

Sandy Elms.

The draft was great and I had a lot of fun reading it. It was a pleasure and an honor to be part of this and I hope you find my comments helpful.

I will try and address my comments by page number as they appeared in my 401 page draft copy. Please let me know if this format doesn't jibe with easy editing and I will try and re-compose my comments.

Page 3 (although the pagination doesn't show a 3....)

While it is not the norm that a facilities director would be in charge of security, you explained later how Toni came into this "added" responsibility. Security of the agents (versus physical security) would typically be the responsibility of the laboratory director – Howard McAlpine. It would ultimately be his ass on the line if material was missing. I don't have any particular suggestions for modification except that I don't think that Howard McAlpine would be so bored or cavalier about sloppy log-books or missing agents.

Agent logging is called "Bio-assurity". This is a relatively new terminology and has gained a lot of gusto since the Anthrax attacks of 2001. It is a term that was really borrowed from the nuclear industry that has to account for all regulated isotopes by weight. It is certainly much harder to account for micro-organisms (viruses) because you can grow them in your lab – ideally you will have more at the end of the day! Many microbiologists (and lab directors) found the task of bio-assurity to be a major task – I'm sure that Lt. Korch can shed some of his trials on the nuances and hardships of bio-assurity.

Agents typically would not be stored in the aerosolized form. Aerosolization is generated only during exposure trials. I suggest deleting the word "aerosolized" before Madoba.

Page 4-

I like the reference to "perfume sprays" – nice aerosolization imagery.

Delete or modify the reference to "antidote" to "anti-viral". Antidotes are used for toxins and venoms.

Consider changing the sentence, "Toni herself had **done** the training...." to "Toni herself had **undergone** the training....". This is a minor point, but my first reading was that she had "conducted" the training.

References to "hazardous materials log" -- consider changing these references to "bio-assurity log". A hazardous materials log usually refers to other lab materials, such as flammables, solvents, acids, etc. These hazardous materials are treated far differently than live agents (especially BSL4 agents).

Page 5-

Another reference to “aerosolized” Madoba. I won’t label all of them.....

Page 6-

This is the first reference to Howard McAlpine’s job as Lab Director. Perhaps this is where you can explain his indifference to the missing agents/ log errors or change his attitude to “Oh shit!”.

Great description of the BSL4 lab and mechanical support.

Page 7-

There is a reference to a “hazardous materials safe”. I suggest changing this to “**the Vault**” –as hazardous materials typically has another reference that I stated above. Typically, live agents are kept in a refrigerator, or a freezer, or a ultra-low temperature freezer (-80 degrees C). The ultra-low are for archival purposes. The refrigerators and freezers in the newer high containment labs are kept in a separate room from the rest of the lab – primarily because they generate so much heat and consequently would make the space uncomfortable for people (even wearing an “air conditioned” suit). These rooms typically aren’t locked because getting into the lab was enough “rigor”, although it would be feasible and logical to lock the freezers and refrigerators. Many lab freezers come with a touch-pad cipher lock – not a padlock. Camera systems are now linked to the cipher locks –so when you touch the pad the camera starts recording. Older model refrigerators and freezers are retro-fitted with a hasp and lock – just like you indicated the “thiefs” broke into.

Page 9-

Reference to entering BSL4 lab – “ Yes. He changed quicker than I did”. If Michael entered the Chemical Shower before Dr. Ansari then he would easily have about 15 minutes (+/-). Passing into the lab goes through a similar protocol as exiting because once a person enters the BSL4 lab from the Chem Shower the Chem Shower is considered CONTAMINATED – therefore before someone can enter the Chem Shower from the clean side the Chem Shower would have to go through a cycle to DECONTAMINATE the Chem Shower without passing contaminated air into the suit room (See sketch 1).

To make a long comment short – Dr. Ansari’s story is fine!

Page 10 –

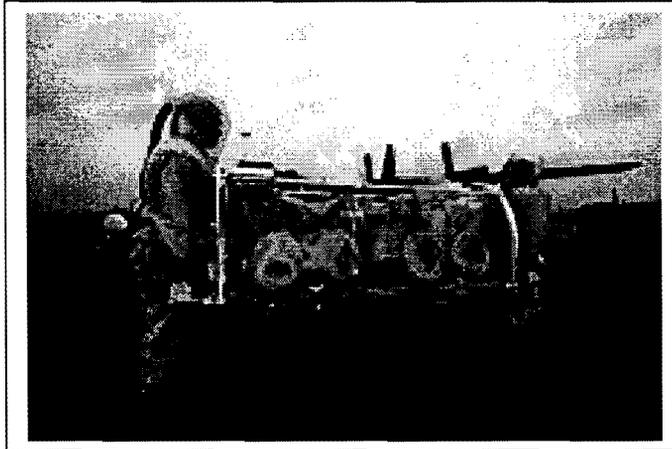
Reference to “the safe” – consider changing to “the Vault”.

Page 11-

The biohazard suits would have to be donned in the field. The blue Dover type suits would not be worn in the field. The most typical are white Tyvek “bunny suits”, boots, and PAPRs (Powered Air-purifying Respirator). PAPRs have a battery pack that is worn on your belt and a small HEPA filter and fan. The blue suits are too bulky (heavy) to be fitted with a small fan that could keep the suit positive. See image of Canadian, USAMRIID team. The Swedes use some swanky orange suits – see image.



Canadian Responders



USAMRIID Aeromedical Isolation Team



Fashionable Swedes – I love the ladies just hanging out!

Consider changing word “cleanse” to “decontaminate”.

Page 12 –

No one would probably catch this, but it would be difficult for Toni to call out “Hello?” in the suit. If she did shout loud enough she might blow-out the other folks with the headsets.

Page 13 –

Reference to smell. Odors do pass through HEPA filters but they are very difficult to detect.

Reference to Michaels “body and unexploded bomb” – actually the hemorrhaging would be more like an EXPLODED bomb.

Page 14 –

What was in the injection that Ruth, the paramedic, gave to Michael? Blood Coagulant? Morphine?

Page 15-

In lieu of “spray cans” consider using garden sprayers. Polypropylene garden sprayers that you can buy at the hardware store are commonly used to mix solutions for area decontaminations as well as decontaminating responders and their suits. The paramedics and others would be deconned after they put Michael in the isolator so they wouldn’t create a huge contamination of the ambulance, etc. A personnel decon can simply be the person standing in a little baby pool while someone sprays them down with solution (like and outdoor Chemical shower!). The solution is left on a prescribed amount of time then they are sprayed with regular water – all in the baby pool. The baby pool is filled last with additional solution to really sock the liquid effluent.

There is a reference to “the Fort” and I believe this is the first reference as there are numerous from this point forward. I didn’t quite understand “the Fort” as there is no previous explanation of this “nickname”. Consider going back to previous nickname of “the Kremlin” or explain the new nickname.

The site decontamination description is a little off – scientifically. Sentence reads, “...sprayed with a powerful disinfectant that would destroy the virus by coagulating the protein capsule containing its lethal DNA”. Virus have an outer protective envelope – bacteria have a “capsule”. Consider changing to “sprayed with a powerful disinfectant that would destroy the virus’ outer protective envelope containing its lethal DNA.”

Page 16 –

Another “Fort” reference. I won’t label all of them.....

Page 27 –

Consider changing “where it germinated” to “where it was first discovered”.

Page 31-

Rabbits, particularly the type used in containment laboratories, don't usually bite.

I don't quite follow the logic of Michael exchanging rabbits including the effort to infect the replacement, but it is also obvious that Michael is not all together. Anyhow.... It would be difficult to impossible to get a rabbit out of the lab because of the Chemical shower routine. He would have to put it into some sort of container so the rabbit would not die from the Chemical exposure. Since Michael is as illogical as he sounds – I suppose he could unzip his suit, put the rabbit in a “papoose” and carry it out. Opening your suit in a BSL4 lab is not a dangerous as it sounds, because most live agents are either containerized, opened in a BSC or deconned immediately (spray solution, etc.) as part of basic safety protocol. If Michael (mistakenly) thought the rabbit was “clean” because it was not yet part of an exposure study, then he would only have to be mildly insane to put it into his suit. If the rabbit had been exposed (when Michael didn't know about it), then Michael would be exposed to Madoba in his suit. Michael would also not have to expose the poor replacement bunny. This scenario would account for the exposure through breathing (in the suit) in lieu of the “Monty Python Killer Rabbit”. There is the issue of exposing the shower, locker room etc., so maybe you need a little UV exposure???? Blind bunny???

.....sorry, I am an architect- not a writer, I feel like it would be easier to draw a picture!!!!

.....moving on.

Page 38 –

Rabbits would not be housed in biosafety cabinets. They would be housed in conventional rabbit racks. The rack would be kept in a flexible isolator with HEPA filters. See image.

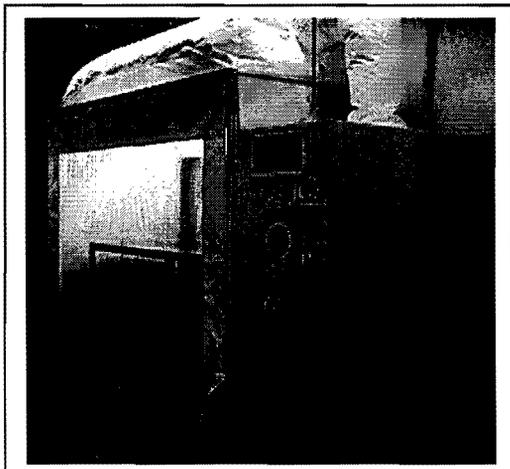
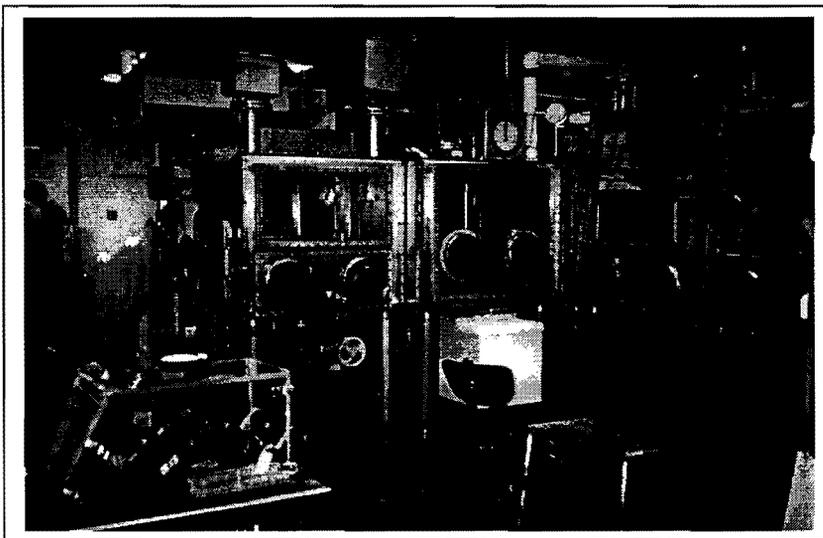


Image of soft-sided isolator with HEPA filters and fan motor assembly. This image just has a stainless steel cart in it, which is also used to stow animal cages (mice, rabbits, etc.)

The aerosol would not be delivered into the animal cage. The animal(s) would be transported to a **Class III** biological safety cabinet (aka – Gloveboxes) and the agent would be aerosolized into the cabinet. After the exposure volume/time is complete – the cabinet is evacuated and the animal(s) are removed through a sealed transport device to minimize gross contamination the room. Sometimes a device is used so only the mouth/nose of the animal is exposed – this reduces having fugitive live agent (virus) in the animals fur.



Class III cabinet at USAMRIID (not active).

Note the plexi-glass contraption on the left is a little “device” to hold primates

Cameras are often installed in the Class III (Glovebox) for a number of reasons, including training, monitoring and bio-assurity. These are very custom devices and can also be fitted with refrigerators and freezers to store material.

Page 40 –

If macaque monkeys are used then it would be rare to have beagles in the BSL4. Typically vaccines are tested on rodents, rabbits and non-human primates (macaques, baboons, etc.). Dogs are usually used for toxicology studies that are not in containment. Tox studies are done to see if the drug or its delivery compound have a negative (toxic) reaction. I’m not exactly a dog lover.....but, puppies????

Page 41 –

Reference to dose of Madoba in Aerosolized form. Note storage would not be in aerosolized form, but rather a concentrated culture.

Here is reference to Michael taking the rabbit out through the shower (Chemical Shower). This would be the place to slip the rabbit into the suit.....

Page 53 –

Reference that “American’s think it’s too dangerous to be done in the United States”. I will let Lt. Korch take this one!

Reference to “transfer the research to Atlanta” might also include “or Ft. Detrick” (USAMRIID).

Page 72-

Change “germs” to “bacteria”.

Page 76 –

Nice reference to CDC and USAMRIID. Work is also done at Battelle Laboratories.

Pages 125 through 133-

This a repeated chrono of 4 p.m. Time warp?

Page 153-

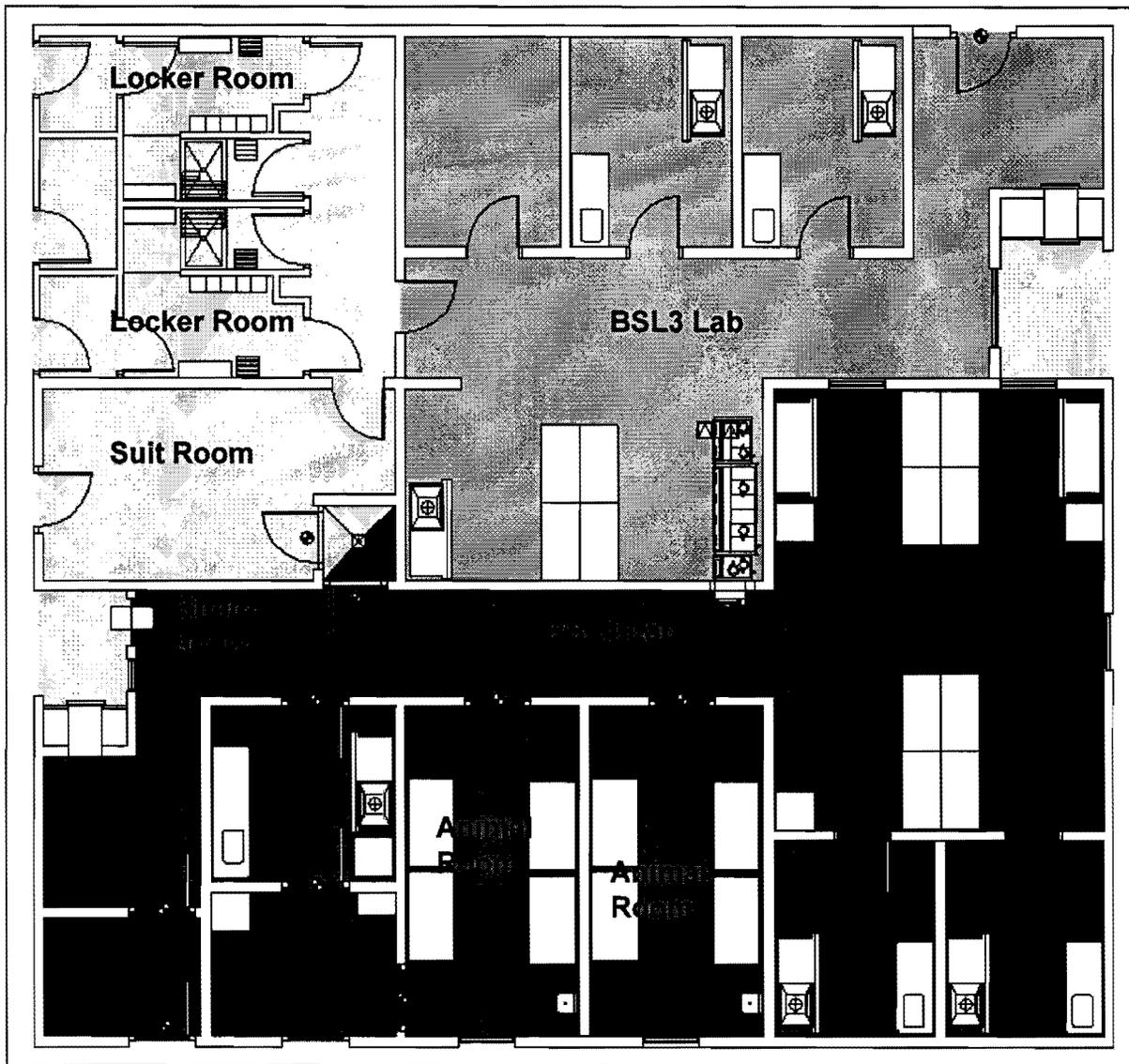
Sentence reads “....to guarantee us four-hour service...” I believe this should be “....to guarantee us **twenty** four-hour service...”.

Page 173 –

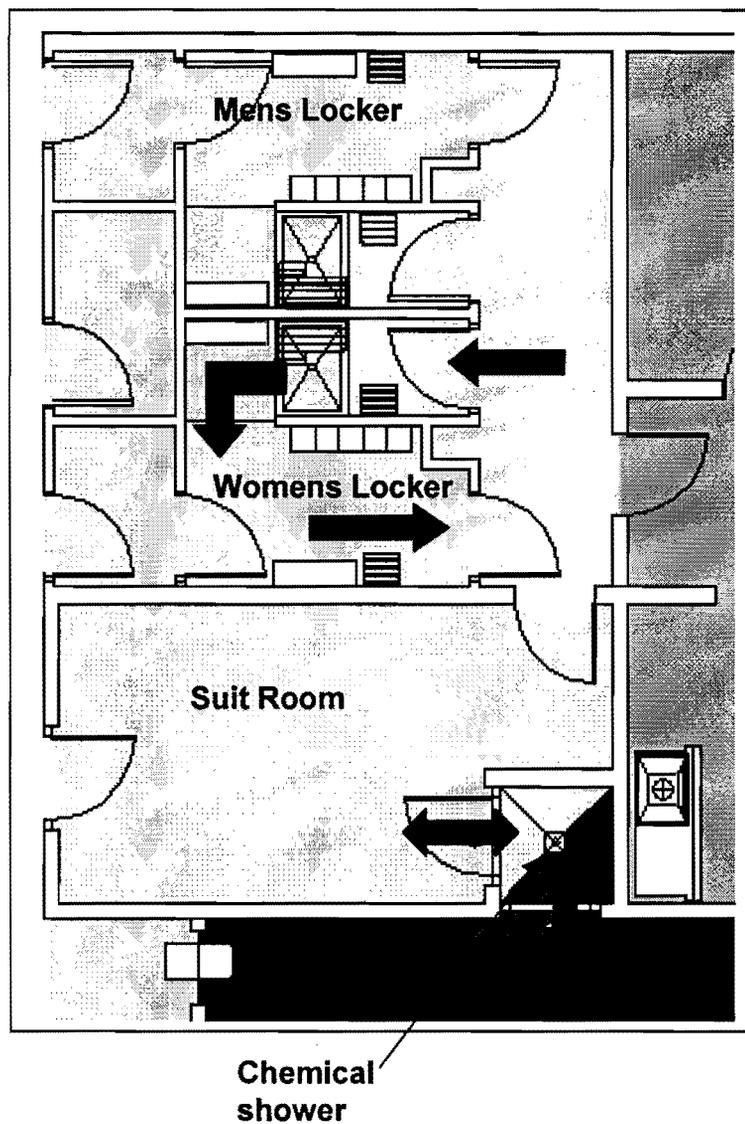
Sentence ending with - she put the gearshift into first ended with a quotation mark. Delete quotation mark.

Page 188-

Okay now I get to draw a picture! The following is a diagram of a BSL4 entry. Typically you could enter into the locker rooms directly from a corridor. Security into the locker rooms would be very tight, just as you described (card and biometric reader) although you wouldn’t need to go through an airlock that would pop your ears – this would be a conventional door with a crack at the bottom. A common ante-room (not airlock) before the locker rooms would be a good idea though – a single secure point, single log-in, etc.thanks for the idea. The ear-popping pressure drop wouldn’t occur until the chemical shower.



This is a schematic plan of a BSL3 and BSL4 lab



Going into the BSL4 is basically how you described, but the lockers and shower aren't really part of "air-tight" containment. The shower is more because you sweat like a pig in the suit working with something that can kill you if you breathe it.

The Chemical Shower is really the line of containment for people flow. It is "airtight" with gasketed doors that are interlocked.

The suit room is where the positive pressure suits are stowed as well as tested for leaks, proper operation etc. prior to donning them.

The ante-rooms I indicated prior to entering the lockers are more for privacy/ humbleness – since you may be standing in your birthday suit when someone opens the outer door.

The dual color for the chemical shower is because once the BSL4 door is opened the shower is considered "hot". The door on the Suit Room side cannot be opened until the (even empty) Chemical shower has gone through a decon cycle and fogged out the shower.

Your text is pretty good. Hopefully this sketch can give you a visual imagine that you can put into literature (not just words) much better than I can.

Page 201 to 202-

Kit and Nigel cannot go into the lab without hooking up to the airhoses they would either suffocate from the CO2 or fog up the face screens with condensation. Suffocating is a given. Hooking up really wouldn't slow them down. All of your other short-cuts were great – I also like the analogy/imagery of driving 130mph!

Sentence reads – “They went through another airlock”. Change this to “They went through the chemical shower next. To save time and by-pass the prerequisite 12 minute cycle, Kit depressed the emergency door release button. The normal alarms were silent.” Your reference to ears popping is exactly what would happen here –particularly since they opened the doors much quicker than the mechanical exhaust and supply valves can react/ compensate – in fact, it may even be a quite painful ear pop.

All of the doors (both shower doors) could be left open to ease their escape – door override alarms would have been silenced by Kit earlier in the control room. Not that there is anyone to react to the alarms anyhow.

You made reference to opening the refrigerator with the bolt cutters – consider using “the Vault”. I suppose somewhere toward the first reference to “the vault” you may need to detail the slang for the reader (??).

Page 203 –

Consider change of reference “...sprayed into biosafety cabinets to infect animals” to “...atomized (or nebulized) into Class III Gloveboxes to infect animals”.

Consider changing “cardboard boxes” to “ boxes of small, graduated pyrex bottles”.

Consider changing “clear plastic tubes” to “ small, graduated pyrex bottles”.

Page 204 –

Double bag the spray bottle. Nigel’s really a bold fellow....

Consider double gloving Nigel at the BSC. “Nigel stripped off his **outer** gloves and left them at the biosafety cabinet”

Page 208-

Typo- BSL4D.

Page 211-

Typo – “Tom started to throw up....

Page 222-

Reference to Hazardous Materials Safe – consider “the Vault”.

Page 223 –

“Plague” is a bacterial agent – Yersinia Pestis. Consider using “massive outbreak”.

Page 240-

Typo – “range” should be “rang”.

Page 244-

Typo- “iinfuriated” – double i.

Page 266-

Typo – “co” should be “go” or perhaps “come”.

Page 324 –

Sentence reads “Nigel stirred and appeared to be coming round...”. I think it should be naked Hugo, not Nigel. Correct?

Page 389-

Sentence reads “Nigel grabbed it”. I think this should be “Kit grabbed it”, because Nigel is dead.

Page 394 (not labeled)-

Typo – “Toni could se...” should be “Toni could see.....”.