



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Bundesamt für Energie BFE  
Office fédéral de l'énergie OFEN  
Ufficio federale dell'energia UFE  
Uffizi federal d'energia UFE



Source: www.zwilag.ch

# Non-Proliferation Introduction to Safeguards

Uwe Georg, Swiss Federal Office of Energy (SFOE)

Non-Proliferation in Switzerland, EPFL, 12 December 2025



# CONTENT

---

## Practical application of safeguards in Switzerland

- Nuclear landscape in Switzerland
- Legal basis in Switzerland
- Safeguards measures by the IAEA
- Statistics and IAEA conclusions for Switzerland

## Export Control

### Introduction





# Short refresher



## SHORT REFRESHER

---

- Material/equipment is similar for peaceful and military nuclear uses.
  - Entire fuel cycle needs to be safeguarded.
- Treaty on the Non-Proliferation of Nuclear Weapons
  - 3 pillars (disarmament, peaceful uses and safeguards).
  - 5 nuclear weapon states.
  - All non-nuclear weapon states accept IAEA safeguards.
- Comprehensive Safeguards Agreement (CSA) is the standard agreement.
  - Can be complemented by the Additional Protocol (AP), which gives the IAEA a more complete picture of nuclear activities in a country.
  - Every CSA is supplemented by a Subsidiary Arrangement and the respective facility attachments.



# NUCLEAR MATERIAL (IAEA STATUTE ART. XX)

## Source material

- **Uranium** containing the mixture of isotopes occurring in nature,
- **Uranium depleted** in the isotope 235,
- **Thorium**,
- any of the foregoing in the form of metal, alloy, chemical compound or concentrate, and...

## Special fissionable material

- **Plutonium-239**,
- **Uranium-233**,
- **Uranium enriched** with the isotopes 235 or 233,
- any material containing one or more of the foregoing, and...



- Dependent on the processing stage
- No lower limit
- Independent of intended use

Pu 232 36.1m	Pu 233 20.3m	Pu 234 8.8a	Pu 235 25.3m	Pu 236 2.60a	Pu 237 45.2d	Pu 238 87.74a	Pu 239 2.411.10 <sup>4</sup> a	Pu 240 150a	Pu 241 14.29a	Pu 242 3.75.10 <sup>5</sup> a
Np 231 48.0m	Np 232 16.7m	Np 233 38.2m	Np 234 4.4d	Np 235 39.61d	Np 236 1.54.10 <sup>5</sup> a	Np 237 2.14a	Np 238 2.117d	Np 239 2.355d	Np 240 65m	Np 241 19.3m
U 230 23.8a	U 231 4.2d	U 232 68.8a	U 233 1.592.10 <sup>5</sup> a	U 234 0.066a	U 235 0.7200a	U 236 2.342.10 <sup>7</sup> a	U 237 6.75d	U 238 4.468.10 <sup>9</sup> a	U 239 23.5m	U 240 14.1m
Pa 229 150d	Pa 230 17.44a	Pa 231 3.276.10 <sup>4</sup> a	Pa 232 1.31d	Pa 233 37.9d	Pa 234 3.70a	Pa 235 14.3m	Pa 236 8.1m	Pa 237 6.7m	Pa 238 2.1m	
Th 228 1.911a	Th 229 7900a	Th 230 7.54.10 <sup>4</sup> a	Th 231 55.5h	Th 232 1.405.10 <sup>10</sup> a	Th 233 160d	Th 234 24.16d	Th 235 7.1m	Th 236 37.5m	Th 237 3.8m	



# **Legal basis of safeguards in Switzerland**



# SWITZERLAND AND THE NPT

---

- Signature of the NPT 1 July 1968.
- Ratification of the NPT 9 March 1977.
- Switzerland renounces possession and manufacturing of nuclear weapons.
- Free access to the peaceful use of nuclear energy.
- All nuclear material will be under international safeguards (IAEA Safeguards).
- CSA and AP in force.
  
- Swiss regulator also implements safeguards for Liechtenstein (bilateral agreement).





# INTERNATIONAL NON-PROLIFERATION TREATIES AND SWITZERLAND

---

Treaty on the Non-Proliferation of Nuclear Weapons (NPT)

CH ratified 9 March 1977

§ Comprehensive Safeguards Agreement (CSA)

CH ratified 6 September 1978

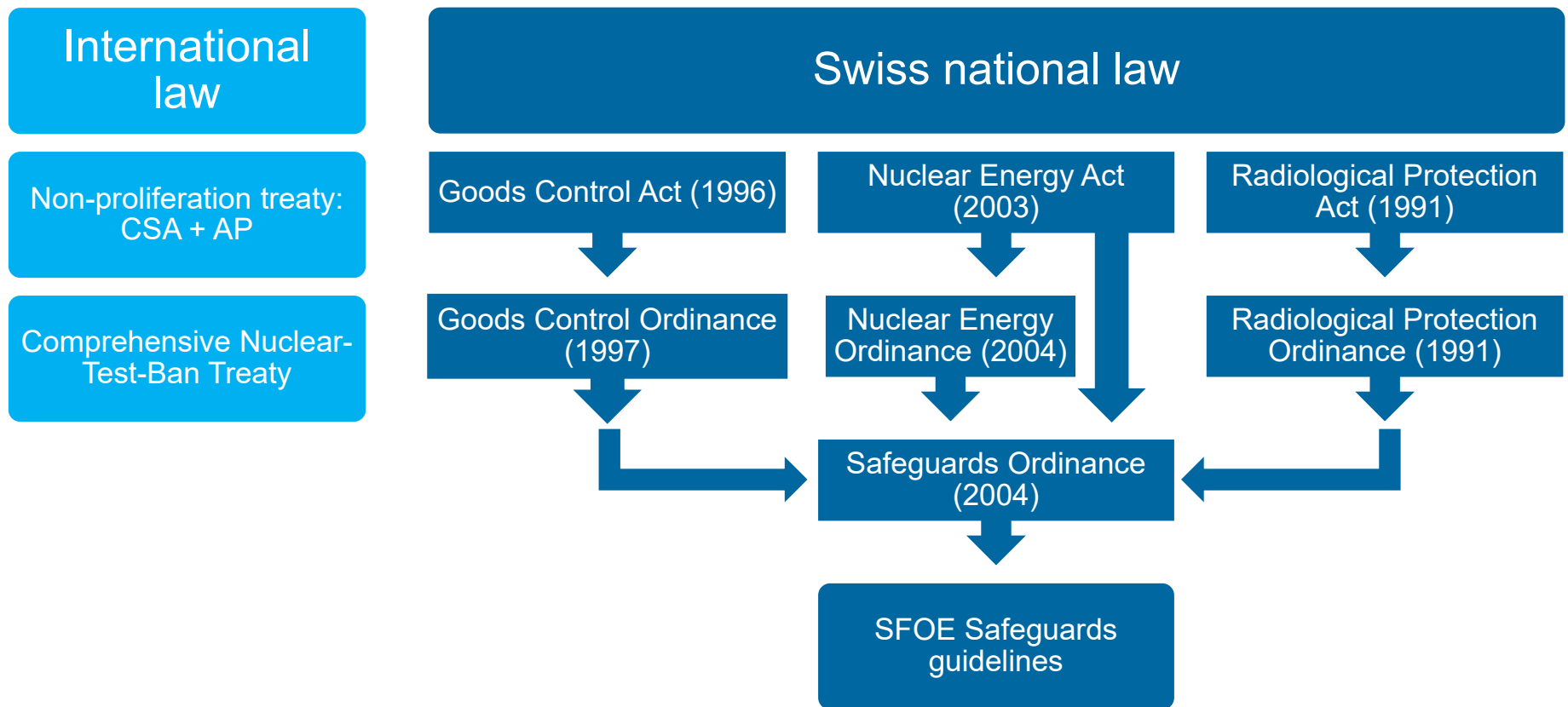
& Additional Protocol to the CSA (AP)

CH ratified 1 February 2005

CH = Confederatio Helvetica = Switzerland  
§ compulsory for non-nuclear-weapon states  
& not compulsory but almost a “standard”



# SWISS LAW ON NUCLEAR NON-PROLIFERATION





# SFOE SAFEGUARDS GUIDELINES

---

- Based on the Safeguards Ordinance SFOE (BFE) has developed Safeguards Guidelines
  - BFE-SG01: Reporting obligations on materials in locations outside facilities
  - BFE-SG02: Safeguards in facilities
  - BFE-SG03: Reporting obligations on nuclear materials in facilities



# FACILITY AND LOCATIONS OUTSIDE FACILITIES

---

- IAEA Glossary 5.24 and 5.25

**5.24. Facility** — “a reactor, a critical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant or a separate storage installation; or any location where nuclear material in amounts greater than one effective kilogram is customarily used” [153, para. 106], [540, Article 18.j]. Under [66], two kinds of facility are defined (in paras 78 and 81, respectively).

**5.25. Location outside facilities (LOF)** — “any installation or location, which is not a facility, where nuclear material is customarily used in amounts of one effective kilogram or less” [540, Article 18.j]. This term also applies under para. 49 of [153], where LOF is described as a location containing “nuclear material customarily used outside facilities”. The corresponding term under para. 66 of [66] is ‘other locations’, which is used in INFCIRC/66-type safeguards agreements to refer to installations where nuclear material outside of principal nuclear facilities is held, e.g. source material stored elsewhere than in a sealed storage facility.



# **Nuclear landscape in Switzerland**



# FACILITIES/LOCATIONS UNDER IAEA SAFEGUARDS

NPP	ID	Type	Operation
Beznau I	KKB I	PWR	1969
Beznau II	KKB II	PWR	1971
Mühleberg <sup>#</sup>	KKM	BWR	1971-2019
Gösgen	KKG	PWR	1979
Leibstadt	KKL	BWR	1984
Interim Storage Facilities			Operation
ZWILAG			2001
ZWIBEZ			2007
AERA, PSI (radioactive waste from medicine, industry and research)			1992
CERN			
Storage of disused nuclear materials			

<sup>#</sup> in decommissioning, no NM anymore

Geological repository in planning

Research Reactors	Status
Crocus (EPFL Lausanne)	in operation (1983)
Proteus (PSI)	in decommissioning
Saphir (PSI)	decommissioned
Diorit (PSI)	decommissioned
AGN 211 (Univ. Geneva)	decommissioned
AGN 201 (Univ. Basel)	decommissioned
Paul Scherrer Institute (PSI)	
Operation	
Hot Labor (with hot cells)	1965
LOFs (Locations outside Facilities)	
ISOLDE (CERN)	
CHX- (ca. 100 locations in Switzerland)	
LNX- (1 location in Liechtenstein)	

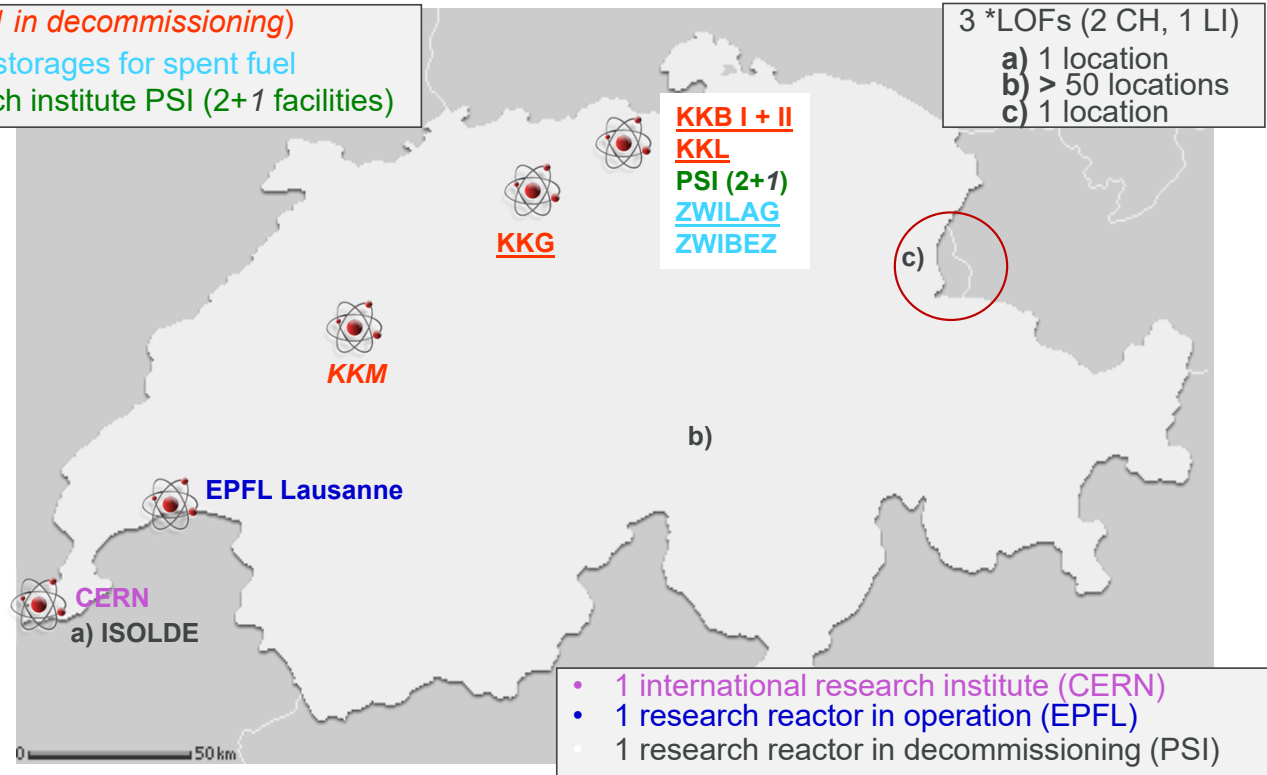
Not anymore under IAEA safeguards



# FACILITIES/LOCATIONS UNDER IAEA SAFEGUARDS

- 4 NPPs (1 in decommissioning)
- 2 Interim storages for spent fuel
- 1 Research institute PSI (2+1 facilities)

- 3 \*LOFs (2 CH, 1 LI)
- a) 1 location
- b) > 50 locations
- c) 1 location



- 1 international research institute (CERN)
- 1 research reactor in operation (EPFL)
- 1 research reactor in decommissioning (PSI)

\* LOF = Location Outside Facilities

Underlined: Facilities with IAEA remote monitoring

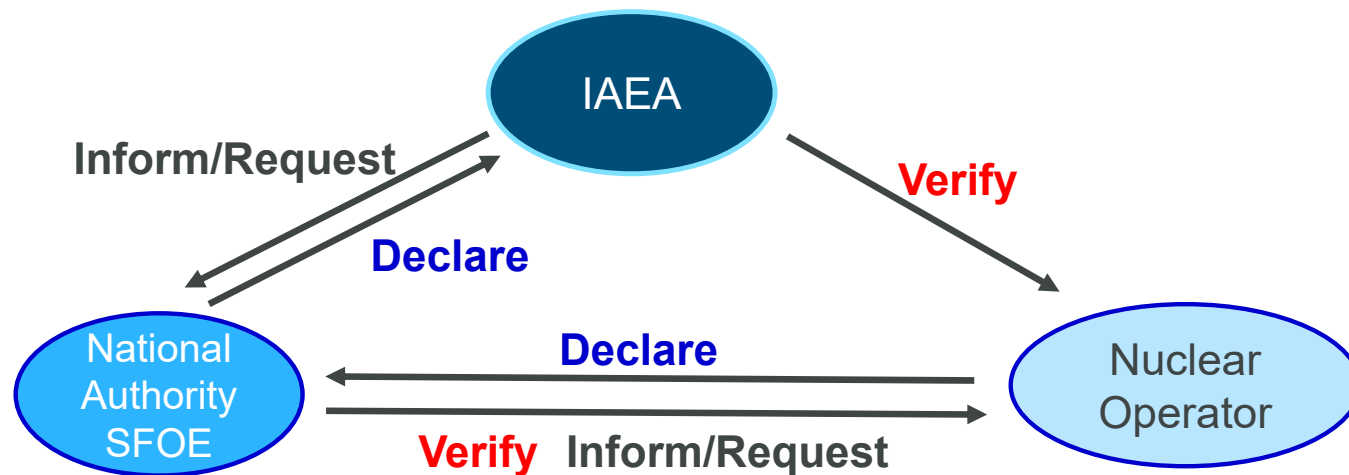


# **IAEA safeguards activities in Switzerland**



# SAFEGUARDS PARTIES

---



- SFOE is always present during IAEA inspections.
- Operator is not in direct communication with the IAEA.



# REPORTING AND NOTIFICATIONS

- Facility operators are obliged to report to SFOE and to cooperate with SFOE and IAEA
- Design Information Questionnaire (DIQ)
- Nuclear Material Accounting (NMA)
  - ICR: Inventory Change Report
  - PIL: Physical Inventory Listing
  - MBR: Material Balance Report
- Notifications
  - Advance notifications (transport of NM)
  - Unscheduled activities and findings
- Declarations according to the AP

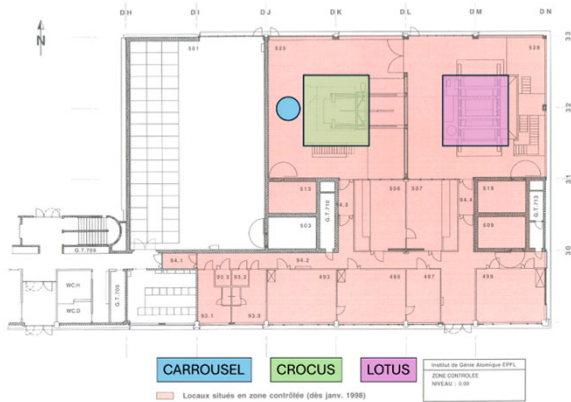
INVENTORY CHANGE REPORT (ICR) FORM															
COUNTRY : CH		REPORTING PERIOD: FROM : 010217 TO : 010326													
FACILITY : CHL-		REPORT No. : 0743		Nr. of En											
MATERIAL BALANCE AREA : CH-L		PAGES No. 1 of 1 PAGES		SIGNATURE :											
MBA/COUNTRY				ACCOUNTANCY DATA											
ENTRY NO.	CONTINUATION	DATE OF INVENTORY CHANGE	FROM	TO	TYPE OF INVENTORY CHANGE	IMP CODE	NAME OR NUMBER OF BATCH	NUMBER OF ITEM IN BATCH	MATERIAL DESCRIPTION	ELEMENT	WEIGHT OF ELEMENT	UNIT kg/g	WEIGHT OF FISSILE ISOTOPES (URANIUM ONLY) (g)	ISOTOPE CODE	MEASUR. BASIS
01		010326	CH-L	F	SF	2	KLG118	1	B03G	U	169660	G	701	G	M
02	C							0		P	1595	G			





# DESIGN INFORMATION QUESTIONNAIRE (DIQ)

- Provides general information about a facility, e.g. location, material capacity
- Establishes Material Balance Areas (MBA) and Key Measurement Points (KMP)



**NUCLEAR MATERIAL FLOW**

33. SCHEMATIC FLOWSHEET FOR NUCLEAR MATERIAL (identifying measurement points, accountability areas, inventory locations, etc.)

DIAGRAM(S) ATTACHED UNDER REF. Nos.

Flow KMPs:  
 1: Receipt and de-exemption of nuclear material, accidental gain  
 2: Shipment, nuclear loss and production, exemption of nuclear material, accidental loss  
 3: Rebatching

Inventory KMPs:  
 A: Fuel storage  
 B: CROCUS reactor  
 C: Spent fuel pond (not applicable)  
 D: Other locations inside the facility

34. INVENTORY STATE QUANTITY RANGE, NUMBER OF ITEMS, AND APPROXIMATE URANIUM ENRICHMENT AND PLUTONIUM CONTENT FOR (under normal operating conditions):

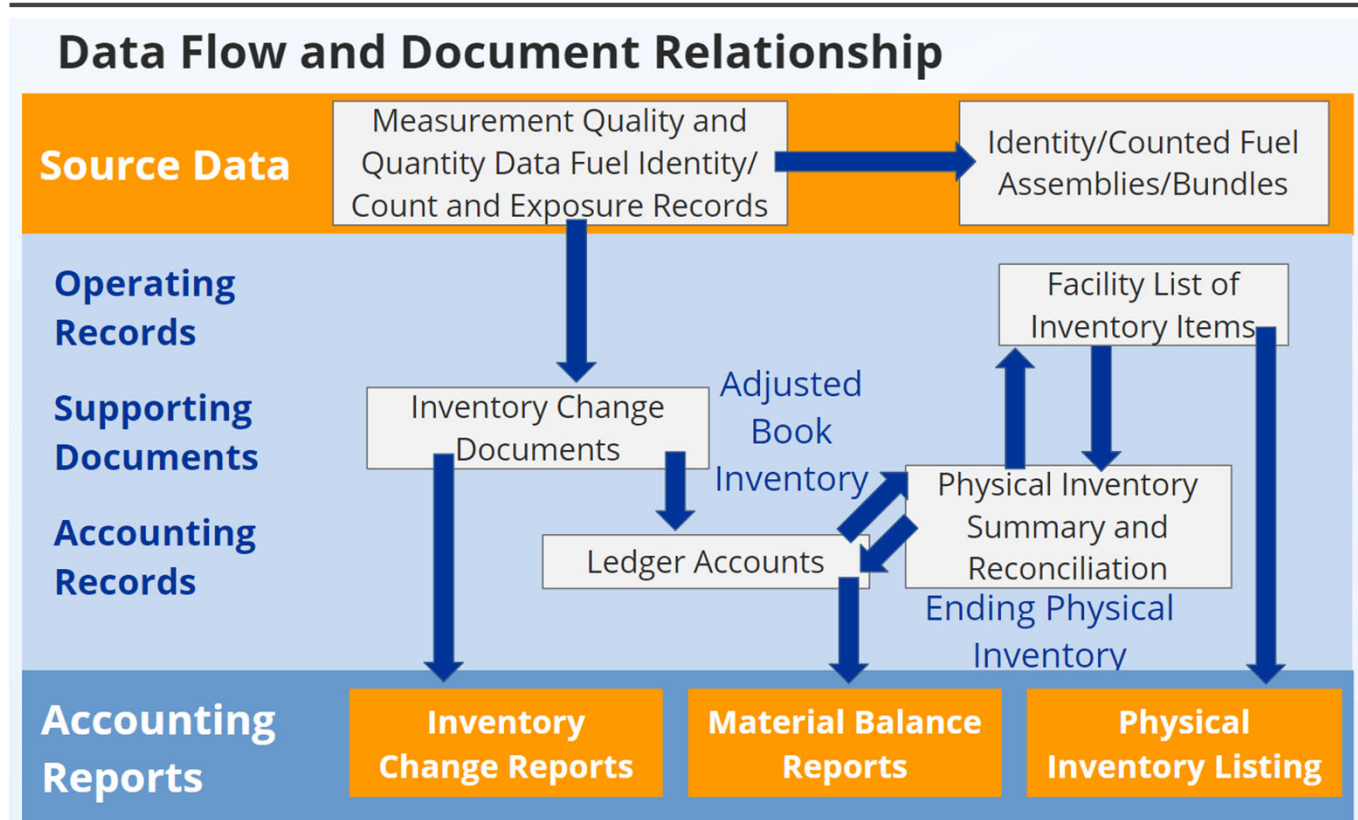
i) Fresh Fuel Storage

About 700 kg U metal with 0.947% enrichment (156 items)  
 About 15 kg U oxide with 1.8% enrichment (14 items)  
 About 3 kg Th  
 About 10 kg natural U  
 About 10 g depleted U

ALL FACILITIES	
GENERAL INFORMATION	
1. NAME OF THE FACILITY (incl. usual abbreviation)	CROCUS is a zero-power research reactor at École Polytechnique Fédérale de Lausanne in Switzerland.
2. LOCATION AND POSTAL ADDRESS	École Polytechnique Fédérale de Lausanne (EPFL) Faculté des sciences de base (SB) Institut de physique de l'énergie et des particules (IPEP) Laboratoire de physique des réacteurs et de comportement des systèmes (LRS) CH-1015 Lausanne Switzerland
3. OWNER (legally responsible)	EPFL: Ecole Polytechnique Fédérale de Lausanne
4. OPERATOR (legally responsible)	LRS: Laboratoire de physique des réacteurs et de comportement des systèmes
5. DESCRIPTION (main features only)	Zero-power light water reactor (100 W)
6. PURPOSE	Teaching and study of reactor behaviour
7. STATUS (planned; under construction; in operation)	In operation
8. CONSTRUCTION SCHEDULE DATES (if not in operation)	Start of Construction      Commissioning      Operation
9. NORMAL OPERATING MODE (days only, two shift, three shift; number of days/annum, etc.)	Approximately 60 days/annum
10. FACILITY LAYOUT (structural containment, fences, access, nuclear material storage areas, laboratories, waste disposal areas, routes followed by nuclear material, experimental and test areas, etc.)	DRAWING(S) ATTACHED UNDER REF. Nos. The LRS includes a facility (LOTUS) dedicated to material irradiation with gamma and neutron sources See attachment 3
11. SITE LAYOUT (site plan showing in sufficient detail; location, premises and perimeter of facility, other buildings, roads, railways, rivers, etc.)	DRAWING(S) AND/OR MAPS ATTACHED UNDER REF. Nos. See attachments 1 and 2
12. NAMES AND/OR TITLES AND ADDRESS OF RESPONSIBLE OFFICERS (for nuclear material accountability and control and contact with the Agency. If possible attach organization charts showing position of officers)	Dr. Pavel Frajtag EPFL SB-IPEP-LRS PH-Ecublens CH-1015 Lausanne Switzerland



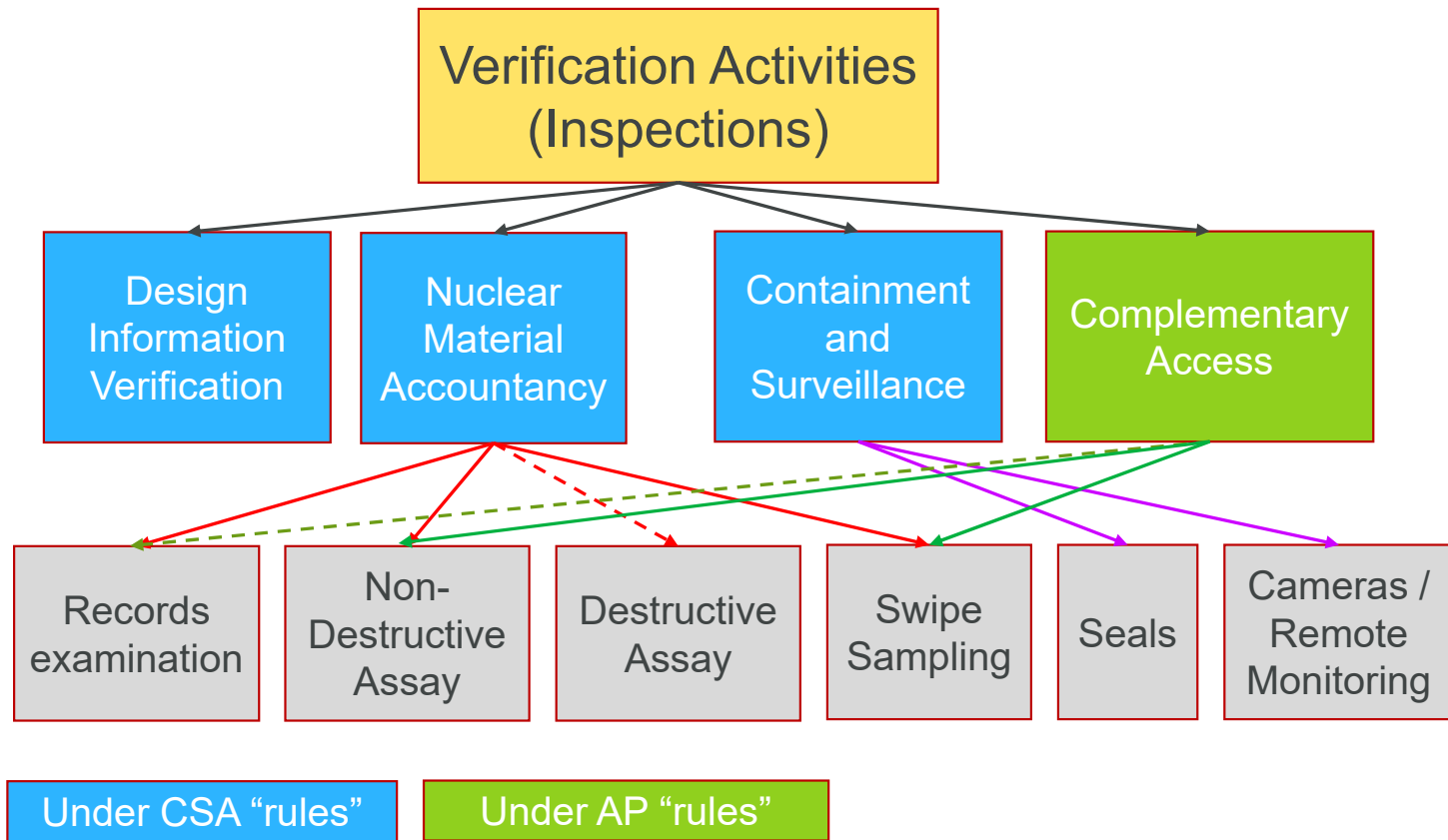
# NUCLEAR MATERIAL ACCOUNTING (NMA)



- NMA is the basis for nuclear safeguards to detect diversion of materials
- IAEA inspectors check the book inventory against the physical inventory
- Nuclear material inventories are reported and tracked for every facility and all MBAs/KMPs



# IAEA ACTIVITIES IN THE FIELD





# CONDUCTING INSPECTIONS

## Typical Procedure

- Work safety and radioprotection briefing (IAEA inspector)
- Pre job briefing
- Contamination check (Equipment and staff)
- Entering controlled area
  
- Verification activities, e.g.
  - Verifying the inventory
  - Installing/Exchanging/Verifying seals
  - Measure enrichment levels
  - Verifying facility design information
  
- Contamination check (Equipment and staff)
- Leaving controlled area
- Post job briefing, open issues etc.

Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Eidgenössisches Departement für Umwelt, Verkehr,  
Energie und Kommunikation UVEK  
Bundesamt für Energie BFE  
Sektion Safeguards

INTERN

### Inspektionsprotokoll

Anlage:	CHI- (EPFL)	Datum: DD.MM.YYYY
Inspektionstyp:	PIV & DIV (mit IAEA)	Beginn: hh.mm Ende: hh.mm
MBP:	DD.MM.YYYY - DD.MM.YYYY	

Teilnehmer

BFE:	
IAEA:	
Anlage:	

Inspektionsstandard

Verif.-Ausrüst.:	<input type="checkbox"/> ICVD <input type="checkbox"/> HM-5 <input type="checkbox"/> FDET <input type="checkbox"/> SFAT	Siegel:	<input type="checkbox"/> Metall <input type="checkbox"/> Passive
	<input checked="" type="checkbox"/> <sup>3</sup> He (Krit.-Test) <input type="checkbox"/> XCVD <input type="checkbox"/> MMCC <input type="checkbox"/> IRAT <input type="checkbox"/> ES		<input type="checkbox"/> EOSS <input type="checkbox"/> Cobra <input type="checkbox"/> Papier

Bemerkungen:

Erledigt	Tätigkeiten	Startzeit (opt)
<input type="checkbox"/>	Pre-Job Briefing: Inspektions-Aktivitäten überprüft und Ablauf vereinbart.	
<input type="checkbox"/>	Dokumente an IAEA überreicht und Buchhaltung geprüft. <input checked="" type="checkbox"/> GL/SL <input checked="" type="checkbox"/> PIL <input type="checkbox"/> Karten/Pläne	
<input type="checkbox"/>	Kritikalitätstest mit <sup>3</sup> He-Detektor im Kanal durchgeführt.	
<input type="checkbox"/>	Item Counting und Identifikation durchgeführt (vollständig/partiell).	
<input type="checkbox"/>	XX Proben mit HM-5 gemessen (Batches ...).	
<input type="checkbox"/>	DIV durchgeführt (...).	
<input type="checkbox"/>	Evtl. Bilder wurden aufgenommen, siehe Ablage «...».	
<input type="checkbox"/>	Debriefing durchgeführt.	
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

Bemerkung(en)

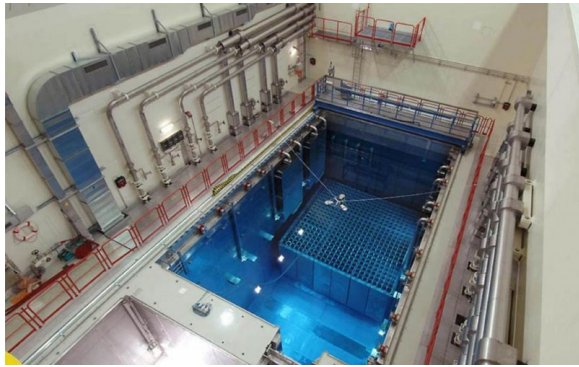
a)	
b)	
c)	

	Aktion(en)	Verantw.	Frist
1)			
2)			
3)			



# DESIGN INFORMATION VERIFICATION (DIV)

---



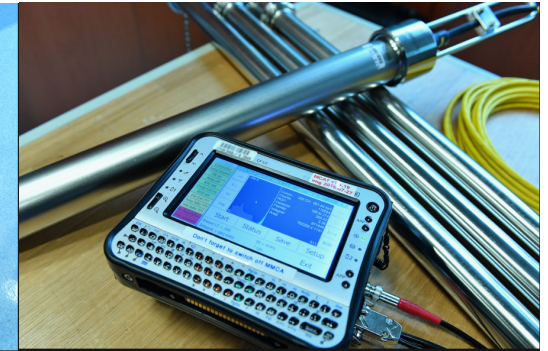


# NON-DESTRUCTIVE ASSAY (GAMMA & NEUTRONS)

Hand-held spectrometer



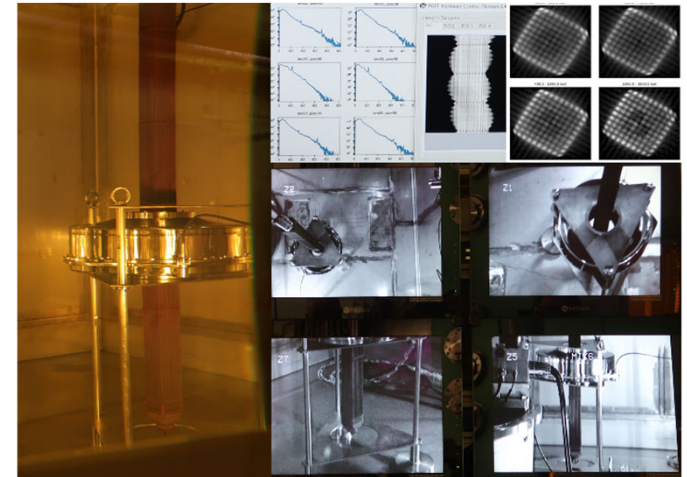
Spent Fuel Attribute Tester (SFAT)



Fork Detector



Passive Gamma Emission Tomography (PGET)



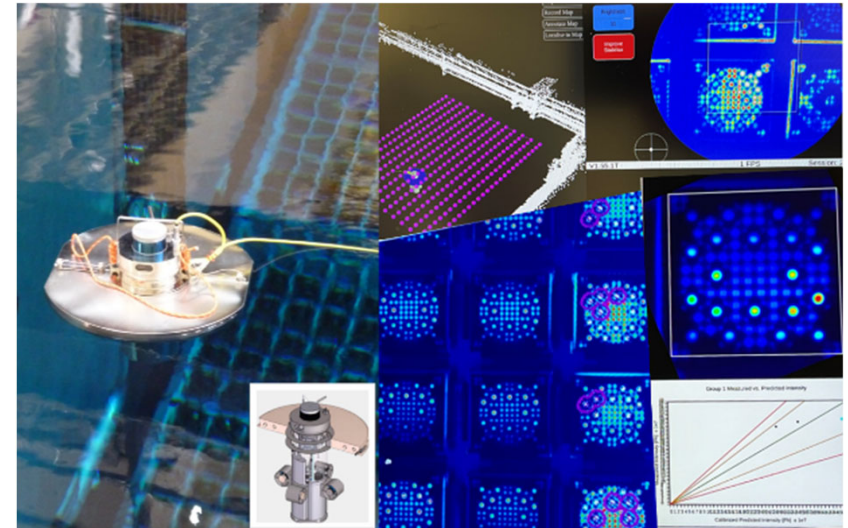


# NON-DESTRUCTIVE ASSAY (CERENKOV RADIATION FROM SPENT FUEL)

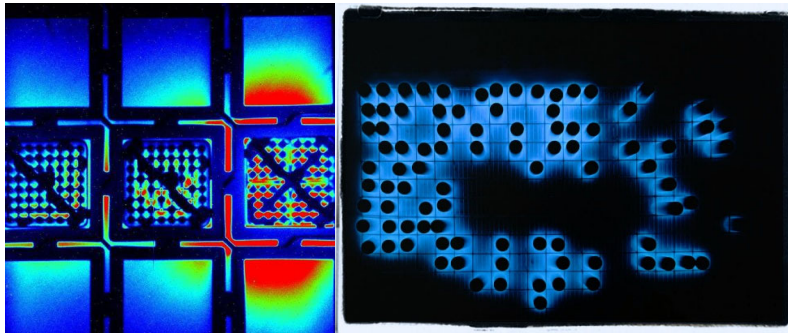
ICVD – Improved Cerenkov Viewing Device



RCVD – Robotized Cerenkov Viewing Device



DCVD – Digital Cerenkov Viewing Device





# SWIPE SAMPLES

---

Collected to verify the absence of nuclear material or to confirm state declarations on nuclear activities.



Sample kit for environmental sampling.

(Photo: IAEA Department of Safeguards)

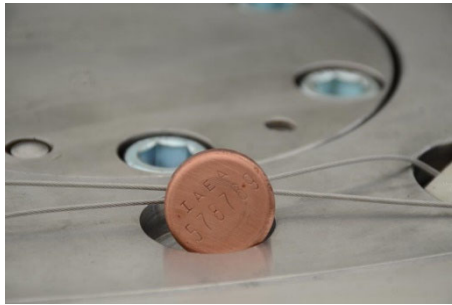


Samples analysed at the IAEA Seibersdorf NML and/or at labs of the Network of Analytical Laboratories (NWAL).



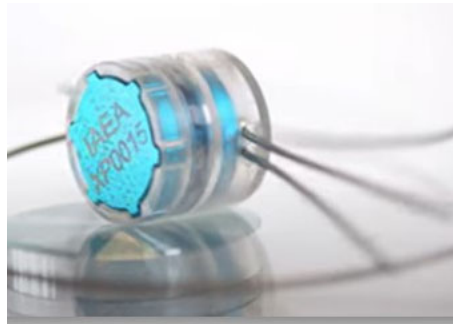
# CONTAINMENT AND SURVEILLANCE C/S (SEALS)

«Old» cap seal (single use)

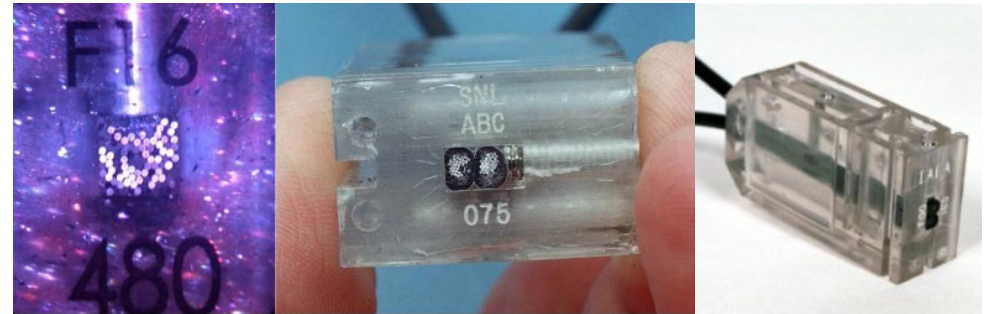


**EOSS** Electronic Optical Seal System (multi use) for regular access and long duration (in situ verifiable)

«New» cap seal: **Field Verifiable Passive Seal** (in situ verifiable)



**COBRA seal** (single use) Fibre optic loop with verification tools (in situ verifiable)





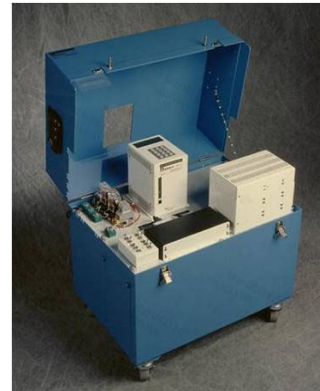
# CONTAINMENT AND SURVEILLANCE C/S (CAMERAS / REMOTE MONITORING)

**NGSS** (Next Generation Surveillance System) for long term installation.

Remote monitoring is performed from the IAEA headquarters.

SFOE has to notify the IAEA about activities in the camera field:

- In advance by RMS monthly reports for planned activities.
- Event based by notification in case of impairment.





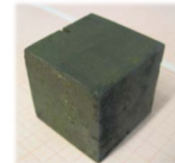
# **Safeguards in location outside facilities**



# LOFS – MATERIALS UNDER SAFEGUARDS

---

- Uranium and thorium in metallic form and in alloys;
- Uranium ores and thorium ores, including other uranium/thorium-containing minerals, from which uranium or thorium is or is to be extracted for industrial use;
- Shielding made of uranium (e.g. in systems for gamma radiography);
- Chemicals containing uranium and/or thorium (e.g. uranyl acetate, uranyl oxalt, uranyl nitrate, uranium oxide, thorium oxide, thorium nitrate hydrate, etc.);
- Uranium used as tritium storage;
- Components made of uranium/thorium/plutonium in measuring instruments (e.g. fission chamber);
- Calibration sources with uranium and/or thorium;
- Plutonium in any form.





# LOFS – MATERIALS OUTSIDE SAFEGUARDS

---

- Objects coated with uranium and/or thorium (e.g. optical lenses);
- Objects made of uranium glass (e.g. optical lenses, plates, bowls, etc.);
- Uranium in filters from drinking water treatment plants, as long as the uranium is not extracted;
- Uranium and thorium contained in natural materials (earth, water, plants, etc.);
- Glazes containing uranium (e.g. tiles);
- Thorium alloys, provided the thorium was terminated during the manufacture of the alloy (e.g. thorium electrodes and engine components);
- Thorium-containing mantles for gas lamps.





# **IAEA safeguards conclusions in Switzerland**



## SOME NUMBERS (2022)



- Material Balance Areas: 12
- Locations Outside Facilities: ~50
  
- Nuclear Material:
  - Plutonium: ~24 t (mainly in spent fuel)
  - Uranium: ~2250 t
  - Thorium: ~190 kg
  
- Staff: 6 (5.6 FTE)
- Person days in the field: 98
  
- IAEA inspections:
  - Regular: 43
  - Non-regular: 62
  - Complementary Access: 1
  
- Environmental Samples:
  - 7 (2023)
  - 9 (2022)
  
- Seals: ~130 installed
- Cameras: 22 fixed (+ 8 temporary)



# MISSION ACCOMPLISHED



## STATE EVALUATION PROCESS BY THE IAEA

Evaluating the fulfilment of States' safeguards commitments



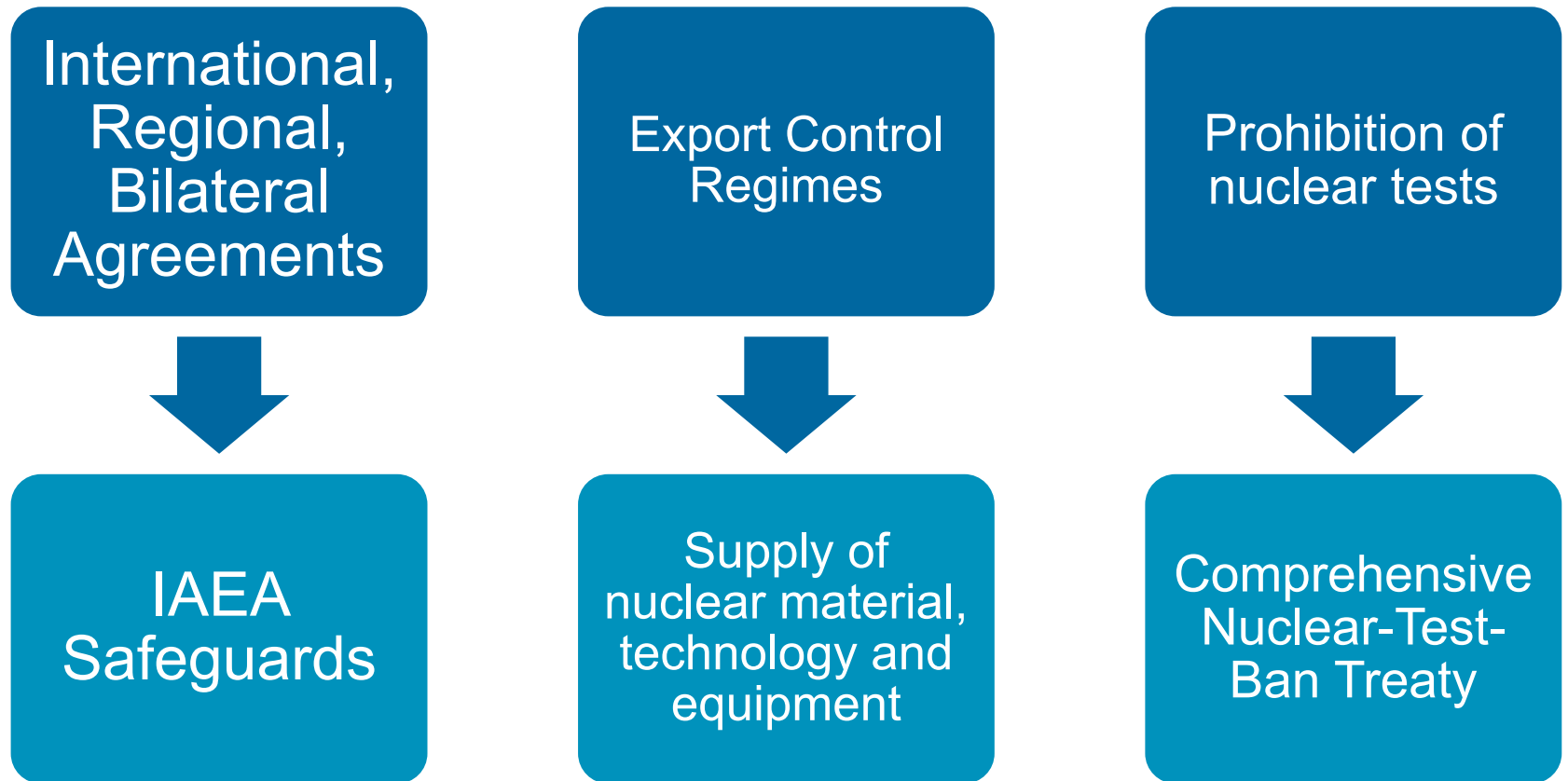


# **Export controls in a nutshell**



# THE NUCLEAR NON-PROLIFERATION REGIME

---





## NPT ART. 3 (2)

---

...

Each State Party to the Treaty undertakes not to provide:

- a. source or special fissionable material, or
- b. **equipment or material especially designed or prepared “(EDP)”** for the processing, use or production of special fissionable material,

to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this Article.

...



## ZANGGER COMMITTEE (ZC)

---

- 1<sup>st</sup> chairman Claude Zangger (former SFOE deputy director)
- Main purpose to define the EDP on a “trigger list” and guidelines to regulate exports
- Mostly done between 1971 and 1974 but continually updated



## NUCLEAR SUPPLIERS GROUP (NSG)

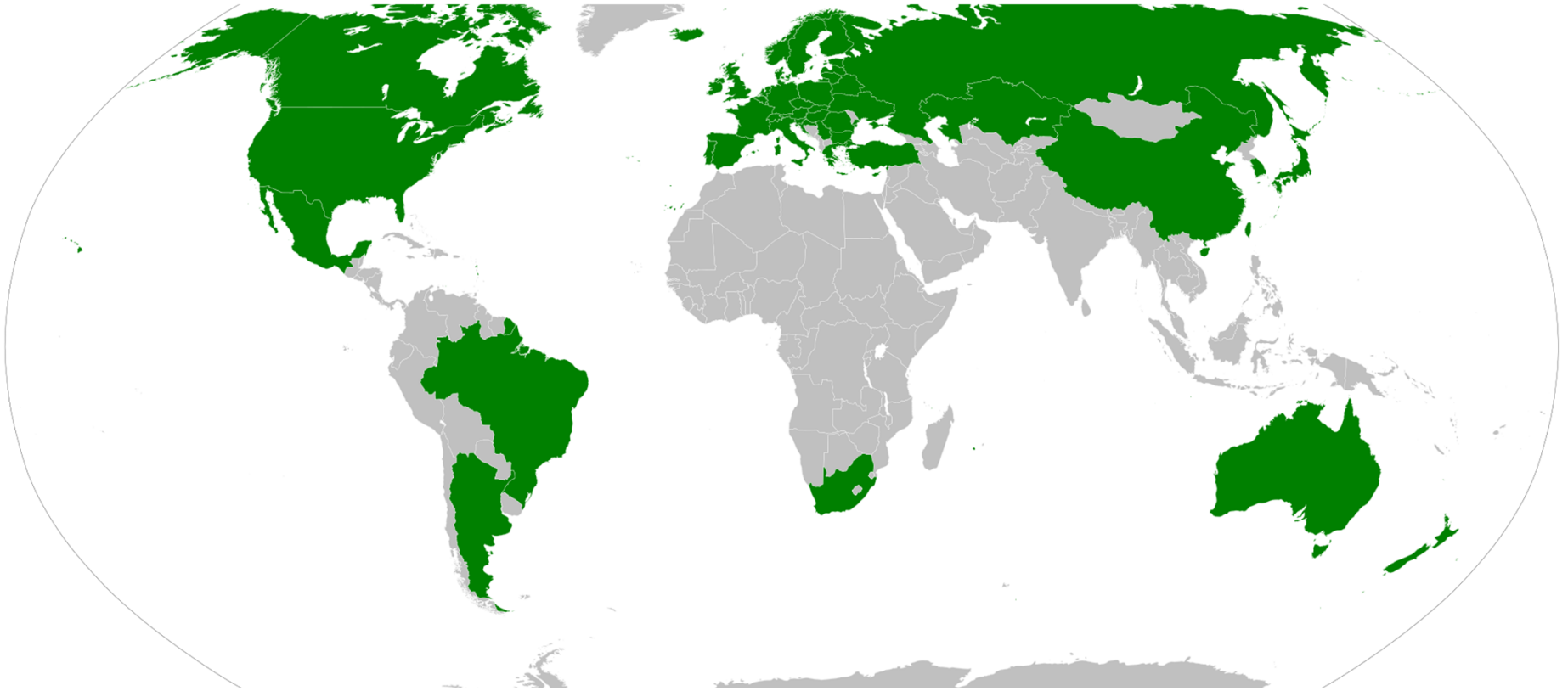
---

- Formed in 1974 as a reaction to first Indian nuclear explosion
- Took over the ZC trigger list and developed further guidelines
- “Government to Government Assurances” cover both exports and imports
- Since 1992 a second list regulates dual-use goods (less stringent controls)
- Core element is international coordination on rejected export requests to prevent subversion of the export controls





# NSG MEMBER STATES



NSG Members - Nuclear Suppliers Group - Wikipedia



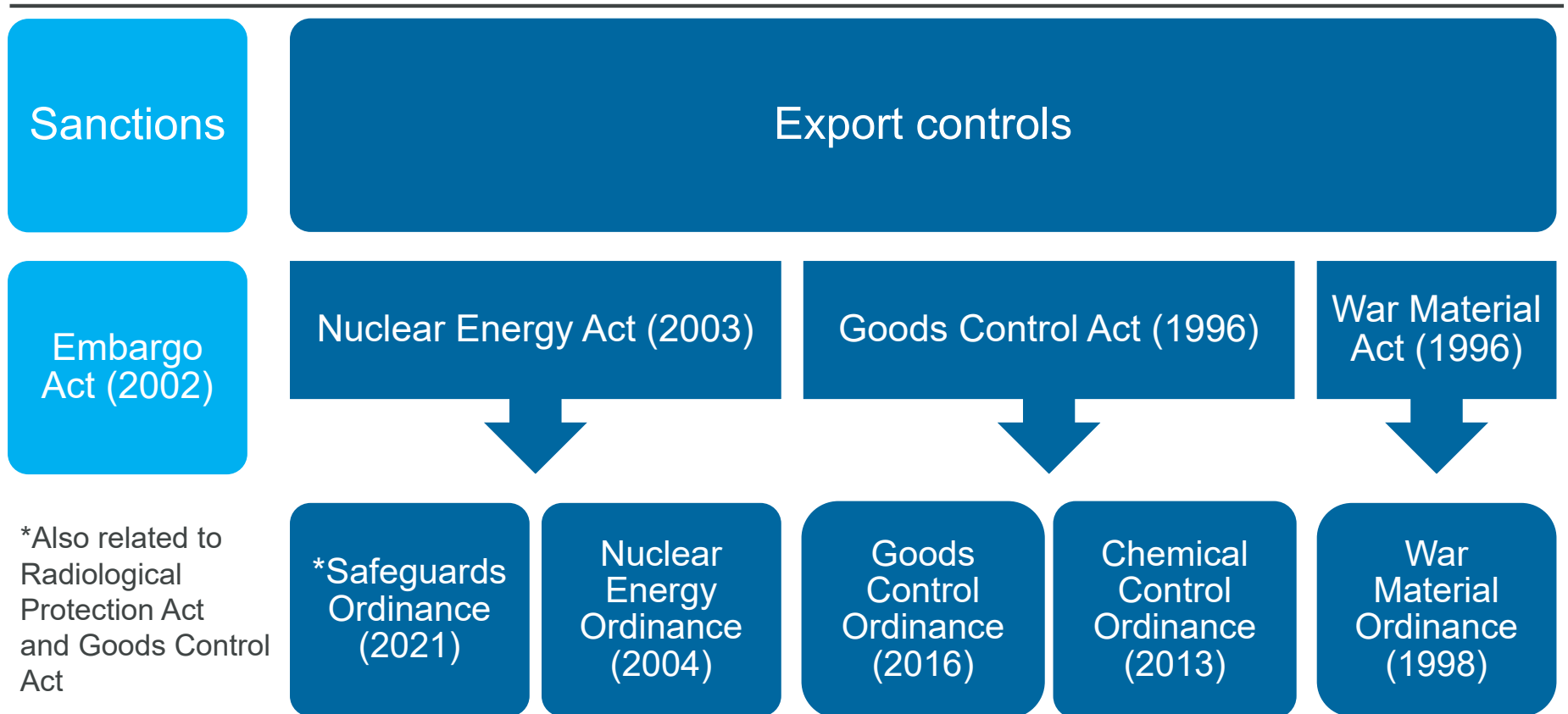
# EXPORT CONTROLS

---

- No general export prohibition, but subject to approval
- Encompasses:
  - Listed goods
  - Technology
  - Software
  - “Catch-all clause” to prevent unlisted exports used in weapons of mass-destruction programmes



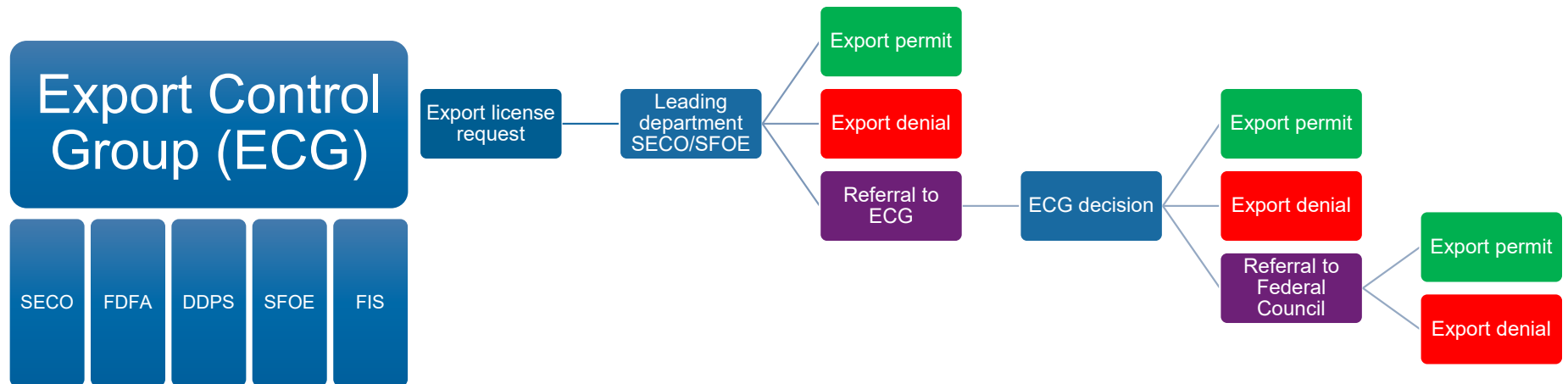
# SWISS EXPORT CONTROL LAW





# SWISS EXPORT CONTROL SYSTEM

- The State Secretariat for Economic Affairs (SECO) is in charge of export controls overall (Goods Control Act)
- SFOE is in charge of nuclear materials (Nuclear Energy Act)
- Complex cases are discussed in the Export Control Group (ECG)
- If ECG cannot agree the matter is referred to the Federal Council





# **Non-proliferation – a success story?**



# IS NON-PROLIFERATION A SUCCESS STORY?

---

- Non-proliferation efforts have:
  - significantly slowed the spread of nuclear weapons;
  - persuaded some states to give up their nuclear weapons programs;
  - made the spread of peaceful nuclear technologies possible in the first place.
  
- not prevented that there are more states with nuclear weapons than in the 1960s;
- not led to nuclear disarmament

International cooperation is essential to keep the non-proliferation regime working



# Take aways



## TAKE AWAYS (1)

---

- International safeguards obligations implemented in Swiss national law
- Reporting obligations by facility operators through the SFOE
  - Design of facilities
  - Nuclear material accountancy
  - Advance notifications
  - AP declarations
- IAEA verifies the declarations e.g. by measuring samples





## TAKE AWAYS (2)

- Broader conclusion for Switzerland since 2015
- Export control regimes control transfer of regulated goods including dual-use goods
- Non-proliferation:
  - is based on legal obligations;
  - is verified by technical means;
  - requires international cooperation spanning various fields of expertise;
  - made the spread of nuclear technology possible.





# THANK YOU FOR YOUR ATTENTION

---

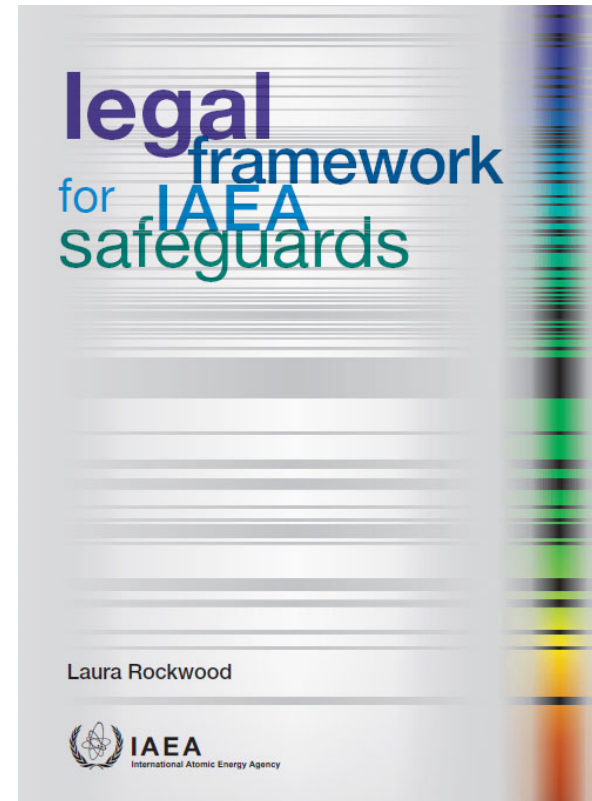
*Questions?*



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

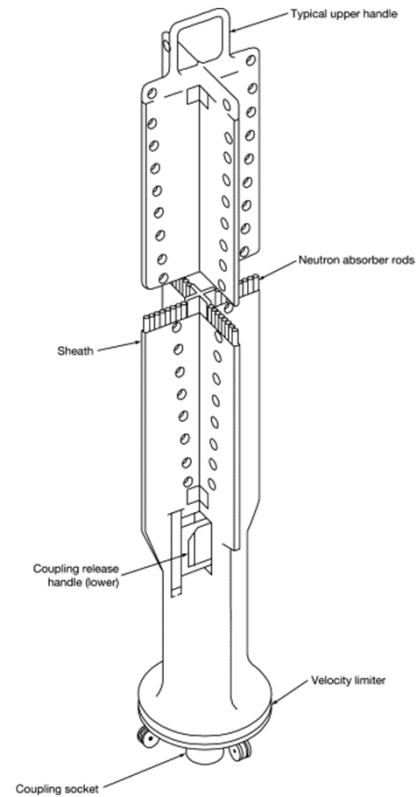
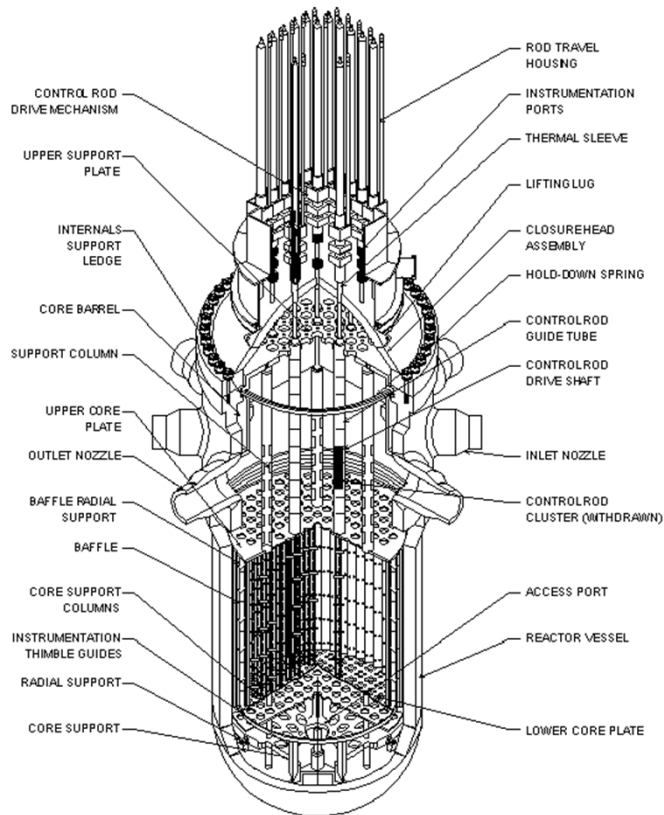
Swiss Federal Office of Energy SFOE  
Uwe Georg  
Head of Safeguards  
CH-3003 Berne

Phone: +41 58 462 00 78  
E-Mail: [uwe.georg@bfe.admin.ch](mailto:uwe.georg@bfe.admin.ch)





# EXPORT LICENSE REQUIRED?





# EXPORT LICENSE REQUIRED?

---





# EXPORT LICENSE REQUIRED?

---





# EXPORT LICENSE REQUIRED?

---





# EXPORT LICENSE REQUIRED?



DEUTERIUM OXIDE 99.9 ± 0.03 %  
CAT NO. D2O-9990-0-0306G  
WARNING: FREEZES AT +4°C - STORE +8 to +32°C  
FOR FURTHER MANUFACTURING ONLY

Net Wt. 15560-24.999	Gross Wt. 18.137 kg
Drum Type: 30 KG Metal Drum	Tap Wt. 3.117 kg
Serial Numbers: 8000004 8000005	Net Wt. 30.010 kg

Product of Canada  
Safety Data Sheet: 03-000-2000  
Isowater Corporation  
40 Sandhill Farm Road, Coltonville, Ontario, Canada L0P 1L7  
www.isowater.com +1 909 299 1208



# EXPORT LICENSE REQUIRED?

---



AFRL-RH-WP-TR-2017-XXXX

Be consistent with the font size (i.e., Main Title-16 pt/Bold, all caps; Subtitle- 14 pt/bold)

## MAIN TITLE

Subtitle *(if applicable)*

Author(s) First name/Last name

Contractor Company Name *(if applicable)*

Author(s) First name/Last name

Subcontractor Company Name *(if applicable)*

Month/Year

Final Report

THIS IS A SMALL BUSINESS INNOVATION RESEARCH (SBIR) PHASE I REPORT

DISTRIBUTION STATEMENT B: Distribution authorized to U.S. Government agencies only; Proprietary Information (SBIR Data Rights), Critical Technology and Export Controlled; Month 2XXX. Other requests for this document shall be referred to 711 HPW/RHC, Wright-Patterson AFB, OH 45433.

WARNING: This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec. 2751, et seq.) or the Export Administration Act of 1979, as amended, Title 50 U.S.C., App. 2401, et seq. Violations of these export laws are subject to severed criminal penalties. Disseminate in accordance with the provisions of DoD Directive 5230.25. (Include this statement with any reproduced portions).

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

*See additional restrictions described on inside pages.*

AIR FORCE RESEARCH LABORATORY  
711<sup>TH</sup> HUMAN PERFORMANCE WING  
AIRMAN SYSTEMS DIRECTORATE  
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433  
AIR FORCE MATERIEL COMMAND  
UNITED STATES AIR FORCE

Figure 1. Sample of a Cover Sheet



## EXPORT LICENSE REQUIRED?

---

**MCNP**<sup>®</sup>  
MONTE CARLO N-PARTICLE

 **OpenMC**



# EXPORT LICENSE REQUIRED?

FLUID DYNAMICS

**Cloud-based engineering platform for fluid dynamic simulation**

[Start Simulating Now](#)

