

ENVIRONMENTAL RISK MANAGEMENT AUTHORITY DECISION

**Amended under S67A; 27 March 2002; 16 November 2004; 18 November 2005,
30 August 2007, 12 November 2008 and 11 March 2010**

Application Code	GMF98009 Part 1	Original Decision	18 November 1999
Hearing Date	25 August 1999		
Considered by	Special Committee of the Authority appointed under <i>section 19(2)(b)</i> of the Hazardous Substances and New Organisms Act 1996.		

Application Details

Application Code	GMF98009
Applicant	New Zealand Pastoral Agricultural Research Institute Ltd (AgResearch)
Purpose	To field test, in Waikato, genetically modified cattle with extra bovine genes, the insertion of the human myelin basic protein gene, and the deletion of the bovine beta-lactoglobulin gene. Genes will be expressed in the milk of the cattle.
Date Application Received	11 December 1998

Decision

The **following organisms** are approved for field testing, with controls:

1. *Bos taurus* (cattle); Construct: casein^{plus} (insertion of additional cattle milk casein protein genes); Phenotype: enhanced expression of casein in the milk of genetically modified cattle to increase the casein content of milk relative to that of total solids.
2. *Bos taurus* (cattle); Construct: BLG^{minus} (disruption of the cattle β -lactoglobulin locus, to inactivate the gene); Phenotype: reduced β -lactoglobulin content of milk of genetically modified cattle relative to total solids.

Consideration of the field testing of the following organism has been adjourned to enable additional information to be obtained under *section 58(1)(a)* of the Act. This information relates to the measures which may be taken to ameliorate any adverse effects for Māori which may arise from the proposed modification (especially Ngāti Wairere, the hapū which has manawhenua status).

3. *Bos taurus* (cattle); Construct: Myelin Basic Protein (MBP) cattle (insertion of the human myelin basic protein gene); Phenotype: Expression of the human myelin basic protein in the milk of genetically modified cattle.

The remainder of this decision relates only to the two modifications which have been approved.

Application Process

The application was formally received on **11 December 1998**, and verified on 12 March 1999, following a number of additional information requests.

The application was publicly notified on **17 March 1999** in *The Dominion*, *The New Zealand Herald*, *The Press* and *The Otago Daily Times*.

Public submissions closed on **30 April 1999**. Thirty submissions were received. A list of submitters is attached as Annex 1 to this decision.

The documents available for the evaluation and review of the application by ERMA New Zealand included: the application (including supporting documentation and confidential information provided), public submissions, submissions and comment from other government agencies [including the Ministry of Agriculture and Forestry (MAF) and the Ministry of Health], and an external scientific review (of the application and submissions) undertaken by Professor Hugh Blair.

In accordance with *section 19(2)(b)* of the Hazardous Substances and New Organisms Act 1996, the Authority appointed a Special Committee to determine the application. The Committee comprised members of the Authority, including: Professor Barry Scott (Chairman), Helen Hughes, Bill Falconer, Dr Oliver Sutherland, Professor Colin Mantell one external member, Leatrice Welsh (expert in Māori culture and traditions).

A public hearing was held on 25 August 1999 in Wellington, with submissions being received from the parties listed below. In addition the Committee invited members of Te Kōtuku Whenua, of Ngāti Wairere, the hapū which has manawhenua over the land on which the field test is to be undertaken, to attend the hearing to provide further information on the risks to the relationship of Māori and their culture and traditions with taonga.

Presentations

Presentations were made to the Special Committee by the following parties:

For the applicant:

1. Dr Keith Steele Chief Executive, AgResearch
2. Dr Phil L'Huillier Scientist, AgResearch
3. Professor Pat Sullivan Massey University

For Ngāti Wairere:

1. Meto Hopa Kaumātua (Ngāti Wairere)
2. Maree Pene Director, Te Kōtuku Whenua (Ngāti Wairere)
3. Jackie Amohanga Researcher, Te Kōtuku Whenua (Ngāti Paretekawa, Kaputui)
4. Maria Henry Te Kōtuku Whenua (Ngāti Wairere)
5. Malibu Hamilton Researcher, Te Kōtuku Whenua (Ngāti Te Wehe)

For ERMA New Zealand:

1. Elizabeth Beale Project Leader, ERMA New Zealand

For Ngā Kaihautū Tikanga Taiao¹:

1. Gerrard Albert Ngā Kaihautū Tikanga Taiao

Submitters:

1. Angeline Greensill Private
2. Martin Dawson **Witness** to Angeline Greensill
3. Reuben Ashford Ngā Pukana, **Witness** to Angeline Greensill
4. Susan Redward Federated Farmers of NZ Ltd
5. Charlie Pedersen **Witness** to Susan Redward
6. Wendy McGuinness Private
7. Claire Bleakley Private
8. Dr Kevin Marshall New Zealand Dairy Board
9. Robert Lind New Zealand Food & Beverages Exporter's Council Inc.
10. Robert Welch NZ Biotechnologies Ltd
11. Noel K Wierzbicki Private
12. Berylla Berylla Private
13. Oraina Jones Private
14. Alan Fricker **Witness** to Berylla Berylla
15. David Foote Private
16. Pauline Blaikie **Witness** to Noel K Wierzbicki

Additional information sought and considered by the Committee included:

1. Further information on the benefits of the application (a part of this material was identified by the applicant as *commercially sensitive* and not released for comment).
2. Information on the impact of spiritual/cultural affront to Māori health (to the social and cultural wellbeing of people and communities).

The information detailed above was forwarded to *parties*² to the application for comment. The Committee considered comments received.

Relevant Legislative Criteria

The application was lodged pursuant to *section 40* of the Hazardous Substances and New Organisms Act 1996, and determined in accordance with *section 45*, the additional matters contained in *sections 37* and *44*, and the matters set out in Part II of the Act.

Consideration of the application followed the relevant provisions of the Hazardous Substances and New Organisms (Methodology) Order 1998 (the *Methodology*).

The Application

The part of the application decided upon is for approval to produce and field test in containment, cattle containing two different genetic modifications, producing two different

¹ Ngā Kaihautū Tikanga Taiao has been formally established under *clause 42* of the First Schedule to the Hazardous Substances and New Organisms Act 1996, as a Māori advisory committee, to advise the Authority on how to take account of issues of concern to Māori (particularly in relation to *sections 6(d)* and *8* of the Act).

² Parties: Including submitters, the applicant and relevant Government agencies from whom comment on the application was received.

phenotypic outcomes, in order to evaluate the milk produced. The two modifications are for casein^{plus} and BLG^{minus} cattle, and are designed to alter the protein content and composition of the milk, and thus its processing characteristics and nutritive value or allergenic properties respectively.

Scope of the Application

The development of genetically modified embryos has or will be undertaken by AgResearch at the Ruakura Research Centre, in accordance with approvals under the Hazardous Substances and New Organisms Act 1996 by AgResearch's Ruakura Institutional Biological Safety Committee (IBSC) under delegated authority from the Environmental Risk Management Authority (the Authority).

The application and additional information provided by the applicant identify a range of regulatory and marker sequences that may be utilised in various constructs to produce cattle of the phenotypes identified. The controls on this approval specify that, any further constructs and genetically modified embryos to be developed, using different combinations of regulatory sequences to those identified in the application and additional information, must be approved by AgResearch Institute's Ruakura IBSC prior to production and field testing of genetically modified cattle. **Schedule 1** to this decision defines the scope of any further constructs to be utilised for the production and field testing of cattle under this approval.

The production and field testing of cattle from these embryos will be undertaken at AgResearch's Ruakura Research Centre. The applicant intends to produce two herds of up to thirty genetically modified cattle each. The total number of cattle involved in the field test, including genetically modified and conventional cattle, will not exceed the capacity of the containment facility³, as approved under the MAF/ERMA New Zealand Animal Health and Welfare Standard 154.03.06, and will not at any one time exceed 200 animals. The purpose of the field test is to produce milk from the cows for evaluation.

In essence, this application covers an extension of research already undertaken on the development of the genetically modified embryos. The herds are to be maintained in containment, and there is no intention for the meat or offal from cattle in the herds to enter the human food chain, or that humans ingest milk from the herds. Nor is there any practical opportunity for these events to occur.

Key Issues

The Committee's consideration of the application encompassed those matters relevant to the application, and included:

1. The adequacy of the proposed containment regime, including:
 - i. The ability of the organism (or any heritable material) to escape from containment, including:
 - containment of bulls;
 - breach of containment following deliberate action; and
 - containment of semen and ova.
 - ii. The ability of the organism to establish a self-sustaining population.

³ The *containment facility* refers to the area where the genetically modified cattle are to be maintained, and that is registered by MAF under the Biosecurity Act 1993 as a *containment facility*.

- iii. The ease of eradication of any population established.

Other containment issues considered, included:

- i. Disposal of genetically modified cattle.
 - ii. Disposal of surrogate mothers.
 - iii. Disposal of milk.
2. The effects of the organism, including:
 - i. Animal welfare issues.
 - ii. Risks to the environment.
 - iii. Risks to public health.
 - iv. Risks to the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, valued flora and fauna, and other taonga.
 - v. The maintenance and enhancement of the capacity of people and communities to provide for their own economic, social, and cultural wellbeing and for the reasonably foreseeable needs of future generations.
 3. The principles of the Treaty of Waitangi and in particular the requirement to consult effectively.
 4. The benefits to be derived from the application.

Adequacy of the Proposed Containment Regime

The Committee's consideration of the adequacy of the proposed containment regime, included:

- i. the ability of the organism to escape from containment;
- ii. the ability of the organism to establish a self-sustaining population; and
- iii. the ease of eradication of any population established.

The ability of the organism to escape from containment

In considering the ability of the organism to escape from containment, the Committee considered *inter alia*, the following specific points:

- i. breach of containment following deliberate action;
- ii. containment of bulls; and
- iii. containment of semen and ova.

The specific location of the containment facility within the Ruakura Research Centre has been provided to the Committee in confidence.

The Committee was satisfied, subject to the controls imposed in this decision, that the containment regime could adequately contain cattle as a part of this field test. The controls require cattle to be produced and maintained in a registered containment facility, operated, constructed and managed in accordance with the Ministry of Agriculture and Forestry

(MAF)/ERMA New Zealand (Animal Health and Welfare Standard) 154.03.06: *Containment Standard for Field Testing of Farm Animals*, and to comply with other controls as specified in this decision.

Additional measures have been put in place over and above the requirements of the standard, to further reduce the probability of any escape of cattle from the containment facility. These include: the erection of two 2 metre perimeter fences (instead of the single 2 metre fence required in the relevant standard), and the installation of a system to electronically monitor the perimeter fencing in order to promptly detect any interference or break in the fence.

Under this regime, the Committee concludes that the probability of an escape from the facility is very low.

i. Breach of containment following deliberate action

The Committee was satisfied that the construction, operation and management of the containment facility minimises the possibility of any deliberate action or sabotage and minimises the possibility of any such action resulting in a breach of containment, taking into account the nature of the fencing, electronic monitoring of the inner perimeter fence, and the location of the containment facility within the Ruakura Research Centre.

In addition, identification measures in place for genetically modified cattle including ear tags and microchips would facilitate rapid retrieval of any animals should a breach of containment occur.

ii. Containment of bulls

Concerns were raised at the hearing regarding the ability of the applicant to contain bulls within the containment facility.

Taking into account the requirements of the standard and the proposed containment regime, the Committee concluded that the probability of bulls escaping from containment is very low. In addition, the location of the containment facility within the AgResearch Ruakura Research Centre would allow close supervision of the small number of bulls to be maintained.

iii. Containment of semen and ova

Any semen or ova derived from the genetically modified cattle is regarded as genetically viable or heritable material and must be retained within the containment facility. Semen or ova may only be transferred out of the containment facility pursuant to an approval for release granted under *section 38* of the Act.

The ability of the organism to establish a self-sustaining population and the ease of eradication

Cattle are domesticated animals, and the probability of the cattle to be produced as a part of this trial, escaping undetected and then establishing a self-sustaining population is very low. All conventional cattle are required to be double tagged, and all genetically modified cattle are required to carry both visible ear tags and a sub-cutaneous microchip. All cattle would therefore be readily identifiable and retrievable.

Similarly, the probability of escape, and then entry into the national herd, through undetected breeding is very low.

Other Containment Issues

Consideration was given to the following aspects with respect to containing the organisms and any biological material:

- i. disposal of genetically modified cattle;
- ii. disposal of surrogate mothers; and
- iii. disposal of waste milk.

i. Disposal of genetically modified cattle

The application proposes that genetically modified cattle, aborted foetuses and offspring from the cattle be disposed of by incineration or burial on-site⁴ in a District Council approved pit.

All genetically modified cattle foetuses and non-genetically modified offspring shall be disposed of by incineration or deep pit burial on-site, in accordance with the requirements of the MAF/ERMA New Zealand Standard 154.03.06.

ii. Disposal of surrogate cows

The applicant requested that any controls imposed by the Committee regarding the disposal of cattle no longer required for the field test allow for the sale of conventional cattle that have failed to become pregnant following embryo transfer.

Consideration was given to whether the sale of conventional cattle that have failed to become pregnant would pose any threat to the environment or public health. The key issues included the possibility of conventional cows following embryo transfer containing any genetically modified cells and the possibility of any failure to detect a pregnancy.

Following embryo transfer, if the animal becomes pregnant but aborts the pregnancy at an early stage, embryonic foetal red cells that reach the maternal circulation and which are 'genetically modified' will circulate for the life of the red blood cell. The life cycle of the foetal red blood cell may be up to 50 days.

The applicant proposes to undertake three pregnancy scans (by ultrasonography) in order to verify pregnancy in conventional cows. Following three negative pregnancy tests the possibility of any cow being pregnant is very low.

The Committee has therefore accepted that conventional surrogate cows that fail to become pregnant may be sold or otherwise disposed of off-site. However the release of such animals from the containment facility is contingent on the animal producing three negative pregnancy scans performed at approximately 28, 35 and 50 days post embryo transfer, and, following the third negative pregnancy scan, holding the cows for a further period of 50 days prior to removal from the containment facility.

⁴ On-site refers to any place on AgResearch property within the Ruakura Research Centre.

iii. Disposal of milk

Additional information supplied by the applicant proposed several methods of disposal of milk derived from genetically modified cows. These included, incineration or autoclaving of small quantities of milk from induced lactation of genetically modified cows at 6-9 months of age, and for surplus milk from lactation of mature genetically modified cows, disposal via incineration, spraying onto pasture, or digestion in an effluent digester, either on-site or by a local effluent disposal company.

Issues were raised by a number of parties to the application regarding the potential risk of contamination of ground water as a result of spraying milk derived from genetically modified cattle onto pasture. However, the issue of pollution of groundwater (or other water) as a result of the land disposal of milk is a matter which is managed under the Resource Management Act 1991. Disposal of milk via treatment and spraying onto pasture is not a possible route for the escape of heritable material and therefore a matter more appropriately dealt with under the RMA.

Control conditions on this approval therefore provide for disposal of waste milk and cream by effluent digester or incineration on-site, or following treatment in order to destroy any cells present in the milk, spraying onto pasture on-site. It is also required that milk derived from genetically modified cattle and used in further experimentation be retained on-site and be disposed of in the same manner when no longer required for experimentation purposes.

Effects of the Organism (Risks to the Environment and Human Health and Safety)

Animal Welfare

A number of issues related to animal welfare were raised at the hearing. This included issues associated with:

- (a) the delivery of calves by caesarean section;
- (b) induced lactation of animals aged 6-9 months; and
- (c) aberrant behaviour of genetically modified cattle as against conventional cattle.

The applicant is required to comply with the relevant sections and regulations of the Animals Protection Act 1960 (and after 1 January 2000, the Animal Welfare Act 1999), and the Animal Welfare Advisory Committee (AWAC) and National Animal Ethics Advisory Committee (NAEAC) guidelines administered by MAF. Any work involving the manipulation of animals undertaken in the course of the production and field testing of cattle must also be in accordance with a code of ethical conduct approved by an Animal Ethics Committee (AEC), in this case the Ruakura AEC.

It is also required, as a condition on this approval, that the applicant report from an animal welfare perspective on issues including; behaviour traits of genetically modified cattle as against unmodified cattle in the field test; number and explanation of caesarean sections performed for genetically modified cows; and any issues associated with the induced lactation of genetically modified calves.

In addition the applicant is required to forward to ERMA New Zealand any reports provided to the relevant AgResearch AEC.

Risk to the Environment

There is no identifiable risk to the environment from cattle within the containment facility itself. For any effects on the wider environment to be realised as a result of this containment application, the organism or any heritable material must first escape into that environment, and either form a self-sustaining population or enter the national herd undetected.

Possible effects on the environment, including people and communities, should any cattle escape, were identified as including, entry of genetically modified cattle into the human food chain. This issue has been dealt with below in the context of risks to public health.

Consideration was also given to whether genetically modified cattle would have any effects on the natural environment different to that of conventional cattle. Cattle are domesticated animals and cannot interbreed with any other native or valued fauna. In addition, genetically modified cattle do not pose any threat to native or valued flora greater than that of conventional cattle.

The effects of genetically modified cattle on the environment should they escape are therefore not considered to be significant.

As noted above, under the proposed containment regime, including controls imposed in this decision, the Committee has concluded that the probability of escape from the facility is very low. In addition it notes that the probability of an escape resulting in entry of genetically modified cattle into the national herd through undetected breeding is very low

The Committee is therefore of the view that the risks posed by this containment application to the environment are negligible.

Risk to Public Health

In the event that the cattle to be produced were to escape from containment, and measures in place to retrieve the cattle failed, risks to public health could arise as a result of the following consequences:

- (a) consumption of milk/meat derived from genetically modified cattle;
- (b) consumption of manufactured products (eg casein, cheese, sausage) derived from genetically modified cattle; and
- (c) any long term unanticipated health effects.

Consumption of milk/meat derived from genetically modified cattle

The key issue is that of whether human consumption is likely to occur at all. The herds produced under this approval are to be maintained in containment, and there is no intention for the meat or offal from genetically modified cattle, or cattle that have given birth to genetically modified calves, to enter the human food chain. Nor is there any intention that humans ingest milk from the herds. The probability of genetically modified cattle escaping is also very low and the probability of genetically modified beef, offal or milk entering the human food chain undetected is thus also very low.

The BLG^{minus} cattle are ‘knockout’ cattle, and therefore will have a cattle protein, β -lactoglobulin, present in lower than normal quantities in their milk. Casein^{plus} cattle contain additional copies of a gene that codes for a cattle milk protein, and therefore it is anticipated that these cattle will produce more casein in their milk. In all cases the milk will contain some modified genetic material. As the transgenes will be present in every cell of the cattle, they will also be present in the meat.

As regards the potential harm to human health resulting from human ingestion of meat, offal or milk from BLG^{minus} and casein^{plus} cattle should it occur, the Committee concluded that as only the relative composition of cattle milk proteins has been altered, the possibility of any ill effects resulting is extremely unlikely.

Therefore, the Committee concluded that the risk to public health arising from this application is negligible.

Potential future uses of products derived from genetically modified cattle in the food chain

While the applicant has no intention of producing food products, if in the future food products were to be developed from casein^{plus} and BLG^{minus} cattle, approvals from the Australia New Zealand Food Authority (ANZFA), would be required before production of products for release could be undertaken.

Long-term unanticipated health effects

The Committee received a number of submissions expressing concerns that the processes and consequences of genetic modification are insufficiently established for the applicant to be able to provide assurance that there will be no unanticipated long term adverse effects on either the environment or human health.

These submissions covered several grounds:

- the uncertainty of genetic modification as a science obliged the Committee to take a precautionary approach under the Act;
- field testing, in addition to being risky in itself because of risks of the organism escaping, was in any case unlikely to extend over a sufficient period of time for long term adverse effects to materialise, so that eventual release applications would proceed without adequate evaluations of the risks;
- the possibility of escape during the field test period, or of inter-breeding following release would jeopardise New Zealand’s expanding organic agricultural and horticultural industries, and its ‘clean green’ image;
- the possibility of long term adverse effects materialising well into the future had to be taken into account in considering the well-being of future generations; and
- if the Committee is able to take into account hypothetical benefits then it should also take into account hypothetical risks.

In terms of the Act the Authority can consider these kinds of issue in relation to:

- the requirement under *section 5(b)* to recognise and provide for the maintenance and enhancement of the capacity of people and communities to provide for their own economic, social and cultural well-being and for the reasonably foreseeable needs of future generations; and
- the requirement under *section 7* Act to take account of the need for caution in managing adverse effects where there is scientific and technical uncertainty about those effects.

The Committee does not dismiss any of the concerns expressed. However, concerns regarding scientific uncertainty, and potential long term adverse impacts on future generations are more relevant to release applications than to an application covering the conduct of research in containment. There may be some scientific uncertainty regarding the potential consequences of the genetic modifications proposed in the present application, but this will not result in adverse consequences for the environment, human health, or future generations while the research is undertaken in containment, and the caution required of the Authority relates to the adequacy of the containment conditions and management regime. In this regard the Authority considers the risks to be negligible for current and future generations alike.

The Committee considers however, that the applicant should take note of the concerns expressed, and be prepared to address them in the event that an application is made to release products or material derived from genetically modified cattle.

At that time the possibility of long term adverse consequences can be expected to be more determinative. This decision relates only to the proposed development of the applicant's research, and should not be taken as any commentary on the safety of any products which may be derived from genetically modified cattle.

Risk to the Relationship of Māori and their Culture and Traditions with Taonga

In taking into account the principles of the Treaty of Waitangi, the applicant, ERMA New Zealand and the Authority held consultations with a number of people associated with Ngāti Wairere, the Tainui hapū which has manawhenua over the land on which the research is to be conducted, and particularly with Te Kōtuku Whenua, a group within the hapū which has undertaken considerable research on environmental issues, and whose representatives appeared at the hearing.

Those consulted contended that each of the proposed constructs would create risks for the relationship between Māori and their culture and traditions with their taonga, irrespective of the fact that the cattle will remain in containment. However no specific objections were addressed to the proposed development of genetically modified cattle not involving human genes ie casein^{plus} and BLG^{minus}. In these cases the modifications do not involve any human genes. The Committee has thus concluded that there are no significant risks under *section 6(d)* of the Act as regards these constructs.

The Committee noted that a control on this decision requires the applicant to maintain on-going consultation with Ngāti Wairere regarding protocols for the disposal of genetically modified cattle and other heritable material.

Beneficial Effects

The Committee concluded that the benefits of the application, as regards each of the proposed constructs, fell into two parts.

The immediate benefit, as with all research, is the scientific information expected to be gained - in this case from the development of genetically modified cattle based on transfers of genetically modified embryos, with the result, if successful, that the proteins generated by the genetic modifications will be expressed in the milk of the cattle.

For the longer term there may be commercial benefits, but these will only materialise as a consequence of second phase research to be undertaken to establish the characteristics of the milk derived from genetically modified cattle, and at this point it would be premature to speculate on what those benefits might be.

Indeed, the Committee acknowledges that the degree of long term benefit to be derived from this research, as with all fundamental research, is difficult to quantify. However, that is not to say that the knowledge accumulated in the research is not beneficial as that information adds to the pool of knowledge from which other benefits flow, and the Committee accepts that exploratory research is an essential prerequisite for scientific progress.

Immediately, and for the purposes of most containment applications therefore, the issue is not so much whether the longer term benefits outlined will be achieved, but whether research leading to those potential benefits is a legitimate and valuable scientific endeavour.

As regards the casein^{plus} and BLG^{minus} modifications, these have been endorsed for funding by the Foundation for Research, Science and Technology (FRST). The Committee accepts that given the significance of the dairy and wider pastoral industries in New Zealand, its research institutions should be at the leading edge of research into the genetic factors which control and regulate milk production (including milk composition, quality and enhanced characteristics) and of associated biotechnological innovation, including recombinant research, and technologies of nuclear transfer (cloning) and surrogacy.

The overall evaluation of risks, costs and benefits and conclusions

1. Pursuant to *section 45(1)(a)(i)* of the Act, the Authority is satisfied that this application is for one of the purposes specified in *section 39(1)* of the Act, being *section 39(1)(b): Field testing any new organism*.
2. The risks to the environment and human health from the possible escape of the genetically modified cattle (comprising two genetic constructs) are considered to be negligible, given the nature and extent of the containment and cattle management regime set out in this decision.
3. As regards the proposed casein^{plus} and BLG^{minus} constructs, the risks to the relationship between Māori and their taonga are not in themselves significant. There are scientific benefits to be obtained from the proposed research. Having considered all the possible effects of the organism, in accordance with *sections 45(1)(a)(ii)* and *(iii)* of the Act, the Committee is thus of the view based on consideration and analysis of the information provided and taking into account the application of risk management controls specified in

this decision, that the risks of adverse effects associated with the field testing of genetically modified cattle containing these two modifications, are outweighed by the benefits of conducting the research in containment.

The Committee is satisfied that the proposed containment regime together with the additional controls imposed by the Authority will adequately contain the organism.

The application for the casein^{plus} and BLG^{minus} – constructs is thus approved, with controls.

Controls

In order to provide for the matters detailed in Part I of the *Third Schedule* to the Act, *Containment Controls for Development and Field Testing of Genetically Modified Organisms*, the approved organisms are subject to the following controls:

1. To limit the likelihood of any accidental release of any organism or any viable genetic material⁵:

- 1.1 The applicant before field testing cattle containing any construct not yet developed, shall obtain development approval, under the Hazardous Substances and New Organisms Act 1996, from the AgResearch Institute's Ruakura Institutional Biological Safety Committee (IBSC) and provide a declaration in writing to the Authority verifying that:
 - 1.1.1 the construct and genetically modified embryo has been developed in accordance with an approval under *section 39(1)(a)* of the Act;
 - 1.1.2 the construct and genetically modified embryo complies with the requirements detailed in the attached schedule to this decision; and
 - 1.1.3 the genetically modified cell line (nuclear donor) from which the embryo is produced contains the transgene (verified by methods including, but not limited to, the Polymerase Chain Reaction (PCR) or Southern hybridisation analysis).
- 1.2 The field test of genetically modified cattle shall be carried out in a *containment facility*⁶ approved by the Ministry of Agriculture and Forestry (MAF) under the Biosecurity Act 1993, in accordance with the MAF/ERMA New Zealand Animal Health and Welfare Standard 154.03.06⁷: *Containment Standard for Field Testing Farm Animals*.
- 1.3 ERMA New Zealand shall be advised of any changes to the timetable for the production of genetically modified cattle and of the field trial of genetically modified cattle if different than indicated in the application.
- 1.4 The maximum number of cattle⁸ in the field trial shall not exceed the capacity of the containment facility as approved under the MAF/ERMA New Zealand Animal Health and Welfare Standard 154.03.06⁷, and shall not at any one time exceed 200 animals.
- 1.5 The production and maintenance of genetically modified cattle in the containment facility shall be in accordance with the relevant sections and regulations of the Animals Protection Act 1960 (and after 1 January 2000, the Animal Welfare Act 1999), the Animal Welfare Advisory Committee (AWAC) and National Animal Ethics Advisory Committee (NAEAC) guidelines administered by MAF, and the local AgResearch Institute's Animal Ethics Committee (AEC).

⁵ Viable Genetic Material is biological material that can be resuscitated to grow into tissues or organisms. It can be defined to mean biological material capable of growth even though resuscitation procedures may be required, eg when organisms or parts thereof are sublethally damaged by being frozen, dried, heated, or affected by chemical.

⁶ The *containment facility* refers to the area where the genetically modified cattle are to be maintained, and that is registered by MAF under the Biosecurity Act 1993 as a *containment facility*.

⁷ Any reference to this standard in these controls refers to any subsequent version approved or endorsed by ERMA New Zealand

⁸ Including; genetically modified cattle, non-modified cattle and conventional cattle.

- 1.6 At all times only persons authorised by the Operator or the Manager of the containment facility shall have access to the field trial site (containment facility).
- 1.7 All conventional cattle in the field trial shall be double tagged (ie by two different ear tags). All genetically modified cattle shall be individually identified by an ear tag for visible identification and also implanted with a subcutaneous electronic microchip for individual electronic identification.
- 1.8 The identification system for genetically modified cattle shall enable the information on the genotype and generation (F0, F1 etc) to be derived from a database maintained by the applicant.
- 1.9 The applicant shall maintain a register with records of identity and fate of all cattle in the field trial.
- 1.10 No genetically modified cattle are permitted to leave the containment facility except in accordance with the MAF/ERMA New Zealand Standard 154.03.06⁷, as described in control 1.2.
- 1.11 Milking of genetically modified cattle shall be performed within the containment facility and the milk shall be transported, in secure containers to prevent spill, to the laboratory (a *containment facility* registered by MAF in accordance with the MAF Biosecurity Authority/ERMA New Zealand Standard 154.03.02⁷ *Containment Facilities for Microorganisms* and operated and managed in accordance with Australian/New Zealand Standard AS/NZS 2243.3:1995⁷ *Safety in Laboratories: Part 3: (Microbiology)*, at physical containment level 1 (PC1)) for evaluation. A log of the quantity of milk obtained and its fate shall be maintained and recorded in a register.
- 1.12 All genetically modified cattle no longer required for breeding and any biological material (including semen and ova) derived from genetically modified cattle no longer required for the purpose of this application shall be disposed of on-site⁹ in accordance with the requirements of the MAF/ERMA New Zealand Standard 154.03.06⁷ Conventional cattle may be disposed of off site, but shall not leave the containment facility until 50 days after the third negative pregnancy test, ie performed at approximately 28, 35 and 50 days post-embryo transfer.
- 1.13 All waste milk, skim milk, and cream shall be disposed of on-site by either an effluent treatment digester, incineration, or by spraying onto pasture following treatment in order to destroy any cells present in the milk.
- 1.14 In the event that operations involving genetically modified cattle cease, all genetically modified cattle in the containment facility shall be destroyed and all biological material (including semen and ova) derived from genetically modified cattle shall be disposed of on-site in accordance with the requirements of the MAF/ERMA New Zealand Standard 154.03.06⁷
- 1.15 The containment facility shall be enclosed by double 2 metre high perimeter fences constructed in accordance with the requirements specified in MAF/ERMA New Zealand Standard 154.03.06⁷. The inner perimeter fence shall be *electronically monitored and alarmed* (in order that the location of any breach of containment is detected immediately), stock-proof and capable of preventing entry and escape of cattle.

⁹ On-site refers to any place on AgResearch property within the Ruakura Research Centre.

- 1.16 The applicant shall engage in on-going consultation with Ngāti Wairere regarding protocols for the disposal of genetically modified cattle and biological material derived from genetically modified cattle.
- 1.17 From the end of the current approval period on 18 November 2008 the genetically modified (GM) cattle and/or derived biological material may continue to be held under this approval. However, no further breeding or production of any progeny may be initiated. This approval expires when all the GM cattle are dead.

2. To exclude unauthorised people from the facility:

- 2.1 The applicant shall comply with the requirements contained in the standard listed in control 1.2 relating to identification of entrances, numbers of, and access to entrances, and security requirements for the entrances and the facility.

3. To exclude other organisms from the facility and to control undesirable and unwanted organisms within the facility:

- 3.1 The applicant shall comply with the requirements contained in the standard listed in control 1.2 relating to exclusion of other organisms from the facilities and the control of undesirable and unwanted organisms within the facilities.
- 3.2 In the event of mortality in genetically modified cattle in the containment facility, carcasses shall be immediately removed to prevent access by scavengers and the carcasses shall be disposed of on-site.

4. To prevent unintended release of the organism by experimenters working with the organism:

- 4.1 The applicant shall comply with the requirements contained in the standard listed in control 1.2 relating to the prevention of unintended release of genetically modified cattle by experimenters working with the cattle.
- 4.2 No part or product of the transgenic organism shall be ingested by any person at any time.

5. To control the effects of any accidental release or escape of an organism:

- 5.1 In case of unintended or accidental release or escape of genetically modified cattle involved in the field trial, the applicant shall recover the escaped cattle to the containment facility. If there has been any possibility of mating occurring, steps shall be taken to abort any possible resulting pregnancies. If abortion technique is not successful, the affected cattle shall be slaughtered and disposed of on-site.
- 5.2 If a breach of containment occurs, the facility operator must ensure that the MAF Inspector responsible for supervision of the facility has received notification of the breach within 24 hours.

6. Inspection and monitoring requirements for containment facilities:

- 6.1 The inspection and monitoring requirements for containment facilities shall be in compliance with the standards listed in control 1.2.

16 November 2005; control 6.4 amended by omitting the words “six years” and substituting the words “nine years” extending the duration of the approval by three years.

Chair

18 November 2005
Date

Dr Kieran Elborough

Amendment: November 2006

Changes to controls:

- Addition of footnotes to the containment facility references and the Australian/New Zealand containment facility references to “future proof” the decision
- Standardise the wording of the breach of containment control
- Replacement of the control regarding inspection of facilities by the Authority, its agent or enforcement officers with the standard control

Dr Kieran Elborough
Chair

Date: 30 August 2007

Amendment: November 2008

- Addition of control 1.17 to clarify the handling and disposal requirements for genetically modified cattle and/or derived biological material at the end of the approval period.
- Amendment of control 6.4 to clarify when the final report must be provided to ERMA New Zealand as a consequence of the addition of control 1.17.

Dr Kieran Elborough
Chair

Date: 12 November 2008

Amendment: March 2010

- Amendment of control 1.17 to clarify the holding requirements of the genetically modified cattle and derived biological material at the end of the approval period. The Committee noted that in the future, animals and derived biological material held under this approval may be regulated under new approval(s).
- Amendment of control 6.4 to clarify when the final report must be provided to ERMA New Zealand.

Dr Kieran Elborough
Chair

Date: 11 March 2010

Schedule

Organism:	Cattle (<i>Bos taurus</i>)
Construct 1:	casein ^{plus} (insertion of additional cattle milk casein protein genes).
Phenotype 1:	Enhanced expression of casein in the milk of genetically modified cattle to increase the casein content of milk relative to that of total solids.
Construct 2:	BLG ^{minus} (disruption of the cattle β -lactoglobulin locus, to inactivate the gene).
Phenotype 2:	Reduced β -lactoglobulin content of milk of genetically modified cattle relative to total solids.
Genetic modifications:	The constructs shall contain only genes, promoters and marker sequences provided to the Authority in confidence in the application and additional information provided in confidence on 30 June 1999 (regarding a further milk protein gene promoter sequence).

Submissions received: Application GMF98009

Submitter	Contact
1. Chris Todd	Private
2. Multiple Sclerosis Society of New Zealand Inc	Dr Tom Miller
3. Mr V Minter	Private
4. Sue Sinclair	Private
5. Neville Sinclair	Private
6. Janice Molloy	Private
7. Claire Bleakley	Private
8. Eric Beardsley	Private
9. PPL Therapeutics	Mike Aitkenhead
10. Maternity Services Consumer Council	Lynda Williams
11. Federated Farmers of New Zealand Ltd	Susan Redward
12. Oraina Jones	Private
13. New Zealand Biotechnologies Ltd	Robert Welch
14. Tom Veitch	Private
15. E Topp	Private
16. Dennis Enright	Private
17. Patricia Scott	Private
18. Susie Lees	Private
19. David Foote	Private
20. New Zealand Dairy Board	Chris Moller
21. Angeline Greensill	Private
22. Zela Charlton	Private
23. Wendy McGuinness	Private
24. Berylla Berylla	Private
25. New Zealand Food & Beverages Exporter's Council Inc.	Robert Lind
26. Sharon Grace	Private
27. Associate Professor Peter Wills	Private
28. Kabal & Gurpal Singh	Private
29. Noel K Wierzbicki	Private
30. James and Wendy Gunther	Private