Australian Government
Department of Health and Ageing
Office of the Gene Technology Regulator

Risk Assessment and Risk Management Plan for

DIR 121

Limited and controlled release of safflower genetically modified for increased levels of oleic acid

Applicant: Commonwealth Scientific and Industrial Research Organisation

July 2013

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Summary of the Risk Assessment and Risk Management Plan

for

Licence Application No. DIR 121

Decision

The Gene Technology Regulator (the Regulator) has decided to issue a licence for this application for a limited and controlled release of a genetically modified organism (GMO) into the environment. A Risk Assessment and Risk Management Plan (RARMP) for this application was prepared by the Regulator in accordance with requirements of the *Gene Technology Act 2000* (the Act) and corresponding state and territory legislation, and finalised following consultation with a wide range of experts, agencies and authorities, and the public. The RARMP concludes that this field trial poses negligible risks to human health and safety and the environment and that any risks posed by the dealings can be managed by imposing conditions on the release.

The application

Application number	DIR 121
Applicant	Commonwealth Scientific and Industrial Research Organisation
Project title	Limited and controlled release of safflower genetically modified for increased levels of oleic acid
Parent organism	Safflower (*Carthamus tinctorius* L.)
Introduced genes and modified traits	• Partial gene sequences from safflower *FATB* gene - altered fatty acid composition • Partial gene sequences from safflower *FAD2* gene - altered fatty acid composition • Partial gene sequences from another safflower fatty acid biosynthesis gene[1] - altered fatty acid composition • Truncated *hph* gene from the bacterium *Escherichia coli* - antibiotic resistance selectable marker • *gfp* gene from the jellyfish *Aequorea victoria* - visual marker
Proposed locations	One site located in the ACT and one site in each of the local government areas of Narrabri and Wagga Wagga in NSW
Proposed release size	Up to 1 hectare per site per growing season, with 1 site in the first season and up to 3 sites in the second and third seasons
Proposed release dates	September 2013 – March 2016
Primary purpose	To evaluate the agronomic performance of up to 190 lines of GM safflower under field conditions

[1] The identity of this gene has been declared Confidential Commercial Information. The confidential information was made available to the prescribed experts and agencies that were consulted on the RARMP for this application.

Risk assessment

The risk assessment concludes that risks to the health and safety of people, or the environment, from the proposed release are negligible.

The risk assessment process considered how the genetic modification and activities conducted with the GMOs might lead to harm to people or the environment. Risks were characterised in relation to both the seriousness and likelihood of harm, taking into account information in the application (including proposed limits and controls), relevant previous approvals, current scientific/technical knowledge, and advice provided in submissions received from experts, agencies, authorities and the public during consultation on the RARMP. Both the short and long term were considered.

Credible pathways to potential harm that were considered included: unintended exposure to the GM plant material; unintended effects of the genetic modification; increased spread and persistence of the GM safflowers relative to unmodified plants; and transfer of the introduced genetic material to non-GM safflowers or other sexually compatible plants. Potential harms associated with these pathways included toxicity to people and other animals, allergic reactions in people and environmental harms associated with weediness. No new risks to people or the environment were identified from the advice received on the consultation RARMP.

The principal reasons for the conclusion of negligible risks are that the proposed limits and controls effectively contain the GMOs and their genetic material and minimise exposure; the introduced genetic modifications are unlikely to cause harm to people or the environment; and genes similar to most of the introduced genes are common in the environment.

Risk management plan

The risk management plan concludes that risks posed by the proposed dealings can be managed so as to protect people and the environment by imposing conditions on the release. Risk management is used to control or mitigate risk. The risk management plan evaluates and treats identified risks, evaluates controls and limits proposed by the applicant, and considers general risk management measures. The risk management plan is given effect through licence conditions.

As the level of risk is assessed as negligible, specific risk treatment is not required. However, as this is a limited and controlled release, the licence includes limits on the size, locations and duration of the release, as well as controls including containment provisions at the trial site; prohibiting the use of GM plant materials in human food or animal feed; destroying GM plant materials not required for further studies; transporting GM plant materials in accordance with the Regulator's guidelines; and conducting post-harvest monitoring at the trial site to ensure all GMOs are destroyed.

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Abbreviations

ACT	Australian Capital Territory
APVMA	Australian Pesticides and Veterinary Medicines Authority
CaMV	Cauliflower mosaic virus
CCI	Confidential Commercial Information as declared under section 185 of the *Gene Technology Act 2000*
cm	Centimetres
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DIR	Dealings involving Intentional Release
DNA	Deoxyribonucleic acid
FAD2	Δ12 desaturase gene
FATB	Palmitoyl ACP thioesterase gene
FSANZ	Food Standards Australia New Zealand
gfp	Green fluorescent protein gene
GM	Genetically modified
GMO	Genetically modified organism
GRDC	Grains Research and Development Corporation
GTTAC	Gene Technology Technical Advisory Committee
ha	Hectare
HGT	Horizontal gene transfer
hph	Hygromycin phosphotransferase gene
m	Metres
miRNA	microRNA
mRNA	Messenger RNA
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
OGTR	Office of the Gene Technology Regulator
PC2	Physical Containment level 2
RARMP	Risk Assessment and Risk Management Plan
Regulations	Gene Technology Regulations 2001
Regulator	Gene Technology Regulator
RNA	Ribonucleic acid
RNAi	RNA interference
siRNA	Small interfering RNA
the Act	The *Gene Technology Act 2000*

Chapter 1 Risk assessment context

Section 1 Background

1. An application has been made under the *Gene Technology Act 2000* (the Act) for Dealings involving the Intentional Release (DIR) of genetically modified organisms (GMOs) into the Australian environment.

2. The Act in conjunction with the Gene Technology Regulations 2001 (the Regulations), an inter-governmental agreement and corresponding legislation that is being enacted in each State and Territory, comprise Australia's national regulatory system for gene technology. Its objective is to protect the health and safety of people, and to protect the environment, by identifying risks posed by or as a result of gene technology, and by managing those risks through regulating certain dealings with genetically modified organisms (GMOs).

3. This chapter describes the parameters within which potential risks to the health and safety of people or the environment posed by the proposed release are assessed. The risk assessment context is established within the regulatory framework and considers application-specific parameters (Figure 1).

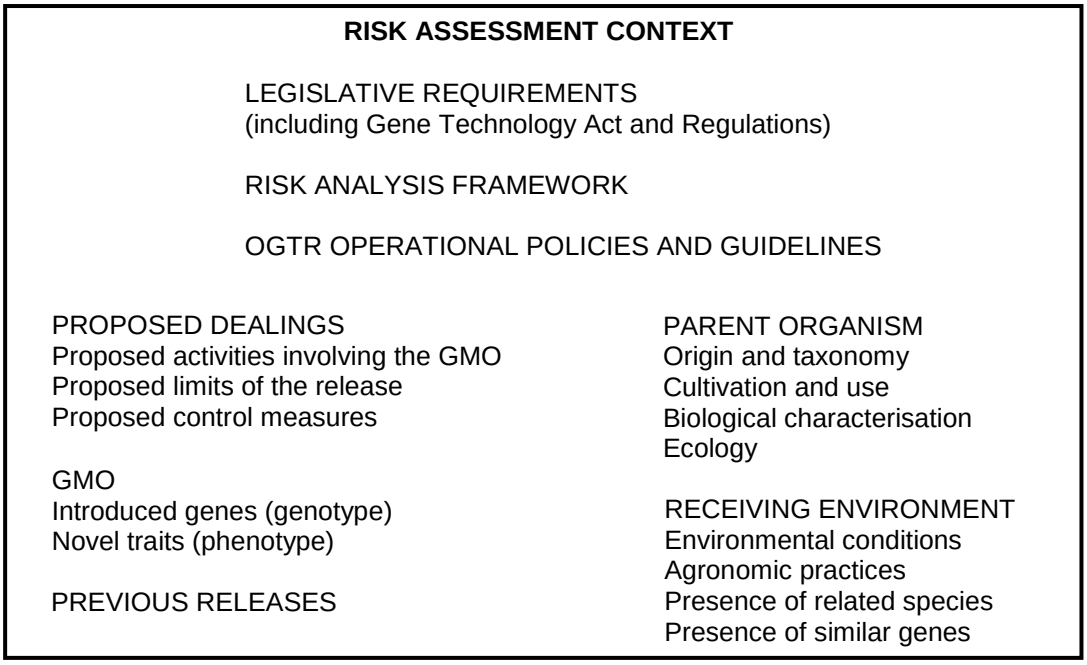

Figure 1. Summary of parameters used to establish the risk assessment context

Section 2 Regulatory framework

4. In accordance with section 50A of the *Gene Technology Act 2000* (the Act), this application is considered to be a limited and controlled release application, as its principal purpose is to enable the applicant to conduct experiments and the applicant has proposed limits on the size, locations and duration of the release, as well as controls to restrict the spread and persistence of the GMOs and their genetic material in the environment. Therefore, the Gene Technology Regulator (the Regulator) was not required to consult with prescribed experts, agencies and authorities before preparation of the Risk Assessment and Risk Management Plan (RARMP; see section 50 of the Act).

5. Section 51 of the Act and regulation 9A of the Regulations outline the matters the Regulator must take into account in preparing a RARMP.

6. Section 52 of the Act requires the Regulator to seek comment on the RARMP from the States and Territories, the Gene Technology Technical Advisory Committee, Commonwealth authorities or agencies prescribed in the Regulations, the Minister for the Environment, relevant local council(s), and the public. The advice from the prescribed experts, agencies and authorities and how it was taken into account is summarised in Appendix A. No public submissions were received.

7. The Risk Analysis Framework (OGTR 2009) explains the Regulator's approach to the preparation of RARMPs in accordance with the legislative requirements. Additionally, there are a number of operational policies and guidelines developed by the Office of the Gene Technology Regulator (OGTR) that are relevant to DIR licences. These documents are available from the OGTR website.

8. Any dealings conducted under a licence issued by the Regulator may also be subject to regulation by other Australian government agencies that regulate GMOs or GM products, including Food Standards Australia New Zealand (FSANZ), Australian Pesticides and Veterinary Medicines Authority (APVMA), Therapeutic Goods Administration, National Industrial Chemicals Notification and Assessment Scheme and Department of Agriculture, Fisheries and Forestry (DAFF) Biosecurity (formerly Australian Quarantine and Inspection Service). These dealings may also be subject to the operation of State legislation declaring areas to be GM, GM free, or both, for marketing purposes.

Section 3 The proposed dealings

9. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) proposes to release up to 190 lines[2] of genetically modified (GM) safflower into the environment under limited and controlled conditions.

10. The purpose of the trial is to evaluate the agronomic performance of the GM safflower lines under field conditions. The trial would also generate data to be used in future regulatory submissions. The applicant proposes to grow both GM safflower lines and control non-GM safflower varieties in the trial.

11. The dealings involved in the proposed intentional release include:

- conducting experiments with the GMOs
- breeding the GMOs
- propagating the GMOs
- growing or culturing the GMOs
- transporting the GMOs
- disposing of the GMOs
- possession, supply or use of the GMOs for any of the purposes above.

12. These dealings are detailed further below.

[2]The term 'line' is used to denote plants derived from a single plant containing a specific genetic modification resulting from a single transformation event.

3.1 The proposed limits of the dealings (size, locations, duration and people)

13. The applicant proposes to grow GM safflower plants over three growing seasons between September 2013 and March 2016.

14. During the first growing season the GMOs would be planted at one site, at the Ginninderra Experiment Station in the ACT. During the second and third growing seasons the GMOs would be planted at up to three sites, at the Ginninderra Experiment Station in the ACT, at the Australian Cotton Research Institute near Narrabri, NSW, and at the Charles Sturt University in Wagga Wagga, NSW.

15. The area of the trial would be up to 1 hectare (ha) per site per growing season. This is a maximum total planting area of 7 ha over the period of the trial.

16. Only trained and authorised staff would be permitted to deal with the GM safflower. Any other visitors to the site would be accompanied by an authorised CSIRO representative and would not deal with the GMOs.

3.2 The proposed controls to restrict the spread and persistence of the GMOs and their genetic material in the environment

17. The applicant has proposed a number of controls to restrict the spread and persistence of the GM safflower lines and the introduced genetic material in the environment. These include:

- ensuring that no other safflower crops are grown within 400 m of the trial sites
- surrounding each site with a 10 m monitoring zone kept bare or planted with vegetation less than 10 cm high
- while the GM safflower is flowering, inspecting areas within 200 m of the trial sites and destroying any safflower or related species
- controlling bird access by bird netting or the use of bird scarers
- controlling any rodent populations by baiting
- harvesting GM safflower separately to other crops or trials
- cleaning equipment prior to removal from the site
- destroying all plant materials not required for testing or future trials
- promoting germination of residual seed by post-harvest tillage and irrigation
- post-harvest monitoring of the trial sites for two years and destruction of any volunteer safflower
- transporting and storing GM material in accordance with the Regulator's *Guidelines for the Transport, Storage and Disposal of GMOs*
- not allowing GM plant material or products to be used for human food or animal feed.

18. Figure 2 shows the proposed site layout, including some of these controls. These controls, and the limits outlined above, have been taken into account in establishing the risk assessment context (this Chapter), and their suitability for containing the proposed release is evaluated in Chapter 3, Section 3.1.1.

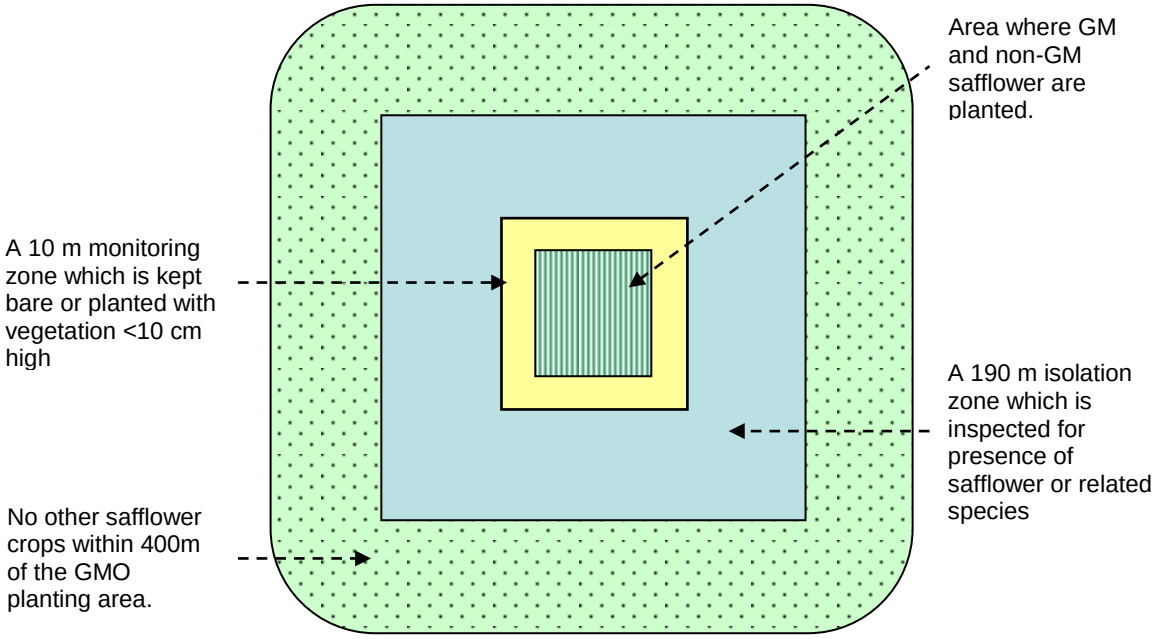

Figure 2. Proposed trial layout, including some of the controls (not drawn to scale)

Section 4 The parent organism

19. The parent organism of the GMOs is safflower (*Carthamus tinctorius* L.), which is exotic to Australia. Safflower is an annual herb from the Asteraceae family. It is bushy with a number of branches and its leaves are spiny (Singh & Nimbkar 2006).

20. Safflower has been commercially cultivated as a minor crop in Australia since the 1950s. The growing area of safflower has fluctuated from year to year, with a peak of 75,000 hectares in 1979, which is less than 0.5% of total cropping area in Australia. Current safflower planting regions are mainly in New South Wales, Victoria and South Australia (GRDC 2010).

21. Safflower is grown in Australia as an oilseed crop. After oil is extracted from the seeds for human consumption, the remaining meal can be used as stockfeed. Alternatively, whole safflower seeds are used as birdseed (GRDC 2010). The different cultivars of safflower that are grown are divided into two main classes. Linoleic safflower varieties have oil rich in lineoleic acid (70-75%), while oleic safflower varieties have oil with high levels of oleic acid (70-80%) (Singh & Nimbkar 2006).

22. The GM safflower lines in the proposed release were derived from four elite oleic safflower cultivars. The identities of the parent cultivars have been declared confidential commercial information (CCI). The confidential information was made available to the prescribed experts and agencies that were consulted on the RARMP for this application.

23. Safflower is generally planted in the winter or early spring in Australia. Safflower has a fairly high water requirement but does not tolerate waterlogging, as this encourages development of *Alternaria* or *Phytophthora* fungal diseases. Safflower seedlings can be damaged or killed by frosts below -4°C during early growth, and mean daily temperatures above 26°C during flowering and maturation reduce yield. Safflower is fairly slow-growing with a period of 18-31 weeks between sowing and maturity, depending on cultivar, sowing time and weather conditions (GRDC 2010).

24. Safflower is either self-pollinated or insect pollinated; safflower pollen is not transported by wind. The most important species for insect-mediated pollination are bees. Outcrossing rates between adjacent safflower plants range between 0-59% (Singh & Nimbkar 2006). Long distance outcrossing between safflower plants has been reported to occur at a rate of 0.01% at a distance of 100 m or not at all when plots were separated by 300 m (Mcpherson et al. 2009a).

The OECD Seed Scheme for Varietal Certification, which applies in Australia and many other countries, requires that crops of certified safflower seed be grown with an exclusion distance of 200 m from other safflower crops, and that basic safflower seed (the source for certified seed crops) be grown with an exclusion distance of 400 m (OECD 2013).

25. Safflower reproduces by seeds, which are smooth and fairly large, weighing approximately 40 mg each (GRDC 2010). The seed heads are highly resistant to shattering. Safflower seeds have very low dormancy and ripe seeds may germinate in the head following rainfall. Over 60% of seeds that fall during harvest are reported to germinate within eight days. Viable safflower seed persistence in the seed bank is less than two years at the soil surface and less than one year if the seeds are buried in the soil either at standard planting depth (2 cm) or significantly deeper (15 cm) (Mcpherson et al. 2009b).

26. Animal predation of safflower is limited due to its spiny nature. Bird predation of safflower seed occurs (GRDC 2010). Safflower seeds that have passed through bird digestive systems are no longer viable (Cummings et al. 2008).

27. Safflower plants are not known to produce toxins. Rare cases of allergic reactions to safflower have been reported (Compes et al. 2006).

Section 5 The GMOs, nature and effect of the genetic modification

5.1 Introduction to the GMOs

28. The applicant proposes to release up to 190 lines of GM safflower. All lines were produced by *Agrobacterium tumefaciens*-mediated plant transformation. Information about this transformation method can be found in the risk assessment reference document *Methods of plant genetic modification* available from the Risk Assessment References page on the OGTR website. Details of the techniques used specifically for transformation of safflower are described elsewhere (Belide et al. 2011).

29. The GM safflower lines contain introduced gene silencing constructs including fragments of either two or three endogenous safflower fatty acid biosynthesis genes. The function of the silencing constructs is to suppress the expression of these target fatty acid biosynthesis genes, and thus alter the oil composition of the GM safflower seeds.

5.2 The introduced genes, encoded proteins and their associated effects

30. The three safflower genes that are targeted for suppression of expression are palmitoyl-ACP thioesterase (*FATB*), Δ12 desaturase (*FAD2*) and another fatty acid biosynthesis gene. The identity of the third gene and molecular details of the silencing constructs have been declared CCI. The confidential information was made available to the prescribed experts and agencies that were consulted on the RARMP for this application.

31. Suppression of the target genes is mediated by a natural regulatory mechanism in plants known as ribonucleic acid interference (RNAi) or gene silencing (Baykal & Zhang 2010). Utilising the RNAi pathway, an introduced silencing construct is transcribed into double-stranded RNA, which is processed by endogenous cellular machinery into short interfering RNAs (siRNAs). The siRNAs direct the degradation of messenger RNA (mRNA) molecules with matching sequence after the mRNAs are transcribed from genes and before they are translated into proteins. The efficiency of gene silencing is generally determined by the extent of homology between the silencing construct and the target gene (usually > 95% homology is required) and the length of the homologous region. In plants, introduced silencing constructs have been shown to effectively suppress expression of the target genes but can also give rise to silencing of non-target genes with closely matching sequences.

32. The target gene *FATB* encodes a carrier protein that mediates export of saturated fatty acids from the plastid, where fatty acid synthesis occurs (Bonaventure et al. 2003). The effect of suppressing expression of *FATB* is to retain saturated fatty acids in the plastid until they undergo a desaturation reaction (usually to form oleic acid) and can be exported by another carrier protein. This decreases the proportion of saturated fatty acids and increases the proportion of oleic acid in the safflower oil.

33. The target gene *FAD2* encodes a desaturase protein that mediates enzymatic conversion of oleic acid to linoleic acid (Harwood 1996). The effect of suppressing expression of *FAD2* is to decrease the proportion of linoleic acid and increase the proportion of oleic acid in the safflower oil.

34. The GM safflower lines produce seeds where 90-95% of the total oil content is oleic acid. This high purity oleic oil has potential application as an industrial raw material.

35. All of the GM safflower lines also contain the introduced *hph* gene which provides resistance to the antibiotic hygromycin B, and is used as a selectable marker during plant transformation. This gene is derived from *E. coli* and truncated for use in plants. It is expressed under the control of either the enhanced tobacco constitutive ubiquitous promoter (enTCUP) or the 35S constitutive promoter from Cauliflower mosaic virus (CaMV) and the nopaline synthase polyA (nos) terminator from *A. tumefaciens*.

36. Some of the GM safflower lines also contain the introduced *gfp* gene, which encodes a green fluorescent protein used to visually identify genetically modified plant cells. This gene is derived from the jellyfish *Aequorea victoria*. It is expressed under the control of the CaMV 35S promoter and the octopine synthase polyA (ocs) terminator from *A. tumefaciens*.

37. The *hph* and *gfp* marker genes are commonly used in gene technology. Further details about these genes can be found in the risk assessment reference document *Marker genes in GM plants* available from the Risk Assessment References page on the OGTR website.

5.2.1 Toxicity/allergenicity associated with the introduced safflower genes

38. Insertion of safflower gene fragments as part of gene silencing constructs does not result in expression of a protein, but only in suppression of the expression of endogenous safflower proteins. This is not expected to lead to increased toxicity or allergenicity.

39. The effect of the gene silencing is to increase levels of oleic acid and decrease levels of other fatty acids in GM safflower oil. Oleic acid is a common constituent of food, for example it is the main constituent of olive oil and canola oil, and it is not associated with toxicity or allergenicity.

5.3 Characterisation of the GMOs

5.3.1 Stability and molecular characterisation

40. Transformation of the GM safflower lines was confirmed using both polymerase chain reaction (PCR) assays and analysis of oil content. Lines were self-pollinated and selected through single seed descent for between 2-5 generations. Standard Mendelian inheritance of the introduced genetic material was observed. The copy numbers of the introduced genetic material were determined by Southern blot hybridisation in some lines only. Lines containing either single or multiple insertions are proposed for release. The genomic locations of the introduced genetic material have not been characterised for any of the GM lines.

5.3.2 Phenotypic characterisation

41. The GM safflower lines were grown in greenhouses under controlled conditions. No phenotypic differences between GM plants and non-GM plants from the same genetic

background were observed. GM safflower lines had the same growth patterns, morphology and fertility as non-GM comparators.

Section 6 The receiving environment

42. The receiving environment includes: any relevant biotic/abiotic properties of the geographic regions where the field trial would occur; intended agricultural practices, including those that may be altered in relation to normal practices; other relevant GMOs already released; and any particularly vulnerable or susceptible entities that may be specifically affected by the proposed release (OGTR 2009).

43. The factors relevant to the growth, distribution and cultivation of commercial safflower in Australia can be found in *Raising the Bar with Better Safflower Agronomy* (GRDC 2010).

6.1 Relevant abiotic factors

44. The three proposed field trial sites are in the ACT, Narrabri Shire in NSW and Wagga Wagga in NSW. The climates of the ACT and Wagga Wagga are temperate with no dry season and the climate of Narrabri Shire is subtropical with a moderately dry winter (according to the modified Köppen classification system used by the Australian Bureau of Meteorology – see the BOM website).

45. The applicant proposes to locate field trials at least 50 m away from natural waterways.

6.2 Relevant agricultural practices

46. GM safflower seeds would be planted in trial sites in winter or early spring. The trial sites would include plots of GM safflower lines, non-GM parental safflower varieties, and non-GM commercial safflower varieties.

47. The proposed 10 m monitoring zone surrounding each trial site may be either kept as bare fallow or planted with vegetation maintained at a height of less than 10 cm such as grass species, and would be kept free of weeds.

48. The applicant proposes to harvest all GM safflower at maturity. The applicant may harvest the safflower by hand, or may use a single row harvester or a small plot harvester. The GMOs would be harvested separately from other crops. Any equipment used for harvesting or other operations would be cleaned on-site prior to removal or use for any other purpose.

49. Fallen seed and non-propagative plant material remaining at the field locations after harvest would be ploughed into the ground. The sites would be watered post-harvest to encourage seed germination and monitored for volunteers. Volunteers would be removed by hand or killed by herbicide application.

6.3 Presence of related plants in the receiving environment

50. Safflower is grown as a minor commercial crop in Australia. The proposed trial sites in Narrabri Shire and Wagga Wagga are within current safflower growing areas and it is possible that non-GM safflower crops will be grown nearby. The proposed trial site in the ACT is not in an area where safflower is known to be grown.

51. Naturalised populations of wild safflower have been reported at low levels in all states and territories of Australia except the ACT (Atlas of Living Australia, www.ala.org.au). Wild safflower is considered a minor weed that primarily establishes on disturbed ground (Groves et al. 2003).

52. The related species *Carthamus dentatus*, *C. leucocaulos* (sometimes known as *C. glaucus*) and *C. lanatus* have also naturalised in Australia (Atlas of Living Australia, www.ala.org.au). Both *C. lanatus* and *C. leucocaulos* have been declared noxious weeds in

some states or territories (Weeds Australia, www.weeds.org.au/noxious.htm). Although *C. lanatus* and *C. leucocaulos* can hybridise with safflower under controlled conditions, there are cytogenetic barriers due to variation in chromosome numbers, and the crosses result in sterile offspring (Mayerhofer et al. 2011). Similarly, formation of viable hybrids between *C. dentatus* and safflower is unlikely due to different chromosome numbers (Mcpherson et al. 2004).

6.4 Presence of similar genes and encoded proteins in the environment

53. The three gene fragments included in the silencing constructs are from endogenous safflower genes that are naturally present in all safflower plants. The *hph* antibiotic resistance gene is from *E. coli*, which is widespread and prevalent in the environment, including in the human and animal digestive systems.

54. Regulatory sequences are derived from common plants or from plant bacteria or viruses that are widespread in the environment. Although some of the regulatory sequences are derived from plant pathogens, they comprise only small parts of the total genomes and cannot of themselves cause disease.

Section 7 Relevant Australian and international approvals

7.1 Australian approvals

7.1.1 Previous releases approved by the Regulator and the GMAC

55. No GM safflower has been previously released in Australia.

56. The Regulator has previously approved field trials of GM cotton with the trait of increased levels of oleic acid under licences DIR 039 and DIR 085. Information on these licences is available from the GMO Record on the OGTR website. There have been no reports of adverse effects on human health or the environment resulting from any of these releases.

7.1.2 Approvals by other government agencies

57. FSANZ has previously approved food derived from lines of GM soybean with the trait of increased levels of oleic acid as safe for human consumption (FSANZ 2009; FSANZ 2011).

7.2 International approvals

58. None of the GM safflower lines proposed for release in this application have been approved for release in other countries.

59. Field trials of different GM safflower lines, with various traits, have been approved in the United States, Canada and Argentina.

Chapter 2 Risk assessment

Section 1 Introduction

60. The risk assessment identifies and characterises risks to the health and safety of people or to the environment from dealings with GMOs, posed by or as the result of gene technology (Figure 3). Risks are identified within the context established for the risk assessment (see Chapter 1), taking into account current scientific and technical knowledge. A consideration of uncertainty, in particular knowledge gaps, occurs throughout the risk assessment process.

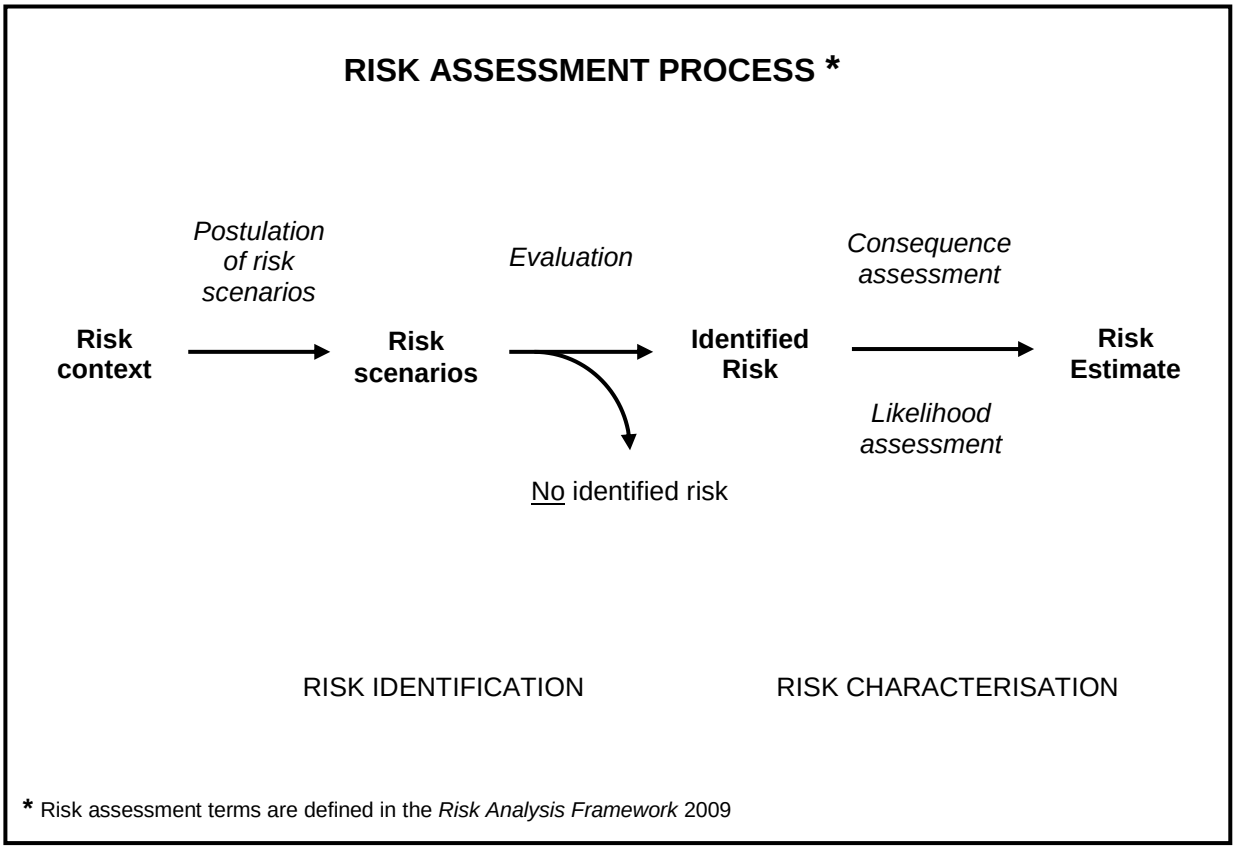

Figure 3. The risk assessment process

61. Initially, risk identification considers a wide range of circumstances whereby the GMO, or the introduced genetic material, could come into contact with people or the environment. Consideration of these circumstances leads to postulating plausible causal or exposure pathways that may give rise to harm for people or the environment from dealings with a GMO (risk scenarios).

62. Each risk scenario is evaluated to identify those risks that warrant detailed characterisation. A risk is only identified for further assessment when a risk scenario is considered to have some reasonable chance of causing harm. Pathways that do not lead to harm, or could not plausibly occur, do not advance in the risk assessment process.

63. A number of risk identification techniques are used by the Regulator and staff of the OGTR, including checklists, brainstorming, common sense, reported international experience and consultation (OGTR 2009). In conjunction with these techniques, risk scenarios postulated in previous RARMPs prepared for licence applications of the same and similar GMOs are also considered.

64. Identified risks (*i.e.* those identified for further assessment) are characterised in terms of the potential seriousness of harm (Consequence assessment) and the likelihood of harm

(Likelihood assessment). The level of risk is then estimated from a combination of the Consequence and Likelihood assessments.

Section 2 Risk Identification

65. The following factors are taken into account when postulating relevant risk scenarios:

- the proposed dealings, which may be to conduct experiments, develop, produce, breed, propagate, grow, import, transport or dispose of the GMOs, use the GMOs in the course of manufacture of a thing that is not the GMO, and the possession, supply and use of the GMOs in the course of any of these dealings
- the proposed limits
- the proposed controls
- characteristics of the parent organism(s)
- routes of exposure to the GMOs, the introduced gene(s) and gene product(s)
- potential effects of the introduced gene(s) and gene product(s) expressed in the GMOs
- potential exposure to the introduced gene(s) and gene product(s) from other sources in the environment
- the environment at the site(s) of release
- agronomic management practices for the GMOs.

66. Three risk scenarios were postulated and evaluated. These scenarios are summarised in Table 2 and more detail of the evaluation of these scenarios is provided later in this Section. In the context of the control measures proposed by the applicant and considering both the short and long term, none of the risk scenarios were identified as giving rise to a risk that could be greater than negligible. Therefore, they did not warrant further detailed assessment.

67. All of the GM safflower lines contain the selectable marker gene *hph*, and some of the GM safflower lines contain the visual reporter gene *gfp*. These genes and their products have already been considered in detail in previous RARMPs (for example, DIR 077/2007 for *hpt* and DIR 096 for *gfp*) and by other regulators. Further information about these genes can be found in the document *Marker genes in GM plants* available from the Risk Assessment References page on the OGTR website. Since neither of these genes have been found to pose risks to either people or the environment, their potential effects will not be further assessed for this application.

68. All of the introduced regulatory sequences are derived from common plants, bacteria and viruses. Similar regulatory elements are naturally present in safflowers, and the introduced elements are expected to operate in similar ways to endogenous ones. Therefore, although the transfer of introduced regulatory sequences to other sexually compatible plants could result in unpredictable effects, the impact is not likely to be greater than that arising from transfer of endogenous regulatory elements. Hence, these potential effects will not be further assessed for this application.

69. The potential for horizontal gene transfer (HGT) and any possible adverse outcomes has been reviewed in literature (Keese 2008) as well as assessed in many previous RARMPs. HGT was most recently considered in the RARMP for DIR 108. This and other RARMPs are available on the OGTR website or by contacting the OGTR. No risk greater than negligible was identified due to the rarity of these events and because the gene sequences are already present in the environment and available for transfer via demonstrated natural mechanisms. Therefore, HGT will not be assessed further.

70. The potential for unauthorised activities to lead to an adverse outcome has been considered in previous RARMPs. The Act provides for substantial penalties for non-compliance and unauthorised dealings with GMOs. The Act also requires the Regulator to have regard to the suitability of the applicant to hold a licence prior to the issuing of a licence. These legislative provisions are considered sufficient to minimise risks from unauthorised activities, and no risk greater than negligible was identified in previous RARMPs. Therefore unauthorised activities will not be considered further.

Table 1. Summary of risk scenarios from dealings with GM safflower genetically modified for increased levels of oleic acid

Risk category	Risk scenario		Identified risk?	Reason
	Pathway that may give rise to harm	Potential harm		
Section 2.1 **Production of a substance toxic or allergenic to people or toxic to other organisms**	Exposure to GM plant material containing the introduced silencing constructs or their end products	Allergic reactions in people or toxicity in people and other organisms	No	• The mechanism of gene silencing, via siRNA, does not lead to expression of any introduced protein. • Oleic acid is not toxic or allergenic. • Plant material from the GMOs would not be used for human food or animal feed. • The limited scale, short duration and other proposed limits and controls minimise exposure of people and other organisms to the GM plant material.
Section 2.2 **Weediness of GM safflower plants in the environment**	The genetic modifications increase the weediness of the GMOs	Environmental harms associated with weediness; allergic reactions in people or toxicity in people and other organisms	No	• The genetic modifications of the GM safflower lines are not expected to alter any characteristics associated with weediness. • The limits and controls proposed for the release would minimise spread and persistence of the GM safflower.
Section 2.3 **Vertical transfer of genes or genetic elements to sexually compatible plants**	Expression of the introduced silencing constructs in safflower plants or weedy related species outside the trial	Environmental harms associated with weediness; allergic reactions in people or toxicity in people and other organisms	No	• Safflower does not produce fertile hybrids with weedy related species. • The applicant has proposed measures to isolate the trial from other safflower plants, which would minimise pollen-mediated gene transfer. • Risk scenarios 1 – 2 associated with the genetic modifications did not constitute identified risks for people or the environment.

2.1 Production of a substance toxic or allergenic to people or toxic to other organisms

71. Toxicity is the adverse effect(s) of exposure to a dose of a substance as a result of direct cellular or tissue injury, or through the inhibition of normal physiological processes (Felsot 2000).

72. Allergenicity is the potential of a substance to elicit an immunological reaction following its ingestion, dermal contact or inhalation, which may lead to tissue inflammation and organ dysfunction (Arts et al. 2006).

73. A range of organisms may be exposed directly or indirectly to the introduced genetic constructs or their end products. Workers cultivating the GM safflower would be exposed to all plant parts. Organisms may be exposed directly to GM safflower plants through biotic

interactions (vertebrates, invertebrates, symbiotic and/or pathogenic microorganisms), or through contact with dead plant material (soil biota) or indirectly through the food chain.

Risk Scenario 1. Exposure to GM plant material containing introduced silencing constructs or their end products

74. The introduced silencing constructs with fragments of safflower genes, or siRNAs produced by transcription of the silencing constructs, or safflower oil with altered composition could be toxic or allergenic for people, or toxic for other organisms. If humans or other organisms were exposed to the GM plant materials through ingestion, contact or inhalation, this may give rise to detrimental biochemical or physiological effects on the health of these people, animals or micro-organisms.

75. In the context of the proposed dealings, both of the following requirements would have to be met for GM safflower to have any increased toxic or allergenic effect:

- the genetic modification would have to result in production of toxins or allergens either not present in commercially grown safflower varieties or at higher levels than present in commercially grown safflower varieties, and
- humans or other organisms would have to be exposed to the GM safflower plants through contact, ingestion or inhalation.

76. The silencing constructs contain fragments of three safflower genes: *FATB*, *FAD2* and another fatty acid biosynthesis gene. These gene sequences are naturally present in non-GM safflower as well. Humans and animals have a long history of safe exposure to non-GM safflower crops.

77. Transcription of the gene fragments in the silencing constructs produces RNA which forms a hairpin structure. This double-stranded RNA enters the RNAi pathway rather than being translated into a protein. Therefore, this gene silencing mechanism does not lead to expression of a novel protein that could potentially be toxic or allergenic.

78. Hairpin RNA transcribed from the silencing constructs is processed into siRNAs. Animals and plants naturally produce thousands of different siRNA molecules and these are consumed by humans whenever they eat plant or animal cells. One paper (Zhang et al. 2011) tracked the metabolic fate of a particular natural miRNA (similar to siRNA) that is produced abundantly in rice and happens to have a near perfect sequence match to a mammalian gene. In a study of mice fed a pure rice meal after fasting, the plant miRNA was detected in mouse livers and was reported to modulate the expression of the matching mammalian gene, reducing levels of the encoded protein in the liver by approximately 50%. The effect on the mouse gene by the plant miRNA was transient and ceased when rice was no longer included in the food intake. However, a recent analysis paper (Petrick et al. 2013) suggests some potential alternate explanations for the findings of the Zhang et al study (2011), and after reviewing a number of other papers in the field concludes that the weight of the evidence does not suggest that miRNAs derived from normal dietary exposure have a meaningful effect on mammalian gene expression.

79. The possibility exists that siRNAs produced in GM safflower lines could modulate expression of human or animal genes, with unknown physiological effects. However, to have any significant effect in people or animals, the GM safflower would need to constitute a large proportion of a large meal. The quantity of rice fed to mice in the Zhang et al study (2011) is equivalent to a human eating approximately 33 kg/day of cooked rice, which does not reflect anticipated dietary exposure levels. Also, the siRNAs would need to be produced at high levels in GM safflower, match a target sequence in a human or animal gene, and be taken up by cells expressing that gene. Mammals do not have genes that are homologous to the safflower fatty acid biosynthesis genes targeted by the introduced silencing constructs. Even if siRNAs were

acquired through eating GM safflower and did affect expression of a mammalian gene, it is expected that any effect would be transient as described in Zhang et al (2011).

80. The expected phenotypic difference between GM and non-GM safflower is that GM safflower oil will contain a higher proportion of oleic acid and a lower proportion of saturated or polyunsaturated fatty acids. Oleic acid is part of the normal human diet, as it is a major constituent of vegetable oils and animal fats, and it is not toxic or allergenic.

81. The genetic modifications have the potential to cause unintended effects in several ways including off-target siRNA-mediated silencing of genes expressed in safflower, altered expression of endogenous safflower genes by random insertion of introduced DNA in the genome, and secondary effects arising from altered substrate or product levels in biochemical pathways. Unintended effects might result in adverse outcomes such as toxicity or allergenicity. Unanticipated changes can also be induced in plants by conventional methods of plant breeding (Haslberger 2003). The range of possible unintended effects produced by genetic modification is not likely to be greater than that from accepted traditional breeding techniques (Bradford et al. 2005; Committee on Identifying and Assessing Unintended Effects of Genetically Engineered Foods on Human Health 2004). More detail on potential for unintended effects as a result the process of genetic modification can be found in the document *Methods of plant genetic modification* available from the Risk Assessment References page on the OGTR website.

82. There is little potential for human ingestion of the GM safflower, as no GM plant material would be used as food. Similarly, livestock would not be intentionally exposed as the GM plant material would not be used as animal feed. The applicant proposes that GM plant materials will only be handled by trained and authorised staff. The short duration (2013-2016) and the small size (up to 3 ha per year) of the proposed field trial will also limit the potential for exposure to the GM plant material.

83. Further features of the GMOs that limit the potential for exposure to GM plant material have been declared confidential commercial information (CCI). The confidential information was made available to the prescribed experts and agencies that were consulted on the RARMP for this application.

84. ***Conclusion***: The potential for harm due to exposure to GM plant material containing the introduced silencing constructs, in the context of the limits and controls proposed by the applicant and considering both the short and long term, is not identified as a risk that could be greater than negligible. Therefore it does not warrant further assessment.

2.2 Weediness of the GM safflower plants in the environment

85. This section addresses the question of whether or not the proposed dealings with the GMOs may lead to harm to human health and safety or the environment as a result of an increased potential for spread and/or persistence due to the genetic modification.

86. All plants have the potential to lead to harm in certain environments. Harms that may arise from a certain plant species in a particular environment include:

- adverse effects on the health of people and/or animals
- reduction in the establishment, yield and/or quality of desired plants
- restriction in the physical movement of people, animals, vehicles, machinery and/or water
- adverse effects on environmental health, such as adverse changes to strata levels, nutrient levels, fire regime, soil salinity, soil stability, or by providing food and/or shelter to pests, pathogens and/or diseases.

87. For the purpose of this document, plant species causing significant levels of one or more of these harms are called 'weeds'. A plant species may be weedy in one or more land uses, such as dryland cropping or nature conservation.

88. Characteristics that influence the spread (dispersal of the plant or its genetic material) and persistence (establishment, survival and reproduction) of a plant species impact on the degree of its invasiveness. These characteristics include the ability to establish in competition with other plants, to tolerate standard weed management practices, to reproduce quickly, prolifically and asexually as well as sexually, and to be dispersed over long distances by natural and/or human means. The degree of invasiveness of a plant species in a particular environment gives an indication of the likelihood of its weediness in that environment. In addition to local experience, a history of weediness overseas can be used as an indicator for weediness in Australia (Pheloung et al. 1999).

89. Some baseline information on the weediness of safflower is given in Chapter 1, Section 6. Safflower is fairly slow-growing, with an extended rosette stage following emergence and prior to stem development, during which it is poorly competitive with other plants (Dajue & Mündel 1996). Safflower plants are susceptible to a wide range of herbicides as well as physical weed management practices (GRDC 2010).

Risk Scenario 2. The genetic modifications increase weediness of the GMOs

90. In the context of the proposed dealings, in order for the GM safflower plants to become weedy in the environment both of the following conditions would need to be met:

- GM safflower plants are present outside the limits (locations and/or duration) of the proposed trial; and
- GM safflower plants are able to establish populations that cause harms associated with weediness.

Presence of GM safflower plants outside the trial limits

91. GM safflower plants could be present outside the trial limits due to survival at the trial sites after completion of the field trial, or due to dispersal of reproductive plant material outside the boundaries of the sites during or after the trial.

92. After completion of the trial, it is possible that whole GM plants could survive at the trial sites, or new volunteer plants could grow from residual seed in the trial sites. The applicant proposes a number of control measures to prevent these eventualities, including:

- destroying all plant materials not required for testing or future trials
- promoting germination of residual seed by post-harvest tillage and irrigation
- post-harvest monitoring of the trial sites for two years and destruction of any volunteer safflower prior to flowering.

93. Typical safflower seed losses during harvest are 3-4%, and up to 50% of these residual seeds are viable (Mcpherson et al. 2009b). Most of these seeds would germinate soon after harvest as safflower seeds have very low dormancy (see Chapter 1, Section 4). It is not expected that the genetic modifications to safflower would affect seed yield, viability or germination. While the fatty acid composition is altered, the total fatty acid content of seeds, and thus their stored energy content, remains constant. GM safflower seeds grown in the greenhouse were reported to germinate and establish at the same rate as non-GM comparators. Likewise, it is not expected that the genetic modifications would affect the ability of the GMOs to survive the control measures listed above.

94. Potential dispersal of reproductive GM plant material outside the site boundaries would be limited to seed or pollen, as safflower does not reproduce vegetatively in the field.

Safflower seed heads are resistant to shattering and the seeds lack seed dispersal characteristics such as stickiness, burrs and hooks, which can contribute to seed dispersal via animal fur or feathers (Howe & Smallwood 1982). These seed dispersal characteristics are not expected to be altered in the GMOs. Gene flow via pollen is discussed in Risk Scenario 3.

95. Dispersal of viable seed could occur in a variety of ways including: endozoochory (dispersal through ingestion by animals), through transport of seeds by animals, through movement of seeds by people, or through extremes of weather such as flooding or high winds.

96. Small birds can feed on ripening safflower seed in the head, and cockatoos can chew off safflower plants at the base in order to access the seeds (GRDC 2010). Safflower seeds that have passed through bird digestive systems are no longer viable (Cummings et al. 2008). Individual safflower seeds are smooth and unlikely to adhere to birds, and although entire seed heads are spiny, they are large and firmly attached to the plant. Some Northern Hemisphere birds engage in seed-caching behaviour but it is not known whether Australian birds carry seeds away for later consumption. The applicant proposes to prevent bird access to one trial site by bird netting, and to control bird pressure at the other two trial sites using bird scarers, which would minimise seed dispersal through bird activity.

97. Large animals are generally deterred from grazing on standing safflower by its spines. Safflower seeds are firmly held within their seed heads, which limits their accessibility to rodents. Residual GM seeds post-harvest may attract animal predation, and could be transported and hoarded by rodents. However, the applicant proposes to till the trial sites post-harvest, which should bury the GM seeds. A 10 m monitoring zone around the trial sites would be kept bare or mowed short, so should not attract or harbour rodents. The applicant also intends to monitor for rodents by trapping and to control populations by baiting if necessary. Hence seed dispersal through animal or rodent activity is unlikely.

98. Dispersal of seeds by people dealing with the GMOs would be minimised by cleaning of all equipment prior to removal from the trial sites. All GM plant material would be transported in accordance with the Regulator's transport guidelines to avoid spillage.

99. Safflower is very resistant to shattering or lodging (Mündel et al. 2004), so seeds are unlikely to be dispersed by wind or via water runoff from irrigation or rainfall prior to harvest. Residual seeds that fall during harvest could be dispersed by water runoff from rainfall or by strong winds. However, the applicant proposes to till the trial sites post-harvest and incorporate GM plant material into the soil. Trial sites would be located at least 50 m away from natural waterways to minimise seed dispersal in the event of flooding. Seeds dispersed by flooding would be unlikely to survive and establish, as safflower is very susceptible to damping off and fungal diseases in wet soil (GRDC 2010).

100. The applicant has proposed that harvested seed not required for further experimentation may be buried as a means of disposal. Burial would be to a depth of at least 1 m, which would restrict access and dispersal by animals and dispersal by wind or water.

Establishment of GM safflower populations that cause harms associated with weediness

101. As summarised in Chapter 1 Section 6, safflower is naturalised throughout Australia, primarily as an agricultural or ruderal weed. In New South Wales agricultural areas, it is classified as a Category 1 weed, indicating that it may be a minor problem but is not considered important enough to warrant control at any location (Groves et al. 2003).

102. The only expected phenotypic difference between GM safflower and non-GM safflower is altered fatty acid composition in the GM safflower oil. In the unlikely event of GM safflower plants establishing themselves beyond trial limits, this trait would not lead populations of GM safflower to cause greater environmental harms associated with weediness, such as reducing

establishment of desired plants, restricting physical movement, or adversely affecting environmental health, than would be caused by unmodified safflower.

103. As discussed in Risk Scenario 1, the genetic modifications have the potential to cause unintended effects. Unintended phenotypic changes could lead to increased weediness. However, the range of possible unintended effects produced by genetic modification is not likely to be greater than those caused by traditional breeding techniques (Bradford et al. 2005; Committee on Identifying and Assessing Unintended Effects of Genetically Engineered Foods on Human Health 2004). No unexpected phenotypic changes were observed during growing of GM safflower lines in greenhouses, and a standard condition of a licence for a field trial would be that the applicant must immediately notify the OGTR of any unintended effects of the dealings authorised by the licence.

104. Toxicity and allergenicity of the GM safflower were considered in Risk Scenario 1 and it is unlikely that GM safflower plants would have higher toxicity and/or allergenicity than non-GM safflower.

105. ***Conclusion:*** The potential for harm due to the genetic modification increasing the weediness of the GMOs, in the context of the limits and controls proposed by the applicant and considering both the short and long term, is not identified as a risk that could be greater than negligible. Therefore, it does not warrant further assessment.

2.3 Vertical transfer of the genetic elements to sexually compatible plants

106. Vertical gene flow is the transfer of genetic information from an individual organism to its progeny by conventional heredity mechanisms, both asexual and sexual. In flowering plants, pollen dispersal is the main mode of gene flow (Waines & Hegde 2003). For GM crops, vertical gene flow could therefore occur via successful cross-pollination between the crop and neighbouring crops, plants, related weeds or native plants (Glover 2002).

107. It should be noted that vertical gene flow *per se* is not considered an adverse outcome, but may be a link in a chain of events that may lead to an adverse outcome. For an increased potential for adverse effects to arise as a result of gene flow of the introduced genetic elements from the GM safflower to sexually compatible plants, both of the following steps must occur:

- transfer of the introduced genetic elements to sexually compatible plants
- increased potential for adverse effects, such as toxicity, allergenicity or weediness of the recipient plants, due to expression of the introduced genetic elements.

108. As summarised in Chapter 1 Section 4, safflower reproduces by a combination of self-pollination and bee-mediated cross-pollination.

109. As described in Chapter 1 Section 6, interspecific hybridisation between safflower and other species of the *Carthamus* genus present in Australia is difficult due to various cytogenetic barriers (e.g. varying chromosome number). Hybrids can be obtained under experimental conditions but are sterile (Mayerhofer et al. 2011).

Risk Scenario 3. Expression of the introduced silencing constructs in safflower plants or weedy related species outside the field trial

110. If the introduced silencing constructs were transferred and expressed in other safflower plants or related species, the resulting hybrid plants could have increased toxicity or allergenicity to people, toxicity to other organisms, or weediness potential.

111. Expression of the introduced silencing constructs, leading to altered oil composition, is not expected to change the pollination characteristics of the GM safflower compared to non-GM safflower.

112. GM safflower could cross-pollinate plants from other *Carthamus* species at low levels if these weedy species were present in close proximity to the trial sites and flowered synchronously. Hybrids between GM safflower and *Carthamus* weeds would be annuals like all *Carthamus* species and would be sterile (Mayerhofer et al. 2011). The hybrids could therefore only be transient weeds in the immediate environs of the trial sites, and could not lead to long-term transfer of the introduced silencing constructs into weedy *Carthamus* species populations. Nonetheless, the applicant proposes to inspect the areas within 200 m of the trial sites prior to flowering of GM safflower and to destroy any plants from related species, which would minimise cross-species pollination.

113. GM safflower could cross-pollinate non-GM safflower plants outside the trial if either naturalised safflower or commodity safflower crops were present in proximity to the trial sites. In principle, GM safflower pollen could be widely dispersed, as bees forage over kilometre ranges. However, safflower pollen transported by an insect must compete with the floret's own pollen to result in outcrossing. Bee-mediated cross-pollination of safflower has low efficiency, as transported safflower pollen is only reported to potentially fertilise the next floret visited by the bee (Cresswell 2010). In contrast, in canola crops pollen collected by a bee at one flower may fertilise up to twenty flowers visited subsequently (Cresswell et al. 2002).

114. Outcrossing rates between adjacent safflower plants in India have been reported to range between 0-59%, depending on cultivar (Singh & Nimbkar 2006). However, the higher range of outcrossing rates may result from physical contact between florets rather than insect-mediated cross-pollination. In a series of experiments in Spain where recipient safflower plants were surrounded by donor safflower plants, but separated by distances of 1-1.5 m to prevent physical contact, average outcrossing rates were 5.7-13.2% (Velasco et al. 2012). In general, commercial safflower varieties in Australia are reported to have less than 10% outcrossing unless bee hives are brought in specifically for the purpose (GRDC 2010). The particular parent cultivars in this proposal are also expected to be predominantly self-pollinating. Additional information on these cultivars has been declared CCI. The confidential information was made available to the prescribed experts and agencies that were consulted on the RARMP for this application.

115. Limited information is available on safflower cross-pollination over distance, or on the efficacy of exclusion distances in preventing hybridisation. For a commercial safflower cultivar studied in Canada, cross-pollination rates were measured as 1.7% at 3 m, approximately 0.01% at 100 m, and no outcrossing in 85,000 tested plants at 300 m (Mcpherson et al. 2009a). However, the experimental design involved four continuous strips of recipient safflower plants 107 m long and 1.6 m wide extending outwards from the donor plot, so the inner recipient plants may have provided a partial barrier against pollen flow to the outermost plants. International guidelines for seed-growers require that crops of certified safflower seed be grown with an exclusion distance of 200 m from other safflower crops, and that crops of basic safflower seed be grown with an exclusion distance of 400 m (OECD 2013). These international guidelines were developed for conditions where pollinators include both bumblebees and honeybees. Bumblebees are reported to be more effective at field-to-field pollination of safflower than honeybees (Cresswell 2010), so long-distance outcrossing rates may be reduced in mainland Australia compared to other countries due to the lack of bumblebees.

116. The applicant proposes to inspect the monitoring and isolation zones within 200 m of the trial sites prior to flowering of GM safflower and to destroy any safflower plants. This would minimise vertical gene flow to any safflower populations within 200 m of the trial site.

117. The applicant also proposes to ensure that no other safflower crops are grown within 400 m of the trial sites. There is a possibility that GM safflower could pollinate dense populations of naturalised safflower growing in the areas between 200 m and 400 m from the

trial sites, but as safflower is not a common weed, the number of wild safflower plants present in these areas is likely to be very low. However, significant numbers of wild safflower plants might be present between 200 m and 400 m from the trial sites if the plants were growing as volunteers following planting of a safflower crop in the previous year.

118. Cross-pollination events between the GMOs and other safflower crops or dense populations of wild safflower located slightly further than 400 m from the trial sites are expected to be rare. However, there is no published quantitative information about long-distance safflower gene flow.

119. Even if the introduced genetic material was transferred from the GM plants to other safflower plants, it is unlikely that expression of the silencing complexes would cause harm. As discussed in Risk Scenario 1 and Risk Scenario 2, the trait of increased levels of oleic acid is not expected to produce any toxic and/or allergenic substance or to increase weediness in recipient plants.

120. ***Conclusion:*** The potential for increased allergenicity in people, toxicity in people and other organisms, or increased weediness due to the expression of the introduced genes or gene sequences in commercial safflower crops or other sexually compatible plants as a result of gene transfer, in the context of the limits and controls proposed by the applicant and considering both the short and long term, is not identified as a risk that could be greater than negligible. Therefore it does not warrant further assessment.

Section 3 Risk estimate process and assessment of significant risk

121. The risk assessment begins with postulation of potential pathways that might lead to harm to the health and safety of people or the environment during the proposed release of GMOs due to gene technology, and how it could happen, in comparison to the parent organism and within the context of the receiving environment.

122. Three risk scenarios were postulated whereby the proposed dealings might give rise to harm to people or the environment. This included consideration of whether expression of the introduced genetic elements 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 it occurred were also assessed.

123. A risk is only identified when a risk scenario is considered to have some chance of causing harm. Risk scenarios that do not lead to harm, or could not reasonably occur, do not represent an identified risk and do not advance any further in the risk assessment process.

124. The characterisation of the three risk scenarios in relation to both the seriousness and likelihood of harm, in the context of the control measures proposed by the applicant and considering both the short and long term, did not give rise to any identified risks that could be greater than negligible and required further assessment. The principal reasons for this include:

- limits on the size, locations and duration of the release proposed by CSIRO
- controls proposed by CSIRO to restrict the spread and persistence of the GM safflower plants and their genetic material
- the genetic modifications are unlikely to give rise to adverse effects on human health and safety or the environment
- widespread presence of the same and similar genes in the environment and lack of evidence of harm from them

- limited ability and opportunity for the GM safflower plants to transfer the introduced genetic material to commercial safflower crops or wild safflower populations
- none of the GM plant material or products will enter human food or animal feed supply chains.

125. Therefore, any risks to the health and safety of people, or the environment, from the proposed release of the GM safflower plants into the environment is considered to be negligible. Hence, the Regulator considers that the dealings involved in this proposed release do not pose a significant risk to either people or the environment.

Section 4 Uncertainty

126. Uncertainty is an intrinsic property of risk and is present in all aspects of risk analysis, including risk assessment, risk management and risk communication. Both dimensions of risk (consequence and likelihood) are always uncertain to some degree.

127. Uncertainty in risk assessments can arise from incomplete knowledge or inherent biological variability[3]. For field trials, because they involve the conduct of research, some knowledge gaps are inevitable. This is one reason they are required to be conducted under specific limits and controls to restrict the spread and persistence of the GMOs and their genetic material in the environment, rather than necessarily to treat an identified risk.

128. For DIR 121, uncertainty is noted particularly in relation to:

- Risk Scenario 1, regarding unintended effects potentially leading to increases in toxicity or allergenicity
- Risk Scenario 2, regarding unintended phenotypic changes with the potential for increasing weediness of the GMOs
- Risk Scenario 3, regarding the potential for gene flow via pollen over long distance.

129. Additional data, including information to address these uncertainties, may be required to assess possible future applications for a larger scale trial, reduced containment conditions, or the commercial release of these GM safflower lines if they are selected for further development.

130. Chapter 3, Section 4 discusses information that may be required for future release.

[3] A more detailed discussion is contained in the Regulator's *Risk Analysis Framework* available from the OGTR website or via Free call 1800 181 030.

Chapter 3 Risk management plan

Section 1 Background

131. Risk management is used to protect the health and safety of people and to protect the environment by controlling or mitigating risk. The risk management plan evaluates and treats identified risks, evaluates controls and limits proposed by the applicant, and considers general risk management measures. The risk management plan informs the Regulator's decision-making process and is given effect through licence conditions.

132. Under section 56 of the Act, the Regulator must not issue a licence unless satisfied that any risks posed by the dealings proposed to be authorised by the licence are able to be managed in a way that protects the health and safety of people and the environment.

133. All licences are subject to three conditions prescribed in the Act. Section 63 of the Act requires that each licence holder inform relevant people of their obligations under the licence. The other statutory conditions allow the Regulator to maintain oversight of licensed dealings: section 64 requires the licence holder to provide access to premises to OGTR inspectors and section 65 requires the licence holder to report any information about risks or unintended effects of the dealing to the Regulator on becoming aware of them. Matters related to the ongoing suitability of the licence holder are also required to be reported to the Regulator.

134. The licence is also subject to any conditions imposed by the Regulator. Examples of the matters to which conditions may relate are listed in section 62 of the Act. Licence conditions can be imposed to limit and control the scope of the dealings. In addition, the Regulator has extensive powers to monitor compliance with licence conditions under section 152 of the Act.

Section 2 Risk treatment measures for identified risks

135. The risk assessment of risk scenarios listed in Chapter 2 concluded that there are negligible risks to people and the environment from the proposed field trial of GM safflower. These risk scenarios were considered in the context of the scale of the proposed release (Chapter 1, Section 3.1), the proposed containment measures (Chapter 1, Section 3.2), and the receiving environment (Chapter 1 Section 6), and considering both the short and the long term. The *Risk Analysis Framework* (OGTR 2009) which guides the risk assessment and risk management process, defines negligible risks as insubstantial with no present need to invoke actions for their mitigation. Therefore, there are no licence conditions to treat these negligible risks.

Section 3 General risk management

136. The limits and controls proposed in the application were important in establishing the context for the risk assessment and in reaching the conclusion that the risks posed to people and the environment are negligible. Therefore, to maintain the risk context, licence conditions have been imposed to limit the release to the proposed size, locations and duration, and to restrict the spread and persistence of the GMOs and their genetic material in the environment. The licence conditions imposed are summarised in this Chapter.

3.1 Licence conditions to limit and control the release

3.1.1 Consideration of limits and controls proposed by CSIRO

137. Sections 3.1 and 3.2 of Chapter 1 provide details of the limits and controls proposed by CSIRO in their application. These are discussed in the three risk scenarios characterised for the proposed release in Chapter 2. Many of these proposed control measures are considered standard for GM crop trials and have been imposed by the Regulator in previous DIR licences. The appropriateness of these controls is considered further below.

138. The duration of the field trial would be confined to three growing seasons, with one trial site during the first growing season and up to three trial sites during the second and third growing seasons, with a maximum area of 1 ha per site. The small size and short duration of the trial would limit the potential exposure of humans, vertebrates and other organisms to the GMOs (Risk Scenario 1).

139. Only authorised personnel with appropriate training would be permitted to deal with the GMOs. This measure would limit the potential exposure of humans to the GMOs (Risk Scenario 1).

140. The applicant proposes, in line with a standard DIR licence condition, that trial sites be located at least 50 m from natural waterways to minimise the chance of viable plant material being washed away from the site. An additional licence condition has been included requiring immediate notification of any extreme weather conditions affecting the trial sites during the release. This will allow control measures to be taken to minimise dispersal of GM safflower outside the proposed trial sites (Risk Scenario 2).

141. The applicant proposes to grow both GM safflower and non-GM safflower in the trial sites. As non-GM safflower may be mingled with or fertilised by GM safflower, a standard licence condition requires that non-GM safflower plants grown in a trial site must be treated as if they are GMOs.

142. At one trial site, the applicant proposes to minimise bird access to the GMOs by covering the site with bird netting. At the two other trial sites, the applicant proposes to control bird predation of the GMOs by the use of commercial bird scarers. As discussed in Risk Scenario 2, birds are unlikely to disperse viable GM safflower seeds either by consumption or by external adhesion. Therefore, measures to deter birds, rather than completely exclude them, are considered sufficient to both limit exposure of wildlife to the GMOs (Risk Scenario 1) and control potential dispersal of GMOs outside the trial sites (Risk Scenario 2). A licence condition requires that for the period from 14 days after commencement of flowering of the GMOs in a trial site until the site has been cleaned, the trial site must be either:

- covered with bird netting, which must be maintained in a state adequate to deter birds; or
- equipped with bird scarers that are expected to deter the main seed-eating bird species present in the vicinity of the trial site.

143. The applicant proposes to monitor for the presence of rodents by trapping and to control populations by baiting if necessary. Combined with the use of a monitoring zone (below) these measures should both limit exposure of rodents to the GMOs (Risk Scenario 1) and minimise potential dispersal of GMOs outside the trial sites by rodents (Risk Scenario 2). A licence condition requires that for the period while GMOs are being grown and until the trial site has been cleaned, measures must be implemented to control rodents within the site.

144. The applicant proposes to surround each trial site with a 10 m monitoring zone, which is either free of vegetation or planted with vegetation mown to a height of less than 10 cm. This would serve three purposes:

- to avoid attracting or harbouring rodents (Risk Scenarios 1 and 2)
- to facilitate detection of naturalised safflower plants or weedy related species that might hybridise with GM safflower (Risk Scenario 3)
- to facilitate detection of GM plant material that has been dispersed during sowing or harvesting (Risk Scenario 2).

145. A licence condition requires that a 10 m monitoring zone around each trial site be maintained in a manner that does not attract or harbour rodents.

146. The applicant proposes that the monitoring zone would be surrounded with a 190 m isolation zone, and while the GMOs are flowering in a trial site, both the monitoring and isolation zones would be inspected every 35 days for the presence of safflower or related species. Although safflower requires at least 45 days to develop from its inconspicuous rosette stage to flowering (GRDC 2010), there is little information available on the rate of development of weedy *Carthamus* species present in Australia, and it is conceivable that in favourable conditions they could develop to flowering in less than 35 days. A higher frequency of inspection is appropriate to deal with this uncertainty. A licence condition requires that for the period from 14 days prior to the expected commencement of flowering of any GMOs in a trial site, until after all GMOs have finished flowering, the monitoring and isolation zones must be inspected every 14 days for the presence of safflower or related species, and any plants discovered must be destroyed prior to flowering. These measures will minimise gene flow to naturalised safflower or related weedy species (Risk Scenario 3).

147. The applicant proposes to ensure that no other safflower crops are grown within 400 m of the trial sites. Commercial safflower cultivars are predominantly self-pollinated, and the limited publications available suggest that the incidence of bee-mediated pollination drops rapidly with distance. The international guidelines for production of basic safflower seed recommend an exclusion distance of 400 m from other safflower cultivars to produce high purity seed (OECD 2013). However, at this exclusion distance there could still be very low levels of cross-pollination that are acceptable for growers, and there is a lack of scientific studies addressing efficacy of exclusion distances for safflower. In these circumstances of uncertainty, it is considered appropriate to increase the exclusion distance by a safety factor. For a Canadian field trial of GM safflower in 2011, the Canadian Food Inspection Agency (see CFIA website) required that GM safflower plants be reproductively isolated from other safflower plants by 800 m, and from safflower seed production by 1600 m. However, the GM safflower in the Canadian trial expressed a pharmaceutical compound that could potentially have adverse effects on humans or animals if ingested, whereas GM safflower with the trait of increased levels of oleic acid is not expected to be toxic or allergenic (Risk Scenario 1). In Risk Scenario 3, it was noted that pollen flow might occur not only to a safflower crop, but also to safflower volunteers if these grow in abundance in the year after planting of a safflower crop. Based on these considerations, a licence condition states that GM safflower must not be grown within 600 m of either a safflower crop that is not a part of the field trial, or an area that was planted in the previous 12 months to a safflower crop that was not a part of the field trial. The 600 m exclusion distance would be a combination of a 10 m monitoring zone, a 190 m isolation zone and a 400 m exclusion zone. This condition will minimise gene flow to other safflower plants (Risk Scenario 3).

148. The applicant proposes to harvest the seed by hand, or using either a single row harvester or small plot harvester. Avoiding the use of large mechanical harvesters would limit the potential for dispersal of GM material during harvesting (Risk Scenario 2). A condition specifying these harvesting methods is included in the licence.

149. In line with a standard licence condition, the applicant proposes to clean equipment used with the GMOs on-site before use for any other purpose. This would minimise dispersal of GM material by humans (Risk Scenario 2).

150. The applicant proposes to clean the trial sites and adjacent areas after harvest by incorporating plant material into the soil. During sowing and harvesting, plant material could be scattered into the area immediately surrounding the trial, so there is potential for residual seed to be present in both the trial site and the monitoring zone. In Risk Scenario 2 it was noted that during the period between harvest and cleaning, residual seed on the soil surface would be susceptible to dispersal by animal predation, water runoff after rainfall, or strong winds. Therefore, it is appropriate to require that cleaning occurs shortly after harvest. A licence condition requires that GMO planting areas and their associated monitoring zones must be cleaned by ploughing plant material into the soil within 14 days after harvest of the GMOs.

151. The applicant proposes regular watering of the trial site post-harvest, to promote germination of residual seed. Due to the low dormancy of safflower seeds (Chapter 1, Section 4), one irrigation is considered sufficient to manage survival and persistence of viable safflower seeds in the soil (Risk Scenario 2). A licence condition requires that GMO planting areas and their associated monitoring zones must be irrigated at least once post-harvest.

152. The applicant proposes post-harvest monitoring of the trial site and any areas used to clean equipment for 24 months, destroying any volunteer safflower plants detected before flowering. The proposed frequency of inspections is monthly, or if no volunteers are found during six consecutive inspections, reduced to once per three months. As safflower has low dormancy, with buried seeds reported to have no viability beyond one year (Mcpherson et al. 2009b), it is considered unnecessary to inspect the trial sites for as long as two years. Licence conditions require post-harvest monitoring and destruction of volunteers at least once every 35 days for at least twelve months, and until no volunteers are found for at least six months. Records must be kept of monitoring activities and findings, including number and location of volunteers, which will allow the Regulator to assess the ongoing suitability of these measures and provide additional information for future assessments.

153. The applicant proposes that harvested seeds not required for further experimentation may be disposed of by burial at a depth of >1m . Due to the low dormancy of safflower, this will be an effective method of destruction, and it will manage persistence of viable safflower seed (Risk Scenario 2). A licence condition includes deep burial as an approved method of destruction.

154. In line with a standard licence condition, the applicant proposes that all transport and storage of GM plant material would comply with the Regulator's Guidelines for the transport, storage and disposal of GMOs, available on the OGTR website. These protocols for the handling of GMOs would minimise exposure of people and other organisms to the GMOs (Risk Scenario 1), and dispersal of GMOs into the environment (Risk Scenario 2) during transport.

155. The applicant proposes that experimental analysis of the GM plant materials would take place in certified PC2 facilities, or that seed oil composition analysis would occur at the CSIRO Animal, Food and Health Sciences Werribee facility, which is not certified. Seeds would be rendered non-viable by crushing and/or oil extraction prior to transport to the Werribee facility. A licence condition states that experiments may take place in a planting site, at the CSIRO Animal, Food and Health Sciences Werribee facility in the case of non-viable GM plant material, or in another facility approved in writing by the Regulator. Experiments with the GMOs or GM plant material may be conducted in certified physical containment facilities as Notifiable Low Risk Dealings (NLRDs) in accordance with all appropriate requirements of the Gene Technology Regulations 2001, and therefore this activity is not covered in the licence.

156. It was noted in Chapter 2 that unexpected effects of genetic modification could potentially lead to increased toxicity or allergenicity (Risk Scenario 1) or increased weediness (Risk Scenario 2). A standard licence condition requires the applicant to notify the OGTR of any unintended effects of the dealing authorised by the licence.

157. The applicant does not propose using any of the GM plant material for human or animal consumption, and the GM safflower has not been assessed for food use by FSANZ. Therefore a condition in the licence prohibits material from the trial from being used for human food or animal feed.

3.1.2 Summary of licence conditions to be implemented to limit and control the release

158. A number of licence conditions have been imposed to limit and control the proposed release, based on the above considerations. These include requirements to:

- limit the duration of the field trial to three growing seasons

- limit the field trial to one site of up to 1 ha during the first growing season, and three sites of up to 1 ha each during the second and third growing seasons
- locate trial sites at least 50 m from natural waterways
- ensure that no other safflower crops are grown within 600 m of the trial sites
- surround each site with a 10 m monitoring zone maintained in a manner that does not attract or harbour rodents
- while the GM safflower is flowering, inspect areas within 200 m of the trial sites and destroy any safflower or related species
- use bird netting or bird scarers to deter birds
- control rodents
- harvest GM safflower separately to other crops or trials
- clean equipment prior to removal from the site
- destroy all plant materials not required for testing or future trials
- promote germination of residual seed by post-harvest tillage and irrigation
- monitor for at least 12 months after harvest, and until no volunteer safflower plants are detected for at least 6 consecutive months, and destroy any safflower plants before flowering
- transport and store GM material in accordance with the Regulator's guidelines
- not allow GM plant material or products to be used for human food or animal feed.

3.2 Other risk management considerations

159. All DIR licences issued by the Regulator contain a number of conditions that relate to general risk management. These include conditions relating to:

- applicant suitability
- contingency plans
- identification of the persons or classes of persons covered by the licence
- reporting structures
- a requirement that the applicant allows access to the trial sites and other places for the purpose of monitoring or auditing.

3.2.1 Applicant suitability

160. In making a decision whether or not to issue a licence, the Regulator must have regard to the suitability of the applicant to hold a licence. Under section 58 of the Act, matters that the Regulator must take into account include:

- any relevant convictions of the applicant (both individuals and the body corporate)
- any revocation or suspension of a relevant licence or permit held by the applicant under a law of the Commonwealth, a State or a foreign country
- the capacity of the applicant to meet the conditions of the licence.

161. On the basis of information submitted by the applicant and records held by the OGTR, the Regulator considers CSIRO suitable to hold a licence.

162. The licence includes a requirement for the licence holder to inform the Regulator of any circumstances that would affect their suitability.

163. In addition, any applicant organisation must have access to a properly constituted Institutional Biosafety Committee and be an accredited organisation under the Act.

3.2.2 Contingency plan

164. CSIRO is required to submit a contingency plan to the Regulator before conducting any dealings with the GMOs under this licence. This plan must detail measures to be undertaken in the event of any unintended presence of the GM safflower lines outside of the permitted areas.

165. CSIRO is also required to provide a method to the Regulator for the reliable detection of the presence of the GMOs and the introduced genetic modifications in a recipient organism. This instrument is required before conducting dealings with the GMOs.

3.2.3 Identification of the persons or classes of persons covered by the licence

166. The persons covered by the licence are the licence holder and employees, agents or contractors of the licence holder and other persons who are, or have been, engaged or otherwise authorised by the licence holder to undertake any activity in connection with the dealings authorised by the licence. Prior to conducting any dealings with the GMOs under this licence, CSIRO is also required to provide a list of people and organisations who will be covered by the licence, or the function or position where names are not known at the time.

3.2.4 Reporting requirements

167. The licence obliges the licence holder to immediately report any of the following to the Regulator:

- any additional information regarding risks to the health and safety of people or the environment associated with the trial
- any contraventions of the licence by persons covered by the licence
- any unintended effects of the trial.

168. A number of written notices are also required under the licence that would assist the Regulator in designing and implementing a monitoring program for all licensed dealings. The notices would include:

- expected and actual dates of planting
- details of areas planted to the GMOs
- expected dates of flowering
- expected and actual dates of harvest
- actual dates of cleaning after harvest
- details of inspection activities.

3.2.5 Monitoring for Compliance

169. The Act stipulates, as a condition of every licence, that a person who is authorised by the licence to deal with a GMO, and who is required to comply with a condition of the licence, must allow inspectors and other persons authorised by the Regulator to enter premises where a dealing is being undertaken for the purpose of monitoring or auditing the dealing. Post-release monitoring continues until the Regulator is satisfied that all the GMOs resulting from the authorised dealings have been removed from the release site.

170. If monitoring activities identify changes in the risks associated with the authorised dealings, the Regulator may also vary licence conditions, or if necessary, suspend or cancel the licence.

171. In cases of non-compliance with licence conditions, the Regulator may instigate an investigation to determine the nature and extent of non-compliance. The Act provides for criminal

sanctions of large fines and/or imprisonment for failing to abide by the legislation, conditions of the licence or directions from the Regulator, especially where significant damage to health and safety of people or the environment could result.

Section 4 Issues to be addressed for future releases

172. Additional information has been identified that may be required to assess an application for a large scale or commercial release of these GM safflower lines, or to justify a reduction in containment conditions. This includes:

- additional molecular and biochemical characterisation of the GM safflower lines, particularly with respect to production of potential toxins or allergens
- additional phenotypic characterisation of the GM safflower lines, particularly with respect to traits that may contribute to weediness
- additional information on long distance gene flow between safflower crops.

Section 5 Conclusions of the RARMP

173. The risk assessment concluded that this proposed limited and controlled release of GM safflower on a cumulative maximum area of 7 ha over three growing seasons at sites in the ACT, near Narrabri in NSW, and in Wagga Wagga in NSW poses negligible risks to the health and safety of people or the environment as a result of gene technology.

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

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Appendix A Summary of submissions from prescribed experts, agencies and authorities[4]

The Regulator received submissions from prescribed experts, agencies and authorities on the consultation RARMP. All issues raised in submissions that related to risks to the health and safety of people and the environment were considered in the context of the currently available scientific evidence and were used in finalising the RARMP that formed the basis of the Regulator's decision to issue the licence. Advice received is summarised below.

Sub.	Summary of issues raised	Comment
1	As no materials from the GM safflower will be used for human food, has no comments on the licence application.	Noted.
2	Saffron thistle is a serious weed in the ACT, NSW and Victoria. Outcrossing between safflower and weedy relatives should be addressed in the RARMP.	As discussed in Chapters 1 and 2 of the RARMP, outcrossing between safflower and saffron thistle, or other weedy relatives present in Australia, produces hybrids that are sterile, and thus unable to spread or persist. In addition, licence conditions restrict outcrossing between safflower and weedy relatives by requiring that during flowering of GM safflower, any weedy relatives growing within 200 m of the trial site must be destroyed.
	No real concerns about safety of the transgene.	Noted.
3	Some caution is needed when modifying biosynthetic pathways that could alter membrane lipids, possibly causing unintended pleiotropic effects. However, considers possible pleotropic effects are limited in this case.	The potential for unintended effects is discussed in Chapters 1 and 2 (risk scenarios 1 & 2) and areas of uncertainty relating to unintended effects are noted. However, it is concluded that negligible risks are posed in the context of the limits and controls of the release.
	Agrees with the OGTR assessment that the proposed dealing poses negligible risk of harm to human health or the environment and considers that the licence has appropriate containment and isolation requirements	Noted.
4	Risk due to the small seed size of safflower, which could lead to loss during harvest or transport.	Loss of a small percentage of safflower seed during harvest is considered inevitable, as discussed in Chapters 2 and 3 of the RARMP. To minimise dispersal of seeds lost during harvest, licence conditions require that any areas where safflower seed may have fallen during harvest must be tilled within 14 days of the harvest in order to bury residual seed, then must be monitored for at least 12 months to destroy any volunteer safflower plants that emerge. The licence holder is required to transport safflower seed in accordance with the Regulator's *Guidelines for the Transport, Storage and Disposal of GMOs*. The guidelines set out measures for containment of GM seed during transport, and contingency plans for the unlikely event of a spill.

[4] Prescribed agencies include GTTAC, State and Territory Governments, relevant local governments, Australian Government agencies and the Minister for the Environment.

Sub.	Summary of issues raised	Comment
	Risk due to strong tendency of safflower to outcross – outcrossing rate of 0-100% (Claassen 1950). Bees can fly distances of >1 km. Is it possible to exclude bees from the trial site during flowering or to apply insecticide during flowering?	The paper cited (Claassen 1950) studied safflower cultivars grown in the United States in the 1940s. As discussed in Chapters 2 and 3 of the RARMP, modern safflower cultivars grown in Australia are >90% self-pollinating, and the rates of bee-mediated cross-pollination drop off rapidly with distance. To manage the risk of gene flow, licence conditions require related species to be controlled within 200m of GM trial sites, and no other safflower crop may be grown within 600 m of the GM safflower. These measures are considered to be effective in managing gene flow. The suggested alternative control measures are not considered to be necessary to effectively manage risk and may not be practically feasible.
	Are the trial sites in regions that are known to have weedy *Carthamus* species? If so, can safflower pollinate these species to produce viable and fertile hybrids?	As discussed in Chapters 1 and 2 of the RARMP, weedy *Carthamus* species are widespread in Australia, so are likely to be present near the trial sites. However, outcrossing between safflower and weedy relatives present in Australia produces hybrids that are sterile, and thus unable to spread or persist. In addition, licence conditions restrict outcrossing between safflower and weedy relatives by requiring that during flowering of GM safflower, any related species growing within 200 m of the trial site must be destroyed.
5	Recommends that the Regulator further consider measures to limit seed dispersal, particularly by birds.	As discussed in Chapters 1 and 2 of the RARMP, safflower seeds that are eaten by birds are not viable when excreted. Information regarding potential bird-mediated seed dispersal by pathways other than consumption has been added to the RARMP. Licence conditions requiring deterrence of birds by bird scarers or bird netting are considered sufficient to minimise seed dispersal.
	Recommends that the Regulator clarify the potential for the silencing construct to produce a protein.	The RARMP has been reworded for clarity.
	Agrees with the overall conclusions of the RARMP.	Noted.
6	Satisfied with the conclusions of the draft RARMP.	Noted.
7	No concerns with the proposed trial given the conditions specified in the RARMP.	Noted.
8	Supports the application as the evidence supplied indicates that the genetic modifications are within the scope for this crop and would pose negligible risks.	Noted.
9	Supports approval of the licence on the terms indicated in the RARMP.	Noted.

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