MABSA June 15, 2023

LAIs that Impacted Biosafety Practice…

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Why I was invited....

TABLE 3.

Number of LAIs associated with indicated primary work purpose

	Clinical		Research		Production		Teaching		Site not listed		Field	Total		
	1930–1975[a]	1979–2015	1930–1975	1979–2015	1930–1975	1979–2015	1930–1975	1979–2015	1930–1975	1979–2015	1979–2015	1930–1975	1979–2015	1930–2015
Bacteria	396	783	914	122	40	81	69	181	378	45–59	1	1,797	1,212–1,226	3,009–3,023
Rickettsiae	27	1	455	204	18	0	0	0	73	0		573	205	778
Viruses	173	215	706	497	73	9	15	13	82	9–10	16	1,049	760–761	1,809–1,810
Parasites	18	5	70	77	0	0	4	81	23	6	1	115	170	285
Fungi	43	4	155	16	2	0	18	1	135	4–5	0	353	25–26	378–379
Unspecified	20	—	7	0	1	0		0	6			34	—	34
Total	677	1,008	2,307	916	134	90	106	276	697	58–74	18	3,921	2,372–2,388	6,293–6,309

[a]Adapted from reference 26.

Byers, K.B. and A. Lynn Harding, Laboratory Associated Infections Biological Safety Principles and Practices, 5th ed. Chapter 4. .

3,230 Primary LAIs - data from 488 references published 1979-2015.

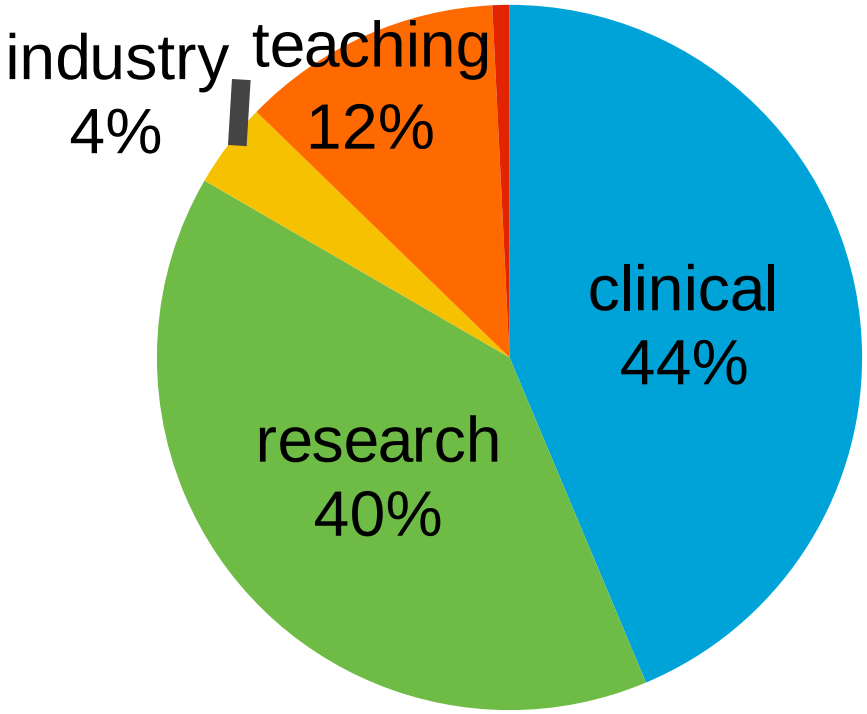
	Symptomatic	Asymptomatic	Total
Bacteria	1212-1226	142	1354-1368
Rickettsia L	205	269 L	474
Viruses	764-766	439	1203-1205
Parasites	170	4	174
Fungi	25-26	0	25
Total	2376-2392	854	3230-3246

Byers, K and L. Harding. 2017. Laboratory Acquired Infections *In Biological Safety, Principles and Practices*, 5th edition, D. Wooley and K. Byers, editors. ASM Press.

LAI in Various Types Work Settings

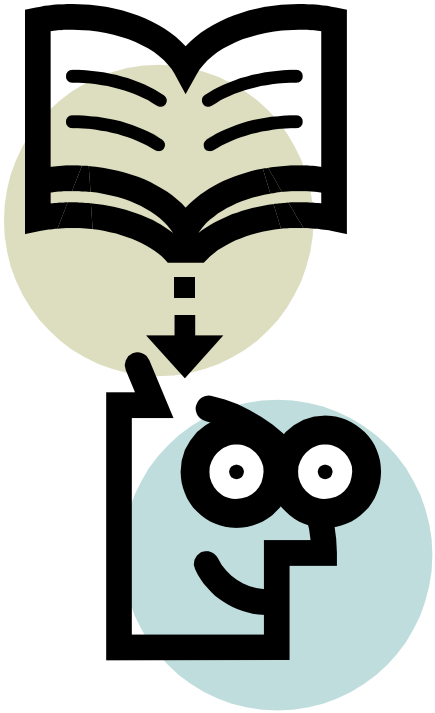
Site	LAI
Clinical	1008
Research	916
Industry	90
Teaching	276
Field	18

TOTAL: 2308



Byers, K and L. Harding. 2017. Laboratory Acquired Infections *In Biological Safety, Principles and Practices*, 5th edition, D. Wooley and K. Byers, editors. ASM Press.

LAIs can help with the Training CHALLENGE: Communicating SOPs.



Step 1:Getting staff to

VISUALIZE

How training applies to what they actually do**, and how adhering will help them (even if it takes a little longer….)**

Biosafety Professionals…make a difference with what we do know.

Hacib Aoun, Doctor Exposed to AIDS Virus

"Dr. Hacib Aoun, 36, the Baltimore physician who became infected with AIDS while treating a leukemia patient at Johns Hopkins Hospital in 1983, died as a result of the ailment Feb. 16, 1992.

A series of stories in The Washington Post in the late 1980s reported how Dr. Aoun became infected when a glass tube, containing a sample of a patient's blood, shattered and pierced his hand. In 1986, Dr. Aoun discovered that he had the AIDS-causing virus, and Hopkins physicians traced it to the leukemia patient."

https://www.washingtonpost.com/archive/local/1992/02/19/hacib-aoun-doctor-exposed-to-aids-virus-dies/11e9b9c3-a8b9-403f-9372-f159701a0550/""

FROM A SINGLE FINGERSTICK...

The year is 1988. HIV/AIDS has reached pandemic proportions with an estimated 600,000 infected worldwide with little to no means of treatment and no cure in sight.

Healthcare workers live in constant fear of exposure, illness, and death due to high risk of exposure to potentially life-threatening blood borne pathogens.

One such individual, a Doctor in Maryland, passed away after contracting the disease through a laceration received while handling a broken glass capillary tube.

This tragic death resonated deeply with Bill Kendrick, Sr. and he resolved immediately that something had to be done to address this crisis. Later that same year, he created a company called **SAFE-TEC® Clinical Products.**

Glass Capillary Tubes: Joint Safety Advisory About Potential Risks

February 1999

Dear Colleague:

The Food and Drug Administration (FDA), the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention (CDC), and the Occupational Safety and Health Administration (OSHA) want to alert you to the potential risk of injury and/or infection from bloodborne pathogens, including human immunodeficiency virus (HIV), hepatitis B and hepatitis C viruses, due to accidental breakage of glass capillary tubes, and to recommend certain steps that can minimize the risk.

Background

Glass capillary tubes are used for the collection of blood in a variety of healthcare settings, including hospitals, ambulatory care facilities, physicians' offices, blood donation facilities, and blood testing centers. Accidental breakage of these slender, fragile tubes has been reported when the tubes are inserted into putty to be sealed and during centrifugation. (1) Breakage of the tubes during putty insertion may result in a penetrating wound and blood inoculation to the user. One such injury resulted in the transmission of human immunodeficiency virus (HIV) to a physician who has since died of acquired immunodeficiency syndrome (AIDS).(2) Glass capillary tubes can break during centrifugation and cause blood to splatter, potentially exposing personnel to bloodborne pathogens. The broken glass fragments can injure the user, resulting in a percutaneous exposure to blood.

Direct quote from DRUMMOND SCIENTIFIC COMPANY SAFE-TEC CLINICAL PRODUCTS, LLC.

“Exposure to HIV via laceration may have been the catalyst for SAFE-TEC®, but in truth the problem was threefold:

- 1). traditional glass tubes would often break during manual clay sealing or when spun down in a centrifuge – lacerations were highly likely
- 2) the clay sealant would not withstand the high RPMs of the centrifuge and frequently “blow-out”, bathing the unit in blood and forcing the technician to reperform the entire process after a lengthy disinfection procedure, and
- 3). the only way to dispense the sample was to “score and snap”, which involved breaking the tube and tapping it onto a refractometer or other device; not only would this cause lacerations, but it also damaged expensive equipment and negatively affected readings.”

- Drummond Whitepaper Bound by Blood September 2021

1987 - 3 HCW infected with HIV –mucosal transmission documented.

Blood test now available.

2 clinical laboratory workers: phlebotomist whose face was splattered

- Apheresis* incident.

*Apheresis is a type of continuous flow centrifugation used for therapy

(to draw off problematic components).

Donors provide platelets for cancer patients - leukemia, lymphoma, bone marrow or stem cell transplants and trauma and NICU patients need platelets.

1984-1986 data for risk assessment of HIV exposures

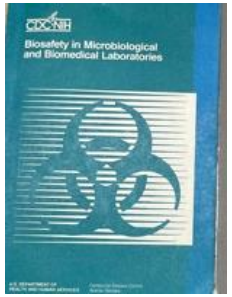
- Several HCW – no risk factors were reported to have HIV; 1 was a laboratory worker
- Risk of work-related HIV infection from research was assessed as very low based on 1985 anecdotal reports:

  2 in2 diff labs exposed to droplets and splash of conc virus;

  1 cut by glass from broken carboy containing HIV infected cells and medium.

  No seroconversions after 18 and 20 mo.

Occupationally Acquired Human Immunodeficiency Virus Infections in Laboratories producing Virus Concentrates in Large Quantities: Conclusions and Recommendations of an Expert Team Convened by the Director of the National Institutes of Health (NIH)



CDC-NIH BMBL 2nd edition 1988

Sept, 1987 - report of HIV infection in "production laboratory worker"

"This individual worked with large concentrations of virus in BSL3 facility. HIV was isolated from the worker's blood; the isolate was genetically indistinguishable from the strain of virus being cultivated in the laboratory.

No risk factors were identified, and the worker recalled no specific incident that might have led to infection. However, there were instances of leakage of virus-positive culture fluid from equipment and contamination of the work area and centrifuge rotors.

The report concluded that the most plausible source of exposure was contact of the workers gloved hand with virus-culture supernatant, followed by inapparent exposure to skin."

Transmission of HIV in Research – first.

September, 1987: Researcher worked with concentrated HIV in BSL3 lab. Isolate from researcher's blood genetically indistinguishable from laboratory strain H9/HTLV-III_B

Host Factors: Individual was inexperienced. Had skin cuts, abrasions, one episode of dermatitis on arm.

PPE: "gloves of questionable integrity"; cloth gown worn over street clothes.

Laboratory practices: frequent leaks during operation of continuous flow centrifuge. Brush used to remove cell debris from rotors.

Follow-up: A specific exposure incident was not identified. Cause considered plausible was contact of the worker's gloved hand with virus-culture supernatant, followed by inapparent contact with skin.

References:

MMWR 1988 37:No. S-4 ; Weiss S. H., et. al. 1988. Science 239:68-71.

Second Report -Transmission of HIV in Research Lab – October, 1987

- Investigators found no issues with equipment, procedures, or training of researchers in this lab.
- Worker sustained puncture wound to finger from blunt stainless steel cannula used to clean rotor after run to concentrate HIV.

MMWR 1988 37:No. S-4 ; Weiss S. H., et. al. 1988. Science 239:68-71.

What could have caused transmission #3?

Seroconversion to HIV: Concentrated virus splashed in face, exposure to eyes, nose, mouth, non-intact facial skin.

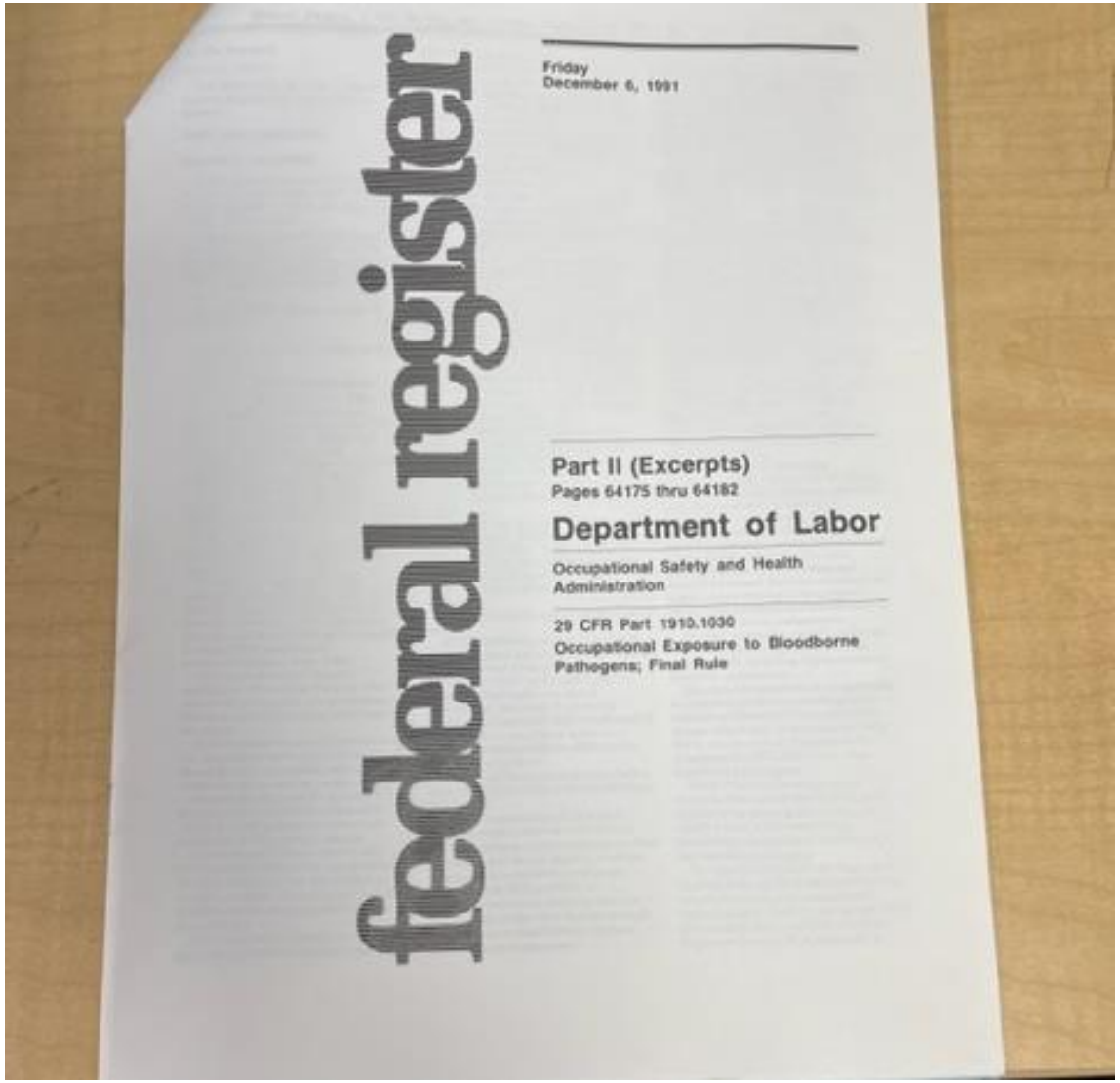
- No details provided about how this happened.
- What do you think could have caused this?

Do, A.N. et.al. 2003. Occupationally Acquired Human Immunodeficiency Virus(HIV) Infection: National Case Surveillance Data during 20 years of the HIV Epidemic in the United States. Infection Control and Hospital Epidemiology. 24(2):86-96

OSHA Bloodborne Pathogen Standard 1910.1030 Dec. 6. 1991

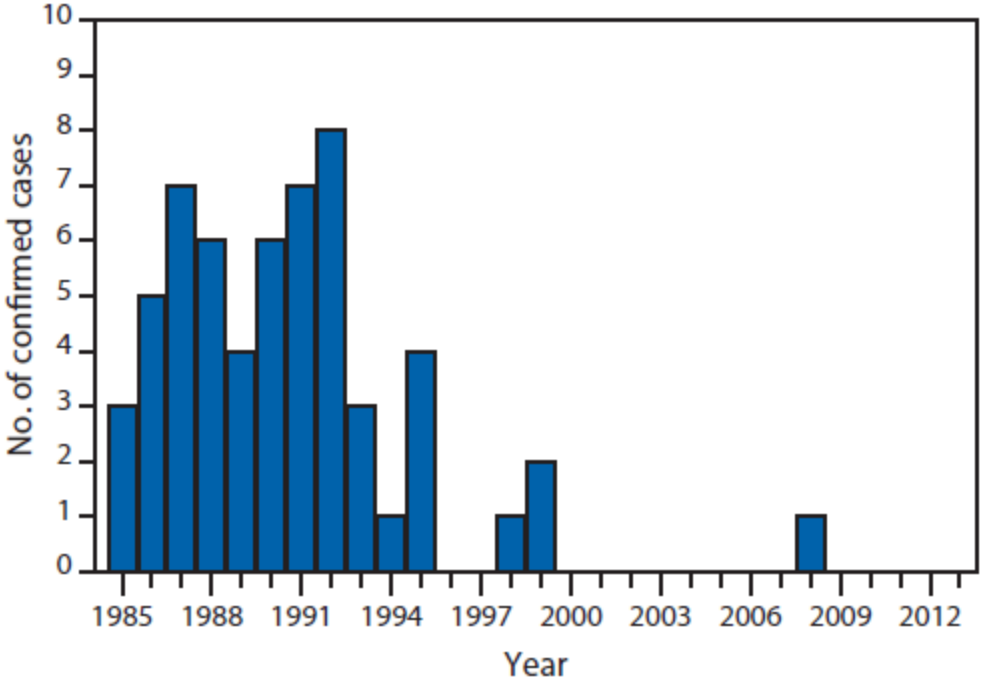
(e) HIV and HBV Research laboratories

This paragraph applies to research laboratories and production facilities engaged in the culture, production, concentration, experimentation, and manipulation of HIV and HBV. It does not apply to clinical or diagnostic laboratories engaged solely in the analysis of blood, tissues, or organs.



Notes from the Field Occupationally Acquired HIV Infection Among Health Care Workers — United States, 1985–2013 *Weekly*

January 9, 2015 / 63(53);1245-1246



Among the 58 confirmed cases, the routes of exposure resulting in infection were: percutaneous puncture or cut (49 cases), mucocutaneous exposure (five), both percutaneous and mucocutaneous exposure (two), and unknown (two). A total of 49 HCWs were exposed to HIV-infected blood, four to concentrated virus in a laboratory, one to visibly bloody fluid, and four to unspecified body fluids.

https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6353a4.htm

Summary of 58 documented healthcare worker occupational Infection in U.S. CDC voluntary reporting system

- 51 exposures were percutaneous
  - 1 sustained 2 sticks in 10 days
  - 2 had concurrent mucocutaneous exposures
- 45 of the percutaneous exposures were with hollow bore needles
- Sudden movement of patient, coworker, or equipment (20%)
- 2 scalpel injuries occurred through 2 pairs of gloves.

Largest number (41%) occurred AFTER a procedure: en route to disposal, or contact with sharps left in the work place. SAFETY ENGINEERED SHARPS

Notes from the field: Occupationally Acquired HIV Infection Among Healthcare Workers – United States, 1985-2013. MMWR 63(53):1245-1246

Fourth Research Seroconversion

Needlestick while working with a live HIV culture

No details provided in report.

Notes from the field: Occupationally Acquired HIV Infection Among Healthcare Workers – United States, 1985-2013. MMWR 63(53):1245-1246

Discussion: What would have been an acceptable use of a needle with a live HIV culture?

- acceptable: inoculation into animal model
- NOT acceptable: used to harvest cesium chloride gradient

5th report: Occupational transmission of HIV in a research laboratory with unknown mode of transmission.

ABSTRACT

A lab-worker was infected with HIV-1 in a biosafety level-2 of containment, without any apparent breach. Through full-genome sequencing and phylogenetic analyses, we could identify the source of infection in a replication-competent clone, unknowingly contaminating a safe experiment. Mode of transmission remains unclear. Caution is warranted when handling HIV-derived constructs.

Soria 2017. https://www.ncbi.nlm.nih.gov/pubmed/28034885https://www.ncbi.nlm.nih.gov/pubmed/28034885

FIRST Cowpox LAI in US

https://pubmed.ncbi.nlm.nih.gov/22539811/

- Lab not working with human pox pathogens.
- Pathogens, including vaccinia in freezer – not used for 5 years.
- Staff informed the viruses were in the freezer; offered smallpox vaccination. All signed declination forms.
- Painful swelling and infection on palm of one hand; sought medical attention. Denied possibility of pox infection.

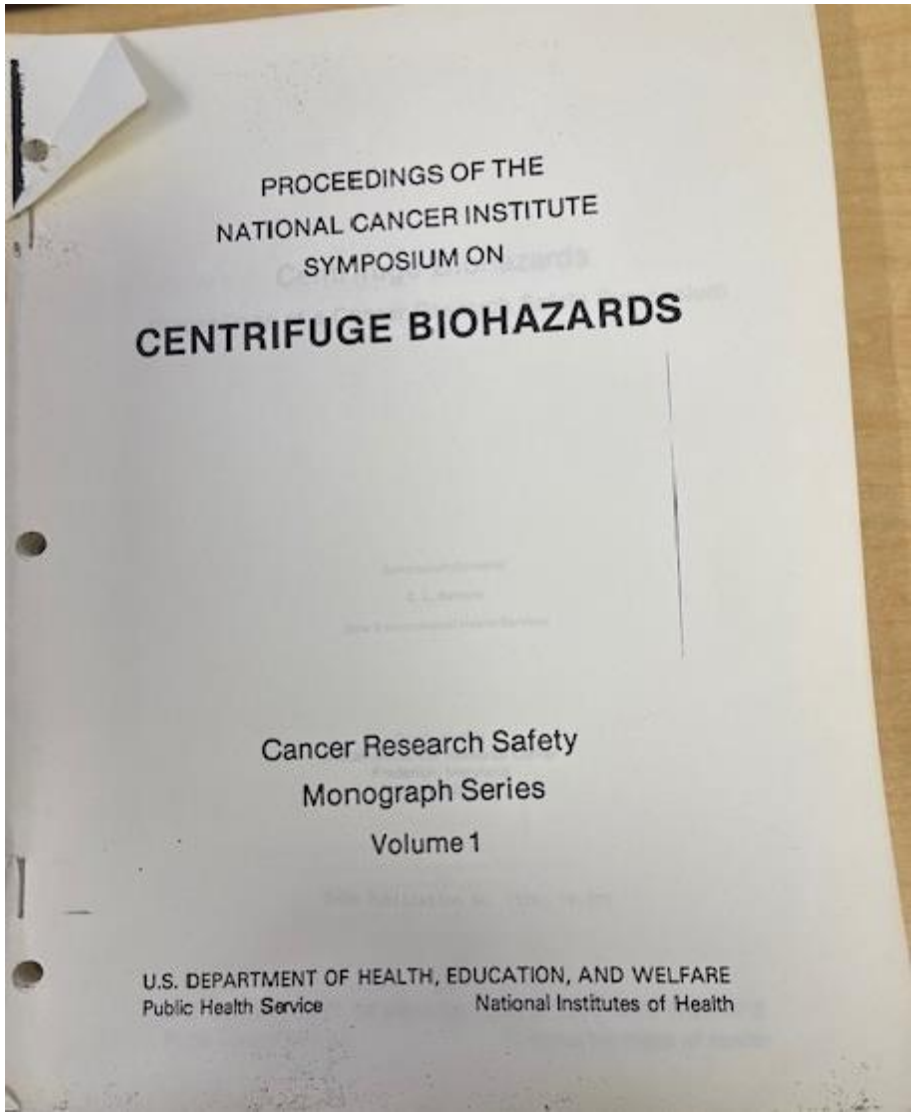
Results of Investigation

- 34 tubes of wild type and recombinant cowpox in SHARED freezer.
- Some boxes held cowpox and the NOC virus used by all 7 lab staff.
- All said they had not used knowingly used cowpox.
- Cowpox contamination in 6 additional laboratory stocks of viruses.
- 20 environmental swabs on lab surfaces – 3 were positive for Orthopox virus DNA.

The centrifuge….

1973 Symposium-”unrecognized hazards”

- “The centrifuge may be responsible for a significant number of the laboratory infections for which no definite action or accident can be assigned. These make up up 80 to 90% of the 1,342 cases in 1951 and the 3,497 cases collected by 1972.
- “It was noticed that less than three months after the laboratory wall had been painted glossy white there were parallel horizontal dirty streaks about 7 inches above the bench on the wall behind an angle centrifuge. This centrifuge is used only for concentrating homogenized sputa for tubercle culture.’’
- Data from Sulkin and Pike, course at NCI in1972.


PROCEEDINGS OF THE
NATIONAL CANCER INSTITUTE
SYMPOSIUM ON

CENTRIFUGE BIOHAZARDS

Cancer Research Safety
Monograph Series
Volume 1

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service National Institutes of Health

DHEW Publication No.(NIH) 78-373

LAIs Assoc with Centrifuge

- 2 research infections with HIV were associated with continuous flow centrifuges.

  Rotor gaskets must be changed frequently or culture leaks into the centrifuge.

  Cleaning the packed cells out of the rotor with a blunt cannula resulted in a deep puncture wound.

- Vacutainer tube with blood sample broke in centrifuge; resulted in transmission Machupo Virus.

Centrifuge BSL2: safety cups, O-rings on rotor lids.

Case study

Machupo virus, the cause of Bolivian Hemorrhaghic fever.

MMWR **43**(50):943-946.

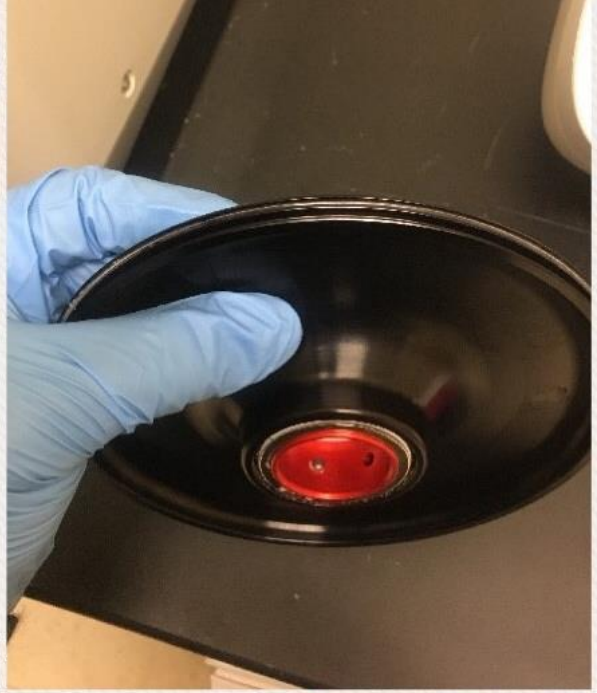
- Aerosols contained.
- Spill clean-up is safer, easier: broken tube stays in bucket.
- Open in biosafety cabinet
- (good transport condition-eliminate spills).

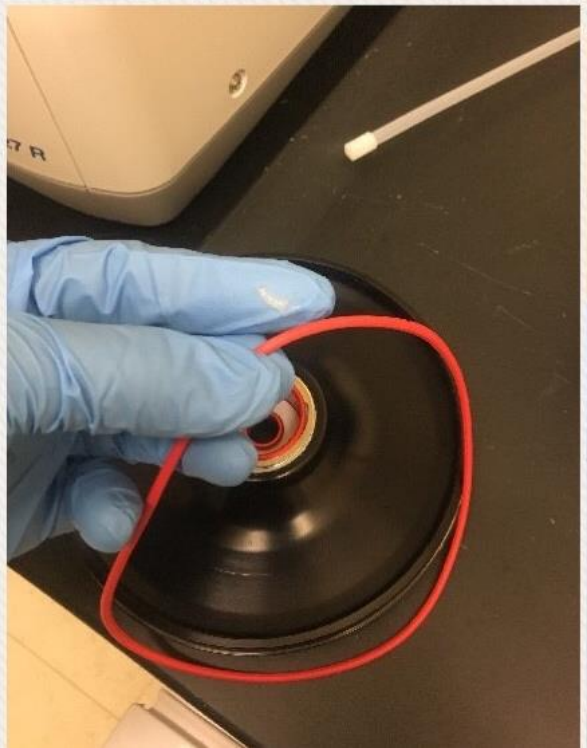
Research Centrifugation-potentially larger volumes, higher concentration.

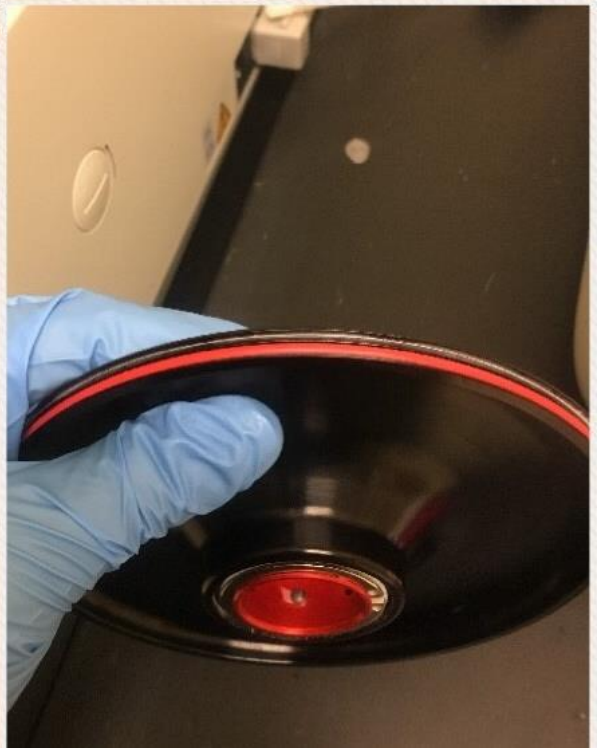
- Large floor model centrifuge rotors are not conveniently opened in the biosafety cabinet.
- Case Study: A centrifuge bottle containing Sabia virus cracked during centrifugation in a large floor-model centrifuge. The centrifuge was opened, the cracked bottle removed, and bleach was added to the spilled culture. PAPR available; not worn. Sabia transmitted by aerosol to researcher.

NEJM 1995 333:294-295.

Spinning:
O rings, gaskets
Lid opening







CASE STUDY WITH IMPACT…
BUT NOT ENOUGH

Sejvar et. al. *Assessing the risk of laboratory-acquired meningococcal disease.*

- Prompted by two cases in the United States in 2000.
- CDC Requested data on e-mail discussion groups of infectious disease, microbiology, and infection control professional organizations.
- 16 cases between 1985 and 2001; including 6 in the US between 1996 and 2000.

All clinical microbiologists. 8 were fatal.

15 cases: “isolate manipulation performed without respiratory protection.”

•J. Clin. Micro.43(9) 4811-4. Free PMC article.

Clinical Laboratory procedures…bench or bsc?

CDC advice:
START in the biosafety cabinet with cultures from sterile sites—
Blood, cerebrospinal fluid, inner ear.

J. Clin Micro. **43**(9) 4811-4814.

Clinical Laboratory procedures…bench or bsc?

CDC advice:
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J. Clin Micro. **43**(9) 4811-4814.

Other observations

- Immunization recommended –decreases risk of A, C, Y and W-135 (not B).

- Experience of infected varies:
  - 1 fatality- first isolate in that lab in 4 years.
  - 1 fatality-state lab worker who worked with approx. 4 isolates/month.

http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pubmed&pubmedid=16145146

ESR meningitis infection case of Dr Jeannette Adu-Bobie

- PhD microbiologist from UK; expert on vaccines.
- migrated to New Zealand to work on Serogroup B *N. meningitidis*.
- 7 days after beginning work, she became ill.
- Amputated legs, left arm, and digits of right hand.
- Denied workers' compensation since it was assumed to be community acquired. (there had been 5 cases).
- Won case 4 years later after submitting Sejvar's article.
- Investigation re-opened: Infected with strain she was working with.

NATURE. Vol 454. 7 August 2008 Researcher wins claim for accidental infection.

Case for Documentation of Immunization

- 21-year old summer student plated Serogroup A *N. meningitidis* on bench
- Stated that they had been immunized to their lab supervisor and physician.
- 5 days of worsening symptoms: fever, headache, vomiting, confusion
- Hospitalized. Day-CSF positive for Serogroup A *N. meningitidis*,
- Admitted lack of immunization.
- Started on appropriate antibiotics; recovered fully.

https://onlinelibrary.wiley.com/doi/pdf/10.1539/joh.49.399

Fatal Meningococcal Disease in a Laboratory Worker- California, 2012

J Clin Microbiol. 2005 Sep; 43(9): 4811–4814.

- 25 year old microbiologist had headache, fever, neck pain, stiffness. Evening of Friday, April 27.
- Admitted to hospital morning of April 28.
- Died 3 hours later of serogroup B meningococcal disease.
- Close contacts provided post-exposure prophylaxis.
- Lab closed, voluntarily, April 30.
- Worked with patient isolates on a research laboratory benchtop
- Had not been offered vaccine.

DROPLET Transmission – only the person handling the agent infected.

43 cases of LAI *N. meningitidis* in literature—

- **<u>ONLY 1</u> microbiologist infected in each case**
- 41 worked on the open bench (catalase assays, made suspensions, etc.) 2 worked behind a plastic shield.
- 1 in a defective biosafety cabinet.
- None were immunized.

One additional case in Argentina was reported. The infected laboratory worker developed septicemia; amputation of both hands was required.

No other details available. (Borrow, 2014)

References for N. meningitidis Data

Sejvar.J Clin Microbiol 43:4811-4814.

Emrys. http::://www.dol.govt.nz/news/media/2008/adu-bobie-report.asp

Bhatti, J Infect 4:247-252.

Kessler. J Occup Health 49:399-401

New Zealand Herald https://www.nzherald.co.nz/nz/scientist-loses-limbs-to-meningococcal-disease/WOXLTD3UUVTDBSIO63OTWLSALU/

Omer PLoS One6:e17145

PromedMail.2009. http://promedmail.org/post/20091112-3924

Campbell Appl Bio 20:12-26.

Guibourdenche J Clin Micro 32:701-704.

Petty JAMA 249:2069-2072.

Public Health Service Laboratory Commun Dis Rep CDR Weekly 2:3Athlin. Scand Infec Dis 39:911-

913.

Baron. Diagn Microbiol infect Dis 60:324-326.

Boutet J. Hosp. Infect. 49:46-47, 55.

Bremmer Aust. Microbiol 13:A106.

MMWR63:770-772. MMWR 51:141-144. MMWR 63:770-772

Borrow, R. et. al. Journal of Infection 2014 68: 305-312.

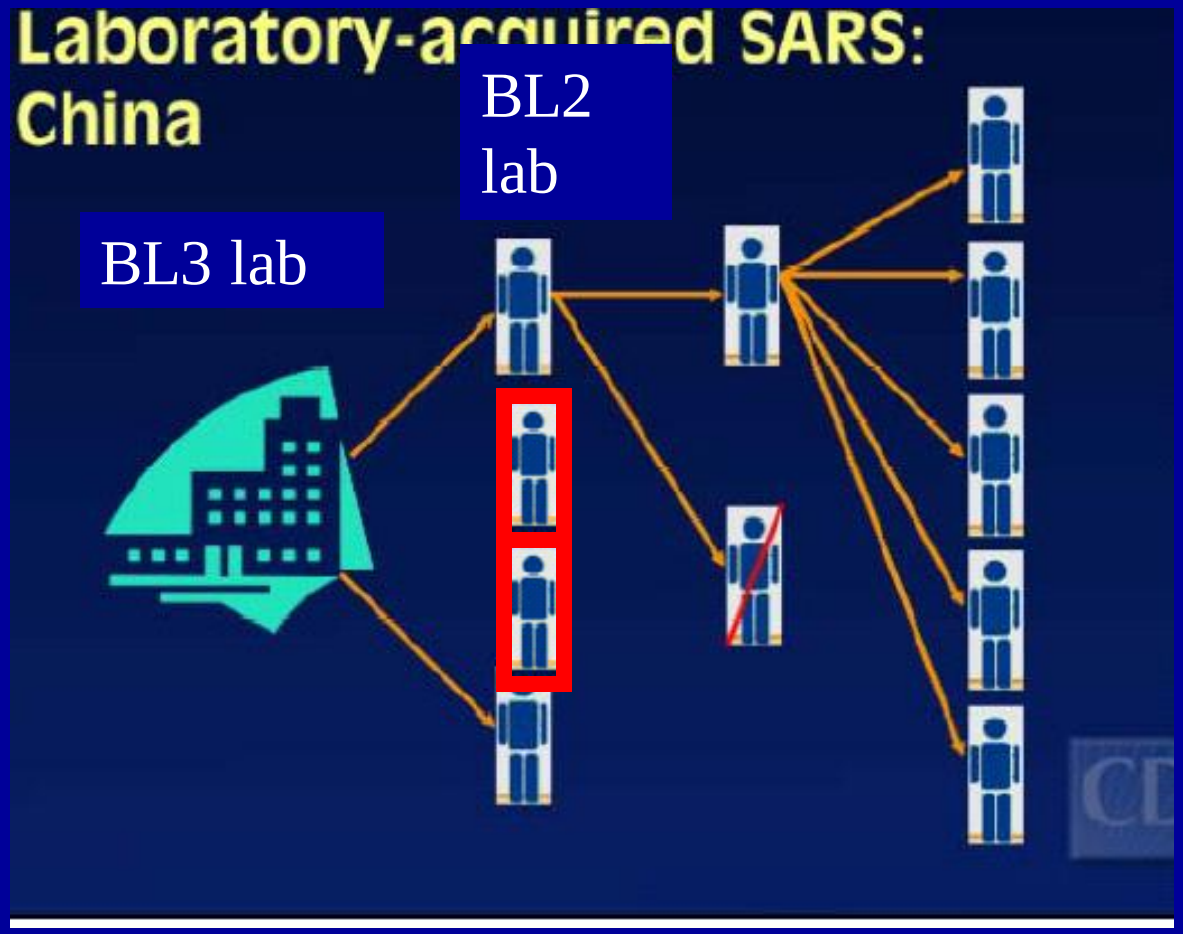
Strain Verification*: F. tularensis*

- Two researchers became ill in May and a third in September, apparently after separate exposures. But their illnesses were not linked to tularemia until October.
- 3rd case of pneumonia in healthy young staff member prompted testing.
- Using avirulent strain without strict BSL2 practices; lab strain was contaminated with virulent strain.

http://www.boston.com/news/local/articles/2005/01/19/bacterium_infected_3_at_bu_biolab/

SARS-BSL3-lesson in validation of inactivation conditions

Image: http://phil.cdc.gov/phil/details.asp



Samples removed for analysis at Biosafety Level 2;Inactivation conditions not verified Modified w/ red boxes to show 2 cases identified frm stored serum samples. Image from CDC.2004. Keeping the "genome" in the bottle: PHL training webcast.

Details:http://www.wpro.who.int/sars/docs/update/update_07022004.asp Applied Biosafety 2009 14(2) :99-101.

FESAP and Occupational Exposures

- All potentially exposed individuals received occupational health services, surveillance, and/ or post-exposure prophylaxis as appropriate.
- No deaths, no secondary infections.

- Note on numbers: “out of an abundance of caution”, if one individual manipulates BSAT, or a culture later determined to be BSAT, all members in the laboratory are considered potentially exposed.

Use of PPE- Usually in use at biosafety cabinet, but is it carried through to other steps of the experiment?

"At one point in this experiment, a 96-well plate containing small amounts of vaccinia–infected mammalian cells was removed from the biosafety cabinet and hand-carried to another room, where the lid of the plate was removed, and the cells were examined for fluorescence. The student did not wear eye protection during this phase of the experiment; whether she wore gloves is unclear."

http://www.cdc.gov/ncidod/eid/vol12no01/05-1126.htm

FEDERAL SELECT AGENT PROGRAM 2021 ANNUAL REPORT | KEY STATISTICS

The *2021 Annual Report of the Federal Select Agent Program* (FSAP) provides insight into the program's regulatory activities and includes a look at compliance with the select agent regulations at laboratories across the nation. The content underscores that overall, most laboratories registered with the program are compliant with the regulations, and none of the small number of reported incidents during the year resulted in a significant risk to public or agricultural health. The report reflects the program's ongoing commitment to transparency. It provides insight into key ways the program has adapted to carry out its mission during the COVID-19 pandemic and highlights FSAP's efforts to engage with the regulated community throughout the year to ensure regulatory compliance.

BACKGROUND

FSAP is managed jointly by the Centers for Disease Control and Prevention's Division of Select Agents and Toxins and the Animal and Plant Health Inspection Service's Division of Agricultural Select Agents and Toxins. The program regulates the possession, use, and transfer of biological select agents and toxins – which are materials that have the potential to pose a severe threat to public, animal or plant health, or to animal or plant products – so that important work with dangerous and deadly pathogens can be conducted as safely and securely as possible.

233 ENTITIES WERE REGISTERED WITH FSAP

- **35%** ACADEMIC
- **17%** COMMERCIAL
- **13%** FEDERAL GOVERNMENT
- **29%** NON-FEDERAL GOVERNMENT
- **6%** PRIVATE

55% of entities were registered for Tier 1* BSAT

LAB BIOSAFETY LEVELS (BSL)

ENTITIES MAY HAVE MULTIPLE TYPES

- **30%** had **BSL-2** and/or **ABSL-2** labs
- **80%** had **BSL-3** and/or **ABSL-3** labs
- **3%** had **BSL-4** and/or **ABSL-4** labs

TOP REGISTERED AGENTS BY AGENCY

CDC's Division of Select Agents and Toxins

1. *Brucella melitensis*
2. *Brucella suis*
3. *Brucella abortus*
4. *Bacillus anthracis* (Pasteur strain)
5. *Francisella tularensis**

APHIS's Division of Agricultural Select Agents and Toxins

1. Newcastle disease virus
2. Avian influenza virus
3. *Ralstonia solanacearum*
4. *Xanthomonas oryzae*
5. *Bacillus anthracis*

COMPLIANCE & ENFORCEMENT

- **3** total entities participated in corrective action plans (with **0** entities newly participating in 2021)
- **2** entities had fully suspended registrations (with **2** new entities put under suspension in 2021)
- **22** matters were shared with the Federal Bureau of Investigation for potential investigation (FBI determined no action was needed in **8** of those cases, with **14** pending)
- **0** entities were referred to the HHS Office of Inspector General or APHIS Investigative and Enforcement Services

THEFT, LOSS, OR RELEASE

- **0** thefts reported
- **8** reports of losses determined to be inventory volume or record keeping discrepancies, or loss of experimental material with no evidence that the material left the laboratory
- **0** releases resulted in illness, death, or transmission among workers or to the outside of a laboratory into the surrounding environment or community (out of **177** reports)

206

TOTAL INSPECTIONS CONDUCTED BY FSAP

139 by DSAT
21 by DASAT
46 joint DSAT & DASAT

19 on-site
106 remote
81 hybrid*

*Combination of on-site and remote

8,367

ACTIVE INDIVIDUAL SECURITY RISK ASSESSMENTS

Denied access for **22** individuals

OUTREACH

- **6** webinars for the regulated community on in-depth select agent topics - **1148 total attendees**
- **2** webinars for the public on regulatory reporting requirements - **411 attendees**

KEY ABBREVIATIONS:

FSAP: Federal Select Agent Program **DSAT:** Division of Select Agents and Toxins **BSAT:** Biological select agents and toxins **ABSL:** Animal biosafety level
CDC: Centers for Disease Control and Prevention **APHIS:** Animal and Plant Health Inspection Service **DASAT:** Division of Agricultural Select Agents and Toxins

*Tier 1 agent, those that pose the greatest risk through misuse

Source: *2021 Annual Report of the Federal Select Agent Program*, September 2022 | www.selectagents.gov/annualreport2021.html

FEDERAL SELECT AGENT PROGRAM 2020 ANNUAL REPORT | KEY STATISTICS

The *2020 Annual Report of the Federal Select Agent Program* (FSAP) provides insight into the program's regulatory activities and includes a look at compliance with the select agent regulations at laboratories across the nation. The content underscores that overall, most laboratories registered with the program are compliant with the regulations, and none of the small number of reported incidents during the year resulted in a significant risk to public or agricultural health. The report reflects the program's ongoing commitment to transparency. It provides insight into key changes made to program operations during the COVID-19 pandemic and highlights FSAP's efforts to engage with the regulated community throughout the year to ensure regulatory compliance.

BACKGROUND

FSAP is managed jointly by the Centers for Disease Control and Prevention's Division of Select Agents and Toxins and the Animal and Plant Health Inspection Service's Division of Agricultural Select Agents and Toxins. The program regulates the possession, use, and transfer of biological select agents and toxins – which are materials that have the potential to pose a severe threat to public, animal or plant health, or to animal or plant products – so that important work with dangerous and deadly pathogens can be conducted as safely and securely as possible.

244 ENTITIES WERE REGISTERED WITH FSAP

- 35% ACADEMIC
- 16% COMMERCIAL
- 15% FEDERAL GOVERNMENT
- 29% NON-FEDERAL GOVERNMENT
- 6% PRIVATE

Note: Percentages are rounded and do not equal 100%

52% of entities were registered for Tier 1* BSAT

LAB BIOSAFETY LEVELS (BSL)

ENTITIES MAY HAVE MULTIPLE TYPES

- 29% had **BSL-2** and/or **ABSL-2** labs
- 78% had **BSL-3** and/or **ABSL-3** labs
- 3% had **BSL-4** and/or **ABSL-4** labs

TOP REGISTERED AGENTS BY AGENCY

CDC's Division of Select Agents and Toxins

1. *Brucella melitensis*
2. *Brucella suis*
3. *Brucella abortus*
4. *Bacillus anthracis* (Pasteur strain)
5. *Francisella tularensis**

APHIS's Division of Agricultural Select Agents and Toxins

1. Newcastle disease virus
2. Avian influenza virus
3. *Ralstonia solanacearum*
4. *Xanthomonas oryzae*
5. *Brucella abortus*

COMPLIANCE & ENFORCEMENT

- **4** total entities participated in corrective action plans (with **3** entities newly participating in 2020)
- **1** entity had a suspended registration (partial) (with **0** new entities put under suspension in 2020)
- **18** matters were shared with the Federal Bureau of Investigation for potential investigation (FBI determined no action was needed in **17** of those cases, with **1** pending)
- **1** entity was referred to the HHS Office of Inspector General

THEFT, LOSS, OR RELEASE

- **0** thefts reported
- **13** reports of losses determined to be inventory volume discrepancies or record keeping discrepancies
- **0** releases resulted in illness among the general public, death or transmission among workers, or transmission to the outside of a laboratory into the surrounding environment or community (out of **158** reports)
- **1** report of occupational exposure resulted in illness of a worker, but no disease transmission to others

149 TOTAL INSPECTIONS CONDUCTED BY FSAP

- **93** by DSAT
- **20** by DASAT
- **36** joint DSAT & DASAT

- **43** on-site
- **103** remote
- **3** hybrid*

*Combination of on-site and remote

8,121 ACTIVE INDIVIDUAL SECURITY RISK ASSESSMENTS

Denied access for **12** individuals

OUTREACH

- **4** webinars for the regulated community on in-depth select agent topics - **731 total attendees**
- **8** webinars for the regulated community on FSAP's electronic information system (eFSAP) - **353 total attendees**
- **1** webinar for the public on regulatory reporting requirements - **404 attendees**

KEY ABBREVIATIONS:

FSAP: Federal Select Agent Program **DSAT:** Division of Select Agents and Toxins **BSAT:** Biological select agents and toxins **ABSL:** Animal biosafety level
CDC: Centers for Disease Control and Prevention **APHIS:** Animal and Plant Health Inspection Service **DASAT:** Division of Agricultural Select Agents and Toxins

*Tier 1 agent, those that pose the greatest risk through misuse

Source: *2020 Annual Report of the Federal Select Agent Program*, September 2021 | www.selectagents.gov/annualreport2020.html

FESAP Data on Potential Exposures:2015,2016 No llnesses

Registered

	Enities	# staff
2015	90	196
25 worked with unknowns outside bsc. 2 seroconversions to *C. burnetti* 1 seroconversion to Brucella		
2016	78	194
7 bites/scratches from animals w/ BSAT 10 equipment failures; 9 sharps exposures; 11 compromised PPE; 7 deviations from training/proper procedure; 19 spills outside of the bsc; 15 handled BSAT outside of BSC.		

Clinical Labs Not Registered Exempt

	#Events	
2015	111	
612 worked with unknowns outside bsc		
2016	99	804
779 worked with unknowns outside bsc		

FESAP Data on Potential Exposures: No illness

Registered

	# Entities	# Staff
2017	108	181
2018	66	121
Most common cause: failure or problem w/ PPE Second most common cause: Manipulation outside BSC or other equipment w/ containment		
2019	92	166
Most common cause: failure or problem w/ PPE		

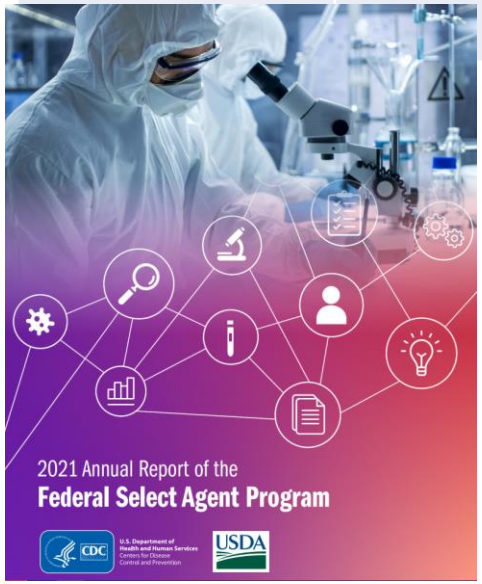
Unregistered

	#Entities	#Staff
2017	129	971
2018		774
Most common cause: Manipulated of BSAT outside of BSC or other equipment w/ containment		
2019	127	910
Most common cause: Manipulated of BSAT outside of BSC or other equipment w/ containment.		

FESAP 2020 and 2021

Registered

	# entities	# Staff
2020	69	134(12 eliminated)
2021	31	52



Exempt

	#entities	# Staff
2020	77	415
Illness of one worker after exposure to *Coxiella burnetii.* The source of the infection was attributed to contact with infected animals in the performance of the worker's duties. The worker received medical treatment and fully recovered from the illness. The entity notified all workers potentially exposed to the infected worker and found no evidence of disease transmission to other		
2021	94	524

https://www.cdc.gov/cpr/dsat/review_reports.htm

Improving U.S. Biosafety and Biosecurity: Revisiting Recommendations from the Federal Experts Security Advisory Panel and the Fast Track Action Committee on Select Agent Regulations www. ncbi.nlm.nih.gov/pmc/articles/PMC9991423

Need for high- containment laboratories –

Rapid development of COVID19 vaccine based on previous research with SARS, MERS.

Need for better research to support

Evidence-based biosafety.

3 incidents in 2014 stated objectively:

- LPAI shipment cross-contaminated with HPAI
- *B. anthracis* samples sent without validated ianctivtion procedure.
- 1954-era cardboard box with 6 sealed glass vials of freeze dried small pox found in a cold room.

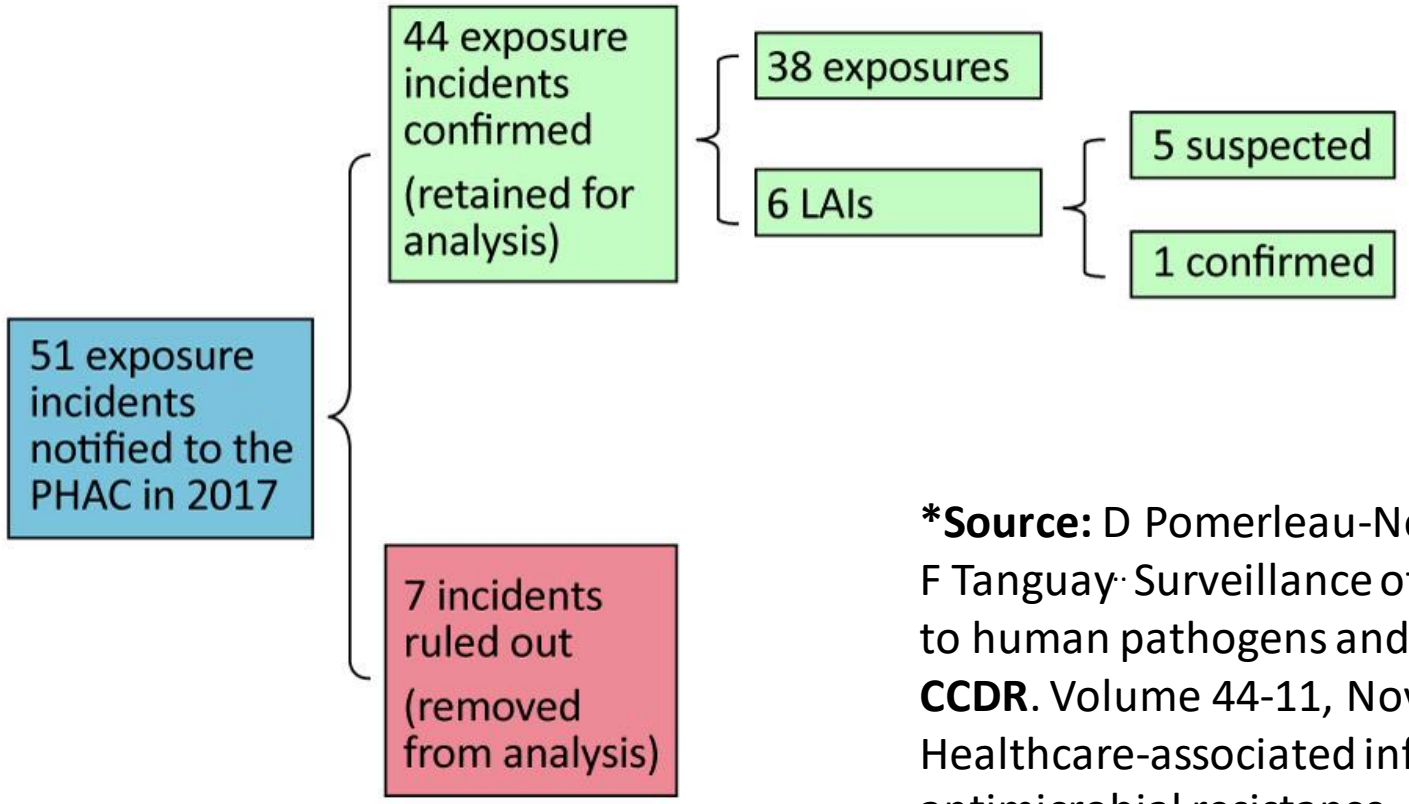
Canadian LINC System in Use since 2017

LAIs and factors associated with these exposures at the license

(by sector of exposures, HPT, occurrence type) and

person (number of affected persons, education, main role, type of activity, years of experience, route of exposure, root causes) level.

Canada: 51 exposure incidents in 2017 from 950 licensed laboratories.



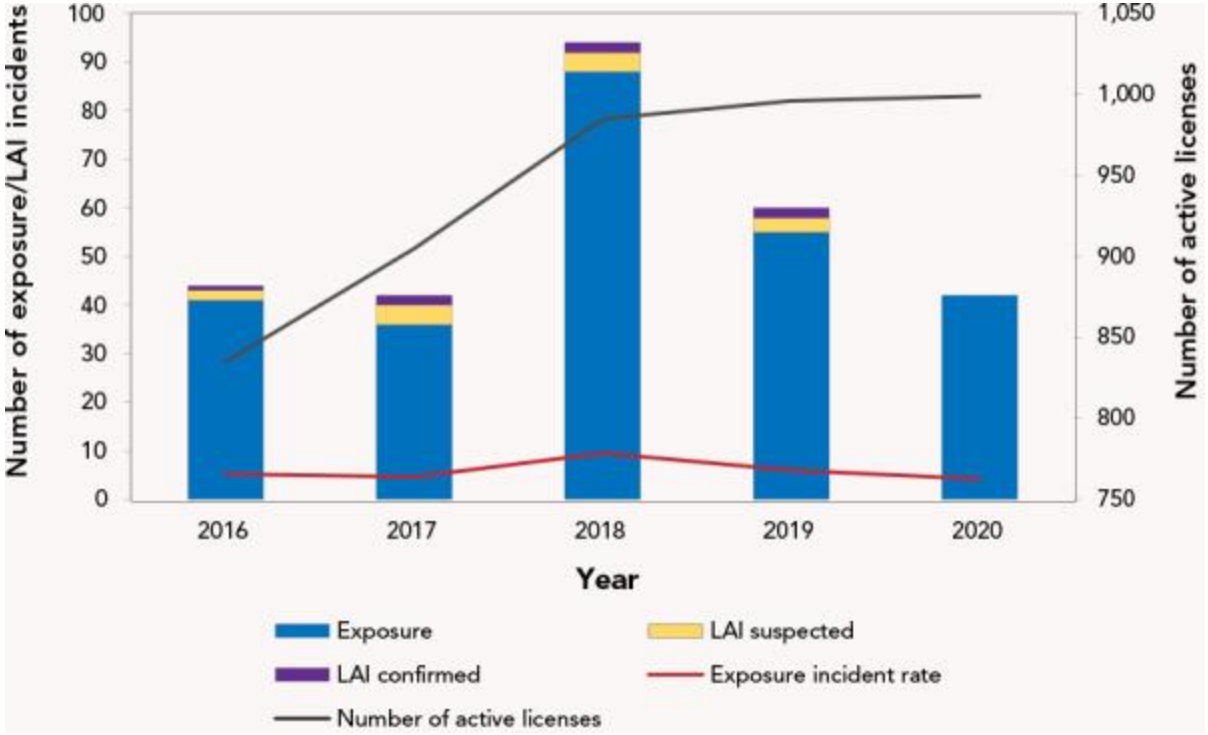
***Source:** D Pomerleau-Normandin, M Heisz, F Tanguay. Surveillance of laboratory exposures to human pathogens and toxins: Canada 2017. **CCDR**. Volume 44-11, November 1, 2018: Healthcare-associated infections and antimicrobial resistance.

Canadian Laboratory Incident Reporting system, 2021

- 43 incidents, 70 exposures, 2 LAI.
- Most incidents: RG2, 22% sharps,
- human interaction (workload constraints,/ pressures/ demands/ human error
- Most by inhalation. 70% technicians or technologists.
- Activity: Microbiology.

- https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2022-48/issue-10-october-2022/surveillance-laboratory-exposures-human-pathogens-toxins-canada-2021.html

Confirmed exposure incidents, suspected and confirmed laboratory acquired infections and active licenses, Canada 2016–2020



2020
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8525605/

Exposure incident rate is per no. of Licensed laboratories.

2016:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5764741/

2017:
https://pubmed.ncbi.nlm.nih.gov/30996692/

2018:
https://pubmed.ncbi.nlm.nih.gov/31650987/

2019:
https://www.proquest.com/openview/aa161cc2cafffc16bedfb6feb67eabec/1?pq-origsite=gscholar&cbl=33057

Ex: 89 Root Causes submitted in 42 Exposure Reports

Root cause	Examples of areas of concern	Citations	
		n	%[a]
Training	Training not in place but should have been in place	9	10
	Training not appropriate for task/activity		
	Staff were not qualified or proficient in performing task		
Standard operating procedure	Documents were followed as written but not correct for activity/task	24	27
	Procedures that should have been in place were not in place		
	Documents were not followed correctly		
Other	Not applicable	5	6

Root cause	Examples of areas of concern	Citations	
		n	%[a]
Communication	Communication did not occur but should have	8	9
	Communication was unclear, ambiguous, etc.		
Equipment	Equipment quality control needed improvement	12	13
	Equipment failed		
	Equipment was not appropriate for purpose		
Human interaction	A violation (cutting a corner, not follow correct procedure, deviating from standard operating procedure)	21	24
	An error (a mistake, lapse of concentration, or slip of any kind)		
Management and oversight	Supervision needed improvement	10	11
	Lack of auditing of standards, policies and procedures		
	Risk assessment needed improvement		

CCDR Laboratory Acquired Infections in Canada 2016-2021-

Laboratory type	Academic	Hospital	Government Public Health	Hospital	Government Public Health	Hospital	Academic	Government (other)
Main work activity	*In vivo* animal work	Microbiology	Microscopy	Microbiology	Microbiology	Microbiology	Animal care	Microbiology
Biological agent	*Staphylococcus aureus*	*Salmonella* spp.	*Salmonella* spp.	*Brucella* spp.	*Salmonella* spp.	*E. coli*	*Vaccinia virus*	*E. coli*
Risk group	RG2	RG2	RG2	RG2 or RG3	RG2	RG2	RG2	RG2
Exposure route	Inoculation	Ingestion (presumed)	Ingestion	Inhalation	Ingestion	Ingestion	Inoculation	Absorption
Exposure cause	Sharps	Unknown	Equipment, PPE, procedural	PPE, procedural	Unknown	Procedural	Sharps, procedural	Spill, equipment, procedural

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National Survey of Zoonoses in Lab Animal Workers 1999-2003

BACKGROUND:
AALAS members
Anonymous survey
Self-reporting
30% response rate=
1,357 responses

Agent	Cases	Exposure	Species
Ringworm	9	Skin contact	Dog,cat, rabbit,ox
Q fever	2	Inhalation	sheep
Giardia	2	unspecified	dog
Pasteurella spp.	2	Bite Needlestick	Rabbit, bat
B. virus	2	Splash unspecified	macaque
Cat Scratch	2	bite	cat
Ectoparasite	2	Skin contact	Mouse, rabbit
Influenza	2	inhalation	Ferret, pig
Rhinovirus	1	inhalation	Chimpanzee

Weigler.2005 Apr. 55(2):183-191.

National Survey of Zoonoses in Lab Animal Workers 1999-2003 Weigler.2005 Apr. 55(2):183-191

Agent	#cases	Exposure	Species
Mycobacterium spp	1	unspecified	Guinea pig
Simian foamy virus	1	Bite or scratch	Baboon
Bacterial infection	1	Splash to mucosa	Sheep

Lessons Learned:

28 infections reported by 23 individuals; 9 medically confirmed.
10 NOT reported to supervisor
15 of the 23 involved safety office or occupational health
ONLY 8 indicated that there had been follow-up


NIOSH HAZARD ID

Cercopithecine herpesvirus 1 (B Virus) Infection Resulting from Ocular Exposure

Key Points

Description of Hazard

Elizabeth R.Griffin

October 29, 1997 exposure

Flushed eye 2-3 minutes for 45 minutes later

Died Dec.10, 1997.

“If you think there is a safer way, don’t just think it. Prove it by research, demonstrate it, and share what you learned with the biosafety community.”
“Commit to never letting a Beth Griffin tragedy happen wherever you may be.”

Quotes from Foreword by:

Caryl P. Griffin, Mdiv, President and Founder
James Welch, Executive Director
Elizabeth R. Griffin Foundation.