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Consumer Protection Directorate

27 September 2020

Action Plan to strengthen radiological security and safety in Switzerland 2020–2025 (Radiss)

"Improving the protection of radioactive materials against human beings (security) and the protection of human beings and the environment against radioactive materials (safety)"

Contents

1 Summary

Radioactive sources are widely used in medical and industrial applications (e.g. in radiotherapy for cancer or in materials testing and sterilisation), as well as in research, providing substantial benefits for the Swiss population. However, if they are not (or no longer) controlled, radioactive sources pose risks to human beings and the environment and can cause significant damage. For this reason, loss of control of radioactive sources as a result of malicious acts (terrorism) or negligence (illegal disposal) must be prevented in all circumstances.

Switzerland has undertaken to implement the latest guidance issued by the International Atomic Energy Agency (IAEA) on the security and safety of radioactive sources. This was taken into account and given effect in the revised version of the Radiological Protection Ordinance which came into force on 1 January 2018, regulating the handling of radioactive sources outside the nuclear energy sector.

The implementation of the “Action Plan to strengthen radiological security and safety” (Radiss) is designed to ensure the prevention of hazards to people and the environment arising from radioactive sources which are not subject to regulatory control or over which such control has been lost. While *security*[1] involves the protection of radioactive materials against human beings, *safety*[2] is concerned with the protection of human beings and the environment against radioactive materials. Prevention and detection measures provide protection not only against the misuse of radioactive materials for terrorist purposes but also against their uncontrolled spread via illegal import, export or transit. Another aim is to optimise response measures and management procedures, so that any damage following radiological incidents can be reduced as far as possible.

The aim of prevention measures is essentially to prevent the theft and sabotage of radioactive sources. Enterprises are required to take appropriate measures to prevent or detect unauthorised access to such sources. It is to be ensured by administrative means that sources can be traced from cradle to grave, and that they are securely managed. In addition, the use of high-activity sealed radioactive sources is to be limited in cases where alternative technologies without radioactive sources are available for an application.

The aim of detection measures is to track down orphan radioactive sources and sources not or no longer subject to control before they can harm workers, the public or the environment. For this purpose, particularly recycling enterprises, where there is an increased likelihood of such materials (e.g. radium legacies) being encountered, are required to conduct appropriate screening, for example via entry measurement (radiation portal monitor). In addition, the authorities will carry out risk-based border controls, using remote monitoring systems, to prevent the illegal import, export or transit of radioactive materials.

To ensure efficient response measures and radiological incident management, it is absolutely essential that there should be smooth cooperation between the enterprise concerned, emergency organisations and the supervisory and investigative authorities responsible. Incidents must be analysed and the necessary insights obtained, so that similar cases can be prevented in the future. The “lessons learned” culture is also supported by international exchanges via existing IAEA information channels.

The implementation of the Action Plan serves, at the same time, as preparation for the expert mission of the IAEA’s International Physical Protection Advisory Service scheduled for 2023. On this occasion, Switzerland’s measures to ensure the safety and security of radioactive materials in medicine, industry and research will be studied by the IPPAS experts and compared with international best practice.

[1] Security = *Sicherung* in German; *sûreté* in French.

[2] Safety = *Sicherheit* in German; *sécurité* in French.

The strength of this FOPH-led Action Plan will lie in close collaboration between a number of federal bodies, deploying available resources in a coordinated manner and making optimal use of existing synergies. The FOPH and Suva as supervisory authorities will be primarily concerned, but other key bodies are the Spiez Laboratory and the Federal Office for Customs and Border Security (FOCBS), as well as the Federal Intelligence Service (FIS), the National Emergency Operations Centre (NEOC), the Office of the Attorney General (OAG), the Federal Office of Police (fedpol), the Swiss Federal Office of Energy (SFOE), the Swiss Federal Nuclear Safety Inspectorate (ENSI) and the Paul Scherrer Institute (PSI). The cantons (emergency services) play an important role in response measures.

2 Background

The use of radioactive sources in medicine, for diagnostic and therapeutic purposes, helps to save lives. Their use in research and industrial applications also provides substantial benefits. However, if they are not (or no longer) subject to control, radioactive sources pose risks to people and the environment and can cause significant damage. Among the hazards are, firstly, the misuse of radioactive sources for terrorist and other purposes. Secondly, in waste management and recycling, there is a possibility of uncontrolled spread of radioactive materials. For this reason, there is a need to strengthen measures to ensure the security and safety of radioactive sources. In this context, radiological security concerns not only measures to prevent theft and sabotage but also the detection of radioactive sources over which control has been lost. While the security of radioactive materials in the nuclear energy sector [1] has long been an extremely important component of overall protection, stronger protection is now also to be provided for radioactive materials outside of nuclear power plants, in accordance with the hazards posed.

2.1 International obligations

At present, the possibility of radioactive materials – in particular, high-activity sealed radioactive sources – being misused for terrorist purposes cannot be excluded in Switzerland. This would include, for example, the deliberate exposure of people to radiation or the production of a dirty bomb. A terrorist attack using a high-activity radioactive source has the potential to cause serious radioactive contamination of the environment, possibly resulting in massive economic, environmental and social damage.

Addressing these potential threats is on the agenda of the International Atomic Energy Agency (IAEA). To prevent such threats, the IAEA has developed recommendations which are to serve as a reference for member states [2] [3] [4]. Switzerland has consequently decided to take measures to strengthen the security of radioactive sources. Switzerland has also undertaken to implement the IAEA's Code of Conduct on the Safety and Security of Radioactive Sources [5], Guidance on the Import and Export of Radioactive Sources [2] and Guidance on the Management of Disused Radioactive Sources [6]. The priority goal is to improve the security and safety of radioactive sources by protecting them against theft and sabotage. In addition, via early detection, the unnoticed spread of sources over which control has been lost is to be prevented. These international obligations have been largely met with the entry into force in 2018 of the revised Radiological Protection Ordinances [7] [8] [9].

At the 2016 Nuclear Security Summit, Switzerland supported an initiative aimed at promoting measures to strengthen the security of high-activity sealed radioactive sources. As well as the physical protection of such sources, these measures involve support for alternative technologies which fulfil the same purpose without using radioactive sources. In this connection, Switzerland signed a Joint Statement on Strengthening the Security of High

Activity Sealed Radioactive Sources [10].

In addition, at the 2020 Nuclear Security Conference, Switzerland emphasised its commitment to this topic by subscribing to the Joint Statement on Strengthening Nuclear Security Implementation [11], which includes the security of radioactive sources.

2.2 Situation in Switzerland

Radiological security and safety are regulated by the Radiological Protection Act [12], the overall purpose of which is to protect people and the environment against the risks associated with ionising radiation.

The Federal Office of Public Health (FOPH) is the licensing authority for the handling of radioactive materials in medicine, research and industry. At the same time, the FOPH is responsible for supervision of radiological protection in the areas of medicine, research and education, while Suva is the supervisory body for radiological protection in industrial and commercial applications.

The supervisory authority for nuclear installations is the Swiss Federal Nuclear Safety Inspectorate (ENSI). ENSI is also the licensing authority for radioactive substances at nuclear installations, for the import and export of radioactive substances for or from nuclear installations and for the transport of radioactive substances from and to nuclear installations. The Swiss Federal Office of Energy (SFOE) is the licensing authority for the handling of nuclear materials.

The implementation of security measures in the nuclear energy sector is long established. In 2018, Switzerland hosted a mission of the IAEA's International Physical Protection Advisory Service (IPPAS), which involved a review of the country's national regulatory framework for nuclear security. This includes the physical protection of nuclear installations, computer security and security for the transport of nuclear goods. Switzerland's security regime was highly rated by the IAEA expert group, which concluded that nuclear security is well established in this country. In addition, recommendations were offered as to how the situation could be further improved.

In recent years, greater importance has also been attached internationally to the question of strengthening radiological security outside the nuclear energy sector. In this context, the FOPH has already taken part in various expert meetings concerning the implementation of the IAEA Code of Conduct [5] and supplementary guidance [4] [13]. Now scheduled for 2023 is an IPPAS follow-up mission which, as well as assessing the measures adopted following the first mission's recommendations, is to review the security of radioactive materials in the areas of industry, medicine and research.

3 Legal foundations

In Switzerland, the handling of radioactive materials outside the nuclear energy sector is regulated by the Radiological Protection Act (RPA [12]), the Radiological Protection Ordinance (RPO [7]) and the technical Ordinances on the Handling of Radioactive Materials (UraM [8]) and the Handling of Sealed Radioactive Sources in Medicine (MeQV [9]). The Ordinances specify from what level of activity the handling of radioactive materials is subject to mandatory licensing and thus to official supervision. Radioactive material can only be exempted from supervision below a nuclide-specific activity level (clearance limit). In general, the licensing and supervisory measures help to ensure that radioactive materials are subject to regulatory control and can only be used by appropriately trained and authorised personnel.

Underlying the Radiss Action Plan are the following legal provisions:

Article 31 letter c RPA [12] requires licence holders to ensure safe operation of radiation sources. On this basis, Article 99 RPO [7] regulates the security and safety of high-activity sealed radioactive sources. Further requirements concerning security measures – in particular, the preparation of a security plan – are specified in the two technical Ordinances (in Art. 3 UraM [8] and in Art. 17 MeQV [9]).

Article 104 RPO [7] regulates the handling of orphan radioactive materials – in particular, the obligation to carry out screening at enterprises which handle scrap metals or receive wastes for incineration. The monitoring of import, export and transit (coordination with the Federal Customs Administration and Spiez Laboratory) is regulated in Article 190 RPO.

To explain the requirements of Article 99 and 104 RPO [7] in more detail, the FOPH, in collaboration with the authorities and professional associations concerned, has prepared two sets of guidelines, specifying the measures to be implemented by the enterprises. These publications are, firstly, the confidential guidelines (only accessible for the enterprises and authorities concerned) “Security of high-activity radioactive material” [14] and, secondly, the guidelines entitled “Monitoring of wastes and recyclable materials for radioactivity” [15].

In prevention efforts to counter security threats arising from radioactive substances, collaboration with the Federal Intelligence Service (information exchange) and the Federal Office for Civil Protection (in particular, the Spiez Laboratory for radioactivity control measurements) is based on the Intelligence Service Act (IntelSA, Art. 6 [16]) and on the revised Federal Act on Protection of the Population and Civil Protection (BZG, Art. 11 [17]).

In the event of felonies or misdemeanours specified in Articles 43 and 43*a* RPA [12] (unjustified exposure of persons and property, illegal handling of radioactive substances) or in Article 226bis Swiss Criminal Code [18] (causing danger by means of nuclear energy, radioactivity or ionising radiation), the matter will be passed by the FOPH, in accordance with Article 46 paragraph 1 RPA and Article 23 paragraph 1 letter d Swiss Criminal Procedure Code [19], to the Office of the Attorney General, which in turn will conduct investigations together with fedpol.

4 Strategy

Radiological security and safety must be strengthened in order to prevent hazards to people and the environment arising from radioactive sources which are not subject to regulatory control or over which such control has been lost. This main goal of the Action Plan is to be achieved via the following strategic objectives:

- prevent radioactive materials from being used for malicious or terrorist purposes;
- prevent the uncontrolled spread of radioactive materials;
- prevent the illegal import, export and transit of radioactive materials;
- limit damage and initiate criminal proceedings after radiological incidents.

National collaboration in the area of radiological protection provides a basis for the achievement of these objectives. The Action Plan is designed to bring together the federal bodies concerned and to pool available resources so as to strengthen radiological security and safety in Switzerland. This should enable the bodies concerned to establish closer relations and to increase the efficiency of efforts to improve radiological security and safety.

In addition, the launch of the Action Plan at this point will enable Switzerland to prepare for the above-mentioned IPPAS mission in an optimal and timely manner. This mission, conducted by international experts, will assess Switzerland’s legal framework and measures to ensure the security of radioactive materials in the light of international best practice. Based on the experts’ recommendations, it can then be determined what additional measures need to be implemented in the second phase of the Action Plan. The results of this mission, together with any recommendations, will be documented in an interim report to be submitted to the Federal Council.

5 Fields of Actions

The Radiss Action Plan 2020–2025 is divided into 3 action areas, for which a total of 8 priorities (P) and 19 measures (M) are defined. Both the action areas and the priorities are derived from the strategy described above, international recommendations and the provisions of the Radiological Protection Ordinance [7].

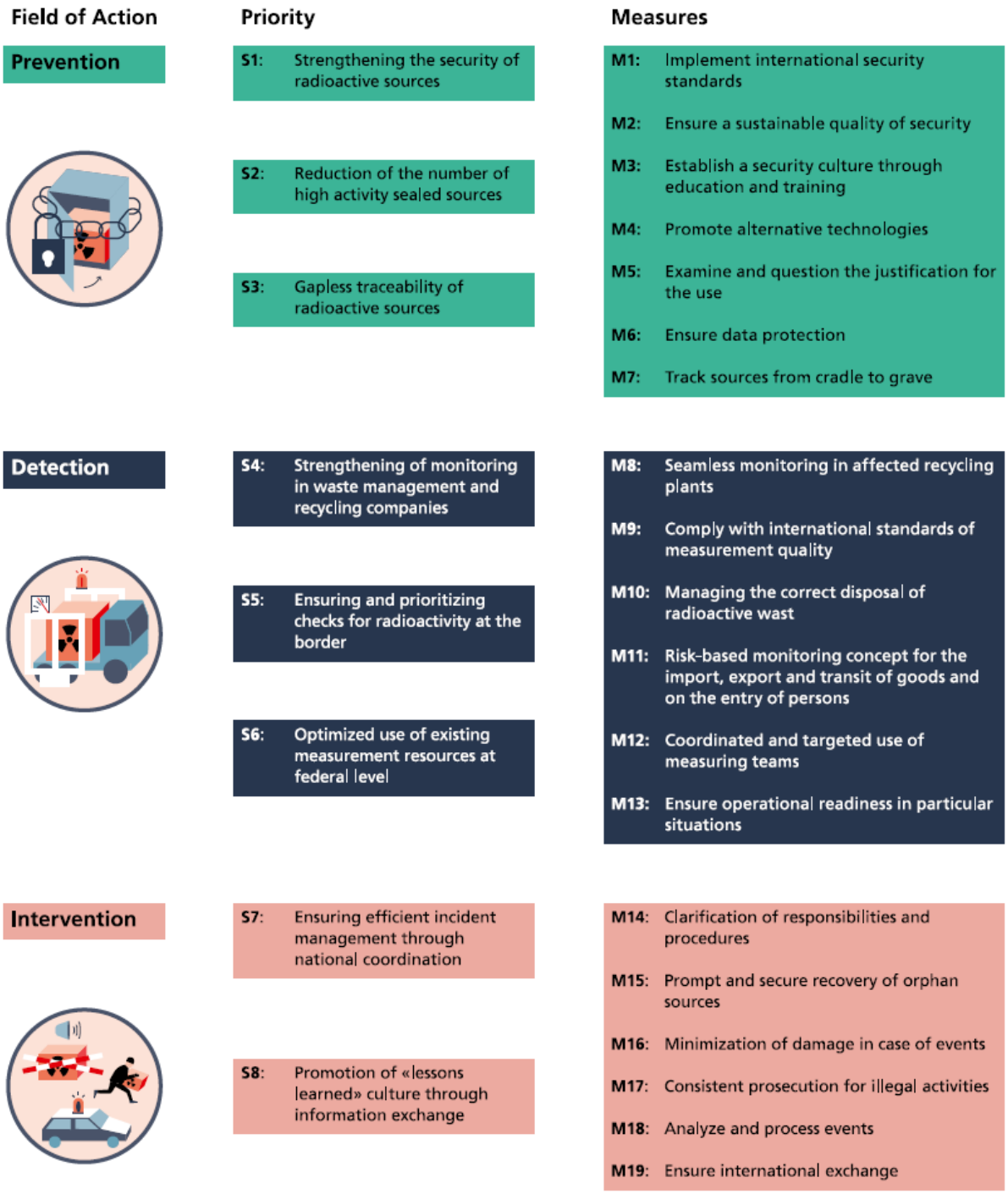

Figure 1 Fields of action, priorities and measures defined in the Radiss Action Plan.

5.1 Prevention

5.1.1 Need for action

Direct exposure to a high-activity sealed radioactive source can lead to a fatal radiation dose within a short period. For this reason, control over these sources must not be lost on any account, either during storage and use or when they are transported. In order to improve safety and security, the revised Radiological Protection Ordinance [7] requires licence holders, for each high-activity sealed radioactive source, to define adequate measures to protect it against unauthorised access, loss, theft, misuse or damage. The aim here is to prevent malicious acts involving radioactive sources, such as the use of a dirty bomb for terrorist purposes or deliberate malicious exposure of people to radiation.[3]
As well as high-activity sealed radioactive sources, numerous other radioactive sources with lower activity are used in Switzerland. These sources must also be adequately and appropriately protected from theft, albeit using less extensive measures. The fact that action is also required in this area was demonstrated by the theft of a relatively strong radioactive source in Switzerland in 2018: in this case, an inadequately secured technetium-99m generator was stolen from a medical radiology institute. Although the impact on people and the environment was negligible, this incident gave rise to significant costs for the parties concerned and, above all, clearly showed that the situation in general needs to be improved.

P1: Strengthening the security of radioactive sources

Around 80 medical, industrial and research enterprises use high-activity sealed radioactive sources and are affected by the **measures to strengthen security against theft and sabotage (M1)**. The aim is to ensure that unauthorised access can be detected, delayed and responded to in good time. The new security standards also concern the transport of high-activity sealed radioactive sources and mobile high-activity sealed radioactive sources.

The security measures have been specifically adapted to the situation in Switzerland on the basis of the IAEA guidance [4] [20] and are defined in FOPH guidelines [14]. These guidelines were developed in cooperation with the Federal Department of Defence, Civil Protection and Sport (DDPS), Suva and ENSI, with the involvement of security specialists and in the light of experience in other countries. Also consulted were enterprises and professional associations concerned.

The **quality (M2)** of security measures implemented on the basis of the guidelines and via the establishment of a strengthened **security culture** in enterprises through appropriate **education and training (M3)** will be assured by supervisory activities and dedicated inspections by the competent authorities.

P2: Reducing the number of high-activity sealed sources

Another way of reducing the potential for misuse is to reduce the number and distribution of high-activity sealed radioactive sources. This is possible if **alternative technologies (M4)** serving the same purpose and offering comparable quality are used to replace high-activity sealed radioactive sources. For certain applications, such technologies – posing no risks to the public through misuse – are already available today. Examples in the field of medicine include the use of powerful X-ray systems to replace caesium-137 blood irradiators, or linear accelerators instead of cobalt-60 radiotherapy machines.

[3] In cases of deliberate release of radioactive substances with consequences at the national level, the response is covered by the emergency management plans included in the FOCP hazard files and does not form part of Radiss. https://www.babs.admin.ch/en/aufgabenbabs/gefaehrdrisiken/natgefaehrdanalyse/gefaehrddossier.html

The required review by the licensing authority of the **justification for use (M5)** of high-activity sealed radioactive sources will in future be subject to even more stringent criteria, especially in cases where equally effective alternatives are already available. The review of the justification for use also concerns already licensed applications involving high-activity sealed radioactive sources, already in use for an extended period.

In addition, the supervisory authorities will monitor the latest international developments and support licence holders in switching to alternative technologies.

P3: Complete traceability of radioactive sources

Licence holders are responsible for ensuring that radioactive sources are securely handled throughout the period of use and do not fall into the wrong hands, and that end-of-life sources are disposed of as radioactive waste in accordance with legal requirements.

Radioactive sources licensed in Switzerland are managed in an inventory by the licensing authority. The source specifications, use/storage site and owner are thus known at all times. In the event of loss or theft, all the information required to search for a source is thus available without delay. This **source inventory (M6)** is integrated into an online portal for the management of radiological protection licences (Radiation Portal Switzerland), satisfying **cybersecurity** requirements. In the future, this portal will also be available to licence holders for the management of their source inventory and other licence-related data. Thus, for example, the replacement of an existing source by a new one can be directly entered in the portal with just a few clicks. Following confirmation by the recipient, the sources concerned are automatically included in the recipient's inventory. This makes it possible for sources to be monitored from the time of first use to the end of life (**M7**). For high-activity sealed radioactive sources, requirements for additional information in the inventory and annual reporting are also specified.

As high-activity sealed radioactive sources are not manufactured in Switzerland, they have to be imported. At the end of life, these sources are generally re-exported to the manufacturer for recycling. The licensing and supervisory authorities ensure that administrative data on sources is exchanged with transit and recipient countries. The transport, import and export of high-activity sealed radioactive sources is subject to internationally harmonised security measures and reporting procedures.

Switzerland is committed to strict compliance with these regulations, so that no problems arise in connection with import and export, the location of high-activity sealed radioactive sources can be traced at all times and **secure handling of sources is assured from cradle to grave (M7)** [2].

5.2 Detection

5.2.1 Need for action

Past experience shows that orphan radioactive sources (e.g. radiological legacies and sources illegally disposed of) are occasionally and for the most part unwittingly disposed of through conventional channels (waste, recycling, landfilling). If such orphan sources remain undetected, this may pose risks to personnel or lead to radioactive contamination of facilities and recycling products. Substantial harm to health and economic damage may arise as a result. In addition, the environment and the public could be exposed to contaminated waste products and recycling materials. Recycling and waste management enterprises must therefore ensure that orphan radioactive sources can be detected at an early stage and disposed of in accordance with legal requirements.

In order to prevent illegal import, export or transit of radioactive materials, spot checks are currently carried out at the border. These controls are not, however, sufficient to be adequately prepared for expected risk situations, such as imports of goods from contaminated areas. Particularly in the context of international efforts concerning the security of radioactive materials, it is important to be able to respond appropriately in the event of an increased risk situation and to ensure that the necessary measurement and control capacity is available.

Another point of concern are large goods-handling areas, such as airport transit zones, Rhine ports, freight depots and parcel sorting centres. In 2017, for example, passengers and flight crew on a scheduled SWISS flight were subject to inadmissible exposure from an inadequately shielded source, packaged abroad. This could have been prevented by permanent monitoring of goods. This could be appropriate, in particular, at extremely busy goods-handling centres such as Zurich Airport. Another example concerns the belated detection of imports of radioactive materials from China, used to produce radioactive jewellery in Switzerland. The need for permanent monitoring at specific sites must be analysed, so as to eliminate any deficiencies concerning imports.

With the resources available today, only spot checks can be performed. Such checks may not, however, be sufficient to ensure radiological safety for the Swiss population over the long term. One of the tasks of the Action Plan is to determine to what extent these controls can or must be strengthened.

P4: Strengthening of screening at waste management enterprises

Under Article 104 of the Radiological Protection Ordinance [7], **in cases where there is an increased likelihood of radioactive materials being encountered, enterprises are required to carry out entry measurements (M8)**. These enterprises include, in particular, Switzerland's roughly 30 municipal waste incineration plants and over a hundred enterprises where scrap metal is processed or prepared for export. A planned risk assessment will indicate whether such screening also needs to be introduced at certain landfill sites.

The enterprises concerned are required to screen incoming materials for radioactivity and, in the event of alerts, to secure and recover orphan radioactive sources. For this purpose, suitable measurement equipment needs to be installed and procedures defined. The requirements specified for enterprises are summarised in FOPH guidelines [15], prepared in cooperation with the bodies concerned (Suva, the Association of Swiss Waste Treatment Plant Operators VBSA and the Swiss Association of Steel, Metal and Paper Recycling VSMR).

Based on these guidelines, enterprises already equipped with a measurement system are required to review and if necessary optimise their equipment and procedures. At the end of the transitional period, **the competent supervisory authority will assess enterprises' measurement quality**, their alert organisation and their incident management procedures. This should ensure compliance with national and international **measurement quality standards (M9)**.

As waste management enterprises' contacts with radioactive materials are usually involuntary, the supervisory authorities raise awareness and provide support on this issue. This includes advice on the procurement of suitable measurement equipment. The supervisory authorities also ensure that personnel are not subject to inadmissible exposure and that, in the event of possible illegal disposal, the party responsible is identified and held accountable.

In addition, to ensure as far as possible that, for example, radiological legacies from the watchmaking industry are not unwittingly disposed of, **awareness of this issue is to be raised among possible owners (M10)** of such legacies. These include, for example,

collectors of vintage watches or army materials which may contain radioactive luminous radium paint. Up until the 1960s, such paint was frequently used in Switzerland, and it is therefore present in many radiological legacies. The aim is to ensure that **such radioactive articles are correctly disposed of** rather than ending up in conventional waste. With information campaigns and factsheets, the FOPH intends to make greater efforts to address owners directly.

P5: Ensuring and prioritising radioactivity controls at the border

Under the revised Radiological Protection Ordinance [7], the FOPH has a legal mandate to organise periodic targeted screening of goods and of persons entering the country in order to detect the illegal import, export or transit of radioactive materials. **The aim is to ensure that for all relevant import, export and transit channels, control plans are available and are successfully tested (M11)**. The FOPH manages and coordinates the targeted screening with the Spiez Laboratory, the Federal Customs Administration and the Paul Scherrer Institute. In addition, at locations where there is an increased likelihood of illegal import, export or transit of radioactive materials, the possibility of permanent, autonomous screening is to be examined and, if appropriate, established. By means of statistical measurements at various sites over an extended monitoring period, possible locations are first to be determined, with a comprehensive, risk-based monitoring scheme subsequently being established.

P6: Optimised use of existing measurement resources at federal level

Under this Action Plan, with the aim of detecting out-of-control or illegal radioactive sources, existing measurement resources (equipment and personnel) are to be pooled. This will involve close collaboration between the FOPH and the Spiez Laboratory, the Federal Customs Administration and the Paul Scherrer Institute. Here, numerous synergies arise for the use of existing measurement equipment, providing opportunities for further optimisation and increased capacity utilisation. At the same time, the procedures to be adopted in the event of any sources being detected, and the steps to be subsequently taken, can be regularly rehearsed and improved.

The FOPH, in consultation with the parties involved, will be responsible for the **oversight and coordination of existing measurement capacity (M12)** and will ensure regular deployments, so that Switzerland is prepared for a possible **emergency and special situations (M13)**. Such an emergency arose, for example, after the 2011 Fukushima nuclear disaster, when controls on goods imported from Japan had to be introduced.

5.3 Response (incident management)

5.3.1 Need for action

In the event of a radiological incident, such as the discovery of an orphan radioactive source, rapid action is required, so that any damage can be limited. This in turn calls for effective collaboration between all parties involved. Since the secure recovery of high-activity sealed radioactive sources also raises questions of national security, the emergency services need to be involved as well as the federal authorities. The example (mentioned in Section 5.1) of the theft of a source in 2018 clearly showed where collaboration already works well and where there is still room for improvement.

P7: Ensuring efficient incident management through national coordination

Efficient incident management always requires effective collaboration between the enterprises concerned and the authorities involved. For this purpose, **roles and responsibilities need to be clarified and procedures defined (M14)**. If orphan radioactive materials are detected at a recycling enterprise, the enterprise must be capable of deciding independently on the steps required to ensure **secure recovery (M15, M16)** and initiating the requisite measures. In certain cases, however, enterprises may be dependent on support from the authorities, which can, if necessary, provide further resources and additional expertise. This includes, for example, a recovery robot which can be made available by the Spiez Laboratory and the Zurich Forensic Science Institute.

For enterprises using high-activity sealed radioactive sources, it must also be defined who is to be alerted in the event of unauthorised access (emergency services or private security companies), so that response times are kept as short as possible. For this reason, the enterprises must also inform the responsible cantonal police about their security plans, so that **response measures can be planned and efficiently executed (M16)**.

In cases of possible illegal disposal of radioactive materials or suspected misuse of radioactive sources, the criminal investigation and judicial authorities (fedpol and Office of the Attorney General) are already involved today, so that **the parties responsible can be identified and held accountable (M17)**. Increased screening at waste management and recycling enterprises will probably lead to more frequent discoveries, and for this reason the necessary information flows between the authorities and enterprises must operate without any delay. If possible, in the future, there should also be an increase in preventive action, so that illegal materials are detected before they are brought into circulation or disposed of. A case in point is the illegal trade in so-called negative ion jewellery. These popular esoteric products contain sometimes large amounts of natural radioactivity, leading to inadmissible exposure [21].

P8: Promoting “lessons learned” culture through information exchange

Intensified cooperation and regular exchanges of information will not only permit a rapid and efficient response to any incidents but also ensure that **the authorities can analyse and evaluate all incidents (M18)**. A comprehensive assessment of the causes of incidents supports a “lessons learned” culture and will thus, at the same time, help to prevent similar incidents in the future. Also important in this context are international cooperation and **rapid exchange of information with the IAEA via existing channels (Incident and Trafficking Database, International Nuclear and Radiological Event Scale)** (**M19**), for which the SFOE and ENSI are responsible. Rapid and straightforward **communication also with neighbouring countries** is all the more important since, in the event of source theft, existing detection resources at the borders would need to be rapidly increased.

6 Organisation

Also involved in the implementation phase of the Action Plan, alongside the FOPH, will be Suva, the Spiez Laboratory, Federal Office for Customs and Border Security (FOCBS), Federal Intelligence Service (FIS), National Emergency Operations Centre (NEOC), Office of the Attorney General (OAG), fedpol, Swiss Federal Office of Energy (SFOE), Swiss Federal Nuclear Safety Inspectorate (ENSI) and Paul Scherrer Institute (PSI), as well as the enterprises and professional associations directly concerned. The federal bodies directly and primarily concerned are listed in Figure 2 as working groups in the relevant action area. These working groups meet regularly to discuss the implementation of measures. The Action Plan is led by the FOPH. The Steering Committee, which includes representatives from the FOPH, Suva and the Spiez Laboratory, is responsible for the approval of completed milestones and for strategic decision-making.

The Advisory Group consists of the federal bodies which already make up the so-called Group of Nuclear sector Partners[4] (GNP), engaging in regular exchanges. Most of the partners in the Advisory Group play an important role in all of the action areas. This group, already operating effectively, will facilitate coordination between the various federal bodies involved.

In addition, with the three action areas of Prevention, Detection and Response, Switzerland is preparing directly for the IPPAS follow-up mission to review radiological security, scheduled for 2023. Overall responsibility for this follow-up mission lies with the SFOE and ENSI. The FOPH will be responsible for Module 4 (Security of radioactive material, associated facilities and associated activities).

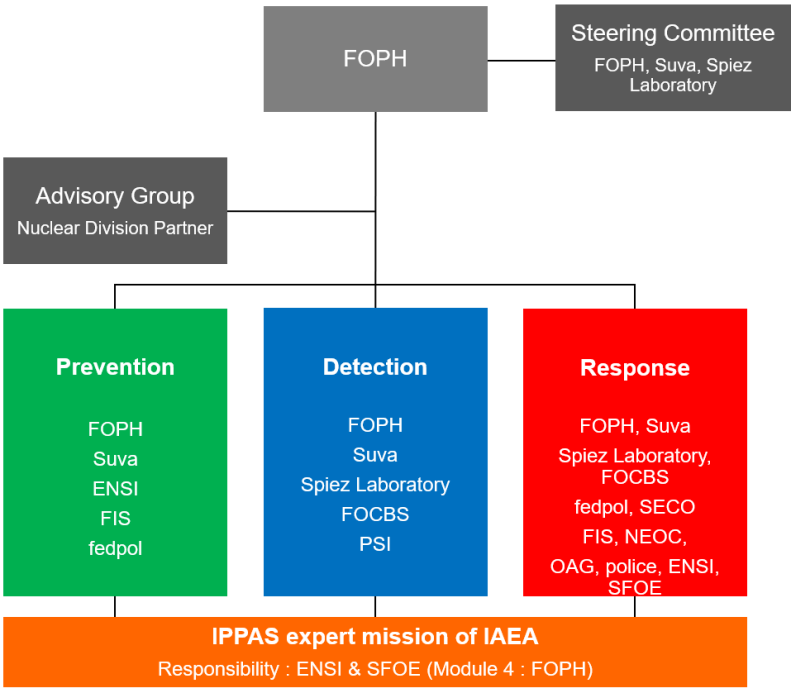

Figure 1 Organisational structure for the various action areas of the Radiss Action Plan

[4] Federal discussion platform with representatives from the Spiez Laboratory, Swiss Federal Office of Energy (SFOE), Swiss Federal Nuclear Safety Inspectorate (ENSI), Suva, Federal Office of Public Health (FOPH), Federal Customs Administration (FCA), fedpol, Office of the Attorney General (OAG), Federal Intelligence Service (FIS), National Emergency Operations Centre (NEOC), ABC-KAMIR competence centre, Armed Forces Staff, Federal Department of Foreign Affairs (FDFA) and State Secretariat for Economic Affairs (SECO).

Also involved in the Prevention and Detection action areas, as well as the federal bodies, are, in particular, the licence holders (enterprises with high-activity sealed radioactive sources, waste management enterprises). Coordination with these enterprises will, however, be assured not only through direct contacts between the enterprises and the supervisory authorities, but also via other specialist bodies and professional associations. The interested parties include, in particular:

- Swiss Society of Radiobiology and Medical Physics (SGSMP/SSRPM)
- Swiss Society of Radiation Oncology (SRO)
- Swiss Association of Medical Radiology Technicians (SVMTR/ASTRM)
- Swiss Society for Nondestructive Testing (SGZP)
- Transport enterprises
- Association of Swiss Waste Treatment Plant Operators (VBSA)
- Swiss Association of Steel, Metal and Paper Recycling (VSMR)

For the Response action area, the emergency services must also be involved. Licence holders are today already required to report to the fire brigade where they store radioactive sources. A new requirement is that enterprises using high-activity sealed radioactive sources must also involve the local police in their security plans.

7 Timeline

The IPPAS expert mission represents an important milestone for the Action Plan. For this reason, the timeline is divided into a first phase, up to the IPPAS mission, and a second phase, thereafter. The first phase is focused on the implementation of measures to meet the new international security standards. In the second phase, the experts' recommendations will be evaluated and, where necessary, also implemented with the requisite resources.

The security measures and mandatory measurements will be implemented by the enterprises responsible. The deadlines for implementation are specified in the RPO [7]. The targeted screening of goods for import, export or transit will be scheduled and implemented in collaboration with the FOCBS and the relevant measurement bodies – Spiez Laboratory, PSI and FOPH.

In most cases, the measures are not interdependent and can proceed either in parallel or in a different sequence. The following Table provides an overview of the timeline for implementation of the measures defined in the Action Plan.

	First phase (before IPPAS)			Second phase (after IPPAS)		
	2020	**2021**	**2022**	**2023**	**2024**	**2025**
Prevention **Priority 1 Strengthening the security of radioactive sources**						
⇨ M1 Implement international security standards						
⇨ M2 Ensure a sustainable quality of security						
⇨ M3 Establish a security culture through education and training						
Priority 2 Reduction of the number of high-activity sealed sources						
⇨ M4 Promote alternative technologies						
⇨ M5 Examine and question the justification for the use						
Priority 3 Gapless traceability of radioactive sources						
⇨ M6 Ensure data protection						
⇨ M7 Track sources from cradle to grave						

	First phase (before IPPAS)			Second phase (after IPPAS)		
	2020	**2021**	**2022**	**2023**	**2024**	**2025**
Detection						
Priority 4 Strengthening of monitoring in waste management and recycling companies						
⇨ M8 Seamless monitoring in affected recycling plants						
⇨ M9 Comply with international standards of measurement quality						
⇨ M10 Managing the correct disposal of radioactive waste						
Priority 5 Ensuring and prioritizing checks for radioactivity at the border						
⇨ M11 Risk-based monitoring concept for the import, export and transit of goods and on the entry of persons						
Priority 6 Optimized use of existing measurement resources at federal level						
⇨ M12 Coordinated and targeted use of measuring teams						
⇨ M13 Ensure operational readiness in particular situations						
Response						
Priority 7 Ensuring efficient incident management through national coordination						
⇨ M14 Clarification of responsibilities and procedures						
⇨ M15 Prompt and secure recovery of orphan sources						
⇨ M16 Minimization of damage in case of events						
Priority 8 Promotion of “lessons learned” culture through information exchange						
⇨ M17 Consistent prosecution of illegal activities						
⇨ M18 Analyze and process events						
⇨ M19 Ensure international exchange						
IPPAS mission						
Review of radiological security and safety by IAEA experts						
⇨ Preparation of documentation						
⇨ Mission						
⇨ Implementation of recommendations						
⇨ Interim report to Federal Council						

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