § 7(a)(2) is not required.

IV. Interim Registration Review Decision

In accordance with 40 CFR §§ 155.56 and 155.58, the Agency is issuing this *Interim Registration Review Decision*. Except for the Endocrine Disruptor Screening Program (EDSP) component of this case, the Agency is proposing to make the following interim decisions: (1) no additional data are required at this time; and (2) no changes to the affected registrations and their labels are needed at this time.

In this interim decision, the Agency is making no human health or environmental safety findings associated with the EDSP screening of heptyl butyrate. The Agency's final registration review decision for heptyl butyrate will be made following satisfaction of the EDSP obligations under FFDCA § 408(p).

V. Next Steps and Timeline

A Federal Register Notice will announce the availability of this *Interim Registration Review Decision*. The Agency's final decision on the heptyl butyrate registration review case will occur following satisfaction of the EDSP obligations under FFDCA § 408(p).

Table 2. Anticipated Registration Review Schedule for Heptyl Butyrate	
Anticipated Activity	**Estimated Month/ Year**
Open Docket and 60-Day Public Comment Period for Combined Preliminary Work Plan and Proposed Interim Registration Review Decision	July 2022
Close Public Comment Period	September 2022
Interim Registration Review Decision	December 2022
Final Decision*	TBD

*The anticipated schedule will be revised as necessary (e.g., need arising under the Endocrine Disruptor Screening Program with respect to the active ingredients in this case).

Appendix A – Summary of Existing Product Analysis Data

The available product chemistry data for heptyl butyrate is considered acceptable. With the exception of the stability to metals and metal ions, and the UV/visible light absorption data requirements, the product chemistry database is considered complete. The lack of stability to metals and metals ions data will not affect the scientific assessment of heptyl butyrate for registration review because currently registered products are not packaged in materials containing metals. Since the use of currently registered products containing heptyl butyrate will not result in significant environmental exposure, the lack of UV/visible light absorption data will not affect the assessment of heptyl butyrate. Table 3 summarizes the current product analysis data requirements and results supporting registration review of heptyl butyrate.

Table 3. Summary of Product Analysis Data (40 CFR § 158.2030)

Data Requirement	Guideline No.	Results / Findings	MRIDs
Color	830.6302	Colorless	47451908
Physical State	830.6303	Liquid	47451908
Odor	830.6304	Sweet-green, slightly tea-like odor	47451908
Stability to Normal and Elevated Temperatures, Metals, and Metal Ions	830.6313	Stable for 36 months when stored in its original packaging, tightly sealed in cool (46-90°F) and dry location out of direct heat and light. Exposure to elevated temperatures can cause decomposition. Not addressed for metals and metal ions. The data will be required if the TGAI is expected to come in contact with these materials during storage.	47451908
pH	830.7000	5.6 ± 0.1 at 21 °C (1.0% w/v aqueous solution)	47451910
UV/Visible Light Absorption	830.7050	No data provided. The data will be required if significant environmental exposure is expected for the TGAI.	-
Melting Point/Melting Range	830.7200	N/A, ingredient is a liquid	-
Boiling Point/Boiling Range	830.7220	225-226 °C	47451908
Density/Relative Density/Bulk Density	830.7300	0.8600-0.8640 g/mL	47451908
Particle Size, Fiber Length, and Diameter Distribution	830.7520	N/A, ingredient is a liquid	-
Partition Coefficient	830.7550	Log Kow = 4.3019	47451908
Water Solubility	830.7840	Insoluble in water	47451908
Vapor Pressure	830.7950	0.0972 mm Hg	47451908

Appendix B – Summary of Mammalian Toxicology Data

Based on the information available in the EPA databases and public literature, the Agency does not foresee the need for new data or for a new human health risk assessment. Based on the available acute toxicity data and information in the public literature, acute oral toxicity, acute dermal toxicity, eye irritation, dermal irritation, and dermal sensitization data requirements have been satisfied. Acute inhalation data requirements were satisfied through the acceptance of waiver rationales based on heptyl butyrate's low acute oral and dermal toxicity, low use rate (1.4 ounces heptyl butyrate/acre/week), application method (traps and lures), high dissipation rate when released outdoors as a vapor from traps due to the heptyl butyrate's volatility, and its slow release as a vapor from traps or lures over an extended period of time. No repeat or prolonged oral, dermal, or inhalation exposures are expected during the use and disposal of registered products containing heptyl butyrate due to its intended use (non-food) and application method (traps/lures). Table 4 summarizes the current mammalian toxicology data requirements and results supporting registration review of heptyl butyrate.

Table 4. Summary of Toxicology Data (40 CFR § 158.2050)

Data Requirement	Guideline No.	Results / Findings	MRIDs / Citation
Acute Oral Toxicity - Rat	870.1100	LD_{50} > 5,000 mg/kg **Non-Guideline/Acceptable** **Toxicity Category IV**	47451913 Moreno, 1982
Acute Dermal Toxicity - Rabbit	870.1200	LD_{50} > 5,000 mg/kg **Non-Guideline/Acceptable** **Toxicity Category IV**	47451913 Moreno, 1982
Acute Inhalation Toxicity - Rat	870.1300	Data requirement satisfied through the acceptance of waiver rationales based on heptyl butyrate's low acute oral and dermal toxicity, low use rate (1.4 ounces heptyl butyrate/acre/week), application method (traps and lures), high dissipation rate when released outdoors as a vapor from traps due to the AI's volatility, and the AI's slow release as a vapor from traps or lures over an extended period of time (approximately two to three weeks). **Acceptable**	47451914 US EPA 2009a US EPA 2009b
Primary Eye Irritation – Rabbit	870.2400	Minimally Irritating **Guideline/Acceptable** **Toxicity Category IV**	47805301
Primary Dermal Irritation - Rabbit	870.2500	Structurally similar compounds (simple esters) are reported to be mild skin irritants. Assigned an *in vivo* irritation score of 1.7 (mild irritant but with no GHS category) in an OECD study using *in vivo* data to validate an *in vitro* skin irritation test method (OECD, 2009). **Acceptable** **Toxicity Category III**	47451504 US EPA 2009a OECD 2009
Dermal Sensitization	870.2600	Not considered a dermal sensitizer based on results from LLNA and *in vitro* (SENS-IS: 3D reconstituted epidermis based model) studies. **Acceptable**	Cottrez et al. 2016
Hypersensitivity Incidents	N/A	None reported	N/A
90-Day Oral (One Species)	870.3100	Subchronic testing data requirements have been satisfied with a waiver rationale – no repeat or prolonged oral, dermal, or inhalation exposures are expected during the use and disposal of registered products. **Acceptable**	US EPA, 2009b

90-Day Dermal – Rat	870.3250	Subchronic testing data requirements have been satisfied with a waiver rationale – no repeat or prolonged oral, dermal, or inhalation exposures are expected during the use and disposal of registered products. **Acceptable**	US EPA, 2009b
90-Day Inhalation – Rat	870.3465	Subchronic testing data requirements have been satisfied with a waiver rationale – no repeat or prolonged oral, dermal, or inhalation exposures are expected during the use and disposal of registered products. **Acceptable**	US EPA, 2009b
Prenatal Developmental	870.3700	Data requirement satisfied with a waiver rationale – No significant exposure to heptyl butyrate is anticipated for female humans. Humans are regularly exposed to heptyl butyrate found abundantly in fresh apples and plums.	47451914 US EPA, 2009b
Bacterial Reverse Mutation Test	870.5100	Data requirement satisfied with a waiver rationale – No significant exposure to heptyl butyrate is anticipated. Humans are regularly exposed to heptyl butyrate found in fresh apples and plums. **Acceptable**	47451914 US EPA, 2009b
In vitro Mammalian Cell Assay	870.5300 870.5375	Data requirement satisfied with a waiver rationale – No significant exposure to heptyl butyrate is anticipated. Humans are regularly exposed to heptyl butyrate found abundantly in fresh apples and plums. **Acceptable**	47451914 US EPA, 2009b

Literature Search Findings

To support registration review, the Biopesticides and Pollution Prevention Division (BPPD) conducts searches of the literature and incident databases to determine if there are any reports of adverse effects that might change risk conclusions or change knowledge of the state of the science for heptyl butyrate. Searches conducted for heptyl butyrate are described below.

Human Health Results:

Searches were conducted using Google Scholar as well as PubChem, ResearchGate, and PubMed databases with terms "heptyl butyrate" and "toxicity," "subchronic toxicity," "developmental toxicity," mutagenicity," genotoxicity," "oral toxicity," "dermal toxicity," "inhalation toxicity," "dermal irritation," "skin sensitization," "androgenic," "estrogenic," "thyroid," and "endocrine disruptor." These searches returned two relevant articles, one of which was an OECD dermal irritation protocol validation study (OECD, 2009). The other study was a comparative study which assessed the predictive capacity of an *in vitro* (3D reconstituted epidermis based model) skin sensitization model using data from LLNA studies (Cottrez et al. 2016). Data and information cited in this review were evaluated and incorporated as appropriate in the Agency's understanding of heptyl butyrate. A human health incident search was also performed for heptyl butyrate using the OPP's incident data system (IDS), and no incidents were returned.

No evidence of human health risks, concerns, or adverse effects/incidents from exposure to heptyl butyrate were found in the literature search.

No additional information was gained from these searches that would alter the BPPD's understanding of the current state of the science for any potential effects of heptyl butyrate on humans.

Appendix C – Summary of Nontarget Organism Data

All nontarget organism and environmental fate data necessary to meet the standard for heptyl butyrate were satisfied through the acceptance of waiver rationales based on lack of exposure to the active ingredient and its non-toxic mode of action. Additionally, no evidence of ecotoxicity was found within the open literature search.

Table 5. Summary of Nontarget Organism Data (40 CFR § 158.2060)			
Data Requirement	**Guideline No.**	**Results / Findings**	**MRIDs**
Avian Acute Oral Toxicity	850.2100	Satisfied through waiver rationales based on lack of exposure and the active ingredient's nontoxic mode of action	47451912
Avian Dietary Toxicity	850.2200		
Fish Acute Toxicity, Freshwater	850.1075		
Aquatic Invertebrate Acute Toxicity, Freshwater	850.1010		
Terrestrial Plant Toxicity, Seedling Emergence	850.4100		
Terrestrial Plant Toxicity, Vegetative Vigor	850.4150		
Nontarget Insect Testing	880.4350		

Literature Search Findings

To support registration review, BPPD conducts searches of the literature and incident databases to determine if there are any reports of adverse effects that might change risk conclusions or change knowledge of the state of the science for heptyl butyrate. Searches conducted for heptyl butyrate are described below.

Ecological Results:

A literature search was conducted using the Web of Science Core Collection, the default database within the Web of Science system, with the terms "heptyl butyrate " and "avian toxicity," "terrestrial mammal toxicity," "plant toxicity," "insect toxicity," "aquatic organism toxicity," "androgenic," "estrogenic," "thyroid," and "endocrine disruptor" which returned 0 results relevant to the toxicity or endocrine effects of heptyl butyrate to non-target organisms. An ecological incident search was performed for heptyl butyrate using the incident data search system, and no incident reports were returned.

No additional information was gained from these searches that would alter the BPPD's understanding of the current state of the science for any potential effects of heptyl butyrate on nontarget organisms.

Appendix D – Endocrine Disruptor Screening Program (EDSP)

As required by FIFRA and the Federal Food, Drug, and Cosmetic Act (FFDCA), EPA reviews numerous studies to assess potential adverse outcomes from exposure to chemicals. Collectively, these studies include acute, sub-chronic and chronic toxicity, including assessments of carcinogenicity, neurotoxicity, developmental, reproductive, and general or systemic toxicity. These studies include endpoints which may be susceptible to endocrine influence, including effects on endocrine target organ histopathology, organ weights, estrus cyclicity, sexual maturation, fertility, pregnancy rates, reproductive loss, and sex ratios in offspring. For ecological hazard assessments, EPA evaluates acute tests and chronic studies that assess growth, developmental, and reproductive effects in different taxonomic groups. As part of its most recent registration decision for the heptyl butyrate case, EPA reviewed these data and selected the most sensitive endpoints for relevant risk assessment scenarios from the existing hazard database. However, as required by FFDCA § 408(p), chemicals in the heptyl butyrate case are subject to the endocrine screening part of the Endocrine Disruptor Screening Program (EDSP).

EPA has developed the 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 the Agency 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 dose-response relationship between the dose and the E, A, or T effect.

Under FFDCA § 408(p), the Agency must screen all pesticide chemicals. Between October 2009 and February 2010, the Agency issued test orders/data call-ins for the first group of 67 chemicals, which contains 58 pesticide active ingredients and 9 inert ingredients. The Agency has reviewed all of the assay data received for the List 1 chemicals and the conclusions of those reviews are available in the chemical-specific public dockets. A second list of chemicals identified for EDSP screening was published on June 14, 2013,[2] and includes some pesticides scheduled for Registration Review and chemicals found in water. Neither of these lists should be construed as a list of known or likely endocrine disruptors. The active ingredient in this case is not on either list. For further information on the status of the EDSP, the policies and procedures, the lists of chemicals, future lists, the test guidelines and the Tier 1 screening battery, please visit the Agency website.[3]

In this interim decision, EPA is making no human health or environmental safety findings associated with the EDSP screening of heptyl butyrate. Before completing this registration review, the Agency will make an EDSP FFDCA section 408(p) determination.

[2] See www.regulations.gov/document/EPA-HQ-OPPT-2009-0477-0074 for the final second list of chemicals.
[3] www.epa.gov/endocrine-disruption

References

Moreno, O. M. (1982, April 30). *Report to Research Institute on Fragrance Materials (RIFM)*.

U.S. EPA. (2009a, March 5). *Science Review in Support of the Registration of New Active Ingredient Heptyl Butyrate and End-Use Product Yellowjacket Attractant*.

U.S. EPA. (2009b, June). *Biopesticides Registration Action Document. Heptyl Butyrate.* https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/decision_PC-100247_1-Jun-09.pdf

OECD. (2009, September 9). *Draft Proposal for New Guideline: In Vitro Skin Irritation: Reconstructed Human Epidermis (RhE) Test Method*. https://www.oecd.org/env/ehs/testing/43664841.pdf

U.S. EPA. (2009c, September 25). *Science Review in Support of the Registration of Bull Run Yellowjacket Attractant, with 99.8% Heptyl Butyrate As Its Active Ingredient*.

Cottrez, F., Boitel, E., Ourlin, J. C., Peiffer, J. L., Fabre, I., Henaoui, I. S., ... & Groux, H. (2016). SENS-IS, a 3D reconstituted epidermis based model for quantifying chemical sensitization potency: Reproducibility and predictivity results from an inter-laboratory study. *Toxicology in Vitro*, 32, 248-260. https://doi.org/10.1016/j.tiv.2016.01.007.