The University *of* Western Ontario
BIOLOGICAL AGENTS REGISTRY FORM
Approved Biohazards Subcommittee: October 14, 2011
Biosafety Website: www.uwo.ca/humanresources/biosafety/

This form must be completed by each Principal Investigator holding a grant administered by the University of Western Ontario (UWO) or in charge of a laboratory/facility where the use of Level 1, 2 or 3 biological agents is described in the laboratory or animal work proposed. The form must also be completed if any work is proposed involving animals carrying zoonotic agents infectious to humans or involving plants, fungi, or insects that require Public Health Agency of Canada (PHAC) or Canadian Food Inspection Agency (CFIA) permits.

This form must be updated at least every 3 years or when there are changes to the biological agents being used.

Containment Levels will be established in accordance with Laboratory Biosafety Guidelines, 3rd edition, 2004, Public Health Agency of Canada (PHAC) or Containment Standards for Veterinary Facilities, 1st edition 1996, Canadian Food Inspection Agency (CFIA).

Electronically completed forms are to be submitted to Occupational Health and Safety, (OHS), (Support Services Building, Room 4190 or to jstanle2@uwo.ca) for distribution to the Biohazards Subcommittee. For questions regarding this form, please contact the Biosafety Officer at extension 81135 or biosafety@uwo.ca. If there are changes to the information on this form (excluding grant title and funding agencies), contact Occupational Health and Safety for a modification form. See website: www.uwo.ca/humanresources/biosafety.

Please ensure that all questions are fully and clearly answered. Failure to do so will lead to the form being returned, which will cause delays in your approval and frustration for you and your colleagues on the Committee.

If you are re-submitting this form as requested by the Biohazards Subcommittee, please make modifications to the form in bold print, highlighted in yellow. Please re-submit forms electronically.

PRINCIPAL INVESTIGATOR:	**Patrick Luke**
DEPARTMENT:	**Surgery**
ADDRESS:	**339 Windermere Road**
PHONE NUMBER:	**519-663-3180**
EMERGENCY PHONE NUMBER(S):	**519-857-8222**
EMAIL:	**Patrick.Luke@LHSC.ON.CA**

Location of experimental work to be carried out :

Building : **LHSC-UH** Room(s): **B4-215**
Building : _____ Room(s): _____
Building : _____ Room(s): _____

***For work being performed at Institutions affiliated with the University of Western Ontario, the Safety Officer for the Institution where experiments will take place must sign the form prior to its being sent to the University of Western Ontario Biosafety Officer (See Section 15.0, Approvals).**

FUNDING AGENCY/AGENCIES: **PSI and KFOC**
GRANT TITLE(S): **Enhancement of allograft function with Carbon Monoxide Releasing Molecules**
Dendritic cell therapy combined with sCD83 to prevent allograft rejection
UNDERGRADUATE COURSE NAME(IF APPLICABLE): _____

List all personnel working under Principal Investigators supervision in this location:

Name	UWO E-mail Address	Date of Biosafety Training
Tao Sun	**tsun7@uwo.ca**	**Oct 20, 2009**
		Oct 16, 2012

Changes to Grants

Please explain how the biological agents are used in your project and how they are stored and disposed of. The BARF without this description will not be reviewed.

Tubular epithelial cells (TEC) will be plated and treated with 10 ng/ml TGF-beta1, 10 ng/ml EGF and 36 ug/ml hydrocortisone to induce Epithelial mesenchymal transition (EMT). During the treatment, cells will also be treated with CORM-3, iCORM-3, control (no treatment), drug treatment (CORM-3 with sGC inhibitor, ODQ, p38 MAPK inhibitor or SB203480). After 6 days, cells will be fixed and stained for zona occludins 1 (ZO-1) to visualize cell junctions or vimentin to visualize the cytoskeleton. Western blots of lysates from cells will be performed, probing for E-cadherin, alfa-smooth muscle actin (alfa-SMA), S100A4 (fibroblast specific protein-1) or beta-actin. This will assess the ability of CORM to prevent the development of EMT in vitro.

Changes made to description

Please include a ONE page research summary or teaching protocol in lay terms.
Forms with summaries more than one page will not be reviewed.

Despite improvements in immunosuppressive therapy, the long-term survival of kidney transplants has not increased over the past decade. With limited survival, the kidney's lifetime is dependent upon wear during age-related use, damage as a result of the transplant process and immune-related injury, as well as development of non-specific chronic kidney transplant injury.

In animal models, carbon monoxide (CO) and carbon dioxide (CO2) inhalation has been shown to protect organs by decreasing inflammation and preventing cell death during the transplantation process. However, carbon monoxide inhalation is difficult to regulate and may lead to serious injury to patients by preventing oxygen delivery to vital organs. Carbon monoxide and carbon dioxide releasing molecules (CORM) are agents that safely deliver CO and CO2 without risk of oxygen deprivation to the patient. We have shown that CORM, like CO or CO2, improves kidney transplant function and survival when given to the kidney donor or when added directly to the kidney during its removal and storage.

We will use cell lines (human) to facilitate experiments to assess in vitro activity of CORM at the cellular level.

Our goal is to opimize kidney transplant protection after the transplant as well. We hypothesize that CORM can improve kidney tranplant function and longevity through regulation of the immune system and reduction of infalmmation and factors that create kidney scarring.

By investigating new compounds such as CORM, we hope to minimize kidney damage during the kidney transplant process as well as in the post-transplant period. We believe that this will lead to minimization of irreversible damage and improvement in the long-term survival of kidney transplants.

Changes made to Summary

1.0 Microorganisms

1.1 Does your work involve the use of biological agents? ☐ YES ☒ NO
(non-pathogenic and pathogenic biological agents including but not limited to bacteria and other microorganisms, viruses, prions, parasites or pathogens of plant or animal origin)? If no, please proceed to Section 2.0

Do you use microorganisms that require a permit from the CFIA? ☐ YES ☒ NO
If YES, please give the name of the species __________
What is the origin of the microorganism(s)? __________

Please describe the risk (if any) of escape and how this will be mitigated:

Please attach the CFIA permit.

Please describe any CFIA permit conditions:

1.2 Please complete the table below:

Full Scientific Name of Biological Agent(s)* (Be specific)	Is it known to be a human pathogen? YES/NO	Is it known to be an animal pathogen? YES/NO	Is it known to be a zoonotic agent? YES/NO	Maximum quantity to be cultured at one time? (in Litres)	Source/ Supplier	PHAC or CFIA Containment Level
NA	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			☐ 1 ☐ 2 ☐ 2+ ☐ 3

Please attach a Material Safety Data Sheet or equivalent from the supplier if the bacterium used is not on this link:
http://www.uwo.ca/humanresources/docandform/docs/ohs/CFIA_Ecoli_list.pdf

Additional Comments: __________

2.0 Cell Culture

2.1 Does your work involve the use of cell cultures? ☒ YES ☐ NO
(If NO, please proceed to Section 3.0)

2.2 Please indicate the type of primary cells (i.e. derived from fresh tissue) that will be grown in culture:

Cell Type	Is this cell type used in your work?	Source of Primary Cell Culture Tissue	AUS Protocol Number
Human	☒ Yes ☐ No	**TEC**	Not applicable
Rodent	☒ Yes ☐ No	**TEC**	**2006-04-111**
Non-human primate	☐ Yes ☒ No		
Other (specify)	☐ Yes ☒ No		

Changes to 2.2 and 2.3

2.3 Please indicate the type of established cells that will be grown in culture in:

Cell Type	Is this cell type used in your work?	Specific cell line(s)*	Containment Level of each cell line	Supplier / Source of cell line(s)
Human	☒ Yes ☐ No	**PT-2**	**1**	**gift from Phil Acott**
Rodent	☒ Yes ☐ No	**HUVEC**	**1**	**ATCC (CRL-1730**
Non-human primate	☐ Yes ☒ No			
Other (specify)	☐ Yes ☒ No			

Please attach a Material Safety Data Sheet or equivalent from the supplier. (For more information, see www.atcc.org)

2.4 For above named cell types(s) indicate PHAC or CFIA containment level required ☒ 1 ☐ 2 ☐ 2+ ☐ 3

Additional Comments: **HUVEC cell line and PT-2 cell line are two level 1 cell line. No special control measures are utilized. All the rodent tissues and HUVEC cells will be disposed inot the biohazard garbage bag**

3.0 Use of Human Source Materials

3.1 Does your work involve the use of human source materials? ☐ YES ☐ NO
If no, please proceed to Section 4.0

3.2 Indicate in the table below the Human Source Materi

Changes made to 3.2

Human Source Material	**Source/Supplier /Company Name**	**Is Hum Materia With Ar Agent? YES/UNKNOWN**		
Human Blood (whole) or other Body Fluid		☐ Yes ☐ Unknown		☐ 1 ☐ 2 ☐ 2+ ☐ 3
Human Blood (fraction) or other Body Fluid		☐ Yes ☐ Unknown		☐ 1 ☐ 2 ☐ 2+ ☐ 3
Human Organs or Tissues (unpreserved)	**ATCC HUFC**	☐ Yes ☒ Unknown		☒ 1 ☐ 2 ☐ 2+ ☐ 3

Human Organs or Tissues (preserved)		Not Applicable		Not Applicable

Additional Comments: **The University of Western Ontario workplace Health provides several health surveillance and testing. We will contact with the Workplace Health if an accidental exposure to a biological accurs.**

4.0 Genetically Modified Organisms and Cell lines

4.1 Will genetic modifications be made to the microorganisms, biological agents, or cells described in Sections 1.0 and 2.0? ☐ YES ☒ NO If **NO**, please proceed to Section 5.0

4.2 Will genetic modification(s) involving plasmids be done? ☒ YES, complete table below ☐ NO

Bacteria Used for Cloning *	Plasmid(s) **	Source of Plasmid	Gene Transformed or Transfected	Will there be a change due to transformation of the bacteria?	Will there be a change in the pathogenicity of the bacteria after the genetic modification?	What are the consequences due to the transformation of the bacteria?
DH5a	**pcDNA4**	**Corp. Qiagen**	**Transfected**	**None**	**None**	**Restense-Amp**
DH5a	**13087: mTLR4 flag**	**Addgene**	**Transfected**	**None**	**None**	**overexpressing Flag-tagged mouse TLR4**

**** Please attach a Material Safety Data Sheet or equivalent***
***** Please attach a plasmid map.***
******No Material Safety Data Sheet is required for the follo***
http://www.uwo.ca/humanresources/docandform/docs/ohs/

Changes made to 4.2

4.3 Will genetic modification(s) of bacteria and/or cells invo
☐ YES, complete table below ☒ NO

Virus Used for Vector Construction	Vector(s) *	Source of Vector	Gene(s) Transduced	Describe the change that results from transduction

**** Please attach a Material Safety Data Sheet or equivalent.***

4.3.1 Will virus be replication defective? ☐ YES ☒ NO

4.3.2 Will virus be infectious to humans or animals? ☐ YES ☒ NO

4.3.3 Will this be expected to increase the containment level required? ☐ YES ☒ NO

5.0 Will genetic sequences from the following be involved?

- HIV ☒ NO ☐ YES, specify
- HTLV 1 or 2 or genes from any Level 1 or Level 2 pathogens ☒ NO ☐ YES, specify
- SV 40 Large T antigen ☒ NO ☐ YES
- E1A oncogene ☒ NO ☐ YES
- Known oncogenes ☒ NO ☐ YES, specify

- Other human or animal pathogen and or their toxins ☒ NO ☐ YES, specify

5.1 Is any work being conducted with prions or prion sequences? ☒ NO ☐ YES

Additional Comments: _____

6.0 Human Gene Therapy Trials

6.1 Will human clinical trials be conducted involving a biological agent? ☐ YES ☒ NO
(including but not limited to microorganisms, viruses, prions, parasites or pathogens of plant or animal origin)
If no, please proceed to Section 7.0

6.2 If YES, please specify which biological agent will be used:
Please attach a full description of the biological agent.

6.3 Will the biological agent be able to replicate in the host? ☐ YES ☒ NO

6.4 How will the biological agent be administered?

6.5 Please give the Health Care Facility where the clinical trial will be conducted:

6.6 Has human ethics approval been obtained? ☐ YES, number: ☒ NO ☐ PENDING

7.0 Animal Experiments

7.1 Will live animals be used? ☒ YES ☐ NO If **NO**, please proceed to section 8.0

7.2 Name of animal species to be used **mouse(C57BL/6-BALB/C), Rat(Lewis/BN)**

7.3 AUS protocol **# 2006-041-11**

7.4 List the location(s) for the animal experimentation and housing.

7.5 Will any of the agents listed in section 4.0 be used in live animals
☒ NO ☐ YES, specify:

7.6 Will the agent(s) be shed by the animal:
☐ YES ☒ NO, please justify:

8.0 Use of Animal species with Zoonotic Hazards

8.1 Will any animals with zoonotic hazards or their organs, tissues, lavages or other body fluids including blood be used (see list below)? ☐ YES ☒ NO - If **NO**, please proceed to section 9.0

8.2 Will live animals be used? ☒ YES ☐ NO

Changes made to 7.2

8.3 If **YES**, please specify the animal(s) used:

- Pound source dogs ☐ YES
- Pound source cats ☐ YES
- Cattle, sheep or goats ☐ YES, species ☐ NO
- Non-human primates ☐ YES, species ☐ NO
- Wild caught animals ☐ YES, species & colony # ☐ NO
- Birds ☐ YES, species ☐ NO
- Others (wild or domestic) ☐ YES, specify ☐ NO

8.4 If no live animals are used, please specify the source of the specimens:

9.0 Biological Toxins and Hormones

9.1 Will toxins or hormones of biological origin be used? ☐ YES ☒ NO If **NO**, please proceed to Section 10.0

9.2 If YES, please name the toxin(s) or hormones(s)
Please attach information, such as a Material Safety Data Sheet, for the toxin(s) used.

9.3 What is the LD_{50} (specify species) of the toxin or hormone

9.4 How much of the toxin or hormone is handled at one time*?

9.5 How much of the toxin or hormone is stored*?

9.6 Will any biological toxins or hormones be used in live animals? ☐ YES ☐ NO
If **YES**, Please provide details:

*For information on biosecurity requirements, please see:
http://www.uwo.ca/humanresources/docandform/docs/healthandsafety/biosafety/Biosecurity_Requirements.pdf

Additional Comments: _____

10.0 Insects

10.1 Do you use insects? ☐ YES ☒ NO - If **NO**, please proceed to Section 11.0

10.2 If YES, please give the name of the species.

10.3 What is the origin of the insect?

10.4 What is the life stage of the insect?

10.5 What is your intention? ☐ Initiate and maintain colony, give location:
☐ "One-time" use, give location:

10.6 Please describe the risk (if any) of escape and how this will be mitigated:

10.7 Do you use insects that require a permit from the CFIA permit? ☐ YES ☐ NO
If **YES**, Please attach the CFIA permit & describe any CFIA permit conditions:

11.0 Plants

11.1 Do you use plants? ☐ YES ☒ NO - If **NO**, please proceed to Section 12.0

11.2 If YES, please give the name of the species.

11.3 What is the origin of the plant?

11.4 What is the form of the plant (seed, seedling, plant, tree...)?

11.5 What is your intention? ☐ Grow and maintain a crop ☐ "One-time" use

11.6 Do you do any modifications to the plant? ☐ YES ☐ NO
If yes, please describe:

11.7 Please describe the risk (if any) of loss of the material from the lab and how this will be mitigated:

11.8 Is the CFIA permit attached? ☐ YES ☐ NO
If **YES**, Please attach the CFIA permit & describe any CFIA permit conditions:

12.0 Import Requirements

12.1 Will any of the above agents be imported? ☐ YES, country of origin ☒ NO
If **NO**, please proceed to Section 13.0

12.2 Has an Import Permit been obtained from HC for human pathogens? ☐ YES ☐ NO

12.3 Has an import permit been obtained from CFIA for animal or plant pathogens? ☐ YES ☐ NO

12.4 Has the import permit been sent to OHS? ☐ YES, please provide permit # ☐ NO

13.0 Training Requirements for Personnel Named on Form

All personnel named on the above form who will be using any of the above named agents are required to attend the following training courses given by OHS:

- Biosafety
- Laboratory and Environmental/Waste Management Safety
- WHMIS (Western or equivalent)
- Employee Health and Safety Orientation

As the Principal Investigator, I have ensured that all of the personnel named on the form who will be using any of the biological agents in Sections 1.0 to 9.0 have been trained.

An X in the check box indicates you agree with the above statement... ☒
Enter Your Name Patrick Luke ***Date:*** 12/10/11

14.0 Containment Levels

14.1 For the work described in sections 1.0 to 9.0, please indicate the highest HC or CFIA Containment Level required. ☒ 1 ☐ 2 ☐ 2+ ☐ 3

14.2 Has the facility been certified by OHS for this level of containment?
- ☐ YES, location and date of most recent biosafety inspection:
- ☐ NO, please certify
- ☒ NOT REQUIRED for Level 1 containment

14.3 Please indicate permit number (not applicable for first time applicants):

15.0 Procedures to be Followed

15.1 Are additional risk reduction measures necessary beyond containment level 1, 2, 2+ or 3 measures that are unique to these agents? ☐ YES ☒ NO

If **YES** please describe:

15.2 Please outline what will be done if there is an exposure to the biological agents listed such as a needlestick injury or an accidental splash:

The University of Western Ontario workplace Health provides several health surveillance and testing. We will contact with the Workplace Health if an accidental exposure to a biological accurs.

15.3 As the Principal Investigator, I will ensure that this project will follow the Western Biosafety Guidelines and Procedures Manual for Containment Level 1 & 2 Laboratories (and the Level 3 Facilities Manual for Level 3 projects). I will ensure that UWO faculty, staff and students working in my laboratory have an up-to-date Hazard Communication Form, found at http://www.shs.uwo.ca/workplace/workplacehealth.html

An X in the check box indicates you agree with the above statement... ☒

Enter Your Name Patrick Luke ***Date:*** 12/10/12

15.4 Additional Comments: _____

16.0 Approvals

1) UWO Biohazards Subcommittee:
SIGNATURE: _____
Date: _____

2) Safety Officer for the University of Western Ontario
SIGNATURE: _____
Date: _____

3) Safety Officer for Institution where experiments will take place (if not UWO):
SIGNATURE: _____
Date: Oct 26, 2012

Approval Number: _____ Expiry Date (3 years from Approval): _____

Special Conditions of Approval:

Cell Biology

ATCC® Number:	**CRL-1730™**	Order this Item	Price:

$431.00 (for-profit list price)
$359.17 (non-profit list price)
Log In with customer # to see your price

Designations:	HUV-EC-C
Biosafety Level:	1
Shipped:	frozen
Medium & Serum:	See Propagation
Growth Properties:	adherent
Organism:	*Homo sapiens*
Morphology:	endothelial 
Source:	**Organ:** umbilical vein **Tissue:** vascular endothelium **Disease:** normal **Cell Type:** endothelial
Cellular Products:	factor VIII
Permits/Forms:	In addition to the MTA mentioned above, other ATCC and/or regulatory permits may be required for the transfer of this ATCC material. Anyone purchasing ATCC material is ultimately responsible for obtaining the permits. Please click here for information regarding the specific requirements for shipment to your location.
Applications:	transfection host
Tumorigenic:	No
DNA Profile (STR):	Amelogenin: X CSF1PO: 11,12 D13S317: 9,11 D16S539: 11,12 D5S818: 11,12 D7S820: 8,12 THO1: 6,9.3 TPOX: 8,11 vWA: 16

Karyology performed for one batch of CRL-1730 in 1996 reflected a hypodiploid human cell line with a modal chromosome number of 45 occurring in 72% of the cells counted, all of which had monosomic N13. The rate of polyploid cells among this population was 15.8%. This karyology differed from earlier work-ups

Related Links ▸

NCBI Entrez Search

Cell Micrograph

Make a Deposit

Frequently Asked Questions

Material Transfer Agreement New!

Technical Support

Related Cell Culture Products

Product Information Sheet

BioProducts

- Cell, microbial and molecular genomics products for the life sciences

BioServices

- Bio-materials management; basic repository to complex partnership-level services

BioStandards

Biological Reference Material and

Plasmid 13087: mTLR4 flag

Gene/insert name	TLR4
Alt name	toll-like receptor 4
Insert size	2500
Species	M. musculus (mouse)
GenBank ID	NM_021297
Entrez Gene	Tlr4 (RP24-209H15.1, Lps, Ly87, Ran/M1, Rasl2-8)
Fusion protein or tag	Flag
Terminal	N terminal on backbone
Mutation	Amino acids 1-19 have been replaced with mammalian signal sequence (SALLILALVGAAVA) followed by Flag tag
Vector backbone	pFlag-CMV-1 (Search Vector Database)
Backbone manufacturer	Sigma
Vector type	Mammalian Expression
Backbone size w/o insert (bp)	4700
Cloning site 5'	SalI
Site destroyed during cloning	No
Cloning site 3'	NotI
Site destroyed during cloning	No
5' sequencing primer	CMV30 List of Sequencing Primers
3' sequencing primer	CMV24
Bacterial resistance(s)	Ampicillin
Growth strain(s)	DH5alpha
Growth temperature ( )	37
High or low copy	High Copy
Sequence	View sequences (1)
Principal Investigator	Ruslan Medzhitov
Terms and Licenses	MTA

Addgene has sequenced a portion of this plasmid for verification. Click here for the sequencing result.

Please acknowledge the principal investigator and cite this article if you use this plasmid in a publication. Also, please include the text "Addgene plasmid 13087" in your Materials and Methods section.

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Carbon monoxide, compressed (MSDS No. P-4576-J)	**Trade Names:** Carbon Monoxide
Chemical Name: Carbon monoxide	**Synonyms:** Carbonic oxide, carbon oxide
Chemical Family: Permanent gas	**Product Grades:** 1.85, 2.5, Ultra High Purity – 3.0, Research - 4.0

Telephone: **Emergencies:** 1-800-645-4633*
CHEMTREC: 1-800-424-9300*
Routine: 1-800-PRAXAIR

Company Name: Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Poisonous, flammable, odorless high-pressure gas.
Acts on blood, causing damage to central nervous system (CNS).
Can be fatal even with adequate oxygen.
Can form explosive mixtures with air.
Harmful if inhaled.
Self-contained breathing apparatus must be worn by rescue workers.
Under ambient conditions, this product is a colorless, odorless gas.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Depending on the concentration and duration of exposure, may cause headache, drowsiness, dizziness, excitation, rapid breathing, pallor, cyanosis, excess salivation, nausea, vomiting, hallucinations, confusion, angina, convulsions, and unconsciousness. With well-established poisoning, the mucosal surface will be bright red (cherry red). Lack of oxygen can kill.

Skin Contact. No harm expected.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure.

Eye Contact. No harm expected.

A vertical line in the left margin indicates revised or new material.

Effects of Repeated (Chronic) Overexposure. Repeated hypoxia from carbon monoxide exposure will cause gradually increasing CNS damage, with loss of sensation in the fingers, poor memory, and mental deterioration. Chronic exposure may facilitate development of atherosclerosis.

Other Effects of Overexposure. Other effects include embryotoxicity, impaired cardiovascular function, pulmonary edema, pneumonia, gross neuropsychiatric damage, memory impairment, permanent CNS damage, and cerebral edema with irreversible brain damage. Late, fatal demyelinization is a rare, but possible, complication.

Medical Conditions Aggravated by Overexposure. Hypoxia from carboxyhemoglobin formation may aggravate established coronary and cerebral circulatory insufficiency.

CARCINOGENICITY: Carbon monoxide is not listed by NTP, OSHA, and IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: No known effects. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Carbon Monoxide	630-08-0	>99%*

**The symbol > means "greater than."*

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration with supplemental oxygen given by qualified personnel. If breathing, qualified personnel should give oxygen. Call a physician.

SKIN CONTACT: Wash skin with soap and water. If irritation persists or contact has been prolonged, call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: An unlikely route of exposure. Flush with water. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are thoroughly flushed. Get medical attention if discomfort persists.

NOTES TO PHYSICIAN: *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Angina and depression of the ST segment of the electrocardiogram indicate myocardial hypoxia. Exposure to high concentrations can result in cerebral edema. With severe doses, the use of hyperbaric oxygen may be beneficial. Individuals repeatedly overexposed may present positive Romberg's sign.*

Contact the Poison Control Center in your area for additional information on patient management and follow-up.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Cannot be detected by odor. Forms explosive mixtures with air and oxidizing agents.

SUITABLE EXTINGUISHING MEDIA: CO_2, dry chemical, water spray, or fog.

PRODUCTS OF COMBUSTION: Carbon dioxide

PROTECTION OF FIREFIGHTERS: DANGER! Poisonous, flammable, odorless high-pressure gas. Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus. Immediately cool cylinders with water spray from maximum distance, taking care not to extinguish flames. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive reignition may occur. Stop flow of gas if without risk, while continuing cooling water spray. Remove all cylinders from area of fire if without risk. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Carbon monoxide cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) If leaking carbon monoxide catches fire, do not extinguish flames. Flammable and toxic vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check with an appropriate device.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Poisonous, flammable, odorless high-pressure gas.

Personal Precautions. Cannot be detected by odor. Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus. May form explosive mixtures with air. Toxic, flammable gas may spread. Before entering area, especially a confined area, check atmosphere with an appropriate device. Remove all sources of ignition if without risk. Reduce gas with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to well-ventilated area.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: May form explosive mixtures with air. Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Keep away from heat, sparks, and open flame. Use only spark-proof tools and explosion-proof equipment. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact

your supplier. Close valve after each use; keep closed even when empty. For other precautions in using carbon monoxide, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Protect cylinders from direct sunlight. Separate carbon monoxide cylinders from oxygen and other oxidizers by at least 20 ft (6.1 m), or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hr. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use of this product, see Praxair publications P-14-153, *Guidelines for Handling Gas Cylinders and Containers,* and P-15-437, *Safe Handling of Carbon Monoxide.* Obtain from your local supplier.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2009)
Carbon Monoxide	50 ppm	25 ppm

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = 1200 ppm

ENGINEERING CONTROLS:

Local Exhaust. Use an explosion-proof local exhaust system with sufficient air flow to keep the carbon monoxide concentration below the applicable exposure limits in the worker's breathing zone.

Mechanical (General). Not recommended as a primary ventilation system to control worker's exposure.

Special. None

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves when handling cylinders.

Eye/Face Protection. Wear safety glasses when handling cylinders. Select per OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Odorless
ODOR THRESHOLD:	Not applicable.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm:	-337°F (-205.0°C)
BOILING POINT at 1 atm:	-312.61°F (-191.45°C)
FLASH POINT (test method):	Flammable gas, not applicable.
EVAPORATION RATE (Butyl Acetate = 1):	Not applicable.
FLAMMABILITY:	Flammable
FLAMMABLE LIMITS IN AIR, % by volume:	**LOWER:** 12.5% **UPPER:** 74%
VAPOR PRESSURE:	Not applicable.
VAPOR DENSITY at 68°F (20°C) and 1 atm:	0.0725lb/ft^3 (1.161kg/m^3)
SPECIFIC GRAVITY (H_2O = 1):	Not applicable.
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	0.9676
SOLUBILITY IN WATER, vol/vol at 32°F (0°C) and 1 atm:	0.035
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	1128°F (608.9°C)
DECOMPOSITION TEMPERATURE:	752°F (400°C)
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	28.01
MOLECULAR FORMULA:	CO

10. Stability and Reactivity

CHEMICAL STABILITY: ☐ Unstable ☒ Stable

CONDITIONS TO AVOID: Temperatures above 752°F (400°C)

INCOMPATIBLE MATERIALS: Oxidizing agents, oxygen, flammables, metal oxides, halogenated fluorides, metals in the presence of moisture and/or sulfur compounds

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide will decompose above 752°F (400°C) to form carbon dioxide and carbon.

POSSIBILITY OF HAZARDOUS REACTIONS: ☒ May Occur ☐ Will Not Occur

Forms explosive mixtures with air and oxidizing agents.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC_{50} = 3760 ppm, 1 hr rat.

STUDY RESULTS: Carbon monoxide produces embryofetal toxicity in laboratory animals but only at doses that cause maternal toxicity. There is no information available on possible effects in humans.

12. Ecological Information

ECOTOXICITY: No information available on ecological effects.

OTHER ADVERSE EFFECTS: Carbon monoxide does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Carbon monoxide, compressed

HAZARD CLASS:	2.3	**PACKING GROUP/Zone:**	NA/D	**IDENTIFICATION NUMBER:**	UN1016
PRODUCT RQ:	None				

SHIPPING LABEL(s):	POISON GAS, FLAMMABLE GAS*
PLACARD (when required):	POISON GAS, FLAMMABLE GAS*

**The words in the POISON GAS diamond are INHALATION HAZARD.*

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, non-ventilated compartment of a vehicle can present serious safety hazards.

Additional Marking Requirement: INHALATION HAZARD

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Carbon monoxide is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None
EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes	**PRESSURE:** Yes
DELAYED: Yes	**REACTIVITY:** No
	FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Carbon monoxide is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Carbon monoxide is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Carbon monoxide is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Carbon monoxide is not listed in Appendix A as a highly hazardous chemical. However, any process that involves a flammable gas on site in one location in quantities of 10,000 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

STATE REGULATIONS:

CALIFORNIA: Carbon monoxide is listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

WARNING: Carbon monoxide is a chemical known to the State of California to cause birth defects or other reproductive harm. *(California Health and Safety Code §25249.5 et seq.)*

PENNSYLVANIA: Carbon monoxide is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***Poisonous, flammable, odorless high-pressure gas.*** Cannot be detected by odor. Use piping and equipment adequately designed to withstand pressures to be encountered. Use only in a closed system. Use a backflow prevention device in any piping. Ground all equipment. Electrical equipment must be non-sparking or explosion-proof. Never work on a pressurized system. If a leak occurs, close the cylinder valve, blow down the system by venting vapor to a safe place in an environmentally safe manner in compliance with all federal, state, and local laws; then repair the leak. Follow safe practices when returning cylinder to supplier. Be sure

valve is closed; then install valve outlet cap or plug, leak-tight. Never place a compressed gas cylinder where it may become part of an electrical circuit.

NOTE: *Prior to using any plastics, confirm their compatibility with carbon monoxide. Avoid using pure nickel. Corrosion of pure nickel in carbon monoxide atmospheres exceeds 50 mil/yr (1.27 mm/yr) at room temperatures.*

Mixtures. When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 3	HEALTH	= 1
FLAMMABILITY	= 4	FLAMMABILITY	= 4
INSTABILITY	= 0	PHYSICAL HAZARD	= 3
SPECIAL	= None		

**An asterisk used in conjunction with HMIS health hazard ratings designates a carcinogenic or reproductive hazard.*

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-350 connection is standard
PIN-INDEXED YOKE:	NA
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-724 *NOTE: Do not use a nickel gasket*

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, http://www.cganet.com/Publication.asp.

AV-1	*Safe Handling and Storage of Compressed Gases*
P-1	*Safe Handling of Compressed Gases in Containers*
V-1	*Compressed Gas Cylinder Valve Inlet and Outlet Connections*
—	*Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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Printed in USA

-------- Original Message --------
Subject: Re: Biological Agents Registry Form - Luke
Date: Mon, 07 Jan 2013 16:26:36 -0500
From: Sarah Langford <Sarah.Langford@lhsc.on.ca>
To: Jennifer Stanley <jstanle2@uwo.ca>
CC: Patrick Luke <Patrick.Luke@lhsc.on.ca>, tsun7@uwo.ca

Hi Jennifer,

Please find the revised version attached. I have made the requested changes and attached the MSDS for Carbon Monoxide. Please note that CORM is not a product that is purchased, and therefore there is no existing MSDS for it. I have also attached additional information on Plasmid 13087: mTLR4 flag.

Thanks,
Sarah

Sarah Langford, BHSc
Research Coordinator, Division of Urology
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