SAND2013-1383P

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Parameter	Units
Production process flow (toxins): Fermentor + centrifug	
Production concentration: Fermentor	mg/L of culture
Production batch time: Fermentor + centrifugation, chromatography	
Production post-processing mass recovery: Fermentor + centrifuge, chromatography	%
Production post-processing active fraction: Fermentor + centrifuge, chromatography	%
Production process flow (toxins): Shake flask, filtration	
Production concentration: Shake flask	mg/L of culture
Production batch time: Shake flask, filtration	
Production post-processing mass recovery: Shake flask, filtration	%

Production post-processing active fraction: Shake flask, filtration	%
Production process flow (toxins): Extraction, centrifuga	
Production concentration: Extraction	Mass fraction in source
Production batch time: Extraction, centrifugation, chromatography	
Production post-processing mass recovery: extraction, centrifugation, chromatography	%
Production post-processing active fraction: extraction, centrifugation, chromatography	%
Production process flow (toxins): Extraction, precipitati	
Production concentration: Extraction, precipitation, filtration	Mass fraction in source
Production batch time: Extraction, precipitation, filtration	
Production post-processing mass recovery: Extraction, precipitation, filtration	%
Production post-processing active fraction: Extraction, precipitation, filtration	%
Production process flow (protozoa): Filtration of feces	

Production concentration: Filtration of feces	oocysts or cysts/g feces
Production batch time: Filtration of feces	
Production post-processing mass recovery: Filtration of feces	%
Production post-processing active/viable fraction: Filtration of feces	%
Agent parameters	
Storage loss	%/day
Alternate storage loss	%/day
Inhalation Median Infectious Dose (ID50)	cfu or spores
Inhalation Infectious Dose Probit Slope	-
Inhalation Median Toxic Dose (TD50)	µg/kg
Inhalation Toxic Dose Probit Slope	-
Inhalation Median Lethal Dose (LD50)	µg/kg
Inhalation Lethal Dose Probit Slope	-

Inhalation mortality rate - untreated	%
Ingestion Median Infectious Dose (ID50)	cfu or spores
Ingestion Infectious Dose Probit Slope	-
Ingestion Median Toxic Dose (TD50)	μg/kg
Ingestion Toxic Dose Probit Slope	-
Ingestion Median Lethal Dose (LD50)	μg/kg
Ingestion Lethal Dose Probit Slope	-
Ingestion mortality rate - untreated	%

Definition	Abrin	Notes/Refs
;e, chromatography		
Highest concentration of toxin in culture medium achieved by experts using fermentor production methods.		
The length of time needed to produce a single batch of agent. This batch time includes not only incubation and purification, but also the preparation and clean-up efforts that would be required. Under this parameter, you will note that when applicable, the incubation time for the bacteria producing the toxin is provided as part of the basis for generating the batch time.		
Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the bacterial culture medium.		
Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses		
Highest concentration of toxin in culture medium achieved by experts using shake flask production methods.		
The length of time needed to produce a single batch of agent. This batch time includes not only incubation and purification, but also the preparation and clean-up efforts that would be required. Under this parameter, you will note that when applicable, the incubation time for the bacteria producing the toxin is provided as part of the basis for generating the batch time.		
Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the bacterial culture medium.		

Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses		
tion, chromatography		
The concentration of toxin in unprocessed seeds/beans/mussels.	0.01 [Hegde et al. 1991]	
The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	5 days [Lin et al, 1981; Wei et al, 1974]	
Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or mussels).	50%	
Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	20% [Hegde et al 1991]	
on, filtration		
The concentration of toxin in unprocessed seeds/beans/mussels.	0.0038 [Dickers et. al 2003 & 1978; Hegde et al. 1991]	
The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	5 days [Lin et al, 1981; Wei et al, 1974]	
Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or mussels).	50%	
Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	20% [Hegde et al 1991]	

Concentration of cysts or oocysts in wet feces		
The length of time needed to produce a single batch of biological agent. This batch time includes not only filtration, but also the infection of calves, collection of calf feces, and preparation and clean-up efforts that would be required.		
highest percentage recovery of agent that would be achieved by experts using filtration production methods. This is the mass of agent present after all processing steps divided by the mass of agent that was present in the calf feces.		
Percent of agent that is active/viable after the production post-processing steps, not including storage, transport, or dissemination losses		
Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0.7% [Olsnes 1978]	
If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		
The dose or amount of agent required to infect 50% of a healthy adult population that inhales it.		
The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		
The dose or amount of agent toxic to 50% of a healthy adult population that inhales it.		
The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		
The dose or amount of agent lethal to 50% of a healthy adult population that inhales it.	3.3 [Dickers et al 2003]	
The change of probability of lethality as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		

The percent of the affected population expected to die without treatment following infection/intoxication by inhalation of the biological agent.		
The dose or amount of agent required to infect 50% of a healthy adult population that ingests it.		
The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.		
The dose or amount of agent toxic to 50% of a healthy adult population that ingests it.	0.1 [Dickers et al., 2003; Houston, 1982]	
The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	
The dose or amount of agent lethal to 50% of a healthy adult population that ingests it.	0.84 [BTRA]	
The change of probability of lethality as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	
The percent of the affected population expected to die without treatment following infection/intoxication by ingestion of the biological agent.		

C. botulinum toxin (Botulinum neurotoxins)	Notes/Refs	Ricin toxin	Notes/Refs	Saxitoxin	Notes/Refs	Staphylococcal enterotoxins A, B, C, D, and E
50 [Sugii and Sakaguchi, 1975; Malizio et al, 2000]						300 [Jarvis et al, 1973; Reiser et al, 1969]
10 days [Malizio et al, 2000]; incubation time 5 days						4 days [Schantz et al 1965]; incubation time 18 hours
39% [Sugii and Sakaguchi, 1975]						80% [Schantz et al 1965]
43% [Sugii and Sakaguchi, 1975]						80% [Schantz et al 1965]
50 [Sugii and Sakaguchi, 1975; Malizio et al, 2000]						300 [Jarvis et al, 1973; Reiser et al, 1969]
10 days [Malizio et al, 2000]; incubation time 5 days						4 days [Schantz et al 1965]; incubation time 18 hours
39% [Sugii and Sakaguchi, 1975]						80% [Schantz et al 1965]

43% [Sugii and Sakaguchi, 1975]						80% [Schantz et al 1965]
		0.03 [Dembek 2007]		0.0003 [Bricelj and Shumway, 1998]		
		5 days [Lin Li 1980]		4 days [Schantz et al 1957]		
		50% [Olsnes 1978]		75%		
		20%		50%		
		0.03 [Dembek 2007]		0.0003 [Bricelj and Shumway, 1998]		
		5 days [Lin Li 1980]		6 days [Schantz et al 1957]		
		50% [Olsnes 1978]		75%		
		20%		50%		

0% [Malizio et al 2000]		0.7% [Olsnes 1978]		0% [Alfonso et al 1994]		0.5% [BTRA]
0.0019 [BTRA]						0.0004 [Dembek 2007]
2.19 [BTRA]						
0.01 [Dembek 2007]		7.5 [Bradberry et al 2003]		5.7 [Patockaa & Stredab, ASA Newsletter, 2002]		0.02 [Dembek 2007]
2.19 [BTRA]		2.5 [BTRA]		5 [BTRA]		

0.0046 [Schantz and Johnson, 1992]				2.3 [BTRA]		0.1 [BTRA]
2.25 [BTRA]		2.25 [BTRA]		2.25 [BTRA]		2.25 [BTRA]
0.12 [Schantz and Johnson, 1992; Arnon et al, 2001]		1000 [Bradberry et al 2003]		20 [BTRA]		31 [BTRA]
2.25 [BTRA]		2.25 [BTRA]		2.25 [BTRA]		2.25 [BTRA]

Notes/Refs	Giardia lamblia	Notes/Refs	Cryptosporidium	Notes/Refs

	15,000 [Nydam et al 2001]		90,000 [Nydam et al 2001]	
	21 days [Nydam et al 2001]		16 days [Nydam et al 2001]	
	40% [Alvarado et al 2006]		40% [Alvarado et al 2006]	
	5% [DeRegnier et al 1989]		0.2% [Brasseur et al 1998]	

	10 [Schaefer et al 1991]		132 (Nydam et al, 2001)	
			0 [Hoxie et al 1997]	

Subject Matter Expert Parameter Vetting Worksheet: Abrin

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

Estimated values are provided when open source references were unavailable.
SMEs are asked to vet these values, in particular, and provide any known references.

Production process flow (toxins): Extraction, centrifugation, chromatography							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Extraction	The concentration of toxin in unprocessed seeds/beans/mussels.	0.01 [Hegde et al. 1991]	Mass fraction in source		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Extraction, centrifugation, chromatography	The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	5 days [Lin et al, 1981; Wei et al, 1974]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: extraction, centrifugation, chromatography	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or	50%	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: extraction, centrifugation, chromatography	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	20% [Hegde et al 1991]	%		☐ Agree ☐ Do Not Know ☐ Disagree		

Production process flow (toxins): Extraction, precipitation, filtration							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Extraction, precipitation, filtration	The concentration of toxin in unprocessed seeds/beans/mussels.	0.0038 [Dickers et. al 2003 & 1978; Hegde et al. 1991]	Mass fraction in source		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Extraction, precipitation, filtration	The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	5 days [Lin et al, 1981; Wei et al, 1974]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Extraction, precipitation, filtration	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or	50%	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Extraction, precipitation, filtration	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	20% [Hegde et al 1991]	%		☐ Agree ☐ Do Not Know ☐ Disagree		

Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0.7% [Olsnes 1978]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that inhales it.		µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Toxic Dose Probit Slope	The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		-		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that inhales it.	3.3 [Dickers et al 2003]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Lethal Dose Probit Slope	The change of probability of lethality as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that ingests it.	0.1 [Dickers et al., 2003; Houston, 1982]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Toxic Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that ingests it.	0.84 [BTRA]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Lethal Dose Probit Slope	The change of probability of lethality as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		

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Dickers, K. J., S. M. Bradberry, P. Rice, G. D. Griffiths and J. A. Vale (2003). "Abrin poisoning." Toxicol Rev **22**(3): 137-142.
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Olsnes, S. (1978). "Toxic and nontoxic lectins from Abrus precatorius." Methods in Enzymology **50**: 323-330.
Wei, C. H., F. C. Hartman, P. Pfuderer and W. K. Yang (1974). "Purification and Characterization of 2 Major Toxic Proteins from Seeds of Abrus-Precatorius." Journal of Biological Chemistry **249**(10): 3061-3067.

1-109.

Subject Matter Expert Parameter Vetting Worksheet: C. botulinum toxin

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

Estimated values are provided when open source references were unavailable.
SMEs are asked to vet these values, in particular, and provide any known references.

Production process flow (toxins): Fermentor + centrifuge, chromatography							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Fermentor	Highest concentration of toxin in culture medium achieved by experts using fermentor production methods.	50 [Sugii and Sakaguchi, 1975; Malizio et al, 2000]	mg/L of culture		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Fermentor + centrifugation, chromatography	The length of time needed to produce a single batch of agent. This batch time includes not only incubation and purification, but also the preparation and clean-up efforts that would be required. Under this parameter, you will note that when applicable, the incubation time for the bacteria producing the toxin is provided as part of the basis for generating the batch time.	10 days [Malizio et al, 2000]; incubation time 5 days			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Fermentor + centrifuge, chromatography	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the bacterial culture medium.	39% [Sugii and Sakaguchi, 1975]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Fermentor + centrifuge, chromatography	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	43% [Sugii and Sakaguchi, 1975]	%		☐ Agree ☐ Do Not Know ☐ Disagree		

Production process flow (toxins): Shake flask, filtration	0						
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Shake flask	Highest concentration of toxin in culture medium achieved by experts using shake flask production methods.	50 [Sugii and Sakaguchi, 1975; Malizio et al, 2000]	mg/L of culture		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Shake flask, filtration	The length of time needed to produce a single batch of agent. This batch time includes not only incubation and purification, but also the preparation and clean-up efforts that would be required. Under this parameter, you will note that when applicable, the incubation time for the bacteria producing the toxin is provided as part of the basis for generating the batch time.	10 days [Malizio et al, 2000]; incubation time 5 days			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Shake flask, filtration	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the bacterial culture medium.	39% [Sugii and Sakaguchi, 1975]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Shake flask, filtration	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	43% [Sugii and Sakaguchi, 1975]	%		☐ Agree ☐ Do Not Know ☐ Disagree		

Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0% [Malizio et al 2000]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that inhales it.	0.0019 [BTRA]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Toxic Dose Probit Slope	The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.	2.19 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that inhales it.	0.01 [Dembek 2007]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Lethal Dose Probit Slope	The change of probability of lethality as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.	2.19 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that ingests it.	0.0046 [Schantz and Johnson, 1992]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Toxic Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that ingests it.	0.12 [Schantz and Johnson, 1992; Arnon et al, 2001]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		

Ingestion Lethal Dose Probit Slope	The change of probability of lethality as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		

References

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Malizio, C. J., M. C. Goodnough and E. A. Johnson (2000). Purification of Clostridium botulinum Type A Neurotoxin. Bacterial Toxins: Methods and Protocols. O. Holst. Totowa, NJ, Humana Press Inc. **145**.

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. Swerdlow, K. Tonat and W. G. C. Biodefense (2001). "Botulinum toxin as a biological weapon - Medical and public health management." Journal of the American Medical Association **285**(8): 1059-1070.

Subject Matter Expert Parameter Vetting Worksheet: Ricin toxin

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

Estimated values are provided when open source references were unavailable.
SMEs are asked to vet these values, in particular, and provide any known references.

Production process flow (toxins): Extraction, centrifugation, chromatography							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Extraction	The concentration of toxin in unprocessed seeds/beans/mussels.	0.03 [Dembek 2007]	Mass fraction in source		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Extraction, centrifugation, chromatography	The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	5 days [Lin Li 1980]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: extraction, centrifugation, chromatography	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or	50% [Olsnes 1978]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: extraction, centrifugation, chromatography	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	0.2	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production process flow (toxins): Extraction, precipitation, filtration							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Extraction, precipitation, filtration	The concentration of toxin in unprocessed seeds/beans/mussels.	0.03 [Dembek 2007]	Mass fraction in source		☐ Agree ☐ Do Not Know ☐ Disagree		

Production batch time: Extraction, precipitation, filtration	The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	5 days [Lin Li 1980]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Extraction, precipitation, filtration	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or	50% [Olsnes 1978]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Extraction, precipitation, filtration	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	0.2	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0.7% [Olsnes 1978]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that inhales it.		µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Toxic Dose Probit Slope	The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		-		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that inhales it.	7.5 [Bradberry et al 2003]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Lethal Dose Probit Slope	The change of probability of lethality as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.	2.5 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		

Ingestion Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that ingests it.		µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Toxic Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that ingests it.	1000 [Bradberry et al 2003]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Lethal Dose Probit Slope	The change of probability of lethality as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		

References

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Lin, T. T. S. and S. S. L. Li (1980). "Purification and Physicochemical Properties of Ricins and Agglutinins from Ricinus-Communis." European Journal of Biochemistry **105**(3): 453-459.

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Subject Matter Expert Parameter Vetting Worksheet: Saxitoxin

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

Estimated values are provided when open source references were unavailable.
SMEs are asked to vet these values, in particular, and provide any known references.

Production process flow (toxins): Extraction, centrifugation, chromatography							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Extraction	The concentration of toxin in unprocessed seeds/beans/mussels.	0.0003 [Bricelj and Shumway, 1998]	Mass fraction in source		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Extraction, centrifugation, chromatography	The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	4 days [Schantz et al 1957]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: extraction, centrifugation, chromatography	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or	0.75	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: extraction, centrifugation, chromatography	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	0.5	%		☐ Agree ☐ Do Not Know ☐ Disagree		

Production process flow (toxins): Extraction, precipitation, filtration							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Extraction, precipitation, filtration	The concentration of toxin in unprocessed seeds/beans/mussels.	0.0003 [Bricelj and Shumway, 1998]	Mass fraction in source		☐ Agree ☐ Do Not Know ☐ Disagree		

Production batch time: Extraction, precipitation, filtration	The length of time needed to produce a single batch of agent. This batch time includes not only extraction and purification, but also the preparation and clean-up efforts that would be required.	6 days [Schantz et al 1957]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Extraction, precipitation, filtration	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the initial source (seeds, beans, or	0.75	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Extraction, precipitation, filtration	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	0.5	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0% [Alfonso et al 1994]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that inhales it.		μg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Toxic Dose Probit Slope	The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.		-		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that inhales it.	5.7 [Patockaa & Stredab, ASA Newsletter, 2002]	μg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		

Inhalation Lethal Dose Probit Slope	The change of probability of lethality as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.	5 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that ingests it.	2.3 [BTRA]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Toxic Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that ingests it.	20 [BTRA]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Lethal Dose Probit Slope	The change of probability of lethality as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		

References

Alfonso, A., M. C. Louzao, M. R. Vieytes and L. M. Botana (1994). "Comparative study of the stability of saxitoxin and neosaxitoxin in acidic solutions and lyophilized samples." Toxicon **32**: 1593-1598.

Bricelj, V. M. and S. W. Shumway (1998). "Paralytic shellfish toxins in bivalve molluscs: occurence, transfer kinetics, and biotransformation." Reviews in Fisheries Science **6**(4): 315-383.

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Patockaa, J. and L. Stredab (2002). "Brief review of natural nonprotein neurotoxins." ASA Newsletter **89**(16).

Schantz, E. J., J. D. Mold, D. W. Stanger, J. Shavel, F. J. Riel, J. P. Bowden, J. M. Lynch, R. S. Wyler, B. Riegel and H. Sommer (1957). "Paralytic Shellfish Poison .4. A Procedure for the Isolation and Purification of

the Poison from Toxic Clam and Mussel Tissues." Journal of the American Chemical Society **79**(19): 5230-5235.

Subject Matter Expert Parameter Vetting Worksheet: Staphylococcal enterotoxins A, B, C, D, and E

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

***Estimated values are provided when open source references were unavailable.**
SMEs are asked to vet these values, in particular, and provide any known references.

Production process flow (toxins): Fermentor + centrifuge, chromatography							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Fermentor	Highest concentration of toxin in culture medium achieved by experts using fermentor production methods.	300 [Jarvis et al, 1973; Reiser et al, 1969]	mg/L of culture		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Fermentor + centrifugation, chromatography	The length of time needed to produce a single batch of agent. This batch time includes not only incubation and purification, but also the preparation and clean-up efforts that would be required. Under this parameter, you will note that when applicable, the incubation time for the bacteria producing the toxin is provided as part of the basis for generating the batch time.	4 days [Schantz et al 1965]; incubation time 18 hours			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Fermentor + centrifuge, chromatography	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the bacterial culture medium.	80% [Schantz et al 1965]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Fermentor + centrifuge, chromatography	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	80% [Schantz et al 1965]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production process flow (toxins): Shake flask, filtration			**0**				
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**

Production concentration: Shake flask	Highest concentration of toxin in culture medium achieved by experts using shake flask production methods.	300 [Jarvis et al, 1973; Reiser et al, 1969]	mg/L of culture		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Shake flask, filtration	The length of time needed to produce a single batch of agent. This batch time includes not only incubation and purification, but also the preparation and clean-up efforts that would be required. Under this parameter, you will note that when applicable, the incubation time for the bacteria producing the toxin is provided as part of the basis for generating the batch time.	4 days [Schantz et al 1965]; incubation time 18 hours			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Shake flask, filtration	Highest percentage recovery of toxin that would be achieved by experts . This is the mass of toxin present after all processing steps divided by the mass of toxin that was present in the bacterial culture medium.	80% [Schantz et al 1965]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active fraction: Shake flask, filtration	Active toxin percent of total solids after the production post-processing steps, not including storage, transport, or dissemination losses	80% [Schantz et al 1965]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0.5% [BTRA]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that inhales it.	0.0004 [Dembek 2007]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Toxic Dose Probit Slope	The change of probability of an illness as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.	0	-		☐ Agree ☐ Do Not Know ☐ Disagree		

Inhalation Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that inhales it.	0.02 [Dembek 2007]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Inhalation Lethal Dose Probit Slope	The change of probability of lethality as a function of change in inhaled dose. A higher probit slope indicates less variance in the dose respose of the population.	0	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Toxic Dose (TD50)	The dose or amount of agent toxic to 50% of a healthy adult population that ingests it.	0.1 [BTRA]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Toxic Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Lethal Dose (LD50)	The dose or amount of agent lethal to 50% of a healthy adult population that ingests it.	31 [BTRA]	µg/kg		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Lethal Dose Probit Slope	The change of probability of lethality as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.	2.25 [BTRA]	-		☐ Agree ☐ Do Not Know ☐ Disagree		

References

BTRA, BTRA 2010 Input Data Sheet, Battelle Memorial Institute.

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Schantz, E. J., W. G. Roessler, J. Wagman, L. Spero, D. A. Dunnery and M. S. Bergdoll (1965). "Purification of Staphylococcal Enterotoxin B." Biochemistry **4**(6): 1011-&.

Subject Matter Expert Parameter Vetting Worksheet: Giardia lamblia

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

***Estimated values are provided when open source references were unavailable.**
SMEs are asked to vet these values, in particular, and provide any known references.

Parameter	Definition	Value	Units	Notes/Refs	Reviewer Evaluation	Proposed value	Reviewer Comments/References
Production process flow (protozoa): Filtration of feces							
Production concentration: Filtration of feces	Concentration of cysts or oocysts in wet feces	15,000 [Nydam et al 2001]	oocysts or cysts/g feces		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Filtration of feces	The length of time needed to produce a single batch of biological agent. This batch time includes not only filtration, but also the infection of calves, collection of calf feces, and preparation and clean-up efforts that would be required.	21 days [Nydam et al 2001]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Filtration of feces	highest percentage recovery of agent that would be achieved by experts using filtration production methods. This is the mass of agent present after all processing steps divided by the mass of agent that was present in the	40% [Alvarado et al 2006]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active/viable fraction: Filtration of feces	Percent of agent that is active/viable after the production post-processing steps, not including storage, transport, or dissemination losses		%		☐ Agree ☐ Do Not Know ☐ Disagree		
Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	5% [DeRegnier et al 1989]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		

Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Infectious Dose (ID50)	The dose or amount of agent required to infect 50% of a healthy adult population that ingests it.	10 [Schaefer et al 1991]	cfu or spores		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Infectious Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.		-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion mortality rate - untreated	The percent of the affected population expected to die without treatment following infection/intoxication by ingestion of the biological agent.		%		☐ Agree ☐ Do Not Know ☐ Disagree		

References

Alvarado, M. E. and M. Wasserman (2006). "Quick and efficient purification of Giardia intestinalis cysts from fecal samples." Parasitology Research **99**(3): 300-302.

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Subject Matter Expert Parameter Vetting Worksheet: Cryptosporidium

Department of Homeland Security, Science and Technology Directorate, Chemical and Biological Division
March 2013

Estimated values are provided when open source references were unavailable.
SMEs are asked to vet these values, in particular, and provide any known references.

Production process flow (protozoa): Filtration of feces							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Production concentration: Filtration of feces	Concentration of cysts or oocysts in wet feces	90,000 [Nydam et al 2001]	oocysts or cysts/g feces		☐ Agree ☐ Do Not Know ☐ Disagree		
Production batch time: Filtration of feces	The length of time needed to produce a single batch of biological agent. This batch time includes not only filtration, but also the infection of calves, collection of calf feces, and preparation and clean-up efforts that would be required.	16 days [Nydam et al 2001]			☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing mass recovery: Filtration of feces	highest percentage recovery of agent that would be achieved by experts using filtration production methods. This is the mass of agent present after all processing steps divided by the mass of agent that was present in the	40% [Alvarado et al 2006]	%		☐ Agree ☐ Do Not Know ☐ Disagree		
Production post-processing active/viable fraction: Filtration of feces	Percent of agent that is active/viable after the production post-processing steps, not including storage, transport, or dissemination losses		%		☐ Agree ☐ Do Not Know ☐ Disagree		
Agent parameters							
Parameter	**Definition**	**Value**	**Units**	**Notes/Refs**	**Reviewer Evaluation**	**Proposed value**	**Reviewer Comments/References**
Storage loss	Percent of agent that is rendered non-viable or inactive, per day, when stored at 4 degrees Celcius	0.2% [Brasseur et al 1998]	%/day		☐ Agree ☐ Do Not Know ☐ Disagree		

Alternate storage loss	If other storage conditions are ideal, describe ideal storage conditions and list the associated storage loss. Storage loss is the percent of agent that is rendered non-viable or inactive, per day.		%/day		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Median Infectious Dose (ID50)	The dose or amount of agent required to infect 50% of a healthy adult population that ingests it.	132 (Nydam et al, 2001)	cfu or spores		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion Infectious Dose Probit Slope	The change of probability of an illness as a function of change in ingested dose. A higher probit slope indicates less variance in the dose respose of the population.		-		☐ Agree ☐ Do Not Know ☐ Disagree		
Ingestion mortality rate - untreated	The percent of the affected population expected to die without treatment following infection/intoxication by ingestion of the biological agent.	0 [Hoxie et al 1997]	%		☐ Agree ☐ Do Not Know ☐ Disagree		

References

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