The University of Manchester
Dalton Nuclear Institute

Dalton Cumbrian Facility

EQUIPMENT PROTOCOL (EQP)

Please refer to the separate EQP guidance document when completing this template.

a) EQP Reference Number	DCF/EQP/0048
b) Version Number	2.0
c) Equipment ID / Description	Sample transport in liquid nitrogen Statebourne Biotrek 3 dry shipper by car
d) Equipment Location & Room Number	Portable
e) Issue Date (date all parties sign)	16/01/2017
f) Review Date (at least annually)	16/01/2018
g) Other Relevant Protocol / Assessment Number(s)	
h) Originators Name	Ruth Edge
i) Originators Contact Details (email address & telephone number)	ruth.edge@manchester.ac.uk 01946 508857
j) Does the equipment involve the use of compressed gases?	Yes ~~/ No~~ Note: You must read and sign risk assessment for appropriate gas cylinder use RA Ref: DCF/RA/0039 Liquid Nitrogen

Note: Operation of DCF equipment cannot commence without a signed equipment protocol in place. Anyone using the equipment must read and sign onto the protocol.

Quick links to Equipment Protocol Sections:-

PLEASE CONSIDER THE ENVIRONMENT AND PRINT DOUBLE SIDED

1. Signatures

I, the Researcher, declare that I:-

- have read & understood this equipment protocol and supporting documents,
- will comply with the procedures outlined,
- have completed all of the pre-requisite training and acknowledged any hold points referenced in section 9.

I, the Supervisor, am signing to confirm that:-

- I am aware this researcher is using this equipment as stated in this protocol,
- appropriate medical/monitoring for the researcher is in place e.g. fitness to work

Researcher Name	Researcher Signature	Date	Supervisor Name	Supervisor Signature
Ruth Edge	Ruth Edge	16/1/17		

I, the Experimental Officer or lab responsible person, am signing to confirm that I have checked and agree with the Equipment Protocol and that all referenced supported documents are in place and a copy has been placed in the Lab folder.

EO or Lab Responsible Person Name	EO or Lab Responsible Person Signature	Date	Job Title
Ruth Edge	Ruth Edge	16/1/17	EO & Lab Manager
Mark White	Mark White	17-01-17	H&S EO

2. DCF Equipment Programme

Please write a detailed description of the equipment operations. (Keep to 1 page, if possible).

Transport of liquid nitrogen in vehicles is a hazardous activity because of the evaporation of liquid nitrogen (which cannot be held in tightly sealed containers because of the likelihood of pressure build up) into the passenger compartment of the vehicle which could cause asphyxiation. The following procedure must therefore be followed when transporting liquid nitrogen in vehicles to minimise risk:

- Dry shippers must be used.

Dry shippers eliminate the potential for spillage during transit by absorbing the liquid nitrogen into a carrier material, effectively keeping the sample in the gaseous phase. Dry shippers which have been correctly charged contain no free liquid nitrogen and are not considered as Dangerous Goods (DG) for any mode of transport provided the material being transported within them is not a DG eg is a non-infectious biological sample. However, liquid nitrogen itself is a DG for all transport modes although there are exemptions.

Template Reference: DCF/D/0127 V3.1

3. Risk Assessment

The University of Manchester
Dalton Nuclear Institute

ASSESSING OUR RISKS: GENERAL RISK ASSESSMENT FORM

DCFD0110 Notes to accompany General F

For full details/guidance on how to complete the risk assessment please refer to the above PDF document.

Calculate: **Probability** multiplied by **Severity** for No/Post control scores.

Note: For scores of 5 or more (Medium) in the residual risk column (14) contact the Health & Safety Experimental Officer for further advice. For scores of 10 or more (High) the Health & Safety Experimental Officer will make a recommendation to the Operations Manager and/or Director.

People Affected (4): Identify who may be at risk with a ✓ below. For each task and hazard specify who will be at risk in the hazard and control table by entering the initial corresponding to that group in the People Affected column.

Visitors (V)	Contractors (C)	Members of the public (P)	Building occupants (BO)	Other people working in the vicinity (R)	Vulnerable persons (VP)	Experimenter (E)
			Vehicle Occupants ✓			✓

Probability \ Severity	Minor injury	Lost time / ill health	Major / > 7days	Permanent disability	Fatal / Site loss
Highly Unlikely 1	1	2	3	4	5
Unlikely 2	2	4	6	8	10
Possible 3	3	6	9	12	15
Probable 4	4	8	12	16	20
Certain 5	5	10	15	20	25

	HAZARDS LIST (Potential for Injury) – tick those that apply		
	Slips, Trips & Low Falls (e.g. from wet/contaminated floors, steps, stairs, spillage risk etc)	✓	Exposure to biological agents or biological hazards (bacterial, rodent, viral, legionella)
	Falls from Height (fragile roofs/work/holes, ladders, zip-up, scaffolding, racking, restricted access, cherry pickers) Note: See Working at Height Risk Assessment No: DCF/RA/0038		Noise/Vibration exposure (over 80dBA, 85dBA, nuisance) Note: A separate noise assessment may be required.
	Ergonomic/Posture Hazards (e.g. repetitive actions, over exertion/effort, awkward positions)		Pressurised systems, boilers, steam systems, pneumatics, hydraulics etc
✓	Manual Handling Risks - lifting, carrying, pushing, pulling (back strains, pulled muscles etc) Note: See Risk Assessment No: DCF/RA/0036		Temperature exposure (variations from normal, inc high/low temps, ventilation/humidity, heat stress/exhaustion)
	Struck by a falling object (lifted materials, lifting operations, overhead working, crane/tackle/beam failures etc)	✓	Burns/Scalds (hot or cold, or flames)
	Striking against objects, head bangs, body bumps		Contact with services (water, gas, electrics)
✓	Eye Injuries (e.g. foreign bodies, dust etc)		Electric Shock (or flash burns, static)
✓	Cuts & Hand tool / power tool injuries and friction injuries (inc glass, needles & paper cuts) and bruises etc		Radiation Exposure (substances or ionising, light - Infra Red, Ultra Violet, Laser, X-Ray) Note: A dose assessment may be required
	Machinery Entrapment, crush injuries, entanglement (e.g. workshop machines, plant, mechanical hazards) Note: A separate PUWER (Provision and Use of Work Equipment Regs) may be required for work equipment / machinery	✓	Transport Risks (FLT/FLT, Veh/pedestrian, trailers, mobile plant or driving for work)
	Display Screen Equipment / Visual Display Unit risks Note: A DSE Assessment is required.		Vehicle Manoeuvres (including reversing and loading)
✓	Exposure to Hazardous Substances (Chemicals, oils etc, skin/absorption, eyes, respiratory, ingestion) Note: A separate COSHH Assessment is required.	✓	Out of Hours Work (Monday to Friday, 17:00 – 08:30, Saturday and Sunday and public holidays) Note: See Risk Assessment DCF/RA/0087
✓	Asphyxiation (Confined spaces, gas suppression systems etc)	✓	Lone working, restricted communications.
	Exposure to gases, fumes (exhaust, solvent etc), dust, asbestos, ammonia Note: A calculation to determine maximum safe concentration of asphyxiant / explosive gas may be required. DSEAR control measures / zoning also may be required.		***** Consider anything else that is foreseeable and could cause significant injury, consider emergency or abnormal activities in addition to start up, normal running and shutdown**
	Fire, Highly Flammable Liquids, Pressurised gases, Explosion (inc Pressure explosions, boilers, hot work, gases & implosions) Note: Refer to DCF fire risk assessment & H&S Guidance		

	POSSIBLE CONTROLS – tick those that apply		
	Prohibition or Elimination - Stop doing the job		Measurement Sensors/Alarms (inc gas detection, oxygen depletion)
	Substitute with another method	✓	Ventilation (forced or general or Local Exhaust Ventilation (LEV)), good lighting, environmental controls
	Isolate job (e.g. enclose process) interlocking, fixed guarding etc or 'lock off & tag'		Specialist Surveys (e.g. noise, dust, vibration, radiation/contam, thermo graphic, magnetic field etc)
✓	Procedures - Safety, Quality, Production, Safe System of Work (approved), Work Instructions	✓	Training, Competent Persons, Authorised Controls, Permits or Licensing, Schedules
	Maintenance and Statutory Checks (inc Planned Maintenance (PM) and PM inspections or tests)		Lifting Equipment/Aids
	Inspections and/or Housekeeping		Emergency Procedures (for foreseeable emergency situations including Personal Emergency Evacuation Plan (PEEP))
✓	Training, Competent Persons, Authorised Controls, Permits or Licensing, Schedules	✓	Suitable PPE e.g. Shoes, Gloves, Hivis clothing, goggles, masks, breathing apparatus ,earplugs, hard hats
✓	Warning Notices/Signs, Physical Restrictions (note - may be portable)	✓	Monitoring Equipment e.g. oxygen depletion monitoring, electronic personal dosimeters, radiation/contamination monitors, SF6 monitor
✓	Audible/Visual Warnings		Dose Assessment
	Safety Equipment (e.g. Mirrors, RCDs, guarding, emergency stops, barriers, handrails, ramps)		***** Consider anything else that is helpful and could reduce the chance of injury**
	Reduced Time Exposure (job rotation etc)		

Template Reference: DCF/D/0127 V3.1

Task Step ref no. (10)	Identified hazards or Injury causes, highlighting risks (Injury focused - see checklist on final page) (11)	People Affected (6)	Score -No controls (12) (Probability x Severity = calculation)	Risk Controls (nformation, procedures, training etc) (13) This should details existing DCF controls as well as further controls identified specific for the task	Residual Risk (14) Score (Calculation)	Further action required (15)	Action Priority (H/M/L) (16)
	Manual Handling	E, BO	3X3=9	Total weight 8.5 kg when full. Proprietary carrying handle and rucksack. Operatives must be trained in manual handling techniques.	1X3=3		
	Eye Injuries due to liquid nitrogen splashes	E, BO	3X4=12	Follow DCF/RA0039. When decanting or removing samples wear safety glasses or visor BS: EN166.	1X4=4		
	Exposure to hazardous substances (e.g. chemicals or biological hazards)		Unknown	A Chemical Risk Assessment is required for hazardous substances			
	Asphyxiation	E, BO	5X5=25	Operative must be 'Gas Safety' and 'Cryogenics' trained. Limited quantities – holds up to 4.2 litres of liquid nitrogen. Dry Shipper – absorbs liquid nitrogen into carrier material therefore prevents spillage. - Limited release rate – 4.1 litres/hour. At least one window of vehicle to be open. Fan must not be set on recirculation mode. Where possible, the Dry Shipper should be carried in a separate compartment or as far away from people as possible. A portable oxygen depletion monitor must be carried by the operative. Operative to be aware that, if monitor alarms, window(s) are to be opened on the vehicle and, as soon as safe to do so, the operative should exit the vehicle.	1X5=5		
	Crygenic Burns	E	3X4=12	Operative must be 'Gas Safety' and 'Cryogenics' trained. Dry Shipper – absorbs liquid nitrogen into carrier material therefore prevents spillage. Safety glasses or visor BS: EN166 and cryogenic gloves must be worn when inserting or removing samples	1X4=4		

	Transport Risks, including out of hours or lone working	E	2X5=10	University Driving Policy must be followed. If private vehicle being used, business use must be on the insurance. University out of hours and lone working policy must be followed as far as reasonably practicable. Dry Shipper is marked as containing liquid nitrogen and propriatory rucksack is marked 'Cryigenic Dry Shipper'.	1X5=5		
	Cuts due to failure of sample container(s) on removal from Dry Shipper due to rapid temperature change	E	3X2=6	Safety glasses or visor BS: EN166 and cryogenic gloves must be worn when inserting or removing samples. This risk should be covered in more detail in a COSHH/Task specific Risk Asessment.	1X2=1		

Action plan (see 15)

Ref No	Further action required	Action by whom	Action Priority (H/M/L)	Action by when	Done

4. Protection

Please confirm details of any protective equipment/apparatus that will be used, these should be detailed in the risk assessment as control measures.

Protection	Yes/No	Comments
Fume Cupboard		
Lab Coat		
Safety Glasses *(specify the type in Comments)*	✓	BS: EN 166
Safety Shoes		
EPD		
Gloves *(specify the type in Comments)*	✓	Cryogenic
Interlocks		
Search Procedures		
Dust Mask		
Ventilation	✓	Car window(s) open
Barriers/Signage	✓	Liquid Nitrogen Labelling
Any Others: *(list below)*	✓	Portable Oxygen Monitor

5. COSHH Assessment

Please note that any chemicals that are used in an experiment at DCF must be registered on our Chemical Database. Document DCF/D/0063 outlines the procedure for ordering chemicals. You will find a copy of DCF/D/0063 in the Chemical, Gases & Materials folder of the DCF shared drive.

If a COSHH Assessment is not required please specify N/A here:

Hazardous substance(s) used:	Liquid Nitrogen

*Please Consider Products and/or By-products

For guidance on how to complete the COSHH Assessment section please click on this PDF link:

Guidance for completing the DCF C

Chemical storage location(s) on site	Portable Dry Shipper
Those at risk of exposure (staff, public, others)	Experimenter and vehicle occupants

Hazards from tasks/chemicals to be used including; reactants, products, bi-products, and waste

Tick ✓ appropriate boxes (g):

Gases Under Pressure

Flammable

Explosives

Oxidising

Caution

Corrosive

Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
✓			✓		✓		✓		✓		✓

Longer Term Health Hazards

Acute Toxicity

Hazardous to the Environment

Yes	No	Yes	No	Yes	No
	✓		✓		✓

Hazardous substances (information on all hazardous substances associated with the task should be entered here):					
Name, strength, form, quantity (h)	(M)SDS on DCF System Y/N or N/A (i)	Hazard category e.g. toxic, risk phrase(s) (j)	Route(s) of exposure (k)	Effects of exposure (l)	Work exposure limit ppm or mg/m^3 8hrs or 15 mins (m)
Liquid Nitrogen, 4.2 litres max	Y	Asphyxiant Cryogen (H281)	Inhalation Skin/Eye contact	Asphyxiation Burns	

EXISTING PRECAUTIONS (What controls are currently in place and are they adequate?)

Engineering measures (✓ as appropriate)

Complete Enclosure (Glove Box) ☐ Fume Cupboard ☐ other LEV ☐

General Ventilation ☒ other (describe) ☐

Procedural measures (✓ as appropriate)

Written Instructions / Procedures (n) ☐ Training (o) ☒ Incompatibility with other lab tasks (p) ☐

Health surveillance (q) ☐ Air monitoring (r) ☒ Fit-testing for RPE (s) ☐

Unattended working allowed (t) ☒ Out of Hours working allowed (u) ☒

Specify: Gas Safety & Cryogenics training; Portable Oxygen Monitor

Personal protective equipment (indicate if used)			
Face & eyes: visor	☒	Goggles	☐
Spectacles	☒	Hands: Gloves	☒
Respiratory (RPE) (v)	☐	Other: ☐ (specify below) (w)	

BS EN 166; Cryogenic Gloves

WITH THESE CONTROLS THE RISK OF EXPOSURE IS: (TICK ✓ AS APPROPRIATE) (x)	Unacceptable	Further controls required	Adequately controlled	Need more information
			✓	

FURTHER CONTROL MEASURES REQUIRED (list further action needed to adequately control exposure) (y)

Disposal measures (list measures relating to disposal). Also list any monitoring of controls			
To Drain* (z)	☐	General Waste	☐
**must show calculations/proof that is non-hazardous*			
Waste Management Co.	☐	Sample taken off-site *please specify below	☐
Other *please specify below	☒ To Atmosphere		

6. Emergency Shutdown Procedures

The University of Manchester
Dalton Nuclear Institute

Dalton Cumbrian Facility

EMERGENCY SHUTDOWN PROCEDURE

Complete Section A for all equipment and experiments. State whether the equipment or experiment can be left on overnight and/or unattended in accordance with the risk assessment and record the associated emergency shutdown procedure. For anything that will be left unattended at any time you must complete the emergency shutdown procedure and leave next to the equipment/experiment. Save an electronic copy of the form with the protocol documentation for future use.

SECTION A:			
Lab Number & Name		Location/Fume Cupboard number	
Protocol, Risk, COSHH reference number(s). *A copy of all documents should be stored in the lab and an electronic copy on the DCF drive*		Unattended (during the day)?	Yes / No
		Unattended (overnight)?	Yes / No
Researcher Name		Researcher's Supervisor	
Type of Apparatus			
The experiment/equipment uses (tick all that apply):			
☐ Water	☐ Electricity	☐ Pressure	☐ Natural gas
☐ Vacuum	☐ Compressed Gas(es) (specify)		
☐ Other (specify)			

EMERGENCY SHUTDOWN PROCEDURE

In the event of an emergency:-

Complete Section B each time the equipment/experiment is to be left running overnight. Leave a completed signed copy at Reception as well as next to the equipment / experiment.

SECTION B Experiment / Equipment to run between:			
From - Date		From - Time	
To - Date		To - Time	
Approval must be given by either the Experimental Officer or Lab Responsible Person.			
Approved by (Signature)		Approved by (Print Name)	
Approval Date		DCF On-Call Contact Details	
Researcher Name		Researcher's Telephone Number	

7. Training and Monitoring Requirements

e.g. lab worker medical, gas safety course, radiation safety course, laser awareness

Gas Handling & Cryogenics Course
Manual Handling Course

8. Consultation

Please detail who has been consulted in preparation of this document, and any relevant University or specialist policies and guidance. Please note it is advised that a quorate group of people should meet with the author to review and sign onto the equipment protocol.
Standard attendance/input: Author, Equipment Owner / Experimental Officer, Supervisor, Health & Safety Experimental Officer
May need additional input depending on the location/risk e.g. RPS, RPA, Laser Safety Officer, Building Manager, Operations Manager.

Ryan Metcalfe DGSA

9. Emergency Actions

Consult information found in (M)SDS
If more than one emergency action is applicable then clearly state which action applies to which chemical(s).

Emergency Problem	Emergency Action
Medical (EYE)	Immediately flush eyes with lukewarm water for at least 15 mins.
Medical (SKIN)	Immediately flush skin with lukewarm water for at least 15 mins.
Medical (MOUTH)	N/A
Medical (LUNGS)	Remove to uncontaminated area wearing breathing apparatus
Spillage	Evacuate area
Disposal	To Atmosphere
Fire (Specify Method)	All known extinguishants can be used
Other:	

In the event of an emergency please tear this page from the protocol in order to provide information to any first aid or medical assistance needed.