

# final report

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Prepared by: David Jordan  
New South Wales Agriculture  
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## Hide cleanliness score development

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## 1 Introduction

Project PRMS.056 was a short term study that aimed describe a standard approach to assessing hide cleanliness in cattle. Thus, the main output from the project is a draft publication that is intended as a resource for stakeholders who are interested in adopting cattle cleanliness scores as part of their quality management system. The document is included with this report as an appendix. A second aim was to recommend a process by which the cleanliness standard could be extended to industry.

These aims are further discussed below with respect to the achievement criteria nominated for this project.

## 2 Development of written guidelines on how to describe hide cleanliness

The draft publication on assessing cleanliness of cattle (attached) has been provided in a format that can be readily transformed into a publication. Alternatively, the document could remain in its current format for small scale distribution as required with editing to meet MLA style requirements.

Goals were set prior to developing the standard and the success in meeting these goals is commented on below.

- *The standard should be sufficiently reliable to be used in an industry setting.* A major reason for adopting the approach described is that it has been well studied and the reliability found to be extremely high.
- *The standard should be practical to implement in processing and farm environments.* The standard as described has been successfully implemented in a range of abattoir environments and in research. It is anticipated the greatest difficulty in using the standard will be in live animals especially on farm where facilities for restraining and viewing cattle can vary enormously in suitability. With time experience with the standard under these conditions may indicate where how the guidelines should be improved.
- *The standard should be suitable for extension to livestock managers and abattoir quality assurance personnel.* The standard has been written to a level that suits this audience. Arguably, the standard could be made more or less sophisticated to suit particular sub-groups. The format arrived at was considered appropriate for informing the broadest audience without compromising technical accuracy. There is scope for abbreviation and simplification of the standard as part of extension to industry (see below).
- *The standard should likely be recognised as a measure of hide cleanliness by experts and regulators abroad.* This aim was included because of the likelihood that hide cleanliness could receive greater emphasis in quality assurance in the future. Therefore, it would be beneficial if any data collected would be in a format that would be recognised by technical experts abroad. To the author's knowledge, the system delivered in this project is the only one that has been scientifically evaluated for reliability with the findings published in an international journal. Approaches resembling this system have been used in North America in the past by commercial plants and in published research. It seems highly unlikely that a system based on anything other than visual appraisal of cleanliness (the basis of the system described in this project) could be implemented in the foreseeable future.

### **3 Recommendations for extending the guidelines**

It is recommended that MLA consider transforming the attached document into one that could be provided as a resource to livestock managers and quality assurance personnel at processing plants. Researchers and cattle producers could also be given the document upon request.

Use of the system for describing cleanliness in industry should be on a voluntary basis. Cattle producers and processors should be encouraged to use it where there is any need to describe cattle cleanliness. After a trial period of use the standard and any accompanying material could be reviewed according to stakeholders needs.

The reason for not recommending that the tag score system be widely promoted at this point in time is because of the scientific uncertainty surrounding the relationship between the extent of hide contamination and the extent of carcass contamination. While quite some studies have attempted to assess this relationship, none have been performed on Australian cattle, and of the remainder many suffer from flaws in study design, analysis or both. The scoring system described in the attached guidelines was used in a study in Alberta, Canada to assess the relationship between cleanliness and carcass contamination (Van Donkersgoed et al, 1996). That study found a null relationship, between the amount of 'tag' (dag) and measures of carcass hygiene. It is possible that this is a correct finding. However, it may also have arisen because the management of plants participating in the study slowed down the production line when lots of dirty cattle were processed thus confounding the comparison with clean cattle. It is also possible that there is too much inherent variability (i.e. measurement error) in single carcass swabs for them to be used in this research context (this would bias the results towards the null). Another explanation is that the true relationship is non-linear and therefore more difficult to detect (a flatter curve) at one end of the cleanliness spectrum than at the other.

Until the scientific uncertainty surrounding hide cleanliness and carcass contamination is reduced it is difficult to justify a general recommendation to processors or cattle producers on what importance to place on hide cleanliness. Nevertheless, in the interim there is keen interest in this subject in some sections of the industry. The guidelines provided as part of this project will allow any interested enterprises to improve their management of hide cleanliness by using a standard system of description. This can continue until such time as an industry-wide approach is established that defines what priority should be given to hide cleanliness during cattle production and processing.

Suggested steps for extending the guidelines are as follows:

- Review of the guidelines as per any requirements set by MLA.
- Seek feed-back on suitability of the draft from experienced stakeholders in industry.

- Conditional on satisfying any requirements established above, consult with publication specialists on bringing the document to a standard for distribution as hard-copy. Here it will be important to ascertain the technical specifications of diagrams and photographs. It may be necessary to collect more photographs depending on reviewers comments and technical requirements as advised by publication experts. Note that collection of new photographs would be helpful as the current drought conditions in eastern Australia have reduced the opportunity for collecting a comprehensive set of images describing levels of hide cleanliness (a larger collection of photographs featuring a greater diversity of cleanliness scores may be helpful for future training and education purposes).
- Consider the development of a simplified version of the standard as a small poster that could be useful for training and awareness in the meat and beef cattle industries.
- Consider making the above resources suitable for electronic distribution.

## 4 Appendix - Assessing the cleanliness of the hides of Australian cattle

Guidelines for use of a standard method for describing the amount of dirt, mud and faeces on cattle hides.

### Introduction

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highly unlikely that a system based on anything other than visual appraisal of cleanliness (the basis of the system described in this project) could be implemented in the foreseeable future.

## The importance of hide cleanliness

Hide cleanliness has a role in delivering safe meat products with long shelf life and this helps the Australian beef industry meet the specifications set by customers and regulators throughout the world. During slaughter, bacteria are transferred from the hide to the carcass<sup>1</sup>. Some of these bacteria (such as *Escherichia coli* O157:H7 and *Salmonella*) can harm humans if they survive the food preparation process or if they cross-contaminate onto other food items. A wide variety of bacteria that cause spoilage can also transfer from the hide to the carcass and result in a reduction in the keeping qualities of beef products. Ensuring that livestock are clean at slaughter helps reduce the opportunity for the transfer of contamination onto carcasses<sup>3</sup>. This in turn promotes the safety and storage attributes of beef products while reducing the need for expensive in-plant interventions aimed at reducing the number of bacteria on carcasses

Why assess hide cleanliness?

Descriptions of the level of hide cleanliness allows decisions to be made about the management of animals or their carcasses. A standard system for scoring hide cleanliness will aid the interpretation and comparison of hide cleanliness information throughout the cattle and processing industries. The remainder of this document therefore describes a system for rating the cleanliness of hides. The rating system is based on a method that has been used in commercial abattoirs in research and surveillance and which has been scientifically evaluated<sup>4 2</sup>. It relies on a visual assessment of the level of cleanliness at three sites on hide of live cattle or carcasses (before skinning). Assessment of cattle for cleanliness using this system can be performed in a farm, saleyard, transport, or abattoir setting. Standard use of this system will allow cattle managers, processors and researchers to discuss cattle cleanliness and as it applies to particular enterprises. The scoring system described here can also be integrated with other quality control data as a way of documenting the cleanliness of animals arriving at a processing plant. It can be used for deciding what additional hygiene measures should be applied to animals that do not meet a specified standard of cleanliness as defined by a particular score in the rating system.

## Overview of how cattle are assessed for hide cleanliness

Take the following steps to assess individual cattle and groups of cattle for hide cleanliness using the standard system:

1. At three specified sites on the animal's hide, allocate a severity score of 0 (nil), 1 (minor), 2 (moderate) or 3 (heavy) based on a visual appraisal of the amount (volume or weight) of contamination. Scores are made so that they are consistent with photographic standards (see later).
2. Add together the severity scores at the three sites on each animal and record this as the whole animal score on a 0 to 9 scale.
3. A group score can be established based on the assessment of a sample of individuals from the group (e.g. processing lot, truck load). The group score is taken as the average

of the whole animal scores. Advice on the way to select animals for obtaining a group score and the number of animals required is given later.

## **Sites of the hide assessed during scoring**

The distribution of contaminated material on hides can vary on animals originating from different transportation processes, marketing systems and herds. For this reason each animal is assessed for the amount of contamination at three specified sites on the hide. An overall score for each animal is derived by combining (summing) the scores from each site to give a whole score for each animal. The three anatomical sites that are assessed are the belly (ventral), lateral, and hind leg (including breach or perineum). When assessing later site and hind leg site, only one side (left or right) of each animal is scored, not both. The site descriptions provided below allow the scoring system to be used in different settings and across a broad range of classes of cattle.

### **Belly (ventral) site**

This comprises both the left and right undersides of the animal's chest and abdomen (known as the ventral surface). It includes all the hide extending from the head-end of the brisket (cranial tip of the sternum) towards the udder or scrotum (and including the latter structures). The boundary at either side and away from the midline is defined by an imaginary line joining the skin fold attachments at the rear (caudal) aspect of the fore leg and the front (cranial) aspect of the rear leg. The belly site identifies much of the surface of the animal that contacts the ground when it is resting upright in a non-standing position (sternal recumbency).

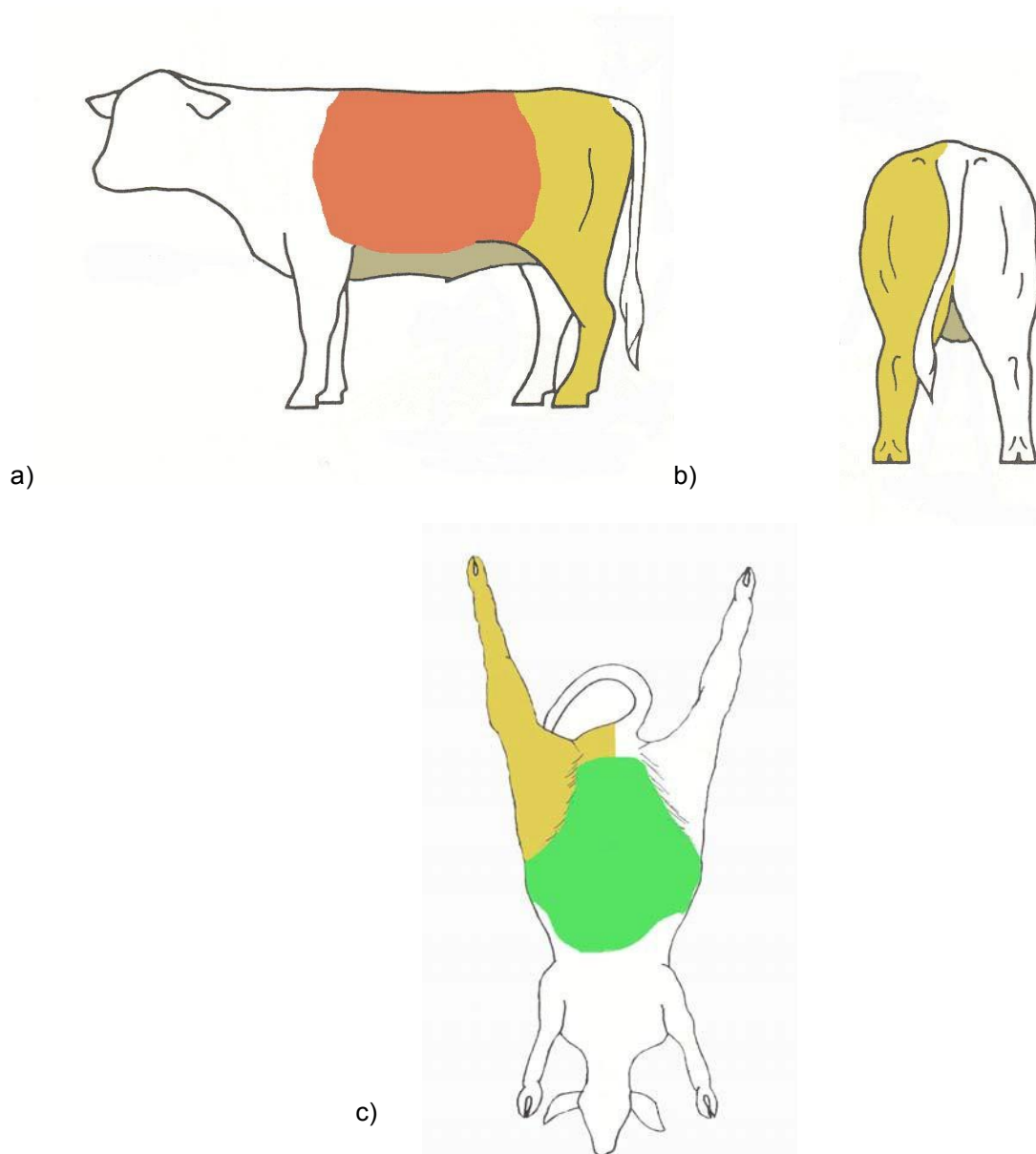
### **Lateral site**

This site comprises the outside surface of flank, abdomen and chest extending approximately from the shoulder blade (scapula) to the pin bone (coxal tuber). The left and right lateral sites (only one side is assessed when scoring an individual animal) meet in the middle of the back (dorsal midline). The lateral site is roughly that part of the abdomen and chest that would touch the ground if the animal were to lay down on one side. When assessing the amount of contamination only the right lateral site or the left lateral site is assessed but not both (for most purposes it doesn't matter which side is assessed).

### **Hind leg site**

Essentially this site includes the entire hind leg and that part of the animal's rump and breach (perineum) that is the same side of the midline as the leg that is being assessed. As in the case of the lateral site, only the left hind leg site or the right hind leg site is scored but not both. Diagrams indicating the extent of the belly, lateral and hind leg sites are shown in Figure 1a, 1b, and 1c.





**Figure 1.** Sites on the hide used in the assessment of cleanliness. A) The left side showing the left lateral site (brown), partial view of the left hind leg site (orange), and a partial view of the belly site (green), b) Rear view showing a partial view of the left hind leg site and a partial view of the belly site, c) View of underside showing the remainder of the belly site and the left hind leg site.

## Definition of cleanliness scores

Each anatomical site receives a cleanliness score of 0 (cleanest), 1, 2 or 3 (dirtiest) based on the extent of accumulation of mud, dirt, faeces on the hide. Note that only whole numbers are used in this scoring system. When the severity appears to be between two whole number scores (e.g. a score of 1½) assessors must round-up or round-down to the whole-number score that is the best approximation. Because the assessment of severity scores is a visual process there is a need to follow guidelines describing the different levels of contamination so to minimise the impact of subjectivity on the reliability of measurements. The guiding principle in allocating a cleanliness score is that it should reflect the amount of contamination (weight or volume) that is stuck to the hide on the site being assessed.

### Score 0

Nil to trace accumulation of mud, dirt, or faeces.

Slight accumulation of mud or faeces. This might consist of a small number of heavy clumps or a thin but widespread covering of mud and faeces.

Medium accumulation of mud, dirt, or faeces. Material tends to form heavier clumps and is more widespread but there is either a substantial area of normal hide visible or the contamination is widespread but only at a moderate thickness.

### Score 3

Severe accumulation of mud, dirt or faeces. These areas of hide are heavily caked with material. Over half of the site being so affected. The thickness of contamination may be up to several centimetres.

## Example severity scores



Figure 2a. Live cattle with cleanliness scores of 0 for the lateral sites.



Figure 2b. Hanging carcass of an adult cow with cleanliness score of 1 for the belly site.



Figure 2c. Live steer with cleanliness score of 2 for both the left and right hind leg sites.



Figure 2d. Live steer with a cleanliness score of 1 for the right hind leg site.



Figure 2e. Live steer with a cleanliness score of 1 for the left lateral site, and 3 for the left hind leg site.



Figure 2f. Live steer showing a cleanliness score of 3 for the left hind leg site and score 2 for the portion of the belly site that is visible.

## **Whole animal scores**

To calculate whole animal scores add together the cleanliness scores for each of the three sites (belly, leg and lateral) on the hide of the animal. Calculate the whole animal score as soon as the scores for all the individual sites are arrived at but before they are recorded. This is in case rounding up or down has occurred for more than one site on the animal. If so then it is appropriate to balance the direction of rounding as evenly as possible (e.g. round-up the belly score and round down the leg score) before adding all the site scores to obtain the whole animal score.

Whole animal scores range from 0 to 9 since the minimum score at each site is 0 and the maximum is 3. This 10 point scale provides ample flexibility to describe the cleanest and dirtiest cattle likely to be encountered.

## **Group scores**

One of the most useful applications of the system for describing hide cleanliness is providing a rating for an entire group of cattle (mob, pen, truckload, sale-lot or processing lot). The group score is obtained by assessing a minimum number of animals from the group then calculating the average of the whole animal scores so obtained. The number of animals sampled and the manner of selecting animals for inclusion in the sample are both important.

## **Number of animals sampled**

Fortunately, cattle that have been managed together tend to have similar cleanliness scores (not surprisingly). This means that only a relatively small number of cattle need to be individually assessed to obtain a good estimate of the average for the entire group (to be within about 1 score of the true average of the group). Based on the findings of research:

- For group sizes up to 50 a sample of seven individual cattle should be assessed.
- For group sizes greater than 50 a sample of ten individual cattle should be assessed.
- For a more precise estimation of the group score (to within half a score of the true average) the required sample sizes must be tripled (i.e. sample size of 21 for group sizes up to 50, sample size of 30 for group sizes greater than 50).

In some circumstance it might be appropriate to obtain precise estimation of the group score (using the larger sample sizes mentioned above) or to score every animal in the group. The larger sample sizes are usually only a minor inconvenience because only a small amount of additional time is required to make the extra observations.

## **Sampling animals from the group**

The way in which the sample of individual animals is selected from a group for defining the group's score (average of whole animal scores) can affect how well the data is accepted by other parties. Estimates of group score will be most acceptable if animals have been sampled 'at random' from their group. However, in practice random sampling is difficult to implement in commercial environments. In these cases 'systematic-random sampling', is an acceptable and practical alternative. In systematic-random sampling, animals are sampled from a group at regular intervals. For example, if seven animals are required from a group of size 40, every fifth animal in the group (either when counting through a pen of animals, or when the entire group is moving past a fixed point in the production chain) has its whole animal score recorded. If 7 animals were required from a group of 50 then every seventh animal would be assessed. In each case the whole body scores would be averaged to obtain the group score.

### **Reporting of group scores**

When reporting group scores the number of animals assessed, the size of the group and the method used to select animals for assessment (e.g systematic-random sampling) should also be noted.

### **Assessing hide cleanliness immediately post-slaughter**

Hide contamination can be easily assessed early in the slaughter process when cattle carcasses are hanging head-down when chained by the hind-leg to the rail. Assessors are best located in a safe standing position up to 5 metres from the carcase, where there is reasonable lighting and at a point along the processing chain before any major incisions are made in the skin of the legs, chest or abdomen. A good line of view to each of the assessment sites (left or right lateral site, left or right leg, and belly) is needed. It is usually an advantage to be able to change position slightly in the event that a carcase has rotated on the chain resulting in a particular site being obscured from vision. This method has been successfully used by a single assessor scoring all carcasses in plants processing at up to 130 carcasses per hour.

### **Assessing hide cleanliness in live cattle**

Live animals are often more difficult to assess than carcasses because of their ability to move about in holding facilities. Obtaining the belly (ventral) score can be the most difficult but can be made easier if the assessor is positioned at a level lower than the animals being assessed.

Groups of live cattle (sale lots, processing lots or truck loads) are often best assessed when being moved quietly past a fixed point in an animal holding facility where an assessor is positioned. If the assessor is standing slightly below the level of the cattle it is possible to obtain an improved view of the belly (ventral) site of the animals. In other circumstances, a good view of the required assessment sites can often be obtained with cattle standing quietly in yards or holding pens.

### **Reliability of hide cleanliness assessment scores**

The performance of the system described here for scoring hide cleanliness has been evaluated in North America<sup>2</sup>. Reliability was measured by comparing the cleanliness scores obtained by multiple assessors when looking at the same sample of carcasses in a commercial processing plant. The estimates of reliability are a way of quantifying how well individual assessors agree with each other. If reliability is low (e.g. less than 0.2) then there is poor agreement in the scores obtained by different people assessing the same animals. If the reliability estimate is high (e.g. greater than 0.7) then there is excellent agreement between assessors scoring the same animals, and an individual assessor is likely to give highly repeatable scores when rating and re-rating the same animals. Reliability was estimated in the study because it was felt that unless reliability was very good (e.g greater than 0.5) or better then the scoring system would not be useful in a commercial setting. At the end of the study the investigators reported a reliability of 0.84 for the whole animal score and 0.83 for the lot (group) score which indicates that the scoring system had excellent reliability and in that production system.

## Recording the data

A standard approach to recording hide cleanliness scores is helpful for rapid review of quality control data and communicating the findings to interested parties. A data recording sheet as set out in the following table is useful and helps with easy transfer of scores into electronic storage.

Location:		Date:		Starting time:		Assessor:	
Lot ID	Animal ID	Site scores			Whole animal score	Comments	
		Belly	Lateral	Leg			

Once data is recorded it can be readily used to give overviews of the state of cleanliness of cattle on a farm or entering a processing facility as in Figure 3.

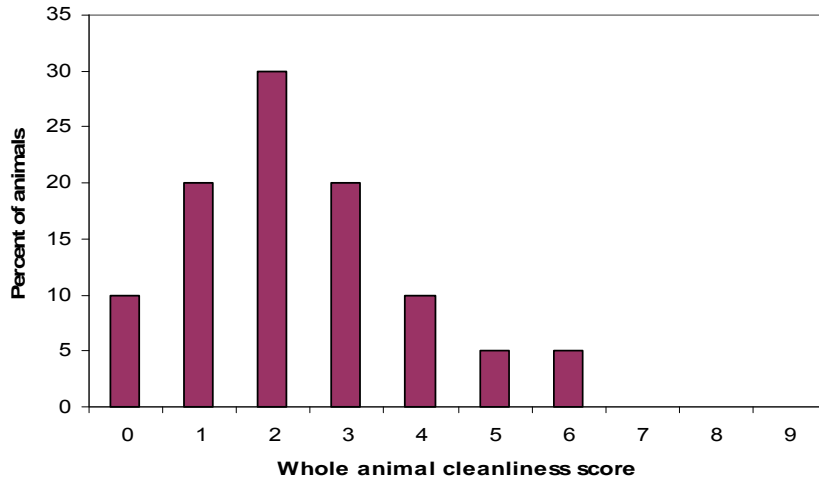


Figure 3. Example display of cleanliness scores for cattle from multiple processing lots entering a facility over a given period of time.



Reporting of group scores as a pie chart showing proportions of lots falling within broad categories of cleanliness may be helpful for communicating scores collected at a processing facility (Figure 4.). The categories might be defined by a processor to align with its policy on when particular interventions are used.

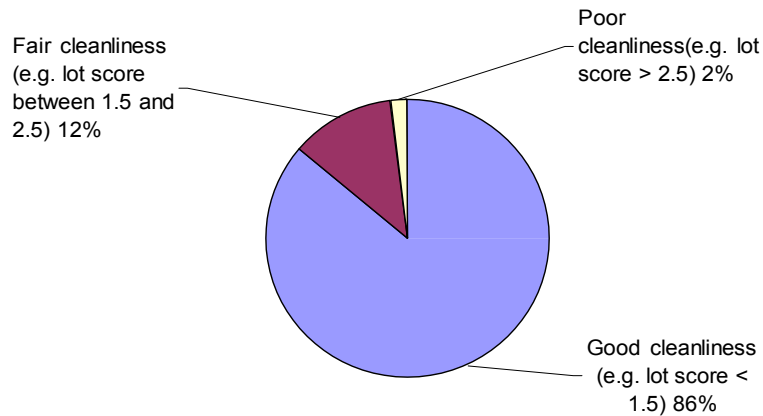


Figure 4. Example use of group (lot) tag scores for describing the cleanliness of cattle entering a processing facility. A processor can use the scoring system to specify what interventions (if any) are applied for lots of cattle in each category.

Under some circumstances it might be of interest to record additional data on hide cleanliness other than what has already been mentioned. This could be in the form of subjective assessment of the 'wetness' of material that is stuck to hides, or more general comments on the apparent cause of the build up of contamination.

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