Canadian beef quality audit 1998–99

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Abstract — The second beef quality audit was conducted in Canada in 1998–99 to determine the prevalence of quality defects in slaughtered cattle and to monitor changes since the first audit in 1995. Approximately 0.6% of the number of cattle processed annually in Canada were evaluated. Brands were observed on 49% and tag was observed on 43% of the hides. Both brands and tag had increased from 1995. Seventy percent of the cattle were polled and 5% had full horns; thus, the number of horned cattle had decreased from 1995. Bruises were found on 54% of the carcasses, which was a decrease from 78% in 1995. Sixty-eight percent of the bruises were minor, 28% major, and 4% critical in severity. The distribution of bruises on the carcass was 17% on the chuck, 36% on the rib, 30% on the loin, and 16% on the round. Grubs were observed on 0.008% of the carcasses, and surface injection site lesions were observed on 0.2% of the whole carcasses, a decrease from the 1.3% seen in 1995. Seventy-two percent of the livers were passed for human food and 14% for pet food; 14% were condemned. Approximately 64% of the liver losses were due to abscesses. Five percent of the heads and tongues and 0.3% of the whole carcasses were condemned. The hot carcass weight was highly variable in all cattle, averaging 353 kg (s = 43). The average ribeye area was 90 cm^2 (s = 13). Both hot carcass weight and ribeye area had increased from 1995. The average grade fat was 9 mm (s = 5), ranging from 0 mm to 48 mm. Lean meat yield averaged 58.8% (s = 4.6). One percent of the carcasses were devoid of marbling, 17% were Canada A, 49% were Canada AA, 32% were Canada AAA, and 1% were Canada Prime, which was an increase in marbling from 1995. Dark cutters were found in 1% of all carcasses; 1% of steers, 0.5% of heifers, 3% of cows, and 14% of bulls. Three percent of the carcasses were underfinished and 13% were overfinished. The number of overfinished carcasses had increased from 1995. Stags, steers with bullish traits, were infrequently observed in 0.5% of the steers, and 0.2% of the steers and 0.3% of the heifers had poor conformation. Yellow fat was not observed in any steers or heifers, but it was found on 65% of the cow carcasses. Only 0.6% of the heifers had an aged carcass, based on skeletal maturity. Based on August 1998 to July 1999 prices, it was estimated that the Canadian beef industry lost $82.62 per head processed, or $274 million annually, from quality nonconformities, which was an increase from 1995. Additional improvements in management, feeding, handling, genetics, marketing, and grading are needed in the beef industry to reduce quality defects.

Résumé — Audit sur la qualité du bœuf canadien — 1998–99. Le second audit canadien sur la qualité du bœuf canadien a été conduit en 1998–99 dans le but de déterminer la prévalence des défauts de qualité rencontrés dans les usines d'abattage de bovins et d'observer les changements par rapport au premier audit tenu en 1995. Lors de cette audit, approximativement 0,6 % du nombre des bovins transformés annuellement au Canada furent évalués. Le marquage et l'étiquettage sur la peau ont été observés à 49 % et à 43 % chez ces animaux de boucherie. Ces deux techniques d'identification ont augmenté depuis 1995. Soixante-dix % des bovins ont été écornés et 5 % avaient leurs cornes complètes; ainsi, le nombre de bovins avec cornes a diminué depuis 1995. Des meurtrissures ont été trouvées chez 54 % des carcasses, une diminution par rapport à 78 % en 1995; lesquelles 68 % des meurtrissures étaient mineures, 28 % majeures, et 4 % critique en terme de sévérité. La distribution des meurtrissures sur la carcasse était de 17 % sur le haut côté, 36 % sur les côtes, 30 % sur la longe, et 16 % au niveau de la ronde. Les larves d'hypodermose bovine a été observée chez 0,008 % des carcasses, et les lésions de sites d'injection furent observées chez 0,2 % de l'ensemble des carcasses, une diminution de 1,3 % par rapport en 1995. Soixante-douze % des foies ont été approuvés pour consommation humaine et 14 % pour nourriture animale; 14 % ont été condamnés. Approximativement 64 % de la perte de ces foies condamnés est attribuable aux abcès. Cinq % des tête et des langues et 0,3 % de l'ensemble des carcasses furent condamnées. Le poids des carcasses chaudes après l'abattage était très variable chez les bovins, environ 353 kg (s = 43). La moyenne de la surface du

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faux-filet était de 90 cm^2 (s = 13). Le poids des carcasses chaudes et la surface du faux-filet ont augmenté tous les deux depuis 1995. La teneur moyenne du gras était de 9 mm (s = 5), avec une étendue de 0 mm à 48 mm. L'indice moyen de la viande maigre 58,8 % (s = 4,6). 1 % des carcasses étaient dépourvues de « marbrage », 17 % étaient Canada A, 49 % Canada AA, 32 % Canada AAA, et 1 % Canada première qualité, laquelle il y a eu une augmentation dans le « marbrage » depuis 1995. Des coupes sombres furent trouvées chez 1 % de toutes les carcasses; 1 % des bouvillons, 0,5 % des taures, 3 % des vaches, et 14 % des taureaux. 3 % des carcasses observées étaient dans un manque de finition (couche graisseuse) et 13 % dans un excès de finition (couche graisseuse). Le nombre de carcasses en excès de finition a augmenté depuis 1995. Des bouvillons avec des caractères mâles de taureaux, furent très peu observés, chez environ 0,5 % des bouvillons, et 0,2 % des bouvillons et 0,3 % des taures avaient une pauvre conformation. Il n'y a eu aucune observation de gras jaune autant chez les bouvillons que chez les taures, mais cette observation fut notée sur 65 % des carcasses de vaches. Seulement 0,6 % des taures présentaient un âge avancé (carcasse) basé sur une maturité au niveau de l'ossature. Basés sur les prix d'août 1998 à juillet 1999, il était estimé que l'industrie canadienne du bœuf a perdu annuellement 82,62 $ par tête de bœuf transformé ou 274 millions$ en vertu des non-conformités relatives à la qualité, lesquelles étaient une augmentation par rapport à 1995. Les améliorations additionnelles en gestion, en alimentation, en manipulation, en génétique, en « marketing », et en classification sont prioritaires et nécessaires dans l'industrie du bœuf afin de réduire les déficiences et les défauts de la qualité.

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Introduction

In 1995, the Canadian beef industry conducted its first national audit on quality defects in slaughtered cattle (1). The audit revealed a number of quality defects on the processing floor and in the cooler that were costing the beef industry $70.52 per head processed or $189.6 million. Following the first audit, an extensive education program was implemented. Good production practice binders (2,3) and fact sheets on nonconformities were developed that discussed how to reduce quality defects. These were given to producers across the country in an attempt to provide information to help them improve management practices and reduce nonconformities.

The purpose of the second audit described here was to monitor quality defects and determine whether any improvements had been made since the first audit. The results of the second audit will be used to identify further strategies to reduce nonconformities.

Materials and methods

Processing plants

Five processing plants in Canada agreed to participate in this study; they were Lakeside/IBP Packers in Brooks, Alberta; Cargill Foods in High River, Alberta; XL Beef in Calgary, Alberta; Better Beef in Guelph, Ontario; and MGI Packers in Kitchener, Ontario. The first 4 packers were the same packers as in the first audit (1), and the last packer was added in order to assess some dairy cows from eastern Canada. These 5 plants currently process over 80% of the cattle slaughtered annually from across Canada; thus, they are most likely representative of the industry. Each plant was visited on 5 consecutive days in August and September 1998, November and December 1998, and March and April 1999. These different times over the year were selected to ensure that the data were representative of the year, since some defects are seasonal. Three days were spent on the processing floor and 2 d were spent grading carcasses in the cooler.

Processing floor audit

Three technicians collected data on the processing floor from every other animal on the line, assessing approximately 50% of 39 184 carcasses. This systematic approach was used to ensure randomization. Based on prevalence estimates from the last survey (1), the sample size used here was well above that needed to estimate the prevalence reliably with a 1% error. The same technicians recorded the same data at each plant to reduce variability. Technicians were trained to assess defects in a similar way to the first audit (1).

The 1st technician recorded data on brands, horns, and tag (mud and manure on the hide) as described previously (1). The 2nd technician recorded data on bruises, grubs, surface injection site lesions, similar to the first audit (1). In addition, the 2nd technician recorded the body condition score from 1 (thin) to 5 (fat). This new outcome variable was added to the second audit as suggested by the dairy industry. The 3rd technician recorded liver abscesses, according to the Elanco system (4,5). A score of 0 = no abscesses; A− = 1 or 2 abscesses or abscess scars; A = 2 to 4 well organized abscesses, generally < 1 in. (2.5 cm) in diameter; and A+ = 1 or more large, active abscesses with inflammation of the liver tissue. An additional category was added for liver scars. As well, this technician recorded the disposition of the livers, based on the meat inspector's decision for human food, pet food, or condemnation. Plant data were collected on the number of head, tongue, and whole carcass condemnations, along with the reasons for condemnation.

Cooler audit

In the cooler, one technician graded approximately 10% of the carcasses, as previously described (1), while another technician recorded the data. The same grader was used throughout the study to reduce variability. Carcasses were graded according to the current Canadian grading system (6), which differed from the system used in 1995, in that marbling had another category called Canada Prime.

Table 1. Prevalence of nonconformities in carcasses of Canadian cattle on the processing floor of 5 plants

Nonconformity	Bulls	Cows	Heifers	Steers	Overall
% with brands[a]	14	57	53	47	49
% with multiple brands[a]	0	18	10	8	10
Distribution of brands (%)[a]					
shoulder	23	14	9	8	10
rib	68	54	49	45	48
hip	9	32	42	47	42
Distribution of horns (%)[a]					
polled	62	69	71	69	70
scurs	12	17	14	14	14
stubs	3	7	6	7	7
tipped	1	3	4	4	4
full horn	22	4	5	6	5
% with tag[a]	51	32	49	41	43
Overall % with bruises[b]	45	79	48	50	54
Distribution by number of bruises[b]					
0	55	21	52	50	46
1	29	27	28	29	28
2	11	25	13	14	15
3	4	15	5	5	7
≥ 4	2	12	2	2	3
Distribution by bruise severity[b]					
% minor	64	60	69	71	68
% major	30	32	28	26	28
% critical	6	8	3	3	4
Distribution by location of bruises (%)[b]					
chuck	24	17	30	28	17
rib	22	32	32	33	36
loin	34	28	25	29	30
round	20	23	13	10	16
Distribution of body condition score (%)[b]					
1 (thin)	26	37	0	0	6
2	44	29	3	6	9
3	23	22	29	39	33
4	7	10	46	42	38
5 (fat)	0	2	22	13	14
% livers[c]					
human food	63	47	75	77	72
pet food	18	35	11	10	14
condemned	19	18	14	13	14
% with liver abscesses[c]					
0	57	61	64	67	65
A−	11	16	10	9	10
A	3	4	6	6	5
A+	5	1	1	2	1
liver scars	24	18	19	17	18
% with grubs[c]	0	0	0	0.03	0.008
% with surface injection site lesions[c]	0.5	0.5	0.4	0.4	0.2

[a]1st technician assessed 155 bulls, 2779 cows, 6663 heifers, 10 602 steers
[b]2nd technician assessed 203 bulls, 2940 cows, 6617 heifers, 10 521 steers
[c]3rd technician assessed 168 bulls, 2844 cows, 6535 heifers, 10 420 steers

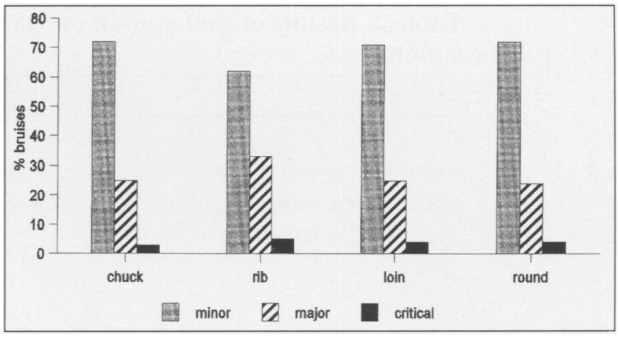

Figure 1. The occurrence of bruises by severity and location in Canadian carcasses processed in 5 plants.

Statistical analysis

All data were entered into a database and then transferred to an analytical software program (STATISTIX 4.1 for Windows; Analytical Software, Tallahassee, Florida, USA). Simple descriptive statistics for the quality defects, such as prevalence and means, were calculated for the entire dataset and by type of animal. Differences in quality measures between dairy and beef cows and between carcasses in 1995 and 1999 were compared by using the chi-squared test and *t*-test. The cut-off value for significance was $P < 0.05$, and only significant differences are discussed hereafter.

For the economic analysis, CANFAX, the national cattle marketing information services in Canada, used the same spreadsheets and formulae as before (1) and updated them with the study's data and current market information from August 1998 to July 1999. Losses due to injection site lesions were based on the Canadian Spring 1999 injection site audit in primal steaks (data not shown), since surface injection site lesions on whole carcasses, as collected here, severely underestimated losses from this hidden defect (7). The losses were calculated on a per head basis and to the industry overall, and these figures were confirmed by consensus with the participating packers.

Results

Processing floor audit

Approximately 0.6% of the Canadian annual number of 3.3 million head of slaughtered cattle were assessed in the processing audit. Based on the packers' work schedules on the lots or groups of cattle processed, approximately 1% were bulls, 12% were cows, 33% were heifers, 52% were steers, and 3% were mixed (more than 1 class within the lot). The steers, heifers, and bulls were beef breeds; whereas, approximately 11% of the cows were dairy breeds. The results of the processing floor audit are presented in Table 1. A breakdown of bruise severity and location is shown in Figure 1.

Five percent of the heads were condemned: 61% from contamination, 38% from pathology, and 1% from other causes. Sixty-five percent of the tongues graded #1 and 30% graded #2. A grade #1 tongue has no defects; whereas, a grade #2 tongue has minor surface defects. Five percent of the tongues were condemned; 51% from contamination, 45% from pathology, and 4% from other miscellaneous causes. Whole carcasses were condemned at a rate of 0.3%. Yearlings were condemned at

Table 2. Results of cooler audit of 3981 carcasses of Canadian cattle processed at 5 plants

Carcass trait	Bulls	Cows	Heifers	Steers	Overall
n	14	270	1326	2371	3981
Average hot carcass weight, kg (*s*)[a]	353 (28)	300 (68)	339 (37)	365 (37)	353 (43)
Average ribeye area, cm^2 (*s*)	85 (5)	75 (14)	90 (13)	91 (12)	90 (13)
Average ribeye fat, mm (*s*)					
top	10 (5)	11 (8)	14 (6)	12 (5)	13 (6)
middle	10 (5)	10 (8)	11 (5)	10 (5)	10 (5)
bottom	10 (4)	9 (7)	11 (5)	10 (5)	10 (5)
grade	9 (3)	8 (7)	10 (5)	9 (4)	9 (5)
Average % lean, % (*s*)	57.6 (3.0)	56.6 (5.9)	58.9 (4.7)	58.9 (4.3)	58.8 (4.6)
Distribution of marbling, %					
devoid	0	4	0	0.2	0.2
Canada A	56	17	12	19	17
Canada AA	33	42	46	52	50
Canada AAA	11	35	40	27	32
Canada Prime	0	1	2	0.9	1
Distribution of grade, %					
A1	21	0.7	56	56	52
A2	21	1	29	30	28
A3	7	0	13	11	11
B1	0	0	0	0.3	0.2
B2	0	0	0	0	0
B3	0	0	0.1	0.2	0.2
B4	14	0	0.5	1	1
D1	NA	7	0.3	NA	0.6
D2	NA	52	0.3	NA	3.7
D3	NA	30	0	NA	2.1
D4	NA	8	0	NA	0.6
E	36	NA	NA	0	0.2
% dark cutters	14	3	0.5	1	1
% poor conformations	0	86	0.3	0.2	6
% underfinished	21	34	0	0.4	3
% overfinished	0	10	17	12	13
% staggy	36	NA	NA	0	0.2
% yellow fat	0	65	0	0	4
% aged	14	98	0.6	0	7

NA — not applicable; *s* — standard deviation

a rate of 0.1%; 95% from disease and 5% from other miscellaneous causes. Cows were condemned at a rate of 1.2%; 70% from disease, 22% from emaciation, and 8% from other miscellaneous causes. Bulls were condemned due to disease at a rate of 0.2%.

Compared with beef cows, dairy cows had significantly fewer tags and brands on their hides, but they had more bruises and more severe bruises. Additionally, dairy cows had a different distribution of bruises, with more bruises on the round and fewer on the loin. As expected, dairy cows were assigned lower body condition scores than beef cows (data not shown).

Compared with the 1995 audit, there were significantly more tags and brands on hides, including multiple brands. The distribution of brands changed to fewer brands on the rib and more on the hip. The number of horns and bruises decreased. The severity of bruises changed to fewer minor bruises, more major bruises, and fewer critical bruises. The distribution of bruises changed to more chuck, loin, and round bruises and fewer rib bruises. Liver condemnations decreased and the proportion of livers fit for human consumption increased. Additionally, liver abscess scores decreased. Surface injection site lesions decreased from 1.3% to 0.2%. Whole carcass and head condemnations increased from 1995; whereas, tongue condemnations decreased. However, the proportion of #1 tongues decreased in 1999 compared with 1995.

Cooler audit

In total, 3981 carcasses were graded, representing approximately 0.1% of the annual slaughter of cattle in Canada. The carcasses were 0.4% bulls, 7% cows, 33% heifers, and 60% steers. All bulls, heifers, and steers were beef cattle; whereas, 57% of the cows were dairy cattle. Results are presented in Table 2. There was considerable variability in hot carcass weights, ribeye areas, ribeye fat, and percent lean overall and within each class of carcass. Findings of the audit were compared with CANFAX averages for the year; they did not differ significantly (data not shown), suggesting that the results were representative of the industry. However, few bull carcasses were graded and few cow carcasses were cut at the ribeye to assess ribeye area and fat and marbling scores; therefore, the results here should be interpreted with caution.

Table 3. Economic costs of nonconformities to the Canadian beef industry

Nonconformity	$ per head loss	Total $ per head loss	Loss to the industry $	Total $ to the industry
Horns		0.032		106 003
Brands		4.76		15 759 912
steers	4.20		6 784 697	
heifers	4.95		5 441 916	
cows	6.20		3 491 741	
bulls	1.20		41 558	
Tag		9.25		30 639 571
steers	9.25		14 950 448	
heifers	9.51		10 452 372	
cows	8.74		4 919 850	
bulls	9.15		316 901	
Bruising		1.30		4 309 385
steers	1.17		1 886 506	
heifers	1.03		1 136 410	
cows	2.23		1 254 860	
bulls	0.91		31 609	
Grubs		0.0002		339
Injection site lesions[a]		5.45		18 053 654
Liver discounts		2.66		8 804 274
steers	2.78		4 484 200	
heifers	2.43		2 676 323	
cows	2.79		1 571 283	
bulls	2.09		72 467	
Condemned heads		0.29		946 161
Tongue discounts		1.28		4 242 195
Condemned carcasses		2.47		8 175 942
steers & heifers	1.15		3 108 867	
cows & bulls	8.48		5 067 075	
Off-weight carcasses[b]		41.01		111 325 281
Grade losses		21.53		71 330 845
steers & heifers	23.11		62 735 184	
cows & bulls	15.26		8 595 661	
Total losses		82.62		273 693 561

[a]Injection site losses were based on the spring 1999 injection site survey at purveyors, which evaluated injection site lesions in steaks from butts, rounds, and blades as they were further processed (7)
[b]Off-weight carcasses were only discounted in steers and heifers

Compared with 1995, there was a significant increase in hot carcass weights, ribeye areas, top ribeye fat, marbling scores, A3 and D2 grades, and overfinished carcasses. There was a decrease in percent lean; middle ribeye fat; A2, B1, D1, and D3 grades; dark cutters; and aged carcasses.

Dairy cows had significantly lower hot carcass weights; smaller ribeye areas; less middle, bottom, and grade ribeye fat; a lower percent lean; a different distribution of grades, with more D3 grades; fewer dark cutters; more underfinished and fewer overfinished carcasses; and poorer conformation than had beef cows (data not shown).

Economic analysis

Results are shown in Table 3 and, where data were available, they were broken down by class of carcass. Losses on the processing floor from nonconformities amounted to $27.48 per head or $91.0 million annually. Cooler losses amounted to $55.14 per head or $182.6 million annually. In total, quality defects cost the Canadian beef industry $82.62 per head processed or $273.7 million annually. Compared with the 1995 audit losses of $70.52 per head or $189.6 million annually, there was an increase in economic losses from quality defects.

Discussion

The results of the processing floor audit indicate a reduction in horns, bruises, liver and tongue condemnations, and surface injection site lesions (1). There was an increase in tag and brands on hides. However, there was some movement of brands from the rib to the hip, which was an improvement and resulted in less hide damage. While the overall number of bruises detected and the number of minor and critical bruises decreased, the number of major bruises increased, indicating more improvements are needed in animal handling before slaughter. Whole carcass and head condemnations increased; however, this increase, while statistically significant, was numerically small.

As expected, dairy cows had fewer tag and brands on their hides than did beef cows. However, they had more severe bruises than beef cows, which may be attributed partially to their lower body condition score. Improvements in the handling and hauling of dairy cattle to slaughter and marketing them in better condition should help to reduce bruising.

In 1998–99, cattle and feed prices were such that feedlots delayed the marketing of feeder cattle

(CANFAX, personal communication). This is reflected in the audit by the increase in hot carcass weights, rib-eye areas and fat; A3 and overfinished carcasses; and a decrease in percent lean meat yield. While the economic discounts for overweight carcasses increased from 1995, they were still insufficient to encourage earlier marketing when feed prices were cheap and live cattle prices were low. Until processors discount overweight and overfat carcasses more severely, it is unlikely that there will be much improvement, and grades will continue to fluctuate depending on live cattle and feed prices.

There was an overall reduction in the number of dark cutters, due to the reduction of dark cutters in cows. The prevalence of dark cutters in cows may have been underestimated, because so few were ribbed to assess this quality defect.

While there were statistically significant differences in the occurrence of some quality defects, partially due to the large sample size, many of the changes were not large numerically. This was reflected in the economic losses, which were higher per head in 1999 at $82.62 than in 1995 at $70.52. The total dollar losses to the industry from quality defects increased, due, in part, to the increased loss per head but due mainly to the larger number of animals slaughtered per year, an increase from 2.2 million in 1995 to 3.3 million in 1999.

Failure to reduce economic losses from quality defects is most likely due to the absence of strong market and economic signals down the beef production chain from consumers to processors to feedlots to cow/calf producers encouraging change and collaboration. Failure to see large improvements in beef quality after the first audit is similar to the outcome of the national studies conducted in the United States (8–10).

The cattle industry in North America is a competitive, segmented business that makes many decisions on an economic basis. While there are a few pricing grids and branded programs available for producers to try to get some economic returns for their efforts in good quality, these programs are few, usually require retained ownership, and frequently only deal with hot carcass weight, lean meat yield, and quality grades. Thus, the economic incentives for major improvements in beef quality are few.

Another reason why there may not have been many improvements in beef quality is that it takes time for change to occur. The first audit was conducted only 3 y previously, and it may take time for some defects to be eliminated, particularly those in cows and bulls, since some defects are long term and occurred early in life, such as branding or injection site lesions. As well, some defects may have a genetic component; thus, it may take 5 to 10 y for improvements to be observed. However, time is not an issue for many improvements to have occurred in yearling cattle, since many of the quality defects could have been reduced during the last 3 y through simple changes in management, such as eliminating brands or moving rib brands to the hip or shoulder, dehorning calves, reducing tag, injecting animal health products only in the neck and by using subcutaneous products, and managing feeding and marketing programs to reduce off-grades and overweight carcasses.

What will it take to encourage improvements? Most likely, a change in Canada's marketing system of cattle, so that high quality cattle are differentiated individually from low quality cattle. With the advent of more branded programs, pricing grids and formulas, and the national cattle identification program, the tools that may help to encourage improvements in beef quality are slowly being developed. Different segments of the industry must work together in order to drive costs out of the system. Extension efforts must continue, since accredited beef quality assurance programs will become an integral part of doing business in the near future, because both domestic and international consumers are demanding proof of beef quality and food safety. Veterinarians are encouraged to do their part to encourage producers to adopt the good production practices that have been described in the "Quality Starts Here ✔" good production and recommended operating procedures binders (2,3,11). Improving beef quality will eventually reduce costs and help all segments of the beef industry to survive.

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