

Sous Vide Salmon Pasteurization Temperature

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Agenda

- Introduction & Literature Review
- Materials & Methods
- Data & Statistical Analysis
- Discussion & Limitations
- Research Conclusion
- Recommendations
- Collaboration & Extensions

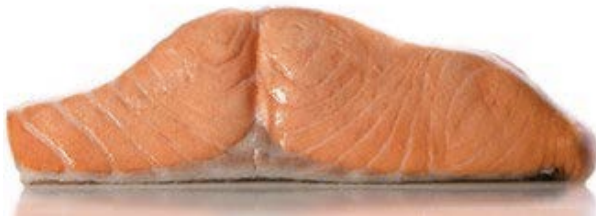


What is Sous Vide?

“Raw materials or raw materials with intermediate foods that are cooked under controlled conditions of temperature and time inside heat-stable vacuumed pouches”

- Schellekens, 1996

SOUS VIDE



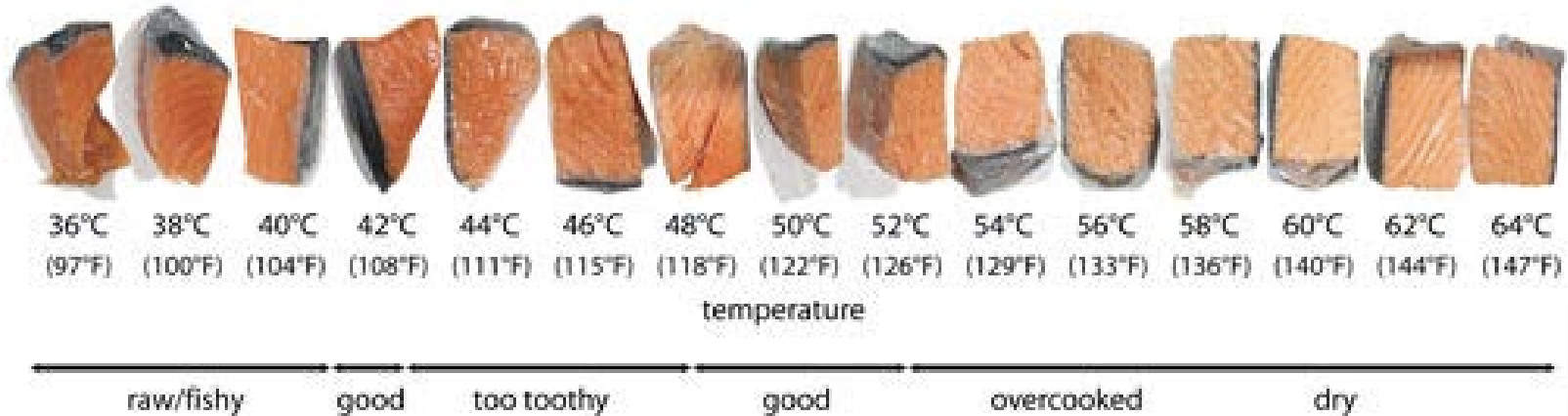
TRADITIONAL



What is Sous Vide?



The “Good” Temperature?



Techniques of Sous Vide



Sous Vide Process Pathways

1. Cook—Serve
2. Cook—Finishing Step—Serve
3. Cook—Chill—Reheat—Serve
4. Cook—Chill—Reheat—Finishing Step—Serve



Advantages

✓ Tenderness



120°F
Rare



130°F



140°F
Medium



150°F



160°F
Well

✓ Temperature Control



✓ Economic Advantages



Concerns

✧ Microbiological



✧ Time and Temperature

✧ Food in “Danger Zone” for extended periods of time



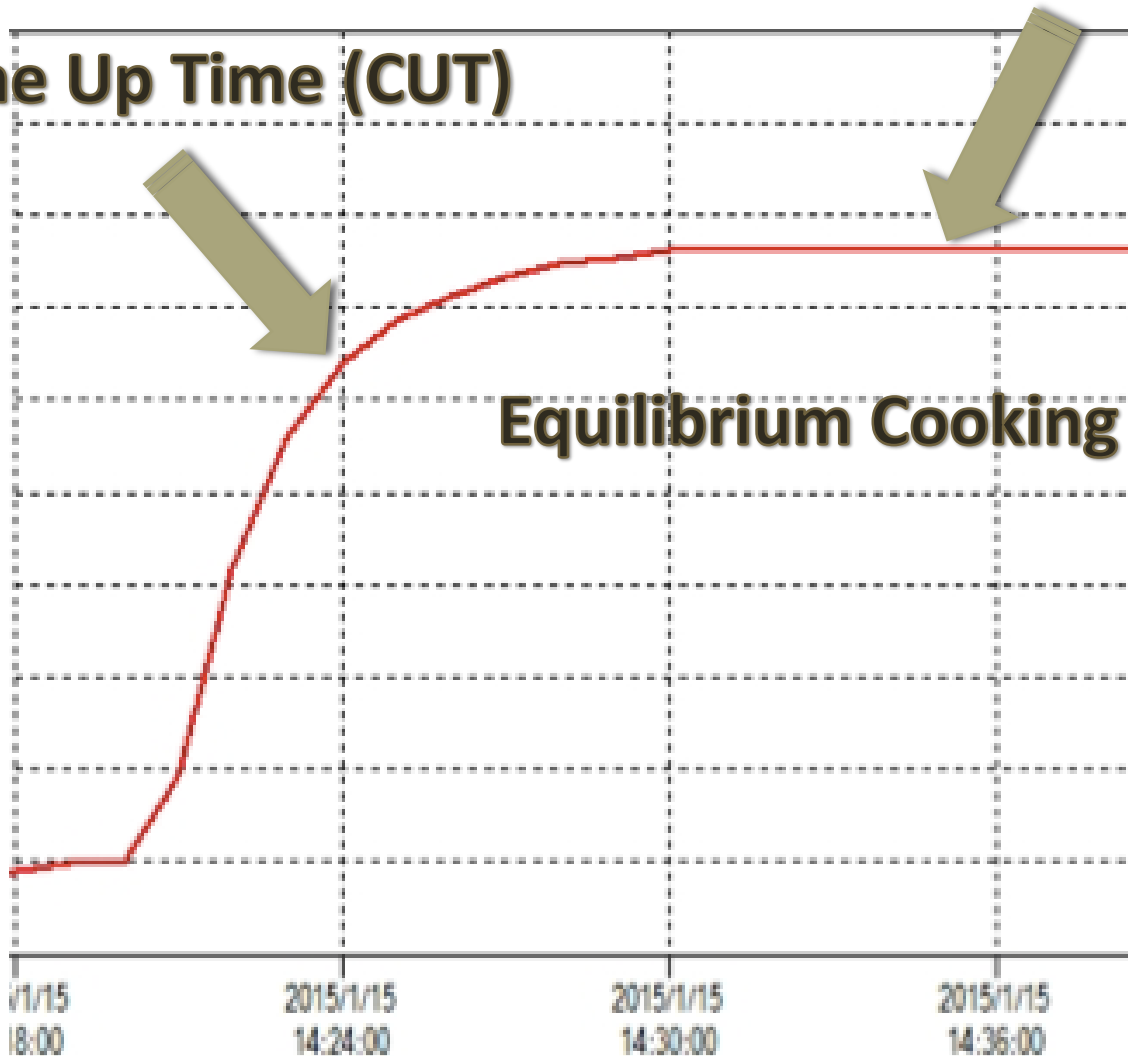
✧ Seafood



Temperature Profile

Pasteurization Time

Come Up Time (CUT)



Equilibrium Cooking

Internal Holding times for meats and poultry for *Salmonella* destruction



Temperature to equilibrate and hold foods for sous vide heating		Amount of time to hold foods to achieve full sous vide pasteurization	
Degrees Centigrade (°C)	Degrees Fahrenheit (°F)	Meats ^{a, 21} 6.5-log ₁₀ lethality	Poultry ^{b, 24} 7.0-log ₁₀ lethality
54.4	130	112 min	Sous vide cooking below 60°C is not recommended
55.0	131	89	
55.6	132	71	
56.1	133	56	
56.7	134	45	
57.2	135	36	
57.8	136	28	
58.4	137	23	
58.9	138	18	
59.5	139	15	
60.0	140	12	16.9 min
60.6	141	9	15.4
61.1	142	8	13.9
61.7	143	6	12.4
62.2	144	5	10.8
62.8	145	4	9.3
63.3	146	169 sec	7.8
63.9	147	134	6.3
64.4	148	107	4.7
65.0	149	85	3.2
65.6	150	67	1.7
66.1	151	54	1.5
66.7	152	43	1.4
67.2	153	34	1.2
67.8	154	27	1.1
68.3	155	22	54 sec
68.9	156	17	48
69.4	157	14	42
70.0	158	0	30
70.6	159	0	24
71.1	160	0	12

Why Sous Vide?

Sous vide: New way of cooking

- Very little scientific research

Suggestion from Lorraine McIntyre and the Sous Vide Working Group (BCCDC)



Purpose

Monitor the **internal temperature** of salmon cooked from raw using the **sous vide** technique to examine if combined effects of sous vide cooking step including the **finishing step** (searing) will achieve **pasteurization**



Hypotheses

***H₀**: Salmon meat cooked sous vide style at 50°C for 20 minutes **will reach 70°C** after final searing step to achieve instantaneous pasteurization.*

***H_a**: Salmon meat cooked sous vide style at 50°C for 20 minutes **will not achieve 70°C** after final searing step to achieve instantaneous pasteurization.*



Methods

how to ...

MATERIALS & METHODS



Heat Resistant Tank

Water



PolyScience Immersion Circulator



ACR SmartButtons

(SmartButton Interface cable/ TrendReader software)



PC Computer

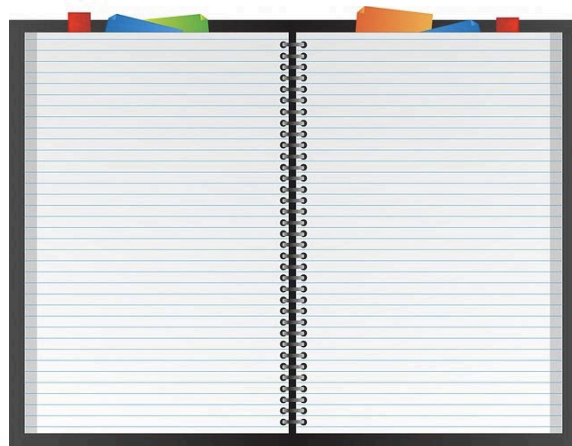


KOMET Plusvac 20 Vacuum Sealer



Salmon



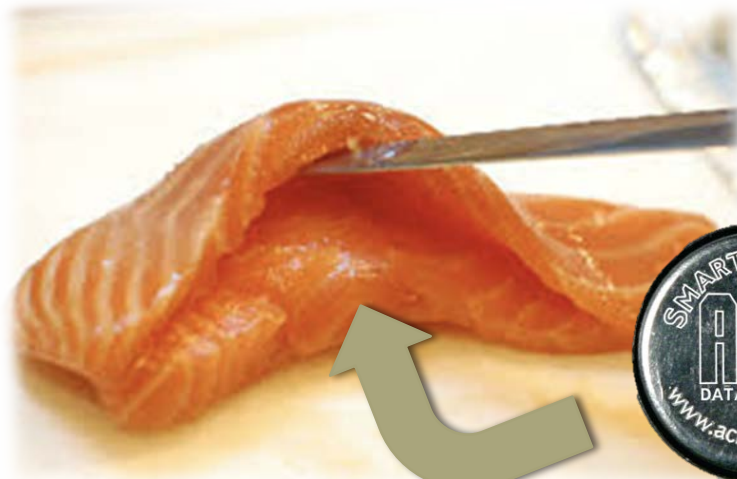
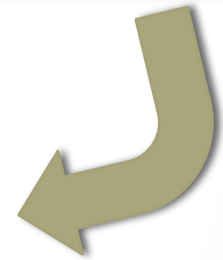


ACR SmartButtons

- ◆ *Data collection interval: 1 minute*
- ◆ *Memory usage: Stop when full*
- ◆ Connected to PC Computer for data retrieval



Fish Preparation



Vacuum Packaging



Immersion Circulator



Experiment Procedure



Control



Finishing Step

220 °C
45 Seconds



Experiment Procedure



Sample	Peak Temperature (°C) BEFORE Final Searing Step	Peak Temperature (°C) AFTER Final Searing Step
1	50	65
2	50.5	70
3	50.5	62
4	50.5	61.5
5	50.5	74
6	50.5	54
7	50.5	70.5
8	50	60.5
9	50.5	70
10	50.5	60
11	50.5	71.5
12	50	65
13	50	56
14	50	62
15	50.5	56.5
16	50.5	61
17	50.5	63
18	50	59.5
19	50	52.5
20	50	61
21	50.5	62
22	50.5	53.5
23	50.5	61
24	50	58
25	50	52
26	50	55
27	50	66
28	50	56
29	50.5	66
30	50	66



Temperature Graph

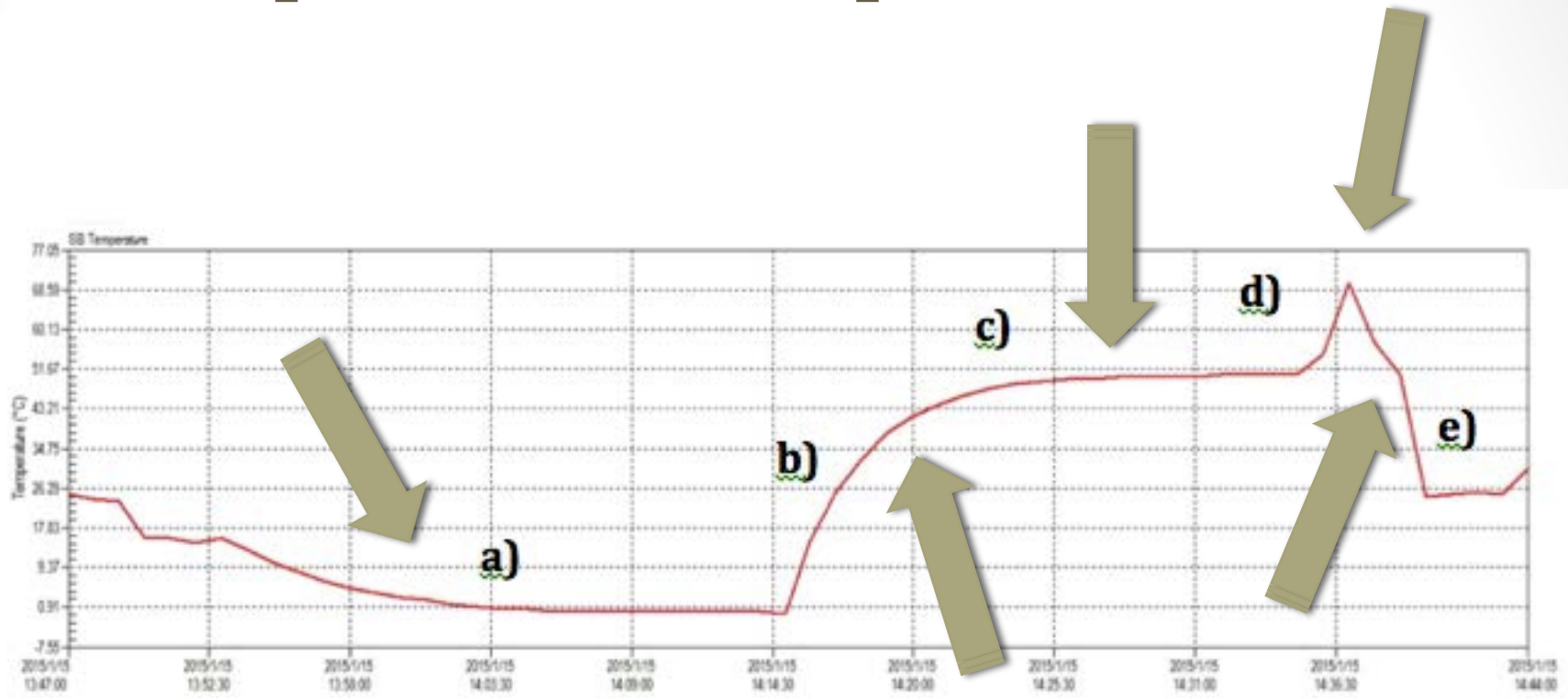


Figure 1: Temperature graph generated by [SmartButton](#)

Statistical Analysis

- Data was **Normally Distributed**
- **One-sample One-tailed T-test**



Interpretations of Data



- Results were **Statistically Significant**
 - P-value = 0.00
 - Power = 1.00
- Null hypothesis (H_0) **rejected**



DISCUSSION & LIMITATIONS

Sous Vide and FBI

Vipin Vikraman (2011)

Sous vide Salmon @ 53°C for 20 minutes:

- 1.0 log reduction



Gonzalez-Fandos et al (2005)

Sous vide Salmon @ 90°C for 15 minutes; Stored at 2°C for 45 days:

- Did not contain *S. aureus*, *B. cereus*, *C. perfringens* and *L. monocytogenes*
- Drastically decreased sensory characteristics and quality

Restaurant Sous Vide



BC Centre for Disease Control
An agency of the Provincial Health Services Authority

Sous vide of shell eggs

Request received from:	Regional Health Authority
Date of request:	January 9, 2015
Issue (brief description):	A premise with 2 confirmed <i>Salmonella enterica</i> var. Enteritidis (SE) was using the sous vide technique on shell eggs. Evaluate the process of shell egg sous vide for risk in transmission of SE.

Sous vide style cooking of duck breast

Request received from:	Regional Health Authority
Date of request:	Date: January 19, 2015
Issue (brief description):	Sous vide duck breast, and grilled duck breast processes are being questioned by inspectors as the meat in centre of breast is pink at service. One <i>Salmonella</i> illness implicated with sous vide duck breast cooking. At another premise where grilled duck breast was served pink, the Chef asserted it was acceptable to cook duck breast to an internal temperature of 57°C as duck meat does not carry <i>Salmonella</i> . Assess health risk of duck in general and sous vide recipe.

Seafood Concerns



Limitations

Small Salmon portions

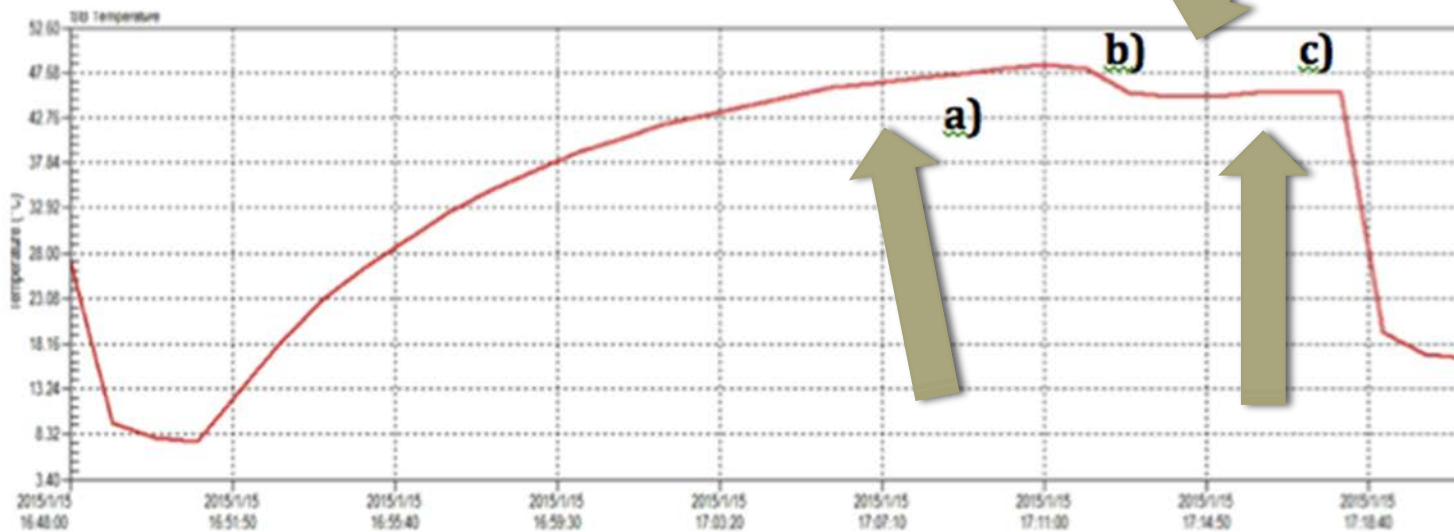


Figure 2: Data collection graph of Sample 32 (Regular serving size of Salmon)

Limitations

SmartButton Collection Intervals



Final Searing Step



Conclusion

Salmon cooked at **50°C** inside a circulating water bath for **20 minutes** with an additional searing step at **220°C for 45 seconds** **did not** achieve appropriate target pasteurization temperature (**70°C**).



Recommendations

✓ Consumer Disclosure

- ✓ Verbal communication
- ✓ Menu labels
- ✓ Table Tents

✓ Freezing Control

- ✓ -35°C for 15 hours
- ✓ -20°C for 7 days



✓ Calibrate Instruments

- ✓ Immersion Circulator
- ✓ Thermometer

Vancouver Coastal Health
Promoting wellness. Ensuring care.



Vancouver Coastal Health advises:

"The consumption of **RAW** oysters poses an increased risk of foodborne illness. A cooking step is needed to eliminate potential bacterial or viral contamination."

Medical Health Officer



Recommendations

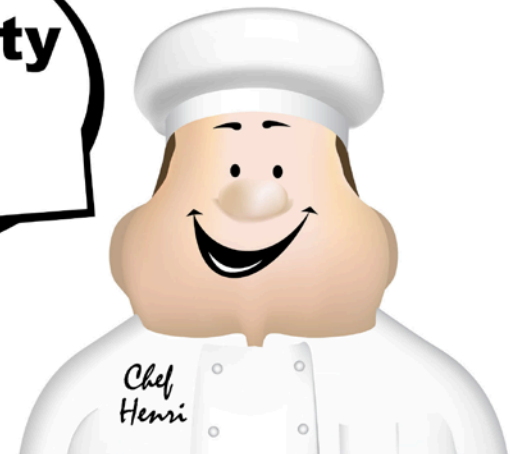
- ✓ **Adhere to Specific Sous Vide Food Safety Plans**

- ✓ Vacuum specifications
- ✓ Temperature measurements
- ✓ Come-up Time & Pasteurization Time
- ✓ Temperature logs

- ✓ **SANITATION!**

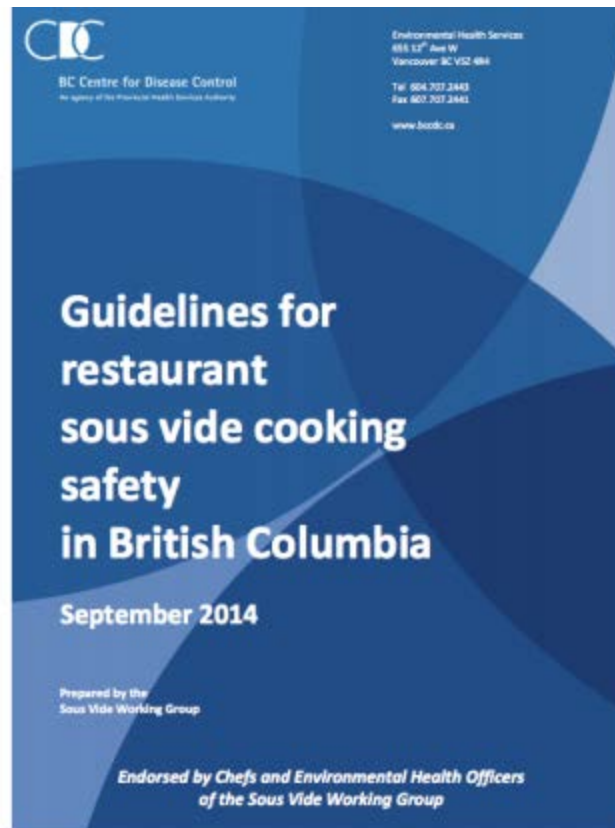


**Food Safety
is my #1
priority!**



BCCDC Sous Vide Working Group

Guidelines for Restaurant Sous Vide Cooking Safety in British Columbia (2014)



Collaborations & Extensions

Lorraine McIntyre, MSc

Environmental Health Services

BC Centre for Disease Control



BC Centre for Disease Control

An agency of the Provincial Health Services Authority

Tobias MacDonald

Executive Chef & Instructor

Vancouver Community Collage



