RISK ASSESSMENT REPORT

OF THE GENETIC MODIFICATION ADVISORY COMMITTEE (GMAC)

FOR

AN APPLICATION FOR APPROVAL FOR RELEASE OF PRODUCT OF CORN T25 (LibertyLink® corn) FOR SUPPLY OR OFFER TO SUPPLY

NBB REF NO: JBK(S) 602-1/1/10

APPLICANT: BAYER CO. (MALAYSIA) SDN. BHD.

DATE: 12 DECEMBER 2012

I - Summary of Assessment Process

The Genetic Modification Advisory Committee (GMAC, please refer to Appendix 1 for details of GMAC), under the purview of the National Biosafety Board was given the dossier by the Department of Biosafety on 24 May 2012 for an application for approval for importation for release [sale/placing on the market] of a product of a Living Modified Organism (herbicide-tolerant corn T25). The application was filed by Bayer Co. Malaysia Sdn. Bhd. (hereafter referred to as "the applicant"). GMAC members also took the opportunity to obtain further clarification on certain details of the activity. Additional information was also provided by the applicant as requested.

A public consultation for this application was conducted from 9 July 2012 to 7 August 2012 via advertisement in local newspapers. There were no comments received from public consultation.

GMAC had three (3) meetings pertaining to this application and prepared the Risk Assessment Report and Risk Assessment Matrix along with its recommended decision, for consideration by the National Biosafety Board.

II - Background of Application

(a) Details of the parent organism

Characteristic of *Zea mays* L. (Corn)

This application is for approval to commercially import and release a product of a Living Modified Organism (Corn T25). The aim of the import and release is to supply or offer to supply for sale/placing on the market - for direct use as food, feed and for processing (FFP). According to the applicant, corn T25 is proven as safe as its conventional counterpart. Corn T25 has already been in the market for over 15 years. It shows no different allergenic or toxic potential compared to conventional corn currently in the market.

Maize or corn, Zea mays L., is the world's third largest cereal crop, following wheat and rice and grown in over 25 countries worldwide. Corn has a long history of safe use for consumption as food and feed. Field corn has been grown for 8000 years in Mexico and Central America and for over 500 years in North America and in Europe. Corn has lost the ability to survive in the wild due to its long process of domestication and needs human intervention to disseminate its seed.

Corn plants are non-invasive in natural habitats and are incapable of sustained reproduction outside of domestic cultivation (OECD 2003 M-257582-01-1)

Center of Origin	Reproduction	Toxins	Allergenicity
Mesoamerican region, now Mexico and Central America	Cross-pollination via wind-borne pollen is limited; pollen viability is about 30 minutes. Hybridization reported with *Teosinte* species and rarely with members of the genus *Tripsacum.*	No endogenous toxins or significant levels of anti-nutritional factors.	Although some reported cases of maize allergy, protein (s) responsible have not been identified.

(a) Details of the donor organism

Characteristics of *Streptomyces viridochromogenes*, strain Tü 494

Latin	Gene	Pathogenicity
Streptomyces viridochromogenes	*Pat*	S. *viridochromogenes* is a common saprophytic, gram positive, aerobic, sporulating bacterium naturally occurring in soil. The spore chains are spiral and spore surface is spiny. The spore mass is blue, the reverse is green and its pigments are pH sensitive. It exhibits very slight antimicrobial activity and is not itself known to be a human pathogen nor has it been associated with other properties (e.g. production of toxins) known to affect human health.

Information about genetically modified corn T25

Corn T25 was developed through genetic modification to allow for the use of glufosinate ammonium, the active ingredient in phosphinothricin herbicides (e.g. Liberty®) as a weed control option in corn crops. The *pat* gene, conferring tolerance to glufosinate ammonium, was cloned from the common aerobic soil actinomycete, *Streptomyces viridochromogenes,* and encodes the enzyme phosphinothricin-N-actyltransferase (PAT)

The herbicides bialaphos, phosphinothiricin and its chemically synthesized from glufosinate ammonium are potent inhibitors of glutamine synthetase (GS), the enzyme that plays a central role in the assimilation of ammonia and in the regulation of the nitrogen metabolism in the plant. The *pat* gene codes for a PAT protein that metabolizes glufosinate to an inactive, acetylated derivative conferring the plant tolerant to glufosinate ammonium. The plants not carrying the transgene can be recognized and destroyed by using the herbicide at an early stage of plant development.

Corn T25 may enter Malaysia as grain, food ingredients for processing or packaging or as finished products ready for distribution, or as feed meal for animals.

III - Risk Assessment and Risk Management Plan

GMAC evaluated the application with reference to the following documents:

(i) CODEX Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants.

(ii) Roadmap for Risk Assessment of Living Modified Organisms, (according to Annex III of the Cartagena Protocol on Biosafety produced by the *Ad Hoc* Technical Expert Group (AHTEG) on Risk Assessment and Risk Management of the Convention on Biological Diversity).

(iii) The risk assessment and risk management plan submitted by the applicant.

GMAC took cognizance of the following as suggested within the AHTEG guidelines:

(i) That the risk assessment exercise be specific to the details of this particular application;

(ii) That the risk assessment exercise be specific to the receiving environment in question; and

(iii) That any risk identified be compared against that posed by the unmodified organism.

A Risk Matrix was prepared based on an assessment mechanism developed by Office of the Gene Technology Regulator, Australia (OGTR, 2005). In applying this matrix, GMAC identified potential hazards, and then added a value/rank for the likelihood of each hazard as well as its consequences. The likelihood of each hazard occurring was evaluated qualitatively on a scale of 1 to 4, with 1 for 'highly unlikely', and 4 for 'highly likely'.

The consequences of each hazard, if it were to occur, were then evaluated on a scale of 1 to 4, with 1 for 'marginal' and 4 to denote a 'major consequence'. A value was finally assigned for the overall risk from the identified potential hazard. The general formula: Overall Risk = Likelihood x Consequence was employed. GMAC also proposed risk management strategies for potential hazards, where appropriate. This methodology of assessment follows the procedure of Risk Assessment in Annex III of the Cartagena Protocol on Biosafety.

Although the applicant has applied for an approval to import for the purpose of feed and processing only, GMAC had conducted a thorough assessment and widened the scope of the risk assessment to include the purpose of food as well.

The Risk Assessment was conducted over a series of three (3) meetings. To start with, the possible pathways to risk/hazard arising from release of the products were identified and listed. The potential hazards were identified in three main areas:

(i) **<u>Effects on human health</u>**

Issues pertaining to acute toxicity of the novel protein/ altering/ interference of metabolic pathways, potential allergenicity, mutagenic/teratogenic/carcinogenic

effects, reproductive toxicity, potential transfer of antibiotic resistance genes in the digestive tract, the pathogenic potential of donor microorganisms and nutritional equivalence were examined.

(ii) **Effects on animal health**

Issues pertaining to allergenicity, toxicity, anti-nutritional properties, compromised nutritional content, effect on performance and survivability were examined.

(iii) **Effects on the environment**

Issues pertaining to unintentional release and planting, weediness, gene transfer to bacteria, accumulation of toxin, cross pollination and toxic effects on non-target organisms were examined.

Based on the above, a final list of 25 potential hazards was identified. Most of these hazards were rated as having an Overall Risk of 1 or "negligible". The potential risk of corn T25 was evaluated in equivalence to, and above any potential risk reported for unmodified corn.

GMAC also took extra caution and further discussed pre-emptive mitigation procedures for hazards where the Overall Risk was estimated to be above the minimal, and also for a few hazards that required further evaluation and data acquisition. As a precautionary measure GMAC recommends that the proposed terms and conditions under section IV should be adhered to.

A few potential hazards where the Overall Risk was found to be 2 or "low" are highlighted below along with the appropriate management strategies.

a) Accidental release of viable seeds

Seeds may be accidentally released during transportation and these spilled seeds may germinate and become established in the ecosystem. Spillage of seed is likely, however, it is unlikely that these spilled seeds will germinate and become established in the ecosystem as the post-harvest drying process of forcing hot air through the grains (seeds) would affect the viability of the seeds. Furthermore, corn generally does not survive well without human cultivation. It is an annual plant. Outcrossing with any locally cultivated corn or wild relative of corn is unlikely as corn is not grown as an economic crop in Malaysia and there is no wild relative. However, as some baby corn and sweet corn are grown in this country, there is a likelihood of outcrossing of the GM corn with these. As spillage of seed during transportation is likely, it is proposed that a post monitoring plan should be implemented and any spillage incident should be managed.

b) Planting of seeds

Plants may be grown through the ignorance of uninformed farmers and perpetuated through small scale cultivations. It is noted that the post-harvest drying process of forcing hot air through the grains, affects the viability of the corn grains. Corn is not a major crop in Malaysia. Nevertheless, there could be persistence of GM crop plants in the environment, albeit at low level. These GM corn may pollinate the non-GM baby corn and/or sweetcorn. It is proposed that a post monitoring plan should be implemented and any spillage incident should be managed. There should also be clear labeling of the product to state that it is only for the purpose of food, feed and processing, and is not to be used as planting material.

IV - Proposed Terms and Conditions for Certificate of Approval

Based on the 25 potential hazards identified and assessed, GMAC has drawn up the following terms and conditions to be included in the certificate of approval for the release of this product:

a) There shall be clear documentation describing the product by the exporter which shall be declared to the Customs of the importing country.

b) There shall be clear labeling of the product from importation down to all levels of marketing to state that it is only for the purpose of food, feed and processing and is not to be used as planting material.

c) Should the approved person receive any scientifically proven information that confirms any adverse effect of corn T25, the National Biosafety Board authority shall be informed immediately.

d) Any spillage (during loading/unloading) shall be collected and cleaned up immediately.

e) Transportation of the consignment from the port of entry to any destination within the country must be in closed containers.

f) A post-monitoring plan should be implemented, whereby the approved person shall submit a yearly report to the National Biosafety Board in compliance with procedures for handling any spillage.

V - Other Regulatory Considerations

a) Administrative regulatory procedures shall be arranged between the Department of Biosafety, Royal Malaysian Customs Department and relevant agencies to ensure accurate declaration of product information and clear labeling of the product is implemented.

b) Administrative regulatory procedures shall be arranged between the Department of Biosafety and the Malaysian Quarantine and Inspection Services (MAQIS) to impose post entry requirements for accidental spillage involving the GM product.

c) Administrative regulatory procedures shall be arranged between the Department of Biosafety and the Malaysian Quarantine and Inspection Services (MAQIS) and other competent agencies to impose post entry requirements for food safety compliance.

d) Administrative regulatory arrangements shall be carried out between the Department of Biosafety and the Department of Veterinary Services (DVS) so that any unanticipated adverse effects in animals caused by any consumption of the GM products shall be reported immediately.

e) Applicant is responsible to ensure that the user and/or importer of the technology are aware of the Terms and Conditions for Certificate of Approval as given in Section IV.

VI - Identification of issues to be addressed for long term use release of this product

a) No additional issues have been identified that would be important during the assessment of an application for long term usage of this product.

b) Continuous monitoring is required from the approved person to report any unanticipated adverse effect caused by the corn T25.

VII – Conclusion and Recommendation

GMAC has conducted a thorough evaluation of the application for approval for importation for release [sale/placing on the market - for direct use as food, feed and for processing (FFP)] of a product of a Living Modified Organism (Corn T25) and has determined that the release of this product does not endanger biological diversity or human, animal and plant health. GMAC recommends that the proposed application for release be **APPROVED WITH TERMS AND CONDITIONS** as listed in section IV - Proposed Terms and Conditions for Certificate of Approval, subject to approval by other relevant agencies (e.g. Department of Veterinary Services, Ministry of Health and Department of Agriculture).

VIII - Bibliography

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Appendix I

GENETIC MODIFICATION ADVISORY COMMITTEE (GMAC) MEMBERS INVOLVED IN SPECIFIC RISK ASSESSMENT AREAS FOR THE APPROVAL FOR RELEASE OF PRODUCTS OF T25 CORN FOR SUPPLY OR OFFER TO SUPPLY

Genetic Modification Advisory Committee (GMAC) members divided the task of looking up more information for the Risk Assessment matrix based on three broad categories. The scope of research aspects for each group is as listed below. Each sub-committee had a nominated leader to coordinate the work and report back to the main GMAC. The respective leader contacted the sub-committee members and discussed the work process with their members. The groupings of GMAC sub-committee members and their assigned tasks are as below:

1. **ENVIRONMENT**

   Effect on ecology of receiving environment due to unintentional release and planting (e.g. weediness, gene transfer to bacteria, accumulation of toxin in the environment, cross pollination and toxic effects on non-target organisms)

   - **Assoc. Prof. Dr. Mohd. Faiz Foong bin Abdullah (Universiti Teknologi MARA) (Leader)**
   - Dr. Sim Soon Liang (Sarawak Biodiversity Centre)
   - Dr. Martin Abraham (Malaysian Society of Marine Sciences)
   - Madam Atikah binti Abdul Kadir Jailani (Department of Agriculture)
   - Madam Jasbeer Kaur (Department of Chemistry)
   - Dr. Tan Swee Lian (Academy of Science Malaysia)-plant breeding
   - Dr. Mohamed Mohd Salleh (previously Malaysian Agricultural Research & Development Insitute)

2. **HUMAN HEALTH**

   Effect on human health (e.g. acute toxicity of the novel protein/ altering/ interference of metabolic pathways, potential allergenicity, mutagenic/tetragenic/carcinogenic effects, reproductive toxicity, potential transfer of antibiotic resistance genes in the digestive tract, the pathogenic potential of donor microorganisms and nutritional equivalence)

   - **Madam T.S. Saraswathy (Institute of Medical Research)(Leader)**
   - Madam Hasimah Hafiz Ahmad (Malaysian Agricultural Research & Development Insitute)
   - Dr. Norwati Muhammad (Forest Research Insitute Malaysia)
   - Dr. Norliza Tendot Abu Bakar (Malaysian Agricultural Research & Development Insitute)
   - Dr. Rahizzan Issa (Institute of Medical Research)
   - Mr. Jamal Khair b Hashim (Ministry of Health)

3. ANIMAL HEALTH

Effect on animal health (e.g. allergenicity, toxicity, anti-nutritional properties, compromised nutritional content, effect on performance and survivability, horizontal gene transfer and animal product contamination)

- **Prof. Dr Jothi Malar Panandam (Universiti Putra Malaysia) (Leader)**
- Dr. Ahmad Parveez bin Hj Ghulam Kadir (Malaysian Palm Oil Board)
- Prof. Dr. Helen Nair (Academy of Science Malaysia)
- Dr. Kodi Isparan Kandasamy (Malaysian Biotechnology Corporation Sdn Bhd)
- Dr. Fuzina Nor Hussein (Universiti Putra Malaysia)