Instrument Safety Readiness Review
Summary of DREAM and General Safety

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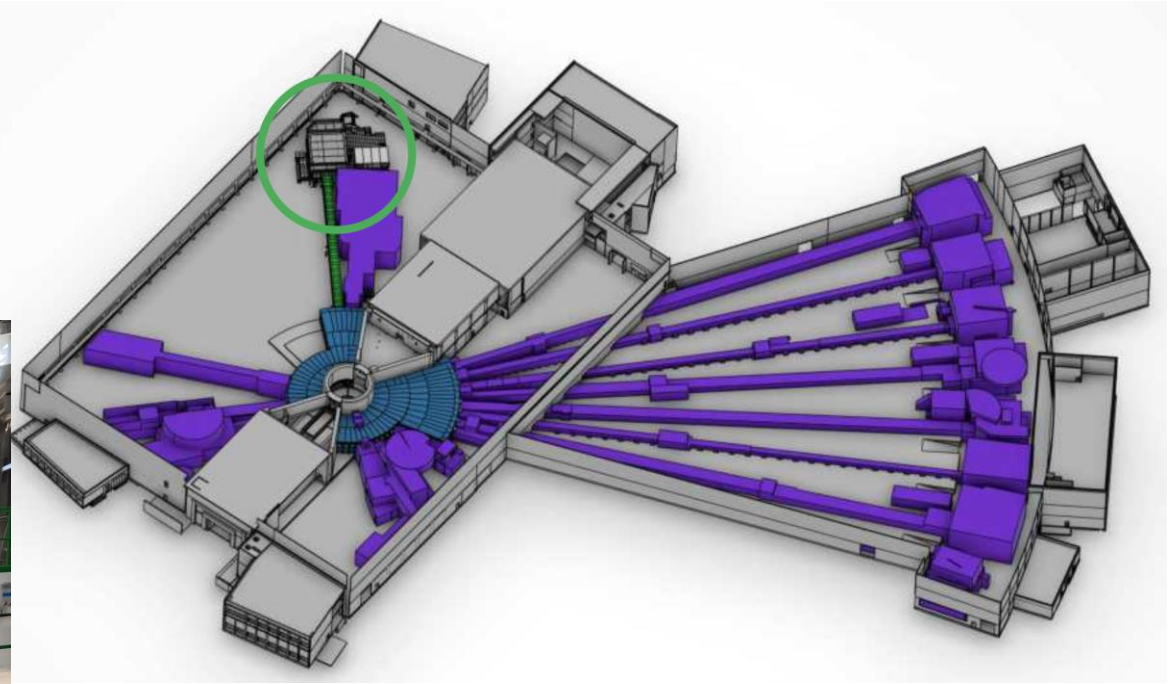
European Spallation Source (ERIC), Lund, Sweden

Outline

1. DREAM Overview
2. Safety Overview

DREAM

Location: D01
Beamport: S3



DREAM overview

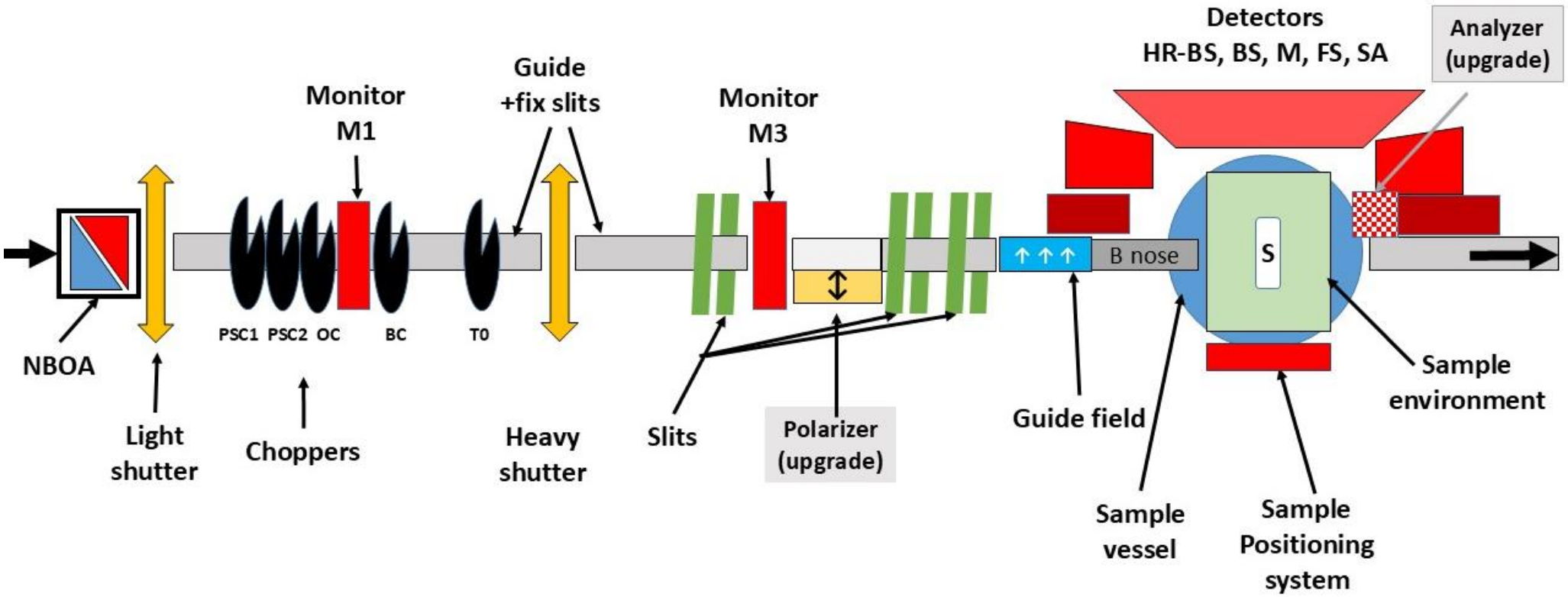


Illustration by F. Porcher

Neutron Instrument States (ESS-0005817)

Maintenance	Instrument not operational, in an unconfirmed state, or otherwise unsafe to receive neutrons.
Access	The instrument is radiologically safe, and access is granted into the controlled space within the shielding.
Halt	The instrument is radiologically safe, and that the neutron beam has been intentionally stopped upstream of the sample position.
Run	This state indicates that the instrument is radiologically safe, and that the neutron beam is delivered to the sample position.

2

Safety Overview

Industrial and Occupational Safety

Documents

- Area Risk Assessment D01+D03 bunker (ESS-4751819)
- Instrument Hazard Analysis DREAM (ESS-0454185)
- Area Risk Assessment DREAM (ESS-5969230)
- Local rules DREAM (ESS-6007318)
- Task Risk Assessment for DREAM General Activities (ESS-5972865)
- Specific Task Risk Assessment: Example Installation and Removal of DREAM Sample Vessel (ESS-6018271)
- Combustibles Inventory for DREAM bunker components (ESS-5918904)
- DREAM ODH Analysis (ESS-4246467)
- DREAM Risk Assessment for Pressurized Systems (ESS-5770346)

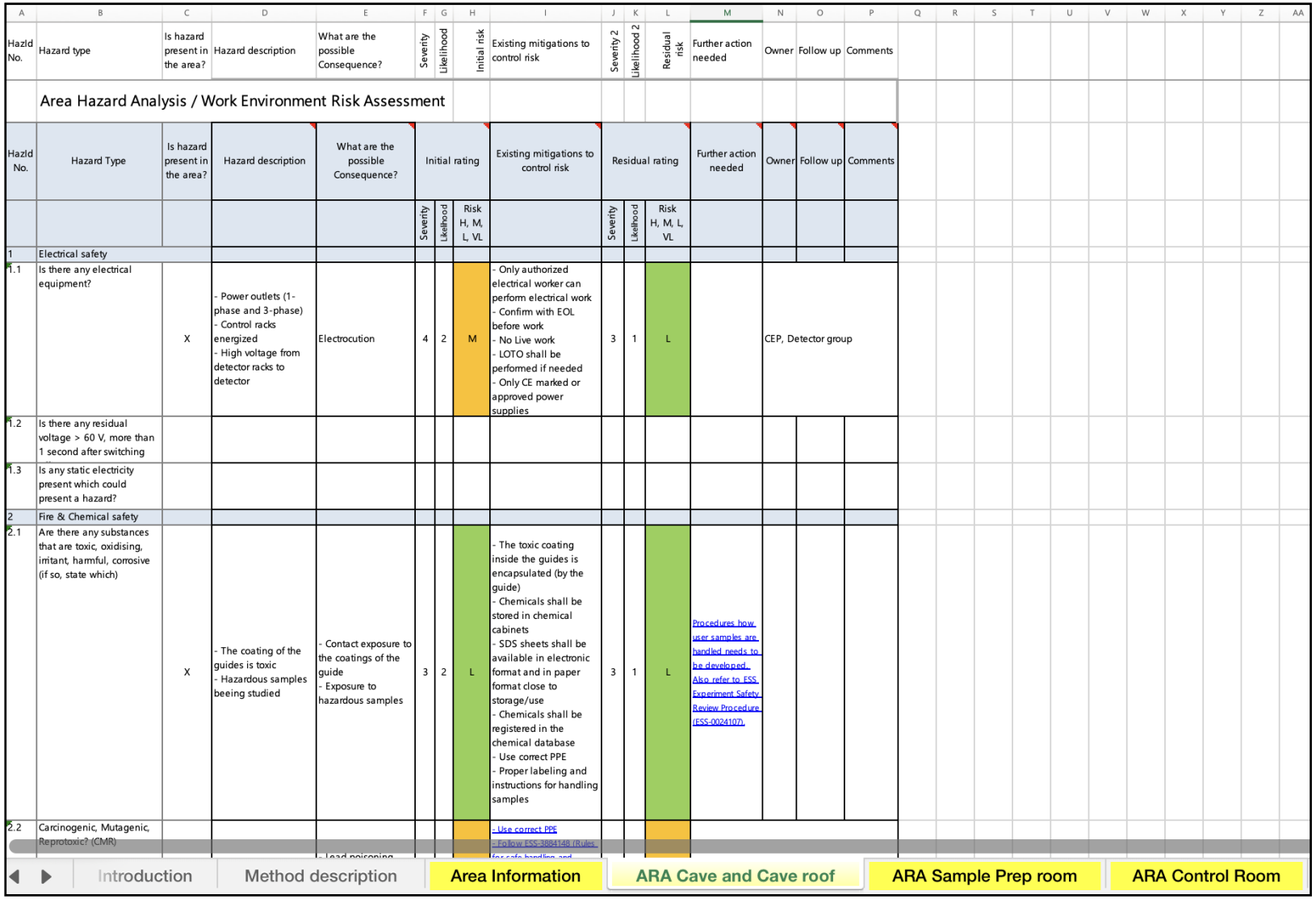
Industrial and Occupational Safety

Area Risk Assessment DREAM (ESS-5969230)

- Informs about the hazards when entering the area
- Should be reviewed least annually or after a major change in the area
- Tabs for the different areas:
  1. Cave and Cave roof
  2. Sample Prep Room
  3. Control Room
  4. Gas bundle area
  5. Elevated floors

Industrial and Occupational Safety

Area Risk Assessment DREAM (ESS-5969230)



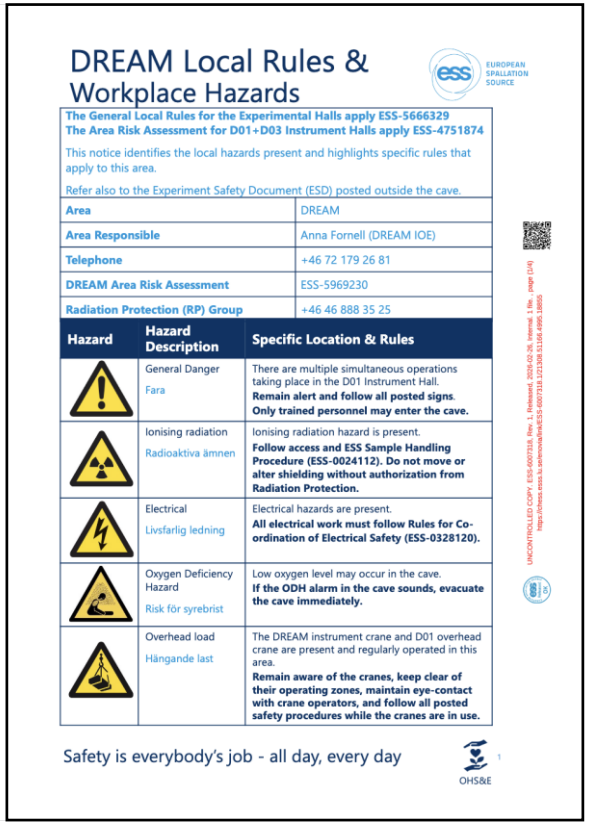
HazId No.	Hazard type	Is hazard present in the area?	Hazard description	What are the possible Consequence?	Severity	Likelihood	Initial risk	Existing mitigations to control risk	Severity 2	Likelihood 2	Residual risk	Further action needed	Owner	Follow up	Comments
	Area Hazard Analysis / Work Environment Risk Assessment														
HazId No.	Hazard Type	Is hazard present in the area?	Hazard description	What are the possible Consequence?	Initial rating			Existing mitigations to control risk	Residual rating			Further action needed	Owner	Follow up	Comments
					Severity	Likelihood	Risk H, M, L, VL		Severity	Likelihood	Risk H, M, L, VL				
1	Electrical safety														
1.1	Is there any electrical equipment?	X	- Power outlets (1-phase and 3-phase) - Control racks energized - High voltage from detector racks to detector	Electrocution	4	2	M	- Only authorized electrical worker can perform electrical work - Confirm with EOL before work - No Live work - LOTO shall be performed if needed - Only CE marked or approved power supplies	3	1	L		CEP, Detector group		
1.2	Is there any residual voltage > 60 V, more than 1 second after switching														
1.3	Is any static electricity present which could present a hazard?														
2	Fire & Chemical safety														
2.1	Are there any substances that are toxic, oxidising, irritant, harmful, corrosive (if so, state which)	X	- The coating of the guides is toxic - Hazardous samples beeing studied	- Contact exposure to the coatings of the guide - Exposure to hazardous samples	3	2	L	- The toxic coating inside the guides is encapsulated (by the guide) - Chemicals shall be stored in chemical cabinets - SDS sheets shall be available in electronic format and in paper format close to storage/use - Chemicals shall be registered in the chemical database - Use correct PPE - Proper labeling and instructions for handling samples	3	1	L	Procedures how user samples are handled needs to be developed. Also refer to ESS Experiment Safety Review Procedure (ESS-0024107).			
2.2	Carcinogenic, Mutagenic, Reprotoxic? (CMR)			- Lead poisoning				- Use correct PPE - Follow ESS-3884948 (Rules for safe handling and							

Introduction | Method description | Area Information | ARA Cave and Cave roof | ARA Sample Prep room | ARA Control Room

Industrial and Occupational Safety

Local rules DREAM (ESS-6007318)

Available at the entrance to DREAM and in CHESS



DREAM Local Rules & Workplace Hazards

EUROPEAN SPALLATION SOURCE

The General Local Rules for the Experimental Halls apply ESS-5666329
The Area Risk Assessment for D01+D03 Instrument Halls apply ESS-4751874

This notice identifies the local hazards present and highlights specific rules that apply to this area.

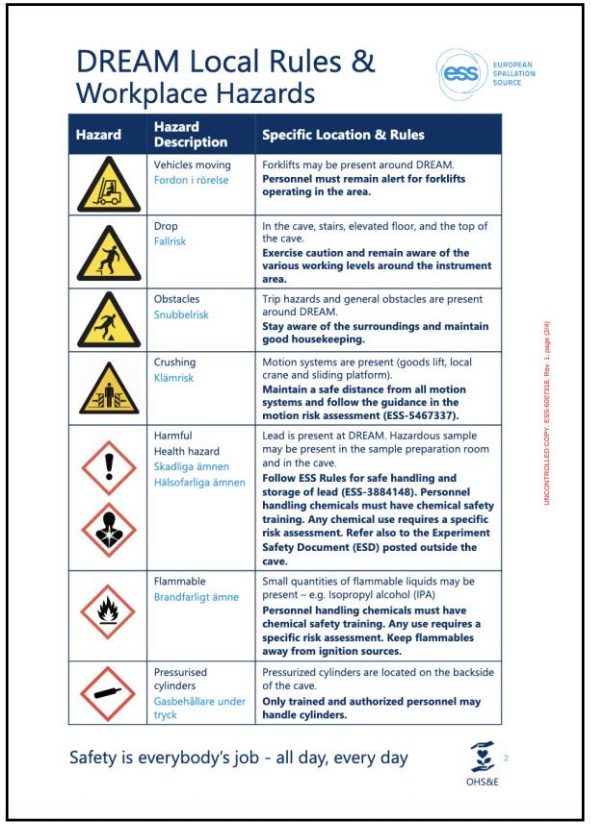
Refer also to the Experiment Safety Document (ESD) posted outside the cave.

Area	DREAM
Area Responsible	Anna Fornell (DREAM IOE)
Telephone	+46 72 179 26 81
DREAM Area Risk Assessment	ESS-5969230
Radiation Protection (RP) Group	+46 46 888 35 25

Hazard	Hazard Description	Specific Location & Rules
	General Danger Fara	There are multiple simultaneous operations taking place in the D01 Instrument Hall. **Remain alert and follow all posted signs.** **Only trained personnel may enter the cave.**
	Ionising radiation Radioaktiva ämnen	Ionising radiation hazard is present. **Follow access and ESS Sample Handling Procedure (ESS-0024112). Do not move or alter shielding without authorization from Radiation Protection.**
	Electrical Livsfarlig ledning	Electrical hazards are present. **All electrical work must follow Rules for Co-ordination of Electrical Safety (ESS-0328120).**
	Oxygen Deficiency Hazard Risk för syrebrist	Low oxygen level may occur in the cave. **If the ODH alarm in the cave sounds, evacuate the cave immediately.**
	Overhead load Hängande last	The DREAM instrument crane and D01 overhead crane are present and regularly operated in this area. **Remain aware of the cranes, keep clear of their operating zones, maintain eye-contact with crane operators, and follow all posted safety procedures while the cranes are in use.**

Safety is everybody's job - all day, every day

OHS&E



DREAM Local Rules & Workplace Hazards

EUROPEAN SPALLATION SOURCE

Hazard	Hazard Description	Specific Location & Rules
	Vehicles moving Fordon i rörelse	Forklifts may be present around DREAM. **Personnel must remain alert for forklifts operating in the area.**
	Drop Fallrisk	In the cave, stairs, elevated floor, and the top of the cave. **Exercise caution and remain aware of the various working levels around the instrument area.**
	Obstacles Snubbelrisk	Trip hazards and general obstacles are present around DREAM. **Stay aware of the surroundings and maintain good housekeeping.**
	Crushing Klämrisk	Motion systems are present (goods lift, local crane and sliding platform). **Maintain a safe distance from all motion systems and follow the guidance in the motion risk assessment (ESS-5467337).**
	Harmful Health hazard Skadliga ämnen Hälsofarliga ämnen	Lead is present at DREAM. Hazardous sample may be present in the sample preparation room and in the cave. **Follow ESS Rules for safe handling and storage of lead (ESS-3884148). Personnel handling chemicals must have chemical safety training. Any chemical use requires a specific risk assessment. Refer also to the Experiment Safety Document (ESD) posted outside the cave.**
	Flammable Brandfarligt ämne	Small quantities of flammable liquids may be present – e.g. Isopropyl alcohol (IPA) **Personnel handling chemicals must have chemical safety training. Any use requires a specific risk assessment. Keep flammables away from ignition sources.**
	Pressurised cylinders Gasbehållare under tryck	Pressurized cylinders are located on the backside of the cave. **Only trained and authorized personnel may handle cylinders.**

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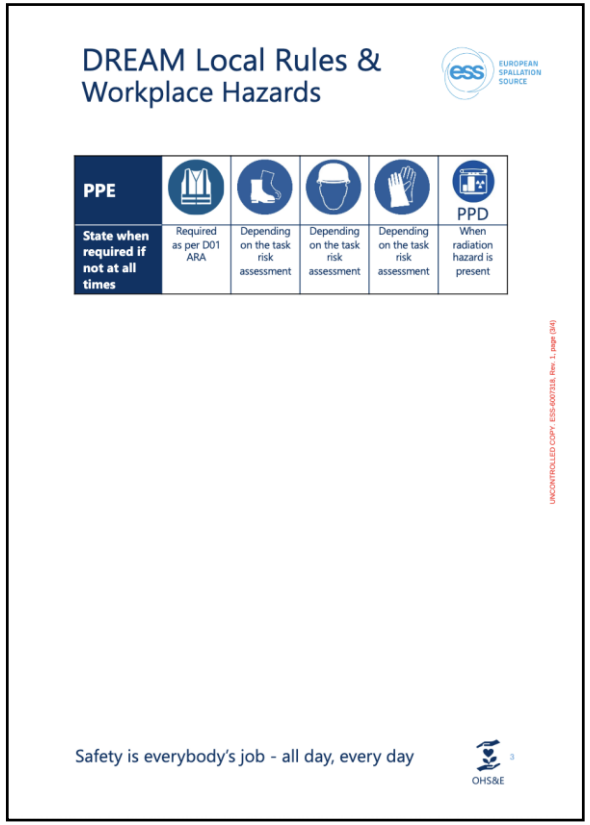
OHS&E



DREAM Local Rules & Workplace Hazards

EUROPEAN SPALLATION SOURCE

PPE					PPD
State when required if not at all times	Required as per D01 ARA	Depending on the task risk assessment	Depending on the task risk assessment	Depending on the task risk assessment	When radiation hazard is present

Safety is everybody's job - all day, every day

OHS&E

Industrial and Occupational Safety

Summary of Risks


General danger


Ionizing radiation (not yet)


Electrical safety


Oxygen Deficiency Hazard (ODH)


Overhead load


Vehicles moving


Slips, Trips, Falls


Crushing (Manual lifting, pinching)


Motion safety


Harmful/Health Hazard/Toxic substances (Pb)


Fire Safety


Pressurized systems

Industrial and Occupational Safety

Non-Applicable Operational Risks

- Working at Heights: Not part of regular operations
- Chemical: Not at the moment
- Heat/Cold: Not at the moment
- Magnetic Safety: Not at the moment
- ATEX: Not at the moment
- Confined Space: Not applicable
- Biological Safety: Not applicable
- Noise: Not applicable
- Vibrations: Not applicable

Industrial and Occupational Safety

PPE requirements

- Hi-vis vest required at all times
- Safety shoes, helmet, and gloves required depending on the task risk assessment
- PPD required when radiation hazard is present

PPE					 PPD
State when required if not at all times	Required as per D01 ARA	Depending on the task risk assessment	Depending on the task risk assessment	Depending on the task risk assessment	When radiation hazard is present

Operational Safety

Summary of Mitigations

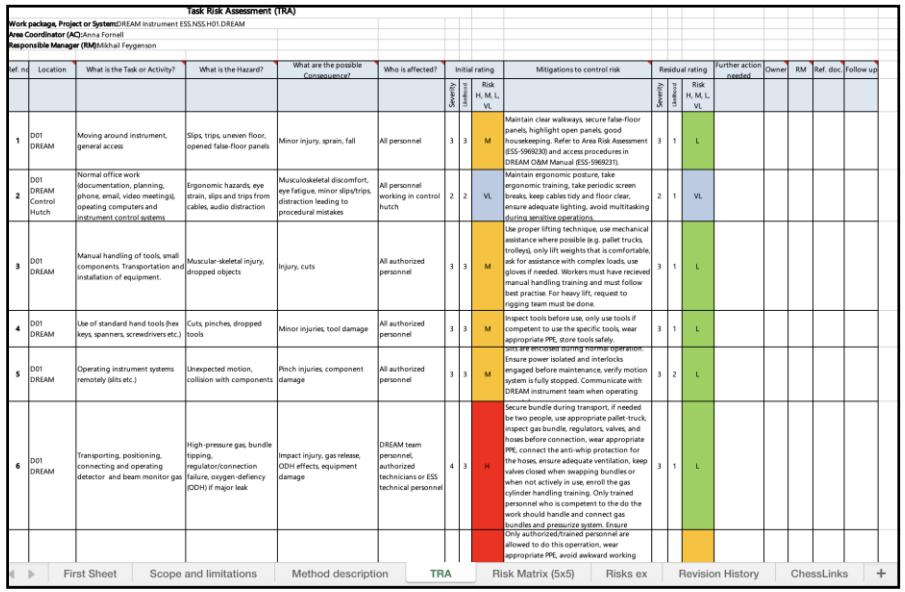
- Fire monitoring and suppression system
- Motion emergency stops
- Beam emergency stops in cave
- PSS interlock system
- REMS monitoring system
- ODH monitoring system
- Roles and Responsibilities
- Training and Certification
- Emergency Procedures (in progress)

- Operations Manual for DREAM Personnel Safety System (ESS-5802045)
- DREAM Systems Operation and Maintenance Manual (5969231)

Operational Safety

Task Risk Assessments

- Task Risk Assessment for DREAM General Activities (ESS-5972865)
  - 20 different tasks/activities
  - For example: Use of battery-driven hand tools, accessing equipment at low heights and use of goods lift for transporting equipment



Task Risk Assessment (TRA)

Work package, Project or System: DREAM Instrument ESS.NSS.H01.DREAM
Area Coordinator (AC): Anna Fornell
Responsible Manager (RM): Mikhail Feygenson

Ref. no	Location	What is the Task or Activity?	What is the Hazard?	What are the possible Consequence?	Who is affected?	Initial rating			Mitigations to control risk	Residual rating			Further action needed	Owner	RM	Ref. doc.	Follow up
						Severity	Likelihood	Risk H, M, L, VL		Severity	Likelihood	Risk H, M, L, VL					
1	D01 DREAM	Moving around instrument, general access	Slips, trips, uneven floor, opened false-floor panels	Minor injury, sprain, fall	All personnel	3	3	M	Maintain clear walkways, secure false-floor panels, highlight open panels, good housekeeping. Refer to Area Risk Assessment (ESS-5969230) and access procedures in DREAM O&M Manual (ESS-5969231).	3	1	L					
2	D01 DREAM Control Hutch	Normal office work (documentation, planning, phone, email, video meetings), opeating computers and instrument control systems	Ergonomic hazards, eye strain, slips and trips from cables, audio distraction	Musculoskeletal discomfort, eye fatigue, minor slips/trips, distraction leading to procedural mistakes	All personnel working in control hutch	2	2	VL	Maintain ergonomic posture, take ergonomic training, take periodic screen breaks, keep cables tidy and floor clear, ensure adequate lighting, avoid multitasking during sensitive operations.	2	1	VL					
3	D01 DREAM	Manual handling of tools, small components. Transportation and installation of equipment.	Muscular-skeletal injury, dropped objects	Injury, cuts	All authorized personnel	3	3	M	Use proper lifting technique, use mechanical assistance where possible (e.g. pallet trucks, trolleys), only lift weights that is comfortable, ask for assistance with complex loads, use gloves if needed. Workers must have recieved manual handling training and must follow best practise. For heavy lift, request to rigging team must be done.	3	1	L					
4	D01 DREAM	Use of standard hand tools (hex keys, spanners, screwdrivers etc.)	Cuts, pinches, dropped tools	Minor injuries, tool damage	All authorized personnel	3	3	M	Inspect tools before use, only use tools if competent to use the specific tools, wear appropriate PPE, store tools safely.	3	1	L					
5	D01 DREAM	Operating instrument systems remotely (slits etc.)	Unexpected motion, collision with components	Pinch injuries, component damage	All authorized personnel	3	3	M	Slits are enclosed during normal operation. Ensure power isolated and interlocks engaged before maintenance, verify motion system is fully stopped. Communicate with DREAM instrument team when operating	3	2	L					
6	D01 DREAM	Transporting, positioning, connecting and operating detector and beam monitor gas	High-pressure gas, bundle tipping, regulator/connection failure, oxygen-deficiency (ODH) if major leak	Impact injury, gas release, ODH effects, equipment damage	DREAM team personnel, authorized technicians or ESS technical personnel	4	3	H	Secure bundle during transport, if needed be two people, use appropriate pallet-truck, inspect gas bundle, regulators, valves, and hoses before connection, wear appropriate PPE, connect the anti-whip protection for the hoses, ensure adequate ventilation, keep valves closed when swapping bundles or when not actively in use, enroll the gas cylinder handling training. Only trained personnel who is competent to the do the work should handle and connect gas bundles and pressurize system. Ensure	3	1	L					
									Only authorized/trained personnel are allowed to do this operration, wear appropriate PPE, avoid awkward working								

First Sheet | Scope and limitations | Method description | TRA | Risk Matrix (5x5) | Risks ex | Revision History | ChessLinks | +

- Specific Task Risk Assessment
  - More will be added over time
  - Example: Installation/Removal of DREAM sample vessel (ESS-6018271)

Radiation Safety 

Summary of Mitigation Measures

- PSS (permits, interlocks, cool down, Estops)
- Personal dosimetry
- REMS system
  - Gamma monitor → Stand alone
  - Area neutron monitor → PSS
- Survey meters (TBD)
- Storage (TBD)
- Waste (TBD)
- Shielding Verification Report DREAM (ESS-6017800)
- Instrument Hazard Analysis DREAM (ESS-0454185)
- Comprehensive Radiation Safety Report (ESS-5974655)
- DREAM Radiation Safety Report (ESS-0454189)
- DREAM BOM/Material inventories for activation analysis system by system
- ESS Radiation Protection Handbook

Thank you!

Questions?