FACT SHEET

APPLICATION FOR APPROVAL FOR RELEASE OF POTATO EVENT SPS-ØØX17-5 (X17) FOR SUPPLY OR OFFER TO SUPPLY FOR SALE OR PLACING IN THE MARKET

NBB REFERENCE NO: JBK (S) 600-2/1/10

The objective of the Biosafety Act 2007 is to protect human, plant and animal health, the environment and biological diversity. Under the Biosafety Act 2007, the National Biosafety Board (NBB) is currently assessing an application for approval submitted by SPS International Inc. (SPSII).

1. What is the application for?

The purpose of the import and release is to supply or offer for sale/ placing on the market- for direct use as food, feed and for processing (FFP) of potato event SPS-ØØX17-5, (referred to as X17 potato).

This application is seeking food, feed, and processing approval of X17 for import only. SPSII does not plan to plant X17 potato in Malaysia.

2. How has X17 potato been modified?

X17 potato was developed by transforming the conventional potato variety Ranger Russet with pSIM1278 and pSIM1678 using *Agrobacterium*-mediated transformation. No selectable markers, such as antibiotic or herbicide markers were used.

The insert from pSIM1278 is made up of genetic elements only from potato and down regulates polyphenol oxidase and asparagine synthetase transcripts in the potato plant using RNA interference. The insert from pSIM1678 is also made up of genetic elements from wild and cultivated potatoes. The inserts down regulate vacuolar invertase transcripts using the RNA interference technique and also contains a late blight resistance gene.

Lower polyphenol oxidase in X17 potato results in reduced black spot, which improves potato quality and reduces waste. Lower asparagine synthetase and vacuolar invertase contribute to lower free asparagine and reducing sugars, which in turn results in lower acrylamide levels in cooked potatoes. Expression of the late blight resistance gene results in protection against foliar late blight disease, which caused the Irish potato famine. Late blight protection in X17 potato lessens fungicide applications.

3. Characteristics of X17 potato

a) Details of the parent organism

The scientific name for cultivated potato is *Solanum tuberosum*. Potato is classified in the tuberosum subspecies, within the *tuberosa* series, and within the *potatoe* subsection of the Solanaceae plant family. Plants in the tuberosum subspecies are cultivated worldwide.

Potatoes have a long history of safe use as food and feed. They are the world's fourth-largest food crop. Potatoes originated in the Andes region of South America approximately four centuries ago and are now an integral part of the world's food supply.

b) Details of the donor organism

The donor organisms are wild and cultivated potato. The sequences transferred into X17 potato are from *S. tuberosum, Solanum verrucosum*, and *Solanum venturii*. *S. tuberosum* is cultivated potato. *S. verrucosum* and *S. venturii* are used in potato breeding programmes and have provided genes for new potato varieties.

c) Description of the trait(s) and characteristics which have been introduced or modified

X17 potatoes have lower free asparagine, lower reducing sugars, lower polyphenol oxidase, and late blight protection. Table 1 summarizes the traits and characteristics that have been introduced or modified in X17 potato.

Table 1. Summary of X17 potato: Genes, Traits, and Benefits

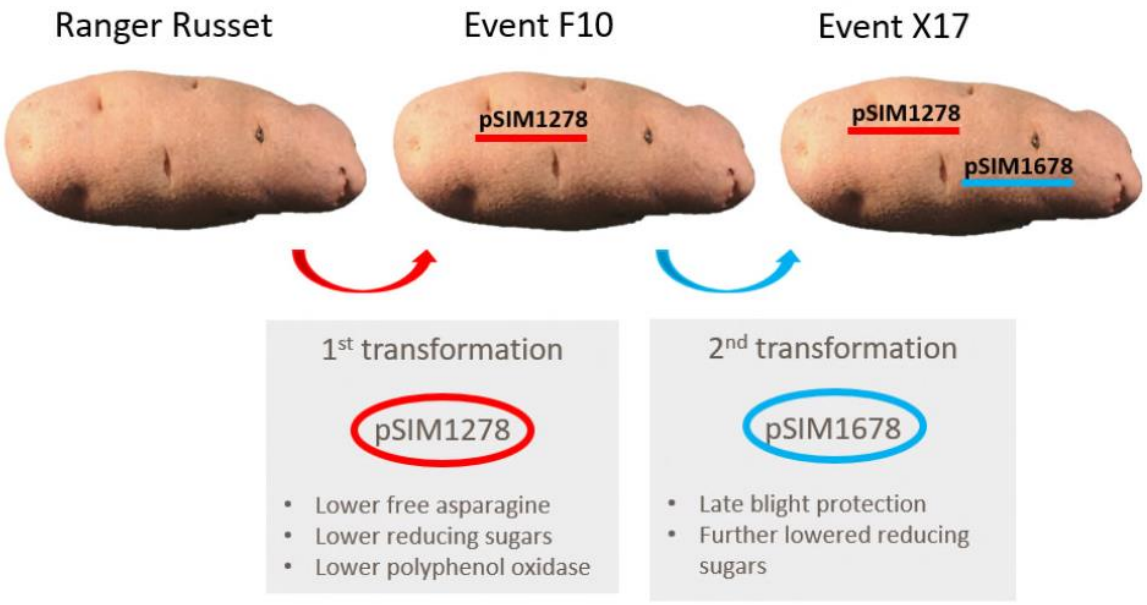
Construct	Inserted DNA	Gene Target	Mechanism	Trait	Benefit
pSIM1278	Asparagine synthetase-1 gene fragment (Asn1 fragment)	*Asn1* gene (Asparagine synthetase)	RNAi down regulation	Reduces free asparagine	Contributes to low acrylamide potential[1]
	Starch-related R1 gene promoter fragment (R1 fragment)	*R1*: gene (water dikinase)	RNAi down regulation	Lowers reducing sugars	Contributes to low acrylamide potential[1]
	Phosphorylase-L gene promoter fragment (PhL fragment)	*PhL* gene (Phosphorylase L)	RNAi down regulation	Lowers reducing sugars	Contributes to low acrylamide potential[1]
	Polyphenol oxidase-5 3' untranslated region fragment (Ppo5 fragment)	*Ppo5* gene (Polyphenol oxidase)	RNAi down regulation	Lowers polyphenol oxidase	Reduces black spot, which improves potato quality and reduces waste
pSIM1678	Vacuolar invertase gene fragment (VInv fragment)	*VInv gene* (Vacuolar invertase)	RNAi down regulation	Lowers reducing sugars	Contributes to low acrylamide potential[1]
	Rpi-vnt1 (*Vnt1*): R- gene	Not Applicable	Protein expression	Confers protection against *P. infestans*	Late blight protection

[1]Acrylamide is formed primarily from free asparagine and reducing sugars heated at temperatures above 120 °C.

4. Modification Method

a) Characteristics of the modification

Ranger Russet was first transformed with pSIM1278, followed by a subsequent transformation with pSIM1678 to generate event X17.



Information about the plasmid used and the sequence of inserted genes are available upon request.

b) Safety of the expressed protein

The only expressed protein in X17 potato is VNT1, encoded by the R- gene *Rpi-vnt1*. An assessment of the potential hazard and potential exposure of VNT1 demonstrated that X17 potatoes are as safe as conventional potatoes for human and animal consumption.

The *Rpi-vnt1* gene is from wild potato *S. venturii*, which is sexually compatible with cultivated potato *S. tuberosum* and used for potato breeding. The VNT1 protein encoded by *Rpi-vnt1* is 98% identical to the protein encoded by *Rpi-vnt1.3*, which is present in a popular European variety, Alouette. VNT1 belongs to a large family of similar proteins found throughout the plant kingdom. Within potato, there are hundreds to thousands of R-proteins with a long history of safe use. Bioinformatic analysis confirmed that VNT1 lacks sequence homology to known or putative allergens and toxins. Like other R-proteins, VNT1 does not have a toxic mode of action. Rather, it is involved in a hypersensitive response to protect plants through programmed cell death and prevent *P. infestans* spread.

With respect to potential human exposure to VNT1 from consumption of X17 potatoes, R-genes are tightly regulated and expressed at extremely low levels. Although the *Rpi-vnt1* transcripts were detected by RT-qPCR in X17 tubers at low levels, VNT1 protein levels were too low to detect in X17 potato tubers (i.e. below limit of quantification).

Exposure estimates for humans and livestock showed negligible VNT1 consumption potential from X17 potato tubers, even using conservative (high-end) assumptions.

5. Assessment of Risks to Human Health

a) Nutritional Data

X17 potato is as safe and nutritious as conventional potatoes. This was demonstrated by a compositional analysis of tubers of X17 potato, Ranger Russet, and conventional potato varieties. Levels of key analytes were measured based on the Organisation for Economic Co-operation and Development (OECD) recommendations to determine whether any nutritionally relevant differences existed between X17 potato and conventional potatoes. The compositional assessment demonstrated that X17 potatoes are compositionally equivalent to conventional potatoes. X17 potato is as safe and nutritious for food and feed use as conventional potatoes with a long history of safe consumption.

b) Toxicology

Glycoalkaloids are toxins commonly found in solanaceous crops, including potato. Together, σ-solanine and σ-chaconine make up 95% of the total glycoalkaloids in potato tubers. The widely accepted safety limit for total glycoalkaloids in tubers for human consumption is 20 mg/100 g fresh weight. Levels of glycoalkaloids in X17 potato were below this limit.

A bioinformatics analysis used to compare open reading frames (ORFs), including the VNT1 protein sequence, generated from the presence of the inserts in X17 potato against the NCBI database of accessions labeled as “toxin” did not identify any matches or safety concerns.

c) Allergenicity

Potatoes are not among the “Big Eight” group of foods that account for about 90% of all food allergies in the United States. Patatin (Sol t 1) has been identified as the primary allergen associated with potato. Because potato protein naturally contains a relatively large proportion of patatin, any change in patatin levels in X17 potato would be unlikely to affect allergenicity enough to alter consumption patterns for people allergic to potatoes. In addition, patatin levels vary considerably between commonly consumed potato varieties.

A bioinformatic analysis of ORFs, including the VNT1 protein sequence, was conducted using the 2019 AllergenOnline.org database available through the Food Allergy Research and Resource Program via the University of Nebraska. The searches were conducted to identify matches between the protein query sequences and known allergens. None of the searches identified any significant homology.

d) Safety of Small Interfering RNA

The inserts from pSIM1278 and pSIM1678 produce small interfering RNA that catalyze the degradation of specific messenger RNA to down regulate target transcripts within the plant. Since small inhibitory RNA are the product of the transformation, their safety was assessed. This assessment indicated that there is a long history of safe consumption of small RNA. Inserts designed to down regulate host genes for quality

traits do not present an increased risk to consumers when compared to currently cultivated food crops.

6. Assessment of Risks to the Environment

The application does not cover an environment release. The application is intended only to cover the import of X17 potatoes from countries where the X17 potatoes are already approved and commercially grown. It may enter Malaysia as fresh potatoes from the United States for processing into chips. These fresh potatoes would not be seed quality and would not be suitable for planting in Malaysia.

In general, *S. tuberosum* is not considered a noxious weed, or reported as a pest or weed in managed ecosystems. It also is not recorded as being invasive of natural ecosystems. Potatoes are known as poor competitors that do not thrive in non-cultivated environments. Safety assessments have not identified any adverse environmental effects related to release of X17.

7. What is the Emergency Response Plan?

a) First Aid Measures

No special first aid measures are necessary. Safety assessments by the United States USDA, FDA, EPA, the Canadian Food Inspection Agency and Health Canada, and Food Standards Australia New Zealand have shown X17 potato to be as safe as other conventional potato varieties.

b) Accidental Release Measures

Any potato tubers imported into Malaysia would need to fulfill quarantine requirements and can be tested for presence of X17 potato. Response to unintended release would be carried out in consultation with the Malaysian regulatory authorities.

c) Handling and Storage

Down regulation of invertase can enable X17 potato tubers to be stored at colder temperatures or for longer periods of time than Ranger Russet tubers. SPSII is developing guidelines for growers with specific recommendations for storage of X17 potato tubers. Although X17 potatoes have less black spot and bruising because of PPO down regulation, care should still be taken to minimize bruising when handling.

Fresh X17 potatoes and products such as fries made from X17 potatoes are stored and handled in the same way as products made from conventional potatoes.

d) Disposal Considerations

X17 potato is disposed of in the same ways as conventional potato varieties.

8. How can I comment on this application?

Any member of the public may submit their comments or queries on publicly notified information about the application. Before submission of comments or queries, the person should review the information provided. Your comments and queries on any possible impacts/risks to the health and safety of the people and the environment that may be posed by the proposed release are appreciated. The submission to the comments or queries

should be prepared carefully as it will be given the same scrutiny as the application by the NBB. The submission of comments and clarifications of queries should contribute to the NBB's assessment. Even if the submission is not science-based, and focuses on cultural or other values, it should still be developed in the form of a well-founded argument.

Please note that the consultation period closes on 17 March 2020 and written submissions are required by that date. Submissions must be addressed to:

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Please include your full name, address and contact details in your submission.