



1 August 2008

**TECHNICAL SUMMARY OF THE RISK ASSESSMENT AND RISK
MANAGEMENT PLAN
FOR
APPLICATION NO. DIR 083/2007
FROM
CSIRO**

Introduction

The Acting Gene Technology Regulator (the Acting Regulator) has made a decision to issue a licence (DIR 083/2007) to CSIRO for dealings involving the limited and controlled release of genetically modified (GM) cotton lines into the Australian environment.

The *Gene Technology Act 2000* (the Act), the Gene Technology Regulations 2001 and corresponding state and territory law govern the comprehensive and highly consultative process undertaken by the Regulator before making a decision whether to issue a licence to deal with a GMO. The decision is based upon a Risk Assessment and Risk Management Plan (RARMP) prepared by the Acting Regulator in accordance with the *Risk Analysis Framework* and finalised following consultation with a wide range of experts, agencies and authorities and the public¹.

The application

CSIRO applied for a licence for dealings involving the intentional release of up to 20 lines² of cotton (*Gossypium hirsutum* cv. Coker 315) that have been genetically modified for enhanced tolerance to waterlogging stress on a limited scale and under controlled conditions. The trial is authorised to take place at one site in the local government area of Narrabri, NSW on a maximum total area of 0.3 hectares (0.1 ha per growing season) between October 2008 and May 2011.

The GM cotton lines contain one or more of three introduced genes encoding proteins expected to enhance tolerance to waterlogging. These genes are *Pdc2* and *Ahb1* from the plant thale cress (*Arabidopsis thaliana*) encoding the enzyme pyruvate decarboxylase and the plant haemoglobin 1 protein, respectively, and *Adh* from cotton (*G. hirsutum*) encoding the enzyme alcohol dehydrogenase. *Pdc2* and *Adh* are genes involved in the anaerobic fermentation pathway in plants, while *Ahb* is thought to be involved in nitric oxide (NO) homeostasis and stress responses.

¹ More information on the process for assessment of licence applications to release a genetically modified organism (GMO) into the environment is available from the Office of the Gene Technology Regulator (Free call 1800 181 030 or at <<http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/process-1>>), and in the Regulator's *Risk Analysis Framework* at <<http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/riskassessments-1>>.

² The term 'line' is used to denote plants derived from a single plant containing a specific genetic modification made by one transformation event.

Up to 10 of the GM cotton lines contain the *Pdc2* gene alone, up to 6 of the GM cotton lines contain both the *Pdc2* and *Adh* genes and up to 4 of the GM cotton lines contain all three genes.

The GM cotton lines also contain the antibiotic resistance selectable marker gene, *hpt*, from the bacterium *Escherichia coli*. The *hpt* gene encodes the hygromycin phosphotransferase enzyme, which provides tolerance to the antibiotic hygromycin. In addition, some of the GM cotton lines also contain the antibiotic resistance selectable marker gene *nptII*. This gene, encoding the enzyme neomycin phosphotransferase, was also derived from *E. coli* and confers kanamycin or neomycin resistance on the GM plant. These genes were used as selective markers during the initial development of the GM cotton lines in the laboratory.

The purpose of the trial is to conduct proof of concept research to assess the tolerance of the GM cotton plants to waterlogging stress under simulated conditions in the field. Cotton seed will be collected and retained for further analysis and possible future trials of lines that may be selected for further development, subject to further approval(s). The GM cotton will not be used for human food or animal feed.

CSIRO proposed a number of controls to restrict the dissemination or persistence of the GM cotton lines and the introduced genetic materials into the environment. These controls have been considered during the evaluation of the application.

Risk assessment

The risk assessment considered information contained in the application, relevant previous approvals, current scientific knowledge, and issues relating to risks to human health and safety and the environment raised in submissions received from consultation with a wide range of prescribed experts, agencies and authorities on the application (summarised in Appendix B of the RARMP). No new risks to people or the environment were identified from the advice received on the consultation RARMP.

Advice received from the public on the consultation RARMP (two submissions) and how it was considered, is summarised in Appendix C.

A reference document on the parent organism, *The Biology of Gossypium hirsutum L. and Gossypium barbadense L. (cotton)*, was produced to inform the risk assessment process for licence applications involving GM cotton plants. The document is available from the OGTR or from the website <<http://www.ogtr.gov.au>>.

The risk assessment begins with a hazard identification process to consider what harm to the health and safety of people or the environment could arise during this release of GMOs due to gene technology, and how it could happen, in comparison to the non-GM parent organism and in the context of the proposed receiving environment.

Eight events were considered whereby the proposed dealings might give rise to harm to people or the environment. This included consideration of whether, or not, expression of the introduced genes could result in products that are toxic or allergenic to people or other organisms; alter characteristics that may impact on the spread and persistence of the GM plants; or produce unintended changes in their biochemistry or physiology. The opportunity for gene flow to other organisms and its effects if this occurred was also assessed.

A **risk** is only identified when a hazard is considered to have some chance of causing harm. Events that do not lead to an adverse outcome, or could not reasonably occur, do not represent an identified risk and do not advance any further in the risk assessment process.

The characterisation of the eight events in relation to both the magnitude and probability of harm, in the context of the control measures proposed by the applicant, did not give rise to any identified risks that required further assessment. The principle reasons for this include:

- limits on the size, location and duration of the release proposed by CSIRO
- suitability of controls proposed by CSIRO to restrict the dissemination or persistence of the GM cotton plants and their genetic material
- limited ability and opportunity for the GM cotton lines to transfer the introduced genes to commercial cotton crops or other sexually related species
- limited capacity of the GM cotton lines to spread and persist outside the areas proposed for release
- none of the GM plant materials or products will be used in human food or animal feed
- widespread presence of the same or similar proteins encoded by, and end products produced as a result of the activity of, the introduced genes in the environment and lack of known toxicity or evidence of harm from them.

Therefore, any risks of harm to the health and safety of people, or the environment, from the proposed release of the GM cotton into the environment are considered to be **negligible**. Hence, the Acting Regulator considers that the dealings involved in this proposed release **do not pose a significant risk** to either people or the environment³.

Risk management

The risk management process builds upon the risk assessment to determine whether measures are required in order to protect people and/or the environment. As none of the eight events characterised in the risk assessment are considered to give rise to an identified risk that requires further assessment, the level of risk is considered to be **negligible**.

The Regulator's *Risk Analysis Framework* defines negligible risks as insubstantial, with no present need to invoke actions for their mitigation in the risk management plan. However, a range of measures have been imposed to restrict the dissemination and persistence of the GMOs and their genetic material in the environment and to limit the proposed release to the size, location and duration requested by the applicant as these were important considerations in establishing the context for assessing the risks.

³ As none of the proposed dealings were considered to pose a significant risk to people or the environment, section 52(2)(d)(ii) of the *Gene Technology Act 2000* mandates a minimum period of 30 days for consultation on the RARMP. However, the Regulator allowed 6 weeks for the receipt of submissions from prescribed experts, agencies and authorities and the public.

Licence conditions to manage this limited and controlled release

The Acting Regulator has imposed a number of licence conditions including requirements to:

- conduct the release on a total area of up to 0.3 ha (0.1 hectare per year) at one site in the NSW local government area of Narrabri, between October 2008 and May 2011
- surround the release site with a 20 m pollen trap
- locate the trial site at least 50 m away from natural waterways
- harvest and gin seed cotton from the release separately from any other cotton crop
- not permit any materials from the release to be used in human food, or animal feed or for the production of fabrics and/or other cotton products
- destroy all plant materials not required for further analysis
- following harvest, clean the site, monitoring zone and equipment used on the site
- after harvest, apply measures to promote germination of any cotton seeds that may be present in the soil
- monitor the site for at least 12 months and destroy any cotton plants that may grow until no volunteers are detected for a continuous 6 month period.

The Regulator has issued guidelines and policies for the transport, supply and storage of GMOs (*Guidelines for the transport of GMOs; Policy on transport and supply of GMOs*). Licence conditions based on these guidelines and policies have also been proposed to control possession, use or disposal of the GMOs for the purposes of, or in the course of, the authorised dealings.

Other regulatory considerations

Australia's gene technology regulatory system operates as part of an integrated legislative framework that avoids duplication and enhances coordinated decision making. Dealings conducted under a licence issued by the Regulator may also be subject to regulation by other agencies that also regulate GMOs or GM products including Food Standard Australia New Zealand (FSANZ), Australian Pesticides and Veterinary Medicines Authority (APVMA), Therapeutic Goods Administration (TGA), National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and Australian Quarantine Inspection Service (AQIS)⁴.

FSANZ is responsible for human food safety assessment, including GM food. As the trial involves proof of concept research, the applicant does not intend any material from the GM cotton lines proposed for release to be used in human food. Accordingly, the applicant has not applied to FSANZ to evaluate any of the GM cotton lines. FSANZ approval would need to be obtained before they could be used in human food in Australia.

⁴ More information on Australia's integrated regulatory framework for gene technology is contained in the *Risk Analysis Framework* available from the Office of the Gene Technology Regulator (OGTR). Free call 1800 181 030 or at <<http://www.ogtr.gov.au/internet/ogtr/publishing.nsf/Content/riskassessments-1>>.

Identification of issues to be addressed for future releases

Additional information has been identified that may be required to assess an application for a large scale or commercial release of any of these GM cotton lines that may be selected for further development, or to justify a reduction in containment conditions. This would include:

- characterisation of the genetic material inserted into the plants, including copy number and genotypic stability
- additional data on the potential toxicity of plant materials from the GM cotton lines
- additional data on the allergenicity of proteins encoded by the introduced genes for enhanced waterlogging tolerance
- characteristics indicative of weediness including measurement of altered reproductive capacity; tolerance to environmental stresses; and disease susceptibility.

Suitability of the applicant

The Regulator determined, at the commencement of the assessment process for this application, that CSIRO is suitable to hold a DIR licence under the requirements of section 58 of the Act. The Acting Regulator is satisfied that CSIRO remains suitable as no relevant convictions have been recorded, no licences or permits have been cancelled or suspended under OGTR legislation relating to the health and safety of people or the environment, and the organisation has confirmed its ability to comply with the licence conditions.

Conclusions of the RARMP

The risk assessment concludes that this limited and controlled release of up to 20 GM cotton lines on a maximum total area of 0.3 ha (0.1 hectare per growing season) over three years in the NSW local government area of Narrabri poses **negligible** risks to the health and safety of people or the environment as a result of gene technology.

The risk management plan concludes that these **negligible** risks do not require specific risk treatment measures. However, licence conditions have been imposed to restrict the dissemination and persistence of the GMOs and their genetic material in the environment and to limit the proposed release to the size, location and duration requested by the applicant as these were important considerations in establishing the context for assessing the risks.