

# Western Canada's Wheat Quality Control System:



## Future Directions



Canadian Grain Commission  
Commission canadienne  
des grains



The Canadian Wheat Board  
La Commission canadienne du blé

# Western Canada's Wheat Quality Control System: Future Directions

July 2000

## *To the Reader:*

This paper is intended to generate a wider understanding of wheat quality control issues and the implications of various options for the evolution of Western Canada's wheat quality control system. A further goal is the eventual movement toward consensus on the best directions to take. The overall objective of this process is an evolving wheat quality system that will result in maximum on-farm net revenue from domestic and export sales of wheat produced in the region.

The points raised in this paper have been prepared by staff of the Canadian Wheat Board (CWB), the Canadian Grain Commission (CGC), and the Canadian International Grains Institute (CIGI), in consultation with many groups and individuals throughout the wheat industry. This is an ongoing discussion process and many decisions remain to be made. Input from all interested parties is encouraged, and can be provided by contacting the Canadian Wheat Board or the Canadian Grain Commission at the coordinates listed below. In the future, there will be more discussions and consultations on specific issues arising from this general discussion paper. However, if you have comments on this paper, we would be pleased to consider them in our subsequent work. Please provide any comments by October 31, 2000.

Two key considerations underlie this entire discussion. The first is that the existing Western Canadian wheat quality control system has succeeded in delivering products that are viewed by customers as the best in the world. This reputation is highly valuable, and any changes to the system must be made with care. The second, somewhat conflicting, consideration is an assumption that we have no choice but to make changes to the current system. In recent years, several new challenges and opportunities have emerged and some longstanding issues have become more pronounced (examples are included in the paper). In fact, some significant changes have already been made. For example, the wheat variety registration process has moved away from a strict application of Kernel Visual Distinguishability (KVD) in all cases. More and more, decisions about the current system will not be a question of whether change will occur, but rather of the degree and speed with which changes are made.

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*Ce document est aussi disponible en français.*

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## Abbreviations

AQT	Automated Quality Testing
CFIA	Canadian Food Inspection Agency
CGC	Canadian Grain Commission
CPSR	Canada Prairie Spring Red
CPSW	Canada Prairie Spring White
CWB	Canadian Wheat Board
CWAD	Canada Western Amber Durum
CWES	Canada Western Extra Strong
CWRS	Canada Western Red Spring
CWRW	Canada Western Red Winter
CWSWS	Canada Western Soft White Spring
GMO	Genetically Modified Organism
HPLC	High-Performance Liquid Chromatography
KVD	Kernel Visual Distinguishability
PAGE	Polyacryamide Gel Electrophoresis
SKCS	Single Kernel Characterization System

## The Current Wheat Quality Control System

Wheat quality control in Western Canada has evolved over the last decades to depend on key four elements:

### 1) Varietal Registration and Kernel Visual Distinguishability (KVD)

Kernel Visual Distinguishability (KVD) is one of the key components in the Canadian registration system and its impact moves right through the entire grading and quality control system. It is unique to Canada. Before a variety can be registered for production in Western Canada, it must undergo careful scrutiny for end-use quality, agronomic performance and disease resistance, and be proven to be equal to or better in all these criteria than the reference variety for its class. It must also be shown not to conflict with the visual distinguishability rule that is used to separate wheats of different classes. The objective is to ensure that buyers receive wheat with consistent end use performance characteristics (e.g., milling and baking) and high inherent quality regardless of the class or grade they purchase.

There are two important features of KVD:

First, each of the seven wheat classes has been assigned a combination of seed-coat color and physical kernel configuration that is distinctive. The differences have to be great enough to permit grain inspectors to readily distinguish one type of wheat from another as they move from farms through primary elevators, terminals, and into ocean vessels. This separation is critical to assure consistency in end use quality. In the absence of replacement technology, contamination of one type of wheat with another would be inevitable without KVD.

A second aspect of KVD is just as important. This feature stipulates that a variety of wheat with the kernel shape of one of the wheat classes will have specific quality characteristics. The association between kernel shape and quality is direct and automatic. A variety that looks like a Canada Western Red Spring (CWRS) wheat must possess the established agronomic, disease resistance, and end-use quality characteristics (e.g., flour yield, protein content, gluten properties) or it will not be registered. Without such a guideline there would be little uniformity. The same principle holds true for the other wheat classes.

Because of the well-established and successful characteristics of the more important CWRS and CWAD classes, specific varieties have been designated the varietal standard of quality for the class – Neepawa for the CWRS class and Hercules for the CWAD class. This means that any new variety must equal the end-use quality characteristics of the standard. “Equal” does not mean “identical;” rather, the requirement is to be not unacceptably different. The concept is vital to maintaining quality standards as a new variety with superior performance in one area, (such as a significantly higher crop yield), must also meet the minimum requirements of all the other characteristics of the standard and must maintain the KVD for the class.

The development concept is the same for the smaller wheat classes only using *reference varieties* that have been shown to exhibit good characteristics for the class. If newer varieties can be developed that demonstrate significant improvement, then they, in turn, could become the reference varieties for future breeding efforts.

### 2) Grading System

The grading system in Canada sets maximum tolerance levels for a range of characteristics that ensure functionality, cleanliness and freedom from disease, noxious seeds or other deleterious factors.

The grading system is responsive to the customers’ end-use requirements and operates on a foundation of scientific support. Grade standards are based on the milling and final product requirements. The Grain Research Laboratory and the Industry Services Division of the Canadian Grain Commission (CGC) continually review the effects on end-use quality of the many grading factors encountered in Western Canada. As well, there is a direct line of feedback from customers either through the CWB or through the CGC when changes to grading standards are needed. This means that the grading factors for Canadian wheat are continuously relevant and responsive to the needs of customers.

In Canada, all export shipments are accompanied by a Canadian Grain Commission *Certificate Final* which indicates the official grade and weight of the shipment.

### 3) Uniformity

The geography of Western Canada and the marketing structure have created a transportation and handling system which causes grain of the same grade grown in different regions to be combined and blended by the time it reaches export position. Further to this, all classes of wheat delivered to Canadian export terminals are binned according to grade. These minimize regional variability, imparting uniformity between and within lots of similar grade.

During loading of a vessel, the wheat is inspected on a continuous basis to ensure that each shipment meets or exceeds the CGC official export standards established for each grade of grain. Only when the Canadian Grain Commission's Inspector-in-Charge is satisfied that the grade and weight of grain loaded to a vessel are correct is the *Certificate Final* issued. This certificate is the buyer's assurance of quality from the Canadian government.

In Canada uniformity is also assured through the registration system. With the strict quality requirements inherent in this system, there are very few new varieties introduced. Currently in Western Canada there are from 15 – 20 million metric tonnes of CWRS grown annually and about 80 per cent of the production comes from only seven varieties. This continuity contributes significantly to the maintenance of uniformity within and between shipments.

Canadian wheat has an enviable reputation for predictability (uniformity or consistency) from shipment to shipment and from year to year. In terms of flour yield, flour ash, protein content, gluten properties, falling number, baking absorption, loaf volume, or whatever the quality criteria may be, millers have a better idea of what they are going to get before they get it simply by buying the higher grades. This is very important to a miller in a wheat importing country, especially when a replacement shipment for a poor quality product could be weeks, if not months, away.

### 4) Cleanliness and Safety

All exports of Canadian grain are cleaned at terminal position and are thus "commercially clean," meaning that there is no dockage allowed. Therefore, Canadian wheat is extremely clean with respect to insect infestation, other cereal grains, or foreign material such as chaff, straw, weeds, or a dozen other possible contaminants. The strict grading standards and cleaning procedures, both at primary and export levels, ensure that buyers get exactly what they pay for, and that millers do not have excessive dockage to clean out. Higher milling yields are the result.

Grain safety is a major quality requirement. The Canadian Grain Commission monitors for numerous chemical residues, mycotoxins, and trace elements, providing the customer the assurance that grain shipments will meet the most stringent tolerances.

Canada's cold winter climate greatly reduces the use of pesticides compared to those used by other exporters. This means that Canadian wheat has negligible levels of infestation and there is very little use of chemicals.

## Why Change?

If Canada's quality assurance system is so effective, why change it?

Several factors are driving this process:

- the demand by some customers to be able to purchase on the basis of more specific quality factors
- the imminent arrival of transgenic wheat varieties
- private plant breeding interests, and
- the potential to create several more wheat classes or types with new genetic material (e.g., hard white wheats).

Of the four key elements of the current system mentioned above, there isn't much pressure to fundamentally change three of them (i.e., grading system, uniformity and cleanliness/safety). The main focus is on KVD. Obviously, alternatives to visual distinguishability involve non-visual methods of quality segregation. Examples of the types of non-visual quality segregations that may be desired include the following:

- Even within the narrow quality window of an existing wheat class such as CWRS, there are some quality differences between varieties. In some cases, a customer may want to select specific varieties, which are visually indistinguishable from the others in that class. The CWB/Warburton's Bakeries program is an example of this kind (in fact, it is the only example of a customer of Canadian wheat selecting specific CWRS varieties). An important feature of this type of program is that there are no concerns regarding the impact of "leakage" from these shipments on the rest of the class. Because the varieties selected by Warburton's are fully accepted as conventional CWRS varieties as well, other CWRS shipments do not have to be monitored to keep Warburton's preferred varieties out (in fact, the same varieties comprise a large proportion of the CWRS class).
- Periodically, a variety surfaces that is reported to have significant agronomic advantages over registered Canadian varieties. If, however, it looks like one of the Canadian classes but doesn't possess the quality required for that class, it cannot be registered for production in Western Canada. The reason for denying registration is concern that some of the production of that variety will find its way into shipments of the class that it resembles, thus damaging the consistency and uniformity of quality of the class expected by the buyer. If acceptable methods of non-visual segregation were available, the new variety could be grown while still maintaining the quality of the class that it resembles. A possible example in this category would be a fusarium-resistant wheat variety that doesn't possess the same end-use quality as the class that it resembles.
- Sometimes, the end-use quality of a new variety is what makes it attractive, rather than its agronomic advantages. For example, some wheat customers find the CWRS class dough strength somewhat weak relative to most Dark Northern Spring (DNS) varieties from the U.S. If Western Canada were able to grow DNS-type varieties while protecting the quality of CWRS shipments - which DNS resembles - some additional sales may occur. Note that many customers prefer CWRS quality to DNS, so CWRS of traditional strength must be protected. Another similar example is the imminent introduction of hard white spring wheat varieties. Wheat similar in end-use quality to CWRS or DNS, but with a white seed coat, is expected to be popular in some markets due mainly to the potential for improved flour or end-product colour at higher flour extraction. Some of these varieties have already been registered in Canada for the purpose of market testing, but there are no longer any distinctive kernel appearance categories left for them to occupy (the newly-registered hard white spring varieties look like CWSWS).
- Transgenic<sup>1</sup> wheat varieties, when they become available, may have agronomic advantages or quality differences that may be desired, even if they don't fit the requirements for KVD. It will be important to segregate these and protect the existing classes from admixtures of transgenics, sometimes because of known differences in quality and sometimes due to demands from customers for shipments with low limits for transgenics. (This may also include exclusion of certain unapproved transgenics but acceptance of other transgenics that are approved in the importing country or by the customer).

Generally speaking, as plant breeding technologies advance, agronomic and quality sacrifices are likely to increase if strict KVD requirements are retained in all cases. Even with new breeding technologies, it can be very difficult to introduce certain agronomic traits into a specific kernel appearance. Furthermore, the variety of possible quality types will increase beyond the limits of visual distinguishability (e.g., hard white spring wheat).

## Non-Visual Quality Segregation

As is apparent from the examples given, most discussion of new quality types implies the need to monitor varietal composition in a shipment. This hasn't been necessary until now since all varieties that look alike have had the same end-use quality. It should be noted that the variety is only an indicator of the information that is really desired, i.e., the end-use quality of a shipment. In some cases, more direct measurements of quality may be possible rather than

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<sup>1</sup> Various terms are used to describe the products of biotechnology in grain variety development. The most common include transgenics and Genetically Modified Organisms. Transgenic is the term used in this paper.

identifying the varieties, much like protein is measured directly today. Automated Quality Testing (AQT)<sup>2</sup> technologies should assist in determining the potential for measuring various quality parameters directly. However, for the most part it is useful to think of new systems of non-visual quality control as being required to identify varieties.

It must be stressed that adequate technologies to facilitate alternative non-visual methods of quality segregation do not yet exist. Going too far too quickly, before technologies develop, risks damaging Western Canada's competitive advantage in wheat markets (e.g., reducing uniformity of quality) and increasing logistical costs (e.g., forcing separate binning of deliveries until variety and quality can be assessed several hours or days later).

### ***Goals and Guiding Principles***

When discussing potential changes, it is useful to use a set of goals and guiding principles to guide such changes. We suggest the following:

- Each wheat class should be designed to satisfy specific end-use market segments so that Canada can produce wheat with appropriate quality for as many different wheat markets as possible where financial returns are relatively attractive.
- Farmers should be provided with several types of wheat with a variety of agronomic characteristics to suit regional agronomic conditions and comparative production advantages.
- New classes or types of wheat should be introduced to enable additional sales in significant new market segments, to provide agronomic adaptations that are not satisfied by existing classes, or both.
- Mechanisms to accommodate new classes or types of wheat must not harm the principal quality features of the "conventional" shipments. For example, the inherent quality, consistency and uniformity of Western Canada's existing wheat classes must not be threatened when varieties that are significantly different in quality are introduced.
- When introducing new classes or types of wheat, the marketability of lower grades must be considered. Potential supply problems and increased handling and segregation costs must also be considered with respect to the number of classes being proposed.
- New systems of quality control must make it easy to monitor the quality of all shipments. Monitoring must be effective and low cost. Tests must also be able to quantify varietal composition, as opposed to a yes/no test that merely detects presence or absence of a particular variety. The costs of monitoring should be allocated fairly.
- Quality monitoring must be quick enough to detect problems before shipments depart, especially in the case of large ocean vessels. By "problems," we generally mean that a shipment does not meet the specifications of a grade or contract.
- Accountability and liability for quality control problems must be assignable and enforceable at reasonable cost.

### ***Affidavits/Contracts/Varietal Declarations***

Due to KVD, elevator managers and terminal operators can be reasonably confident that they know the class and quality of wheat delivered to their facility, merely by looking at samples from the truck or rail car. Therefore, a declaration of the delivery's varietal composition made by the farmer (or primary elevator manager, in the case of deliveries to terminals) is generally unnecessary. However, in the absence of KVD, a legally enforceable declaration will be necessary.

In theory, the development of AQT technologies would eliminate the need for declarations since some sort of machine could substitute for the elevator manager's visual inspection. However, this is unlikely to be the case for two reasons. Firstly, it will be years before fully functional AQT technologies are available, and KVD is already being compromised. Secondly, it may be the case that even with AQT technologies, the elevator manager would rather rely on a written declaration in addition to or instead of a physical test (perhaps the test will still be costly or

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<sup>2</sup> AQT is a research project established by the Canadian Grain Commission, Canadian Wheat Board, Agriculture and Agri-Food Canada, and others in the Canadian grain industry to develop and improve upon technologies to identify grain varieties non-visually, improve grain safety analysis, and predict end-use functionality. This project was formerly referred to as RIOT, for Rapid Instrumental Objective Testing.



somewhat slow) This means that some form of varietal declaration or contract, or affidavit will be required. For simplicity, the term “affidavit” will be used in this paper.

“Affidavit” is one of those terms that means something different to almost every reader. Before reading this section, it is important to emphasize two points:

- *The authors do not advocate widespread replacement of KVD by affidavits in the current environment. We stress that additional safeguards would be necessary (e.g., fast and effective varietal identification technology), many of which are not currently available.*
- *We also assume that if and when affidavits are used, they need not require an overly-complicated system of forms and paper trails. In this paper, affidavit merely refers to some form of varietal declaration. It is this concept, and not the details of how it might be implemented, that are important at this stage of the discussion.*

Affidavits are likely to be a critical component of any non-visual quality control system. As noted previously, especially until cheap, effective technologies are available to identify varietal composition of shipments from the farm forward, affidavits will be required to assign liability for problems detected after shipment. For example, farmers will have to sign affidavits attesting to the variety of wheat they deliver to a primary elevator. Likewise, the primary elevator will have to sign an affidavit indicating the varietal composition of rail cars shipped to terminals, and the terminals will have to do the same upon loading ocean vessels. If problems are detected, the source of the problem must be identifiable and those responsible held accountable.

There are five vital concepts that must be understood in discussing the possibilities of affidavit systems:

1. *Farmers and grain handlers will be expected to know the varietal composition of their wheat shipment.* Currently, as long as someone knows that their wheat looks like CWRS and that it is a registered variety, for purposes of delivery and grading it doesn't matter what variety it is. That would change in any move toward non-visual quality segregation and affidavits. Minimally this would imply improved and more complex record keeping for all involved, and possibly the increased use of certified seed, or at least on-farm testing of varietal composition.
2. *The validity of affidavits must be verified by actually testing shipments* Even though the vast majority of those delivering grain are honest and careful, one cannot assume there will be no problems and therefore no need to check shipments. At a minimum, all cargo shipments and composite shipments to rail or truck customers would need to be verified. In addition, random checks on truck and rail deliveries would be necessary, as well as thorough checks back to the primary elevator and the farm level when a problem is detected in a cargo.
3. *Quality control checks (i.e. checking to ensure a shipment is of the varieties specified in the grade or contract) must be performed on all shipments, not just those of the “special” varieties or shipments.* Often, discussions regarding Identity Preservation or similar concepts centre on the requirements to assure the quality of the “IP'd” product. Although this comes with its own challenges, in Canada this would actually be a small part of the problem. The bigger issue is quality control for all other shipments with similar kernel appearance that could be damaged by admixture with the IP variety. For example, introduction of DNS varieties, even if they only totaled 50,000 tonnes of production, would potentially create the need for strict (and expensive) quality checks on a very large tonnage of CWRS shipments to ensure the absence of admixtures.
4. *An appropriate duration of liability for problems caused by inaccurate affidavits is critical, and difficult to define.* In a bulk grain handling system, various lots of wheat are continuously being blended with other wheat as it makes its way through several handling facilities from farms to customers. This process actually contributes to uniformity and consistency in shipments, but it poses a challenge in determining accountability for contamination of shipments with unacceptable varieties. For example, it is possible that one farmer's wheat delivered to a primary elevator could be included in an ocean vessel a few weeks later. It is also entirely possible that part or all of that farmer's shipment could be held – blended with other wheat – in a primary or terminal elevator for months or, in extreme cases, more than a year. If a particular ocean vessel is determined to contain unacceptable varieties, how can the source be traced? If a retained sample from a farmer's delivery one year previous is determined to contain those unacceptable varieties,

should he be held accountable for the current vessel's problems? Should there be a time limit for such accountability? Presumably, some methods of terminating liability can be devised, but marketers and grain handling companies will certainly need answers to these questions if such systems are to function<sup>3</sup>.

5. *Liability must be clear and simple to enforce.*

Those individuals or organizations whose shipments are harmed by admixture with non-conforming (to the grade or contract) wheat must not be unduly prevented from collecting damages due to excessive legal costs or time delays. No one wants the grain industry to become bogged down in legal battles over problem shipments. However, all would agree it is important that accountability be clear. Pre-determined penalties for non-compliance with affidavits may be an option, as long as these penalties reflect the potential damage that may occur because of non-compliance.

***What Technologies Currently Exist to Facilitate Affidavit Systems?***

As noted above, in a non-visual quality system, wheat shipments would have to be checked in order to identify their varietal composition. How? The answer is varietal identification technology.

The only methods of varietal identification technology currently in use are Polyacryamide Gel Electrophoresis (PAGE) and High-Performance Liquid Chromatography (HPLC). Other technologies are currently in development but are some time away from being commercially available.

Of the two, PAGE is the method most commonly used to identify most registered (and the main unregistered) wheat varieties in Western Canada. Although very useful for certain purposes, it cannot distinguish all varieties, and it is slow, expensive and not widely available.

The actual PAGE test takes less than 24 hours to complete. However, sample preparation, preceded by sending the sample to a central lab in Winnipeg, can translate into more than a day to obtain a result. The test is also expensive: \$155 to test 30 kernels of wheat, which statistically will verify whether a particular variety or group of varieties comprises at least 90 per cent of a particular lot (e.g., a railcar) of grain. Greater accuracy can be achieved, but at greater cost using more kernels. The technology is also unlikely to become cheaper with more samples – there are no economies of scale to be gained. Finally, relatively sophisticated labs are required to perform PAGE tests, limiting the number of locations where this work can be done.

The costs and deficiencies of using PAGE to back up an affidavit system can be demonstrated by example. Imagine that one 25,000 tonne shipment of wheat, when tested, is determined to contain excessive levels of unacceptable varieties, e.g., five per cent of the shipment. The first problem is that this test result would be available only after the vessel has sailed, so the best that could be done is to divert it to a different customer (at great expense), or to inform the customer that there will be a problem with this particular shipment. The second problem is the cost of tracing the source. A 25,000 tonne shipment is the equivalent of 280 rail cars. Testing the varietal composition of each car (assuming each car making up that cargo can be identified) to a 90 per cent confidence level would cost over \$43,000. This might trace the source of a problem back to a particular primary elevator. Further testing would be required to determine which truckloads were the source of the problem. Because the sales contracts with customers would in almost all cases result in damages in the millions of dollars in such an example, all parties involved (marketer, terminal elevators, primary elevators, farmers) would want to hold the source responsible. It is easy to see, however, how enforcement of such a system of accountability could be extremely costly.

It is for these reasons that the CGC, CWB and others in the grain industry have embarked upon a process to develop better, cheaper varietal identification technologies through the AQT research program. In a direct attack on the problems with PAGE, AQT technologies are envisioned as being able to distinguish all varieties quickly, cheaply, and in many locations.

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<sup>3</sup> Many discussions would be necessary to assess the options. Three possible options might be (1) defining which rail cars and even truck shipments comprise a particular cargo, therefore allowing liability for those shipments to be terminated once the cargo is determined to be acceptable, (2) farmers or primary elevators paying for testing of each of their deliveries in return for a "sign off" of liability, or (3) setting a time limit on liability for any shipment.

## Contract Registration

In addition to the conventional registration of grain varieties for production in Canada, the Canadian Food Inspection Agency (CFIA)<sup>4</sup> now also provides for “contract registration.” This category is used for those varieties whose delivery into traditional commodity channels would cause harm to those channels. Thus, a variety must demonstrate the possibility of harm if granted an unrestricted registration in order to qualify for contract registration. Examples of this include high erucic acid rapeseed, or crops modified to produce cosmetic, pharmaceutical or industrial substances.

Under contract registration, the applicant must make available to the Registrar (CFIA) a quality control system that describes fully how potentially adverse effects of the variety will be managed. Appendix A contains further information on the type of system required. Essentially, the applicant must agree in writing to provide information on the distribution, use and disposition of any seed of the variety or any progeny thereof to the Registrar, upon request.

Contract registration has not been used for wheat. In fact, guidelines for using contract registration were only implemented in early 1999. Part of the rationale behind contract registration was to offer a mechanism to register potentially harmful varieties, while still protecting mainstream commodity products. The guidelines make it sound like contract registration might offer this protection. Does it? The following discussion examines whether, in fact, contract registration provides this solution for wheat.

A few key points are helpful in discussing the merits of contract registration.

*1. Definition of Harm:* Just what constitutes “harm” (or “adverse effect” – the term used in regulations)?

According to discussions with the CFIA, harm is restricted to situations where co-mingling would affect the quality of the commodity in a way that could be measured scientifically. For example, a wheat variety that would harm the bread-making quality of the class that it resembles, might fit this definition. Market impact alone is insufficient. For example, a transgenic variety that poses no scientifically measurable harm would not be eligible for contract registration, even though many wheat customers would insist it be absent from any wheat cargoes they purchase.

*2. Monitoring:* As noted previously, quality control checks must be performed on all shipments, not just those of the “special” varieties or shipments. Therefore, contract registration of a “harmful” wheat variety that resembles CWRS would force a system of non-visual monitoring of CWRS shipment quality. The costs of such monitoring using current technology would be very high (see example above in description of electrophoresis). Who would pay this cost? It wouldn’t be CFIA, since its legislation and regulations don’t mandate the CFIA to monitor grain shipments. Neither would the party proposing the contract registration be obliged to pay for adequate monitoring. Therefore, it seems that those shipping the non-contract-registered varieties (and, ultimately, the farmers who grow those varieties) would be left on their own to monitor their shipments to ensure no contamination from contract registered product.

*3. Accountability:* Assume that some system of monitoring detects a problem where a contract registered variety has contaminated another product stream. What happens? Who takes the lead regarding corrective action, determining who caused the problem, and holding them accountable? The current guidelines would leave it to those shipping the non-contract registered varieties. The only route open to those marketing the potentially harmed product would be to take independent action. Section 9(2) of the Seeds Act does allow for a fine of up to \$50,000. However, even assuming any regulatory violations could be proven to a criminal standard – beyond a reasonable doubt – no monetary compensation would be available to the parties who had suffered harm. In order to recover losses suffered as a result of contamination, resort would have to be made to civil litigation. The odds of success of such an action would depend first of all upon the ability of the complainant to prove the source of the problems. The complainant would have to demonstrate that any defendant committed a breach of the Contract Registration Statute as written, that the action taken by the Defendant caused a loss, that the statute

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<sup>4</sup> The CFIA is a federal government agency. Through its Variety Registration Office, it is responsible for the registration of grain varieties for commercial production in Canada.

was intended to prevent such a loss, and that the complainant was a party intended to be protected by the statute. In other words, recovery of any damage suffered would be a lengthy, expensive and difficult process.

### ***Comments on Contract Registration***

In light of the above discussion, it appears that the contract registration guidelines as currently written are not an acceptable solution to the problem of trying to achieve both flexibility to register potentially “harmful” wheat varieties, while protecting the quality of conventional shipments. One flaw is the lack of a cost-effective monitoring system, and the fact that it appears the cost of monitoring would fall on parties other than the contractor or the regulator. The second flaw is the lack of accountability within the contract registration guidelines.

This leads to the conclusion that contract registration would not be helpful in wheat without changes to the guidelines. Moreover, it might cause problems. By creating the illusion that a “system” is in place to keep harmful varieties separate from the mainstream, there is a real danger that the wheat quality control system could be loosened before mechanisms (technologies and related procedures) are available to replace KVD. This is not to say that the KVD requirement should not be relaxed in some circumstances. Rather, it merely implies that it is necessary to be fully aware of the risks of doing so, recognizing that there is no acceptable alternative currently available.

Discussions are currently taking place with CFIA to address these concerns.

### **Possible Directions**

The ultimate goal should be a quality control system that removes the constraints of KVD without losing its benefits. Previous sections have described reasons why the ultimate goal cannot be achieved today. In summary, they are:

- Current technology to support such a system (PAGE, HPLC) cannot identify all varieties, and is slow, expensive, and not widely available.
- Contract registration does not provide a viable solution, due to problems with both monitoring and accountability.

### ***Stages***

Although the ultimate solution is not immediately achievable, it may be possible to implement change in stages, working toward a future when technology can supplement, and eventually, replace KVD. The staged approach outlined below, is presented for discussion purposes only. At each stage, the guiding principles outlined at the beginning of this section would need to be observed. In each successive stage, dependence on KVD is reduced.

Many consultations within the grain industry would have to take place in order to determine the requirements and feasibility of these, or alternative, stages. Implementation of any stage would be subject to the availability of appropriate technology; moreover, grain handlers and marketers would require sufficient notice to prepare for new systems.

#### ***Stage 1. Segregating registered varieties that conform to current KVD requirements and fit existing quality windows.***

This describes programs such as the CWB-Warburton’s selection of certain CWRS varieties, described previously. There are no significant problems with contamination of conventional shipments so this stage can occur now with current technology.

#### ***Stage 2. Loosening of Selected Registration Quality Criteria as Effective AQT Technologies Become Available to Segregate on the Basis of Those Quality Characteristics (Case by case evaluation required)***

Some effective AQT technologies are already available, and others may be introduced as advances are made. An example of currently-available technology is NIR. NIR is widely used to measure protein and moisture, among other factors. In the section on CWRW, it is suggested that NIR might be used to facilitate a system in which CWRW deliveries are only eligible for milling grades if they meet a minimum protein content. This would allow the registration of lower protein, higher yielding CWRW varieties for the feed market. Quality criteria other than protein content would remain as targets for registration, but the biggest constraint to yield advances – protein content – would be removed. This would in effect create two types of CWRW quality categories. As other technologies become widely available, other registration criteria could be reviewed.

*Stage 3. Segregation of potentially harmful varieties, with effective monitoring at terminals/points of export.*

In this case, an AQT technology would be available at terminals but not more widely than that. If technology is cheap enough and effective, all railcars could be tested and problems could be detected before the vessel is loaded so pre-emptive action can be taken. A huge issue in this stage is that primary elevator companies would have to accept liability for problems without having adequate technology to test trucklots as they are unloaded. This is a very significant issue and likely means this stage may not be possible in most cases. Terminal operators may also be concerned as the pre-emptive action may involve them losing a bin for a certain vessel. Having them make the primary elevator responsible may not be an acceptable solution. A potential solution is to test all railcars while they are in transit.

*Stage 4. Ultimate Solution*

This final stage might have the following characteristics:

- AQT technologies would be widely available and cheap. That is, varietal composition and/or end-use quality of shipments could be determined cheaply, quickly and with assurance, from at least the primary elevator level, and preferably at the farm gate.
- As is the case with the current system, market requirements would determine the acceptability of new varieties from the point of view of functional quality. However, KVD may not be required and the constraints on registration of varieties with an array of end-use qualities would be much fewer.
- Quality would be controlled by defining which varieties and levels of quality would be acceptable to be delivered as grades other than feed wheat. AQT technologies would be used to keep out undesirable varieties.

*The role of affidavits (variety declarations) and definition of eligibility for CGC grades*

The preceding discussions regarding non-visual methods of quality segregation suggested it would be necessary to introduce both affidavits and a list of approved varieties for each wheat grade. In preparation for a time when such tools may be a fundamental part of the wheat quality control system, discussions on their design and implementation should begin now.

With regard to affidavits, there is no current requirement for farmers or elevator managers to declare the variety of wheat they are delivering. The delivery can be downgraded if it is found to contain unregistered varieties in a quantity above the allowable grade tolerances, but this is more passive than an actual declaration. An actual declaration of the varietal composition would be necessary in order to enforce accountability and liability for problems encountered in shipments. Financial actions taken might include a pre-determined penalty that would be levied, or the pursuit of damages through civil litigation.

We suggest that varietal declarations be used for both farmer deliveries and primary elevator shipments to ports. This might be restricted to certain classes or regions for some period of time. This would be done for two purposes :

- to acquaint the industry with the need to have procedures to determine varietal composition of shipments
- to test methods of varietal declaration so that as they become more and more necessary, systems will already be set up to accommodate them.

Random testing of the validity of the declarations would be part of this implementation project. The primary purposes of the random testing would be to test monitoring systems and to educate system participants with respect to the accuracy of their declarations. During the early stages, assessment of penalties for misdeclarations might not be used, although they could be considered for detection of varieties that are not registered.

Secondly, approved variety lists need to be examined. Currently, any variety that is equal to or better than certain reference varieties, is eligible for all milling grades of a particular class. It would be desirable to change this system so that, for example, certain varieties might only be eligible for lower grades (when AQT is available). This, combined with all of the other conditions for movement toward non-visual quality segregation, would be necessary for the registration of a wider range of quality types. The approved lists might be sanctioned by the CGC's Western Grain Standards Committee. The CGC is examining this issue and will provide further background and proposals at a future date.

## Logistical Issues

The most challenging area of discussion in evolution of the wheat quality system is logistics. Providing additional options to customers in terms of new quality types or to farmers in terms of improved agronomic traits will not help increase on-farm revenue if the result is increased logistical costs that negate any potential price or yield gains. The problem is that there are no economies of scale in the grain handling system when increasing the types of quality being handled. In fact, the opposite is true. As the number of wheat classes or types requiring segregations or identity-preserved movement increases, unit logistical costs increase. While it may be relatively easy to accommodate a small percentage of grain movement as special segregations, the more segregations that are added, the more all grain movement will cost<sup>5</sup>.

Another significant logistical challenge lies in the area of accountability and liability. While it is relatively easy to describe a system of affidavits and suggest each participant in the grain movement system will be held accountable for any quality problems, the actual implementation of such systems is an entirely different matter. First comes the challenge of keeping the system efficient even if everything goes right. What's the best form design for the affidavits and how should this information be stored? Do samples of each shipment need to be retained? Where and under what conditions and cost? Secondly, what if problems are encountered? How can accountability be enforced without consuming inordinate amounts of staff time and legal costs in the grain industry? While these problems may not be insurmountable, they should not be underestimated.

Wheat quality control and varietal registration issues have traditionally been the domain mainly of end-use quality experts, agronomic experts, and plant breeders. Given the logistical issues that need to be dealt with in evolving toward non-visual quality segregation, experts in grain logistics need to be more involved in these decisions than they have been in the past. It is also clear that these decisions need to be made while taking into account the impact on other industry participants and other wheat classes and types.

## Class-Specific Comments

To this point, we have discussed issues that apply across most or all wheat classes. The CWB/CGC/CIGI staff have also considered specific directions for each existing wheat class, given the preceding context. Many decisions are still to be made, but the following summarizes the preliminary conclusions and suggestions the group reached for each class.

### *CWRS*

- CWRS is the largest class of wheat grown in western Canada; therefore, there must be tight control in variety development to assure that quality remains consistent.
- The class should maintain KVD requirements that will permit the continued ability to assure rapid, efficient segregation of the class through the handling system.
- We should continue to develop higher protein varieties and to maintain the superior baking characteristics that have become the cornerstone of CWRS marketability.
- There should be continued development of varieties that will move the average strength of the class to a slightly higher level, but not to the detriment of gluten mellowness and extensibility.
- As the Hard White Spring class develops and moves into the marketplace, market reaction will need to be monitored to review any changes that might be advantageous in the functional quality profile of the CWRS class.

### *CWAD*

- Based upon two years of small-scale laboratory and commercial-scale market development tests and numerous discussions with processors, it is clear that two types of durum wheat are needed to meet the needs of the marketplace.

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<sup>5</sup> It should also be noted that an increased number of segregations also increases the risk of supply problems, i.e. being able to supply customers with a certain wheat type of the desired grade year after year. An advantage of a limited number of wheat types being grown is the ability to assure supplies unless production problems are severe and widespread.

- The first type is composed of durum varieties with increased gluten strength comparable to that of AC Morse. These varieties would possess most of the quality characteristics of conventional CWAD varieties and would fit into the current CWAD class.
- The second type is composed of durum varieties with extra strong gluten characteristics significantly stronger than varieties in our current class or in a CWAD class with AC Morse strength.
- Recognizing that they are visually indistinguishable, we examined two options for the registration, handling and marketing of these two types of durum:
  - One option would be to segregate extra strong varieties through the process of contract registration. In theory, the main advantage of this approach would be the capacity to segregate the two types by regulating and monitoring production and handling of extra strong varieties through an audit trail. An additional theoretical advantage would be the ability to control off-grade production through application of the rules of contract registration. However, as noted in a previous section, contract registration, as currently designed, appears to have two flaws which prevent it from being useful for wheat. Therefore, contract registration does not appear to be a short term solution for extra strong CWAD.
  - The second option would be to provide interim registration for the extra strong varieties within the current CWAD class. In this scenario, the extra strong varieties would be segregated and marketed using some method of non-visual quality segregation. For a period of several years, extra strong durum would be graded using grades equivalent to conventional CWAD for No. 1, 2 and possibly 3. Off grade production of the No. 4 or 5 feed grades would be graded and co-mingled as No. 4 and No. 5 CWAD. This system would have the advantage of providing simplicity for the registration, handling and marketing of extra strong durum. The primary risk of this approach would be potential for leakage between types since they are visually indistinguishable. Additional monitoring of conventional CWAD shipments (frequency to be determined), through non-visual electrophoretic or similar testing would be necessary to protect the uniformity and consistency of the class. Variety testing, by non-visual testing also would be necessary for extra strong shipments since these would presumably be of higher value and would require some assurance of varietal purity.
- It also must be recognized that in initial stages the registration quality criteria will be somewhat different for the extra strong types. In particular, the strength expected will be much higher than that of conventional CWAD durum (AC Navigator minimum strength). Protein content requirements will initially also be somewhat lower since extra strong varieties tend to be lower in protein content as compared to conventional varieties. The protein content of future extra strong varieties will be expected to move toward that of the conventional durum varieties.
- Extra strong durum varieties appear to have significant potential for western Canadian farmers. As such, farmers should be provided with a realistic opportunity to test the market on a commercial scale. Consequently, the second option is being tested. Although it does present some risk, it seems to be the most flexible, least costly and workable alternative for managing the introduction of this type of durum. Vigilance will be needed through monitoring since the potential for leakage is present. Significant leakage either way could cause problems with uniformity and consistency of quality, a major marketing feature of Canadian durum.
- Finally, it must be stressed that a conscious decision, based on market signals, was made to develop Canadian extra strong durum. It must not be construed that introduction of extra strong durum within the CWAD class is a precedent for unrestricted and undirected registration of other varieties (with novel quality characteristics) into any of the other wheat classes.
- Future registered varieties in the conventional CWAD class should show protein content improvements over the prominent variety Kyle and preferably towards the protein content of the new variety AC Avonlea.
- Improvement to the overall colour of the Canadian durum crop is needed. The increase in colour should not be excessive since some processors have noted that too much colour will make the pasta appear as if it has been artificially coloured.
- Lower cadmium content should be a target for new CWAD varieties.

#### ***CPSR***

- The CPSR class has never been successful as a high quality milling wheat. Although protein level has been acceptable, varieties to date have had deficiencies in dough strength. The class should move to a functional quality profile that will allow it to compete effectively with US HRW.
- Current varieties have had disease problems and producers in the eastern prairie region require fusarium and midge tolerant varieties. Better regional adaptability is an important factor for both the milling and the feed markets.

- A cautious attitude should be taken toward elimination of KVD between CPSR and CWES (see option 2 discussed under CWES). Prior to AQT technologies becoming available, there should be further investigation of non-visual quality segregation techniques to allow this to happen without misrepresentation and compromising shipment integrity.

### ***CWRW***

- The main problems in the CWRW class are inconsistent quality and logistical problems associated with low and variable production volumes. However, CWRW does offer several agronomic and environmental advantages and has the potential for quality improvements to better fill demand for a lower protein, medium quality winter wheat.
- Because of a desire for lines with improved winter hardiness and other agronomic advantages, quality requirements for CWRW have not been strictly applied when registration decisions have been made.
- Two options for future directions are presented :
  - In Option 1, the class would be split into two quality types: milling and feed varieties. The two types would be segregated by a combination of affidavits and varietal testing;
  - In Option 2, current non-protein quality requirements would be implemented for all CWRW varieties. Protein content would be removed as a registration criteria, accompanied by the introduction of protein as a grading factor in the CWRW class.
- Option 2 is recommended.

### ***CWES***

- CWES has achieved success in high quality milling wheat markets for specific applications where unique dough strength characteristics are needed. Quality targets for this class should include continued development of Glenlea-type strength varieties with improved milling and water absorption characteristics while maintaining inherent Glenlea protein level as a minimum requirement.
- Better regional adaptability to improve resistance to certain disease pressures is an important factor in the future development of this class. Producers in the eastern prairie region require fusarium and midge tolerant varieties.
- The options discussed for the class are:
  1. Maintaining current quality requirements;
  2. Maintaining current quality requirements while eliminating the requirement for KVD between CPSR and CWES.

The problem with eliminating KVD is the likely ineffectiveness of current technologies to help determine variety or class composition in a particular shipment within the short time requirements of the current handling system. A cautious attitude should be taken toward elimination of KVD between CPSR and CWES. Prior to AQT technologies becoming available, there should be further investigation of non-visual quality segregation techniques to allow this to happen without compromising shipment integrity and misrepresentation.

### ***CWSWS***

- Production of CWSWS has declined significantly in recent years, in response to market prices. The class has been relatively successful in its target markets, with the main constraints being unpredictable supply and difficulty in achieving low enough protein for cookie quality markets.
- In an attempt to accommodate higher yielding, higher protein varieties in the class, two options other than the status quo (with some tightening of quality targets) were considered:
  - Option 1 was to further loosen all quality targets for CWSWS;
  - Option 2 re-established tighter non-protein quality requirements with segregation by protein content.
- There is an export market for generic quality soft white wheat that would likely be satisfied by the CWSWS quality that would result from Option 1. Given the current costs of variety segregation and the attractiveness of growing higher yielding varieties if they are available, it is unlikely that segregation of lower protein, cookie quality varieties for offshore markets would be desirable. With Option 1, the most likely market for the lower yielding varieties would be domestic mills, who would have to offer variety-specific contracts with a premium price in order to attract supplies. It is not clear that this will occur, and domestic mills may in fact choose to import U.S. soft wheat to meet their needs, or end processors may import flour from U.S. mills.
- Option 2 has the advantage of offering a cheaper method of segregation, but it may also present a similar problem in that very small quantities of low protein CWSWS would be produced, making it difficult to satisfy



markets on a consistent basis. It is also possible that non-cookie quality, lower protein varieties would be produced in sufficient quantity to cause consistency problems in the “cookie” segregation.

- At the February 2000 variety registration meetings, it was decided that a cautious but possibly productive approach would be to implement Option 1 and observe the outcome with respect to how much cookie-quality CWSWS would be produced for domestic mills, basis whatever premiums might be offered. If there is ample supply for the domestic market, means of segregating further quantities for export markets might then be considered. Thus, Option 1 has been implemented.

#### ***CPSW and Hard White Wheat***

- Initial HWS varieties coming out of the AAFC-CRC breeding program show excellent potential for a number of different markets and were supported for registration as part of the 2000 PRRCG evaluation. In order to manage their introduction and allow them to be evaluated in the marketplace, they will be placed into experimental grades with specifications similar to CWRS.
- Further quality direction, as a result of the five-year (maximum) experimental class designation, should be the result of marketplace review which has begun. Decisions for the introduction of stronger rheological dough properties, at least at the CDC Teal, Laura, Roblin level, if not stronger (Grandin), similar to US Dark Northern Spring, will have to be reviewed in light of marketplace response and the future direction of CWRS. Retention of a mellow extensible gluten remains highly desirable.
- These properties should be developed to express themselves over a wide range of protein levels, as is the case for CWRS. Protein segregation will probably be needed.
- Introduction of another white wheat class will generate increased problems in KVD between classes and existing CPSW and CWSWS varieties as well as potential white winter wheats. The issue is not confined to KVD but also the dramatic differences in the functionality of the wheat classes and their potential harm if mixed. An affidavit system, with technology to back it up (further development is required – see below) will be required in order to maintain segregation between CWSWS and the new HWS varieties.
- Canada is developing and promoting HWS varieties to remain competitive with the large scale white winter wheat breeding programs of the U.S.
- It is recognized that since this is a completely new wheat category there will be a long-term development process in order to merge the desirable quality, agronomic and disease resistance traits.

#### ***Canada Prairie Spring White***

- The class quality target is moving toward medium protein, medium to hard kernel texture and stronger gluten properties.
- Marketing samples of AC Vista have received marketplace interest and should be further investigated.
- However, because of its greater hardness, AC Vista can cause problems for a mixed grist miller when mixed with existing varieties, AC Genesis, and AC Karma, within the CPSW class. AC Vista will have to be kept separate from the other CSPW varieties, including the new HY446 cultivar, if registered.
- The variety HY446 appears to combine the better properties of AC Karma and AC Vista and could represent an ideal quality target for the class.
- Further developments should be toward agronomic and disease resistance improvements with a particular focus on yield improvements, which have remained relatively stagnant in the class.

#### ***Other proposals (white wheat):***

- There should not be development of white CWES wheat varieties. There is no indication of a market need. Since CWES is rarely milled on its own, a blend of white and red seed coat in a grist may be a disadvantage. CWES quality development focus should be on milling yield, ash content and water absorption characteristics.
- The name Canada Prairie Spring White appears to have a negative connotation with quality-conscious customers, as it is often related to the poor functional characteristics of Genesis. Further development and market promotion of the class, e.g., HY446, should be done under a new identifier.
- Further study needs to be conducted on developing NIR and/or Single Kernel Characterization System (SKCS) testing protocols to be used for differentiating (segregating) levels of quality of white wheat using hardness or other characteristics. This may mean an eventual move to one class of hard white wheat.

## Concluding Comments

As stated early in this paper, much of the discussion about directions for the wheat quality control system are about the future of KVD. It may be helpful to review some examples of what is already happening to KVD. First, the main decisions which have already been made that affect KVD are:

- Extra Strong CWAD: These varieties are not distinguishable from conventional CWAD and mixture of the two in cargoes may cause problems in some cases;
- CPSW: Genesis, Karma, and Vista – the three existing varieties in this class - have different quality characteristics and in some cases need to be kept separate;
- CWSWS: As noted, at the February 2000 variety registration meetings, there was agreement to relax quality criteria to accommodate higher yielding varieties. Domestic mills will source by variety if desired. There may be future sourcing by variety for export, if warranted;
- Hard White Spring: Two varieties received interim registration in February 2000. These varieties are not distinguishable from CWSWS.

In addition, there are several other near-term decisions to be made which also will have an impact on KVD.

- CWRW: Discussions with farm groups will take place to determine the desirability of using protein as a means of segregating quality types in this class.
- CPSR: A 2<sup>nd</sup> year line (HY644) has good fusarium resistance and could be used as high yielding feed type. Its milling quality, however, doesn't meet the requirements for the class.
- Transgenics: Transgenic CWRS varieties (indistinguishable from CWRS) could be available for registration as early as spring 2002 or 2003.

Clearly, many more discussions will take place to decide how far and how quickly changes can be made. When making these decisions, proper emphasis will have to be placed on the potential impact individual decisions may have on other parts of the wheat quality system. In this way, the appropriate balance can be struck between maintaining Canada's current excellent reputation for wheat quality, keeping logistical costs down, and pursuing new opportunities.

We would appreciate your comments and questions.

*Appendix A: Quality Control System Requirements for Varieties Subject to Contract Registration  
(from CFIA Website)*

**Background**

These requirements apply to varieties where the "biochemical or biophysical characteristics of a variety distinguish it from the majority of registered varieties of the same kind or species and the variety may have an adverse effect on the identity of those registered varieties". Because these varieties have the potential to cause harm if they enter the traditional commodity channel, there must be assurance of appropriate means of control, via "quality control systems" (Q.C.S.). There must be assurance that the systems are in place and that they are effective.

The quality control system was designed to be consistent with other quality management systems designed for seed industry programs. The principles of these quality management systems are:

- show what you propose to do;
- do it; and
- prove it was done.

**Requirements**

As part of the application for restricted (contract) registration of varieties that could otherwise cause harm, the applicant must submit a proposed Q.C.S. to manage potentially adverse effects that could be caused by the variety. The proposed Q.C.S. should be submitted in the form of a quality manual to be used by the relevant parties for the handling of the variety. Components of the Q.C.S. include, but are not limited to, the following:

- a) management responsibility;
- b) training of personnel;
- c) contract review;
- d) product identification and traceability;
- e) inspection and testing;
- f) methods for control of non-conforming product;
- g) procedures for corrective action; and
- h) control of records.

**A) Management Responsibility:**

1. Define the organization's quality policy. This is a written statement of potential adverse effects that could result if the variety were to enter the traditional commodity channels.

An example of the quality policy is as follows: The entrance of a high erucic acid rapeseed into traditional canola channels must be prevented as it has the potential to cause harm:

- if insufficient isolation distances are observed from the production of commodity canola;
- if high erucic acid rapeseed is crushed and the oil is marketed as canola oil;
- the oil would be in violation of labeling laws as it would not be canola oil;
- the oil would be in violation of food regulations with respect to compositional standards for canola oil and could pose a human health risk due to the presence of elevated levels of erucic acid; and
- the sale of non-conforming product could have a negative impact on domestic and international markets of Canadian canola seed and canola oil.

2. Indicate who is responsible for ensuring the quality policy is followed and the variety is handled appropriately.

The responsibility, authority and interrelation of all personnel who manage, perform and verify work affecting quality systems shall be identified. The interrelation of personnel should be identified through the use of an organization chart. The applicant should appoint a management representative who, irrespective of other responsibilities, shall have defined authority and responsibility for ensuring that the Q.C.S. is implemented and maintained. Ensure that the person responsible for the disposal of non-conforming product is specifically identified.

3. Provide commitment that the quality policy for the variety is understood, implemented and maintained at all levels of the organization.

4. Submit procedures for the Q.C.S. procedures, internal quality audits, and their documentation. The Q.C.S. should be reviewed at appropriate intervals by the designated management representative to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained.

**B) Training of Personnel and Communication:**

1. Submit and maintain documented procedures for identifying and addressing Q.C.S. training needs on a routine basis. Personnel performing specific assigned tasks shall be qualified on the basis of appropriate education, training and/or experience, as required.

2. Provide appropriate training of all personnel involved in the Q.C.S. Appropriate records of training shall be maintained and be available upon request.
3. Indicate the level of availability of Q.C.S. procedure documents to personnel, the frequency of review of Q.C.S. documents and the means of ensuring that obsolete documents are removed from all points of issue or use.
4. Indicate how the results of internal quality audits of product and quality management systems will be communicated to personnel having responsibility in the area audited.

**C) Contract Review:**

1. The management representative shall describe and maintain the procedures in place for reviewing contracts to ensure compliance of the quality policy.
2. Each contract should be reviewed by the management representative to ensure that:
  - a) the quality policy is adequately addressed; and
  - b) all parties involved have the capacity to meet contractual requirements.

Records of such contract reviews should be maintained.

**D) Product Identification and Traceability:**

The management representative shall establish and maintain documented procedures and records for identifying the variety during all stages of seed and crop production, handling, processing, storage, delivery and use. This will include procedures for monitoring of growers' fields, identifying harvested product, processed product, etc. to ensure that the quality policy has been addressed by contract adherence.

Where isolation distances are required, documentation of actual isolation distances used must be maintained. Any non-conforming procedures or product must be identified, including deficiencies in documentation.

**E) Inspection and Testing**

The management representative shall establish and maintain documented procedures for inspection and testing to ensure the specific product quality requirements are met including the testing of harvested products.

**F) Control of Non-Conforming Product or Process:**

1. The management representative shall establish and maintain procedures to ensure that any seed or harvested product that does not conform to the specified standards is prevented from entering traditional commodity markets or being used as seed for further planting. (This could include ensuring non-conforming product is rendered unviable for seed purposes.) This procedure must ensure that non-conforming materials are identified, documented and segregated. Where the non-conformity relates to a requirement under the Seeds Regulations, the procedures must stipulate that the Director of Plant Products Division is contacted.
2. The management representative shall maintain records detailing the nature of non-conformities and the disposition of any non-conforming product or process. This should include contract review, documentation or record control procedures that do not conform to the prescribed process.
3. Where isolation distances are required from surrounding traditional commodity crops, and where these distances were not maintained, details must be provided on the disposal of seed or grain produced within the required isolation zone.

**G) Corrective and Preventive Action:**

1. The management representative shall document and maintain procedures for:
  - a) investigating causes of non-conformities;
  - b) immediately notifying those individuals/growers/organizations concerned;
  - c) developing and implementing a corrective action plan to prevent recurrence;
  - d) analyzing all processes, work operations, quality records and service reports to detect, identify and eliminate potential causes of non-conforming product;
  - e) initiating preventive actions to address potential non-compliance;
  - f) by monitoring and following up on corrective action implementation and its effectiveness; and
  - g) by implementing and recording changes to documented procedures resulting from corrective action.
2. The management representative shall document the corrective actions taken to address specific non-compliances.

**H) Control of Records:**

1. Records shall be maintained by all parties involved to demonstrate achievement of the required quality policy and the effective operation of the Q.C.S. Pertinent sub-contractor, grower and processor quality records are elements of this system.
2. The management representative shall maintain procedures for identification, collection, indexing, filing, storage, maintenance and disposition of quality records including:
  - a) product identification and traceability;
  - b) monitoring, audit, inspection and testing results;
  - c) records of nonconformance;
  - d) disposal/action records;
  - e) reviews of Q.C.S.;
  - f) training of personnel on the Q.C.S.;
  - g) contract reviews; and
  - h) record retention times.
3. Records must be clear, legible, readily retrievable and accessible.

**General Information:**

The Q.C.S. manual should be submitted as part of the application for registration. The manual should be written so that:

- a) all required activities are described;
- b) all Seeds Regulations requirements are comprehensively covered;
- c) the language can be easily understood by the individuals who have to read it, follow it and implement it;
- d) it is free of ambiguity and conflicting statements;
- e) it clearly specifies individual responsibilities;
- f) all required documents and records are identified and their use explained; and
- g) there is a mechanism for ensuring that documentation is kept up to date and properly supported.