Determination of the Safety of Monsanto's
Sugar beet H7-1(Glyphosate- Herbicide Tolerant Sugar beet)
For Direct Use as Food, Feed and For Processing

Food and Feed Safety:

The product dossier on Sugar beet H7-1 was reviewed for safety and nutritional differences compared with the conventional sugar beet. The focus of the review was on any new or altered expression trait and changes in composition and nutritional content or value relative to the conventional sugar beet. At the end of the safety assessment, a conclusion was made that the Sugar beet H7-1 is as safe as the conventional sugar beet taking into account dietary impact of any changes in nutritional content or value.

A biosafety permit for Sugar beet H7-1 and all progenies derived from crosses of the product with any conventionally-bred sugar beet containing approved-biotech events for direct use as food, feed and for processing was issued to Monsanto Philippines Inc. on July 28, 2005. The permit is valid for five years and shall expire on July 27, 2010 subject to the terms and conditions set forth in DA Administrative Order No. 8, Series of 2002. The said Sugar beet event was included in the Lists of Approval Registry (Delisting) being prepared by the Department of Agriculture-Bureau of Plant Industry.

This approval is for direct use as food, feed and for processing only. This does not include cultivation of Sugar beetH7-1 in the Philippines. Food and Feed use of Sugar beet H7-1 and its by-products is therefore authorized as of July 28,2005. The Biosafety Permit (No.05-020) stated that "Glyphosate Herbicide-Tolerant Sugar beet H7-1 is as safe for human food, livestock feed and for processing as its conventional counterparts".

I. Brief Identification of the Genetically Modified Organism (Living Modified Organism)

Designation: Sugar beet H7-1

Applicant: MONSANTO PHILIPPINES INC.
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Madrigal Business Park
Alabang 1770 Muntinlupa City

Plant Species:

Name:	Sugar beet (*Beta vulgaris* ssp.*vulgaria* L.)
Parent Material:	Sugar beet proprietary line designated as 3S0057
Center of Origin:	Mediterranean Basin and Middle East
Toxic Factors/Allergen(s):	Saponins are triterpenoid glycosides that occur naturally in numerous food and feed crops including beans, peas, potatoes, tea and sugar beet. Hydrolysis of glycoside

	releases a lipid-soluble sapogenin. The predominant sapogenin in sugar beet is oleanolic acid, whose structure is well characterized. Generally saponins have a bitter and astringent taste and act as a deterrent to foraging. Saponins are actively eliminated during sugar processing and thus do not pose a risk to human health. Analysis for saponins in sugar beet usually consists of liberation of the oleanolic acid, which is quantified by HPLC.
Trait Description:	Herbicide (glyphosate) tolerance
Trait Introduction Method:	*Agrobacterium tumefaciens* mediated transformation
Donor Organism:	Agrobacterium sp. strain CP4, the source of the *cp4epsps* gene, which confers tolerance to the herbicide glyphosate.
Pathogenicity:	*Agrobacterium* sp. CP4 is non-pathogenic, ubiquitous in nature and is ordinarily present in food derived from plant sources
Proposed Use:	For direct use as food, feed and for processing

II. Background Information

On October 27, 2004 Monsanto Philippines Inc. submitted an application to the Bureau of Plant Industry requesting for biosafety permit under AO#8 part 5 for Sugar beet H7-1 which has been genetically modified for herbicide resistance.

Monsanto Philippines, Inc. has provided data on the identity of Sugar beet H7-1 a detailed description of the transformation method, data and information on the gene insertion sites, copy number and levels of expression in the plant, the role of the inserted genes and regulatory sequences in donor organisms and full nucleotide sequences. The novel proteins were identified, characterized and compared to the original bacterial proteins, including an evaluation of their potential toxicity to livestock and non-target organisms. Relevant scientific publications were supplied.

Sugar beet H7-1 has been evaluated according to BPI's safety assessment by concerned agencies (Bureau of Animal Industry (BAI), Bureau of Agriculture, Fisheries and Product Standards (BAFPS) and a Scientific Technical Review Panel (STRP). The process involves an intensive analysis of the nature of the genetic modification together with a consideration of general safety issues, toxicological issues and nutritional issues associated with the modified sugar beet.

The petitioner/applicant published the said application on two widely circulated newspapers (Malaya and Manila Times) on June 1, 2005 for public comment/review. BPI received no comment on the petition during the 30-day comment period.

III. Description of Novel (Introduced) Traits

Glyphosate, the active ingredient in Roundup® agricultural herbicides, kills plants by inhibiting the enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). This enzyme is a critical step in the shikimic acid pathway for the biosynthesis of aromatic amino acids in plants and microorganisms, and its inhibition leads to the lack of growth in plants. The aromatic amino acid biosynthetic pathway is not present in mammalian, avian or aquatic animals. This explains the selective activity in plants and contributes to the low risk to human health and the environment from the use of glyphosate according to label directions.

Using modern biotechnology, Monsanto Company has developed Roundup Ready® sugar beet plants (*Beta vulgaris* ssp *vulgaris*) that are tolerant to glyphosate. The genetically modified sugar beet plant was produced by the introduction of: the *cp4 epsps* gene derived from the common soil bacterium *Agrobacterium* strain CP4 which encodes for the production of the CP4 EPSPS enzyme and the *gox* gene from *Ochrobactrum anthropi* strain LBAA which encodes for the production of the enzyme glyphosate oxidase (GOX). Both gene products are responsible for conferring tolerance to glyphosate.

Safety of Expressed Proteins

The CP4 EPSPS protein is from *Agrobacterium* sp. CP4 strain, a common soil bacterium, and the GOX v247 coding sequence is from *Ochrobactrum anthropi* train LBAA, also a common soil bacterium. Both bacteria do not encode for any known pathogenic or allergenic proteins.

The CP2EPSPS proteins are functionally similar to a diverse family of EPSPS proteins typically present in food and feeds derived from plant microbial sources. EPSPS proteins are found ubiquitously in all plant-derived foods. The amino acid sequence of CP4EPSPS and other EPSPS proteins found in food are comparable. The CP4 EPSPS protein has no known similarity with known protein toxins; CP4 EPSPS are not stable to heat or processing. The Cp4 EPSPS is rapidly degraded by proteolytic enzymes (digestibility in vitro), limiting the exposure of the GIT and less likelihood that the protein can exert pharmacological, toxic or allergic effects.

GOX is an enzyme involved in the oxidation of a synthetic compound known as glyphosate and is not directly involved in the basic metabolism of mammalian systems.

Both proteins are non-toxic and non-allergenic based on comparative analysis of their amino acid sequences to known protein toxins and allergens using specific bioinformatics tools.

Glyoxylate is a compound naturally present in plant cells involved in carbohydrate and amino acid metabolism. It is of no safety concern.

AMPA is of no toxicological concern. It can be non-selective bound to natural plant constituents, further degraded to one carbon fragment that are incorporated into natural products, or conjugated with naturally occurring organic acids. Both substances are not prevalent in sugar beet event H7-1. They are not stable to digestion and processing, and have no similarity to known allergen.

IV. Nutritional Composition (Compositional Analysis)

Under the same agronomic condition as conventional counterpart sugar beet did not significantly (statistically and biologically) differ in terms of quantity and quality of the key nutrients, the amino acids-Alanin, Arginine, Aspartic, Cystine, Glutamic, Glycine, Histidine, Isoleucine, Leucine, and Lysine. CP4EPSPS and GOXv247 proteins have no effects on the key nutrients. Values were well within the range.

The acute oral toxicity studies (gavage assay) on mice using highest dose administered (572 mg/kg body weight) gave no adverse effects and this represented a "NOEL" or NO-EFFECT-LEVEL.

V. Anti-Nutritional Factors

The levels of anti-nutrients (saponins) are only data provided. Saponin is actively eliminated during processing and level content is comparable to conventional sugar beet.

VI. Regulatory Decision

After reviewing the scientific data and information relevant to the application of Monsanto Philippines Inc., it is concluded that Sugar beet event H7-1 and all progenies derived from crosses of the product with any conventionally-bred sugar beet, and sugar beet containing approved-biotech events for direct use as food, feed and for processing is as safe and substantially equivalent to its unmodified counterpart, and is therefore approved for direct use as food, feed and for processing. Monsanto hall duly inform the public of this approval by way of publishing in any one (1) of the top three (3) leading newspapers in the country that imports of this product is covered by conditions for approval as provided in Department of Agriculture Memorandum Circular No. 8, Series of 2003.