Programmatic Environmental Assessment for Marketing Orders for Two ENDS Tobacco Products by NJOY, LLC

Prepared by Center for Tobacco Products U.S. Food and Drug Administration

June 14, 2024

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1. Introduction

1.1 Background

On March 30, 2020, NJOY, LLC submitted premarket tobacco product applications (PMTAs) for two closed e-liquids collectively referred to as "NJOY DAILY ENDS products" in this document. In the PMTAs, NJOY, LLC requested the U.S. Food & Drug Administration to issue marketing orders under section 910 of the Federal Food, Drug, and Cosmetic Act (FD&C Act) (Public Law 111-31).

This document reviews the potential environmental impacts from marketing the NJOY DAILY ENDS products in the United States and from the no-action alternative of the Agency not issuing marketing orders for the new products.

1.2 Applicant and Manufacturer Information

Applicant Name:	NJOY, LLC
Applicant Address:	155 6th Ave., 2nd Floor, New York, NY 10013
Manufacturer Name:	(b) (4)
Product Manufacturing Location:	

1.3 Product Information

New Product Names and Submission Tracking Numbers (STNs)

STN New Product	New Product Name
PM0000628	NJOY DAILY Menthol 4.5%
PM0000629	NJOY DAILY Extra Menthol 6%

Product Identification

Product Category	Electronic Nicotine Delivery System (ENDS)
Product Subcategory	Closed E-Cigarette
Product Number per Retail Unit	PM0000628: NJOY DAILY Menthol 4.5%, 0.9mL of e-liquid with 4.5% weight by weight nicotine in pre-filled device, sealed, non-refillable, single use. PM0000629: NJOY DAILY Extra Menthol 6%, 0.9mL of e-liquid with 6% weight by weight nicotine in pre-filled device, sealed, non-refillable, single use.
Product Package	The packaging materials consists of a silicon mouthpiece cap, two silicon end caps, and a sealed foil bag. The foil bag is embossed on the outside, not in contact with the product. Additional packaging material not in contact with the product comprises a firm paper tray and a firm

	paper outer box with tuck flap ends sealed with a holographic sticker. Five individual product packs are packed into a firm paper tray display carton and sealed with shrink wrap. Twenty display cartons are placed into a shipping case. Shipping cases are made of corrugated cardboard for protection during transport. Display cartons might be used for fulfillment from the distributor to the retail store and at the point of sale. Packaging material for the product includes silicon, foil, ink, spot gloss, paper, shrink wrap, stickers, and cardboard.

2. The Need and Purpose for the Proposed Actions

Purpose: The applicant wishes to continue marketing the new products in interstate commerce for commercial distribution in the United States and submitted PMTAs to the Agency to obtain marketing orders. Upon receipt of a PMTA, FDA considers the submission, using criteria detailed in section 910(c) of the FD&C Act, to make a finding as to whether a marketing order for the product would be appropriate for the protection of public health.

Need: FDA's responsibility to review a PMTA, make a finding as described in the previous paragraph, and subsequently determine whether or not to issue a marketing order for the tobacco product is a statutory requirement under section 910(c) of the FD&C Act.

3. Proposed Actions and Alternatives

The proposed actions, requested by the applicant, are for FDA to issue marketing orders under the provisions of section 910 of the FD&C Act for introduction or delivery for introduction of tobacco products into interstate commerce in the United States after finding the new products would be appropriate for the protection of public health.

The no-action alternative is FDA does not issue marketing orders for the new products. The products would not be marketed in the United States and, for the purposes of the analysis in this programmatic environmental assessment, it is assumed that there would be no changes to the current ENDS market and no changes to the current or future use of tobacco products.

4. Potential Environmental Impacts of the Proposed Actions and Alternatives – Manufacturing the New Products

The applicant stated that the manufacturing facility is in compliance with all the applicable environmental regulations. However, because this facility is located outside the United States, environmental impacts associated with manufacturing the new products will not be discussed.

5. Potential Environmental Impacts of the Proposed Actions and Alternatives – Use of the New Products

The Agency considered potential impacts to resources in the environment that could be affected by use of the new products and found no significant impacts based on Agency-gathered information and the applicant's submitted information. Included in the information the Agency considered were the projected market volumes (Confidential Appendix 1) for the first- and fifth-year of marketing of the new products.

5.1. Affected Environment

The affected environment includes human and natural environments in the United States because the marketing orders would allow for the new products to be sold to consumers in the United States.

5.2. Air Quality

The impacts from use of ENDS tobacco products include exposure to second and thirdhand vapor. Secondhand vapor is created when an ENDS user exhales mainstream vapor into the environment (Czogala et al., 2014). Thirdhand vapor is created when an ENDS is inhaled and the chemicals in the vapor, exhaled by the user, deposit on surrounding surfaces (Goniewicz & Lee, 2015) and clothing (Nath & Geraghty, 2020). Recent studies have shown that secondhand ENDS vapor contains chemicals such as propylene glycol (PG), glycerol, volatile organic compounds (VOCs), nicotine, particulate matter, and other tobacco-specific nitrosamines (TSNAs)(Tan et al., 2017; Visser et al., 2019). In addition, studies suggest that for every 70 mL puff, 0.019% of the e-liquid byproduct can deposit (Davis et al., 2017) on metal, floors, wood, windows, and walls (Li et al., 2020).

Exposure to secondhand and thirdhand ENDS vapor may have short- and long-term, adverse effects on human and environmental health. Exposure to nicotine from secondhand vapor may cause an increase in blood pressure and palpitations (Visser et al., 2019). Heavy metals found in secondhand vapor from ENDS include chromium, iron, aluminum, lead, copper, nickel, cadmium (Li et al., 2020), and silver (Hess et al., 2017). These metals may cause irritation to the respiratory system and respiratory damage. The aromatic VOCs found in exhaled vapor include benzene and toluene, listed by the International Agency for Research on Cancer (IARC) as a human carcinogen and a potential neurotoxin, respectively. The carbonyls include formaldehyde (a known carcinogen), acetaldehyde (a potential carcinogen), acetone, acrolein, and propanal. These are considered cytotoxic aldehydes that cause damage to the respiratory system (Li et al., 2020). Exposure to PG and glycerol from secondhand vapor may cause respiratory irritation (Visser et al., 2019). Over time, as PG levels build up in the body, it can cause hemolysis, hypoglycemia, lactic acidosis, seizures, coma, and central nervous system depression clothing (Nath & Geraghty, 2020). Tobacco-specific nitrosamines found in secondhand vapor, such as nicotine-derived nitrosamine ketone (NNK) and N-nitrosonornicotine (NNN), are known to cause increased risk of tumor development and cancer (Visser et al., 2019). The levels of nicotine and other chemicals released to the air differ depending on a number of factors including type of device, composition of the e-liquid used, temperature of the heating coil, and power voltage of the device (Li et al., 2020).

Secondhand ENDS vapor impacts indoor air quality and is not risk-free to bystanders, in vehicles or residences (Palmisani et al., 2019). Although room size, temperature, air exchange rate, and relative humidity have an effect on vapor dilution, these vapors do not dilute in the air of enclosed locations (i.e. cars, homes, workplaces) as compared to outdoors (Li et al., 2020). Independent of the e-liquid chosen by the user, the concentration of ultrafine particles found in ENDS vapor exhaled from the user can be up to 3800 times more concentrated than secondhand smoke from a combustible cigarette (Palmisani

et al., 2019). Higher concentrations of smaller particles may place bystanders at increased risk due to the particles' high penetration capacity of the respiratory system (Davis et al., 2017; Palmisani et al., 2019). This may pose a greater risk to vulnerable populations such as pregnant women, children, and adolescents (Hess et al., 2017; Palmisani et al., 2019). Short-term exposure to secondhand vapor may cause respiratory and cardiovascular disease and may adversely affect susceptible populations with respiratory complications such as asthma (Li et al., 2020).

Route of exposure to thirdhand vapor is achieved through ingestion (Goniewicz & Lee, 2015), inhalation, and touch (Goniewicz & Lee, 2015; Nath & Geraghty, 2020). Nicotine exposure from thirdhand vapor may place children and infants at higher risk of adverse health effects (Goniewicz & Lee, 2015). Studies using animal models show that thirdhand vapor from ENDS including those from e-liquids that do not contain nicotine may compromise immune response, brain, and spleen development (Chen et al., 2020), placing infants at increased risk of disrupting brain development (Nath & Geraghty, 2020).

More research is required in order to determine the full health implications that secondhand and thirdhand exposure from ENDS aerosol has on public and environmental health.

As of April 2024, 26 states and the District of Columbia had implemented state-level bans on the use of electronic nicotine delivery systems (ENDS) in many public spaces (American Nonsmokers' Rights Foundation, 2024; Public Health Law Center, 2023). Twenty-six states had state-level regulations on the use of ENDS while at least 40 states had city or county level restrictions on ENDS. Such laws are also expected to reduce the levels of non-users' exposure to secondhand and thirdhand aerosol.

The Agency does not anticipate new chemicals would be released into the environment as a result of use of the new products, relative to chemicals released into the environment due to use of other ENDS products already on the market because (1) the new products are expected to compete with other currently marketed ENDS tobacco products, and (2) the ingredients in the new products are used in other currently marketed tobacco products.

5.3. Environmental Justice

Recent studies suggest that ENDS use prevalence is lower among minorities compared to non-Hispanic whites (NHW) (QuickStats, 2019; Du, Shah, Weber, & Lightstone, 2019; Bello, et al., 2019; Roberts, Keller-Hamilton, Ferketich, & Berman, 2020; McCabe, Boyd, Evans-Polce, McCabe, & Veliz, 2020; Gilbert, Kava, & Afifi, 2020). Data from the 2014 and 2018 National Health Interview Survey showed an increase in ENDS ever use among adults in the United States for all races, with the highest prevalence rates observed among NHW adults for both years (QuickStats, 2019). Prevalence rates among minority youth also appear to be lower compared to NHW youth (Bello, et al., 2019; McCabe, Boyd, Evans-Polce, McCabe, & Veliz, 2020; Gilbert, Kava, & Afifi, 2020). Data from national surveys show significantly higher use prevalence among NHW adolescents and at schools with higher proportions of NHW students (McCabe, Boyd, Evans-Polce, McCabe, & Veliz, 2020; Gilbert, Kava, & Afifi, 2020). Two studies analyzing data from local and regional surveys reported higher prevalence of ENDS ever use among Hispanics compared to NHW (Springer, et al., 2018; Barrington-Trimis, et al., 2019). One nationally representative survey reporting higher odds of ENDS use among Hispanics also reported lower odds of use among non-Hispanic Blacks and Asians compared to NHW (Yu & Lippert, 2017).

Studies describing ENDS use by socioeconomic status (SES) reveal inconclusive results. While some studies analyzing nationally representative survey data report inverse associations with household income and educational attainment (Stallings-Smith & Ballantyne, 2019; Assari, Mistry, & Bazargan,

2020), other studies analyzing data from regional and product-specific surveys report positive association with high SES (Du, Shah, Weber, & Lightstone, 2019; Roberts, Keller-Hamilton, Ferketich, & Berman, 2020; Vallone, et al., 2020). Among adolescents, lower parental education and school subjective societal status have been reported to be associated with increased odds of past or current use of ENDS (Bello, et al. 2019). Also, ENDS retail landscape poses environmental health risks to youth (Bostean et al., 2016; Giovenco et al., 2016; Venugopal et al., 2020). A recent national analysis reported that specialty vape shops are more densely distributed, and are in closer proximity to schools, in school districts with higher proportions of Asian and Black or African American populations, raising environmental justice and health equity concerns (Venugopal, et al., 2020). However, vape shops were further away from schools in school districts with higher proportions of the population in poverty (Venugopal, et al., 2020).

At this time, these data do not show disproportionately high ENDS use prevalence among minorities and low-income groups. Therefore, the agency does not anticipate potential disproportionate environmental impacts on Environmental Justice populations from using the new products.

5.4. Impacts from the No-Action Alternative

The environmental impacts of the no-action alternative would not change the existing condition of use of ENDS tobacco products because many similar tobacco products would continue to be used in the United States.

6. Potential Environmental Impacts of the Proposed Actions and Alternatives – Disposal of the New Products

The Agency evaluated potential impacts to resources in the environment that may be affected by disposal of the new products and found no significant impacts based on Agency-gathered information and the applicant's submitted information. Included in the information the Agency considered were (1) the projected market volumes (Confidential Appendix 1) for the first- and fifth year of marketing of the new products; and (2) results of screening-level assessment of the cumulative acute toxicity risks to aquatic organisms from nicotine and heavy metals of concern in the new NJOY DAILY products (Confidential Appendix 2)

6.1. Affected Environment

The affected environment includes human and natural environments in the United States because the marketing orders would allow for the new products to be sold to consumers nationwide who would dispose of the used products and packaging as municipal solid waste (MSW), recycled material, or litter.

6.2. Air Quality

The Agency does not anticipate disposal of the new products or the packaging material would lead to the release of new or increased chemicals into the air.

No changes in air quality are anticipated from disposal of the new products. The chemicals in the ENDS device and battery are not likely to be emitted to the air in any distinguishable amount because these are closed systems. Although littering of the devices may cause some of the e-liquid to leach into the environment, the majority of e-liquid will be consumed by the user, leaving only trace amounts remaining in the device that may leach out and be emitted to the air.

No changes in air quality from disposal of the packaging materials in the new products would be expected because (1) the paper and plastic components of the packages are more likely to be recycled or at least a portion of the packaging waste is likely to be recycled, (2) the packaging materials are commonly used in the United States, and (3) the waste generated due to disposal of the packaging is a minuscule portion of the MSW based on the projected market volume of the new products.

6.3. Biological Resources

Proper disposal of the used new products and packaging in the MSW stream would not affect biological resources. Improper disposal (littering or landfilling) of the used new products could lead to terrestrial wildlife having direct exposure to the used products and hazardous substances leaching to aquatic environments and soils. E-liquid is composed of several chemicals that may leach into the environment if not properly disposed. In general, e-liquids are composed of a base, which is typically PG and vegetable glycerin, as well as nicotine and flavorants (Dai, et al., 2018; DeVito & Krishnan-Sarin, 2018), vanillin, ethyl maltol, and ethyl butyrate being the most common flavoring ingredients (Krüsemann, et al., 2021). Leaching of chemical constituents in e-liquids from the disposal or littering of used cartridges is of environmental concern (Baran, Madej-Knysak, Sobczak, & Adamek, 2019; Panitz, Swamy, & Nehrke, 2015; Chang, 2014). Further, transfer of metals from the cartridge or device into the e-liquid also raises potential environmental concerns (Hess, et al., 2017; Zervas, et al., 2020). At the time of writing this environmental assessment, studies identifying and characterizing environmental impacts of ENDS leachate are not available. Available ecotoxicity assessments report that nicotine in e-liquids impaired the developmental rate and brood size of soil-dwelling nematodes (Panitz et al., 2015). The growth and reproduction of earthworms were inhibited when exposed to metals in e-cigarette waste soils (Nfor et al., 2022). In contrast, e-cigarette leachate may not pose a considerable threat to microbial communities (Baran et al., 2019). While other flavorants and chemicals may be present in e-liquids, their concentration is typically low. Furthermore, although users may dispose of used cartridges improperly as litter, the majority of e-liquid will be consumed, leaving only trace amounts to potentially leach into the environment. Therefore, to the best of our knowledge, no significant environmental impacts are expected due to disposal of the new products

6.4. Water Resources and Water Quality

Proper disposal of the used new products and packaging in the MSW stream would not affect water resources. Improper disposal (littering) of the used new products could result in hazardous substances leaching into water systems. However, no net increase in littering would be expected because the new products will continue to compete for the same market share occupied by other currently marketed ENDS products. Additionally, although littering of the devices may cause some of the e-liquid to leach into the environment, the majority of e-liquid will be consumed by the user, leaving only trace amounts remaining. Nicotine is especially concerning because it is considered hazardous waste (U.S. Environmental Protection Agency, 2020), however, only trace amounts are expected to remain in littered devices and nicotine has a very short half-life on the order of hours to days (Seckar, et al., 2008), depending on the media it is in. Therefore, these impacts are not considered significant.

Also, the Agency conducted a screening-level assessment of the cumulative acute toxicity risks to aquatic organisms from nicotine and heavy metals of concern in the new NJOY DAILY products. The agency calculated Risk Quotients (RQ) from estimated aquatic expected environmental concentrations (EEC) of the chemicals of concern and their lowest acute toxicity endpoint values (Confidential Appendix 2). The RQ values are several orders of magnitude lower than the Level of Concern for acute risks (high, restricted use or endangered species) to aquatic animals (US Environmental Protection Agency, 2024) (Confidential Appendix 2). Based on the screening-level risk assessment, nicotine and heavy metals in

the new products do not pose risks to aquatic animals. Therefore, no significant impacts on water resources and water quality from the disposal of new NJOY DAILY products are expected.

6.5. Solid Waste and Hazardous Materials

Requirements for disposal of e-liquid cartridges containing nicotine vary by state and collecting entity responsible for disposal. EPA has the authority to control hazardous waste from "cradle-to-grave" under the Resource Conservation and Recovery Act (RCRA) in 40 CFR Parts 260 through 273 (U.S. Environmental Protection Agency, 2020). Under Subtitle C of RCRA, nicotine (including nicotine salts) is regulated as an acute hazardous waste. Cartridges containing nicotine must be handled according to applicable federal, state, and local regulations (Public Health Law Center, 2019). Additional laws may apply, including 40 CFR Part 266 Subpart P, where ENDS products containing nicotine must be managed as hazardous waste pharmaceuticals (U.S. Environmental Protection Agency, 2021a).

Non-residential disposal of e-liquid cartridges containing nicotine is the responsibility of the collecting entity (e.g. schools, airports, etc.), which EPA considers "generators" of hazardous waste by accumulating RCRA-listed chemicals. Due to nicotine being considered an acute hazardous waste, generators are registered as either a very small quantity generator or large quantity generator based on a threshold of one kilogram generated per month (U.S. Environmental Protection Agency, 2020). Following collection by state or local authorities, hazardous waste is recycled, treated, stored, or disposed (U.S. Environmental Protection Agency, 2021b).

Residential disposal (household hazardous waste) of e-liquids containing nicotine is excluded from Subtitle C of RCRA. Residential disposal is regulated under Subtitle D of RCRA as non-hazardous solid waste, 40 CFR parts 239 through 259 (U.S. Environmental Protection Agency, 2021c). Additional state and local laws may apply for disposal.

Improper disposal of e-liquids can pose a threat to the environment; therefore, cartridges containing nicotine or nicotine residue should not be rinsed (U.S. Food and Drug Administration, 2020). Additionally, cartridges should be stored in a cool, temperature controlled environment (U.S. Food and Drug Administration, 2020) and separated from the ENDS device prior to disposal as nicotine is combustible when exposed to heat (National Institute for Occupational Safety and Health, 2011) and lithium-ion batteries have been linked to explosions during MSW transportation (U.S. Food and Drug Administration, 2020). As of May 2021, the Agency did not find any data reporting the amount ENDS containing nicotine collected or littered in the United States; however, the *Marine Debris Tracker* mobile application allows individuals to track debris in the United States (U.S. National Oceanic and Atmospheric Administration, 2021). At this time, the Agency does not anticipate any significant impacts due to cartridge disposal.

The Agency does not foresee that the introduction of the new products into the U.S. market would notably affect the nationwide waste generated from the use of ENDS. The distribution of waste generated due to disposal of the new products and packaging is anticipated to correspond to the pattern of the products use in the United States. Therefore, no net increase in littering would be expected.

6.6. Socioeconomics and Environmental Justice

The Agency does not anticipate changes in impacts on socioeconomic conditions or environmental justice from disposal of the new products. The waste generated due to disposal of the new products would be handled in the same manner as the waste generated from disposal of other ENDS products in

the United States. No new emissions are expected due to disposal of the new products; therefore, there would be no disproportionate impacts on minority or low-income populations.

6.7. Impacts from the No-Action Alternative

The environmental impacts of the no-action alternative would not change the existing condition of disposal of ENDS products and their packaging, as many other similar ENDS products would continue to be disposed of in the United States.

7. List of Preparers

The following individuals were primarily responsible for preparing and reviewing this programmatic environmental assessment:

Preparer:

Dilip Venugopal, Ph.D., Center for Tobacco Products
Education: M.S. in Ecology and Ph.D. in Entomology
Experience: Twenty-two years in various scientific activities
Expertise: NEPA analysis, environmental impact analysis and risk assessment, applied ecology, geo-statistics

Reviewer:

Susana Addo Ntim, PhD, Center for Tobacco Products
Education: PhD in Environmental Science
Experience: Twelve years in various scientific activities including six years in NEPA practice
Expertise: NEPA analysis; fate, transport, and ecotoxicology of new and emerging contaminants; applications and environmental implications of nanotechnology

8. A Listing of Agencies and Persons Consulted

Not applicable.

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CONFIDENTIAL APPENDIX 1: Market Volume Projections for the New Products

Product	Unit	Market Volume Projections		
		First-Year	Fifth-Year	Tenth-Year
NJOY DAILY Menthol 4.5%	DEVICES	(b) (4)		
NJOY DAILY Extra Menthol 6%	DEVICES			
Total				

CONFIDENTIAL APPENDIX 2: Screening-level risk assessments of nicotine and heavy metals in NJOY DAILY devices for aquatic animals

The agency calculated risk quotients for nicotine, cadmium, cobalt, nickel and lithium using estimated aquatic expected exposure concentration (EEC) and acute toxicity endpoint data (EC_{50}/LC_{50}) as shown in the table below.

Chemical	Product	Aquatic Environmental Introduction Concentration (µg/L) [1]	Aquatic Environmental Exposure Concentration (µg/L)[2]	lowest Acute Toxicity Endpoint Value (EC50/LC50) (µg/L) [3]	Species	Risk Quotient[4]
Nicotine	NJOY DAILY Menthol 4.5%	(b) (4)				
	NJOY DAILY Extra Menthol 6%					
	Total					
Chromium	NJOY DAILY Menthol 4.5%					
	NJOY DAILY Extra Menthol 6%					
	Total					
Cobalt	NJOY DAILY Menthol 4.5%					
	NJOY DAILY Extra Menthol 6%					
	Total					

[1] Expected Introduction Concentration (EIC)-aquatic (ppb or µg/L)=A*B*C*D; where A=kg/yr shipped quantity, B=1/1.214x1011 L/day entering POTW (*Source*: 1996 Needs Survey, Report to Congress), C=year/365, D=10^9 µg/kg (Source of EIC estimation equation: Guidance for Industry Environmental Assessment of Human Drug and Biologics Applications, 1998). Available from: https://www.fda.gov/downloads/Drugs/Guidances/ucm070561.pdf

[2] Environmental expected concentration (EEC) calculated by applying a dilution factor of 10 to the the aquatic-EIC values (Guidance for Industry: Environmental Assessment of Drug and Biologics Applications, 1999).). Available from: https://www.fda.gov/downloads/Drugs/Guidances/ucm070561.pdf

[3] Lowest acute toxicity endpoint value and the corresponding species for each chemical obtained from U. S. Environmental Protection Agency's ECOTOXicology Knowledgebase (ECOTOX) available at https://cfpub.epa.gov/ecotox/search.cfm (retrieved December 22, 2021).

[4] Risk Quotient (RQ) calculated as Expected Environmental Concentration (EEC)/LC_{50} or EC_{50} per U. S. Environmental Protection Agency methodology (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-risk).

Chemical	Product	Aquatic Environmental Introduction Concentration (µg/L) [1]	Aquatic Environmental Exposure Concentration (µg/L)[2]	lowest Acute Toxicity Endpoint Value (EC50/LC50) (µg/L) [3]	Species	Risk Quotient[4]
Lithium	NJOY DAILY Menthol 4.5%	(b) (4)				
	NJOY DAILY Extra Menthol 6%					
	Total					
Nickel	NJOY DAILY Menthol 4.5%					
	NJOY DAILY Extra Menthol 6%					
	Total					