

**COPING WITH CONTESTED TERRITORIES: THE SUCCESSFUL CASE OF THE
REMOVAL OF DISUSED RADIOACTIVE SOURCES AND MATERIALS IN MOLDOVA**

Artem Lazarev¹, Margarita Kalinina-Pohl², Miles Pomper², George M. Moore²

¹Vienna Center for Disarmament and Non-Proliferation (VCDNP), Vienna, Austria,

²James Martin Center for Nonproliferation Studies (CNS), Monterey, CA, USA.

ABSTRACT

The governance of nuclear and other radioactive materials in contested territories has proved highly challenging, particularly in the former Soviet states, where numerous cases involving missing, lost, or stolen material took place in or near these uncontrolled territories. Yet, there are examples of successful cooperation between states and their breakaway regions, such as the Republic of Moldova’s removal of disused radioactive sources and material from the Transdnistria region. Since 2012, about 2,700 disused sealed radioactive sources and devices with radioactive materials have been removed, including orphan sources, from 25 sites/facilities in the Transdnistria region. The Organization of Cooperation and Security in Europe (OSCE) facilitated removal processes to a secure disposal and storage facility near Moldova’s capital Chisinau. Using data obtained from academic and technical literature, stakeholders involved in the removals, and technical experts, the paper analyses political, technical, and other factors that contributed to the success of this initiative. It also derives lessons that might be applicable for tackling radiological security challenges in territories not controlled by the central government.

INTRODUCTION

According to the International Atomic Energy Agency (IAEA), the responsibility for security of nuclear and other radioactive material and associated facilities and activities primarily rests with states [1]. However, there is a lack of clarity about how to carry out these responsibilities when it comes to “contested territories,”¹ areas where political authority is unclear because of “frozen” or active conflicts aggravated by territorial, religious, political, or other disputes. These territories can be ungoverned or administered by quasi-state authorities, which are not formally recognized by the international community.

Such “grey zones” pose a wide array of challenges and threats due to non-existent or weak regulatory mechanisms and can thus serve as fertile grounds for criminal activities, including illicit trafficking in radioactive materials. One particular concern is the presence of Soviet-era legacy nuclear and radioactive materials in such contested territories as Abkhazia, South Ossetia, Nagorno-Karabakh, Transdnistria, and most recently, the Donbas Region of Eastern Ukraine. Particularly vulnerable are radioactive materials contained in sealed radioactive sources due to their abundance, wide application, and lax security arrangements. After the collapse of the Soviet Union, many devices containing

¹ For the purposes of this report, the authors use the term “contested territories,” as defined by Ratz, L. et al. in [2]: “geographical areas, the political jurisdiction of which is contested between two or more parties.”

radioactive materials went missing or were abandoned or stolen, with the most notable cases taking place in or near these territories or involved material that allegedly came from these territories [3, 4].

The absence or insufficiency of nuclear and radiological regulators or shortage of technical capacities in disputed territories, as well as lack of dialogue between the states and secessionist governments, make a task of securing and protecting radioactive sources extremely difficult if not impossible. However, there are examples of successful cooperation between states and their breakaway regions, such as Moldova's removal of disused radioactive sources and materials from the Transdnistria region. Since 2012, the Republic of Moldova has conducted more than 20 missions to remove about 2,700 disused sealed radioactive sources and devices containing radioactive materials, including orphan sources, from 25 sites in the Transdnistria region [5]. The Organization of Cooperation and Security in Europe (OSCE) facilitated removal processes to ensure a smooth transfer of these materials to a secure disposal and storage facility near Moldova's capital Chisinau.

Based upon the results of a study conducted by CNS and VCDNP researchers, this article analyses a wide range of political, technical, and other factors, which have contributed to the success of this initiative. It starts with a brief overview of the history of the Transdnistria conflict. The authors then identify challenges to radiation safety and security in Transdnistria. The article further proceeds with a summary of removal cases and the review of communication channels between various parties and entities to launch, prepare for and implement this initiative. Finally, the paper concludes with an analysis of the lessons learned during this process.

The research methodology for this paper included a combination of data collected from (1) stakeholders who were directly or indirectly involved in various stages of removals of radioactive sources from Transdnistria, as well as technical consultations with various experts; and (2) publicly available sources, such as academic and technical literature.

The authors believe that Moldova's experience with the removal of disused radioactive sources and materials from the Transdnistria region with the facilitation by the OSCE can serve as a successful model of cooperation and confidence building measures for other countries grappling with radioactive materials in contested territories. While recognizing that each country and conflict is unique, the lessons learned can be adapted and applied to their own national mechanisms to secure radioactive, and other dangerous material in contested territories.

BRIEF HISTORY OF THE TRANSDNIESTRIA CONFLICT

The Republic of Moldova is located between Romania and Ukraine, with its breakaway Transdnistria region occupying the major part of country's the left bank of the Dniestr River. This small republic has significant geopolitical influence as it stands at the crossroads of Western and Russian spheres of influence. Language is intensely political in this part of the world; even the name we use to describe this contested territory is divisive. Throughout the article, the authors will use the term "Transdnistria" for this region, as adopted by the OSCE. However, when referencing a contact with the government of the Republic of Moldova, the term "Transdnistria region" will be used, and when referring to the Transdnistrian authorities, we will use the term "Pridnestrovian Moldavian Republic (PMR)" as shorthand to designate authorities responsible for administration in the region. The capital of the Republic of Moldova is Chisinau. The capital of PMR is Tiraspol.

There are various interpretations of the causes of this breakaway action, the analysis of which is beyond the scope of this project.² Conflict erupted in March – July 1992 between ethnic Russian separatists backed up by Russia’s troops and Moldovan government forces supported by Romania. The toll of the 1992 Transdnistria conflict resulted in the loss of 1,000 lives, and the displacement of more than 100,000 people both inside Moldova and beyond [7].

On July 21, 1992, the parties signed a Russia-mediated ceasefire agreement, known as the *Agreement on Principles of Peaceful Settlement of the Military Conflict in the Transnistrian Region of Moldova* [8]. Under Article 2 of the ceasefire agreement, the parties established the Joint Control Commission (JCC) to implement the cessation of hostilities. Initially composed of representatives of Moldova, Russia and Transdnistria, the JCC now also includes representatives of Ukraine and the OSCE.

Political settlement of the conflict over Transdnistria was also advanced through the *Permanent Conference for Political Questions in the Framework of the Negotiating Process on the Transdnistria Settlement*. This process, also known as “5+2 negotiations,” includes representatives of both sides, as well as mediators and observers in the negotiation process – the OSCE, the Russian Federation, Ukraine, the European Union and the United States. The goal of the 5+2 talks is to establish the parameters of a comprehensive settlement “based on the sovereignty and territorial integrity of the Republic of Moldova within its internationally recognized borders with a special status for Transdnistria within Moldova.” [9]

Transdnistria’s protracted conflict is considered unique among the frozen conflicts in the former Soviet Union as relations between residents of Transdnistria and the rest of Moldova are regarded as amicable. Currently, population of this region is evenly spread between three large ethnic groups: Moldovans, Russians and Ukrainians. The Russian language serves as a *lingua franca* between ethnic groups. Residents of Transdnistria can effortlessly travel within Moldovan territory and hold both Moldovan and Russian passports. Although political tensions continue on both sides of the Dniester river, the Republic of Moldova and PMR maintain dialogue on several important social, economic, and security issues.

Transdnistria was a hotbed of criminal activities throughout the 1990s. Although criminal activities in Transdnistria have receded in recent years and it is not a smugglers paradise as it was dubbed before, there remain concerns over porous borders which continue to attract smugglers and other criminal elements trading in dangerous commodities and goods.

CHALLENGES TO RADIATION SAFETY AND SECURITY IN TRANSDNIESTRIA

After the collapse of the Soviet Union, many Transdnistrian enterprises contained devices with Soviet-era legacy and disused radioactive sources that were taken out of commission and were unsuitable for further use, such as smoke detectors, liquid content gauges, and densitometers, to name a few. There was also a considerable number of radioactive sources unaccounted for, commonly referred to as orphan sources. In its statement at the 63rd IAEA General Conference in Vienna, the Republic of Moldova’s representative indicated that legacy radioactive sources on the territory of the Transdnistria region pose a major challenge to the country [10].

² Some research suggests that the discontent was sparked a year prior by new language policies adapted in Moldova which were perceived by population of Transdnistria as discriminatory. In 1989, Moldova introduced the language policy which stated that Moldovan in Latin script should be the only official language. See [6].

Tiraspol has established radiation safety measures, including regulations on radiation protection for its population³ and assigned functions of radiation control, monitoring, response and licensing to several Transdniestrian institutions.⁴ Transnistria nevertheless does not have the technical capacity to dismantle and dispose of disused radioactive sources, according to the breakaway region's former Foreign Minister Nina Shtanski. She noted that during the Soviet period, such processes were carried out at special centralized enterprises located outside of Transnistria, presumably at the disposal facility in Chisinau. There is also no prior record of a precise inventory of radioactive sources carried out in Transnistria. Moreover, Transnistria lacks technical specialists to assess and conduct an expert inventory of these sources, which further undercuts its ability to implement radiation safety and security laws and regulations. Contributing to the complexity of this situation is that from a legal standpoint, these sources and materials belong to the Republic of Moldova.

The combined lack of these technical and human resources, as well as some political and economic factors, laid the foundation for an initiative which resulted in a successful removal of many disused radioactive sources from Transnistria to safe and secure disposal at the facility near Chisinau.

REMOVAL OF DISUSED SEALED RADIOACTIVE SOURCES AND MATERIALS FROM TRANSDNIESTRIA

Between 2012 and 2019, more than 20 missions were conducted by Moldovan representatives and experts, with support by their Transdniestrian counterparts, to assess, dismantle, package, and transport nearly 2,700⁵ disused and orphaned radioactive sources from current sites in the Transnistria region to the designated storage facility of the National Radioactive Waste Management Company "Special Facilities 5101, 5102" in Chisinau. Sources and devices containing them were removed from 25 sites located in four cities in Transnistria: Rybnitsa, Tiraspol, Bender, and Dnestrovsk.⁶ While most of the sites are industrial enterprises such as factories, plants, and a power station, the removal project also included local government buildings as well as public facilities such as libraries, a cultural community centre, and medical facilities. Most of these facilities were established during the Soviet era and all but one of them are currently operational.

Removed sources belonged to IAEA category 2-5 and included a wide range of isotopes, including Co-60, Cs-137, Sr-90, Am-241, Ra-226 and other, with applications of these sources ranging from smoke detectors to industrial and research equipment. The largest number of sources removed – from 2,137 to 2,262⁷ – were low activity radioactive sources containing Pu-239.

³ For example, regulations "*On sanitary and epidemiological welfare of the population*" and "*On radiation safety of population*," and several orders by the Ministry of Health on radiation safety, including "*On hygienic requirements for ensuring radiation safety at procurement and sale of scrap*" and "*On radiation monitoring of scrap metal*."

⁴ The State Institution "Regional Center for Hygiene and Epidemiology" under the Ministry of Health, including its Laboratory of Radiological Control and the Radiation Safety Department; the Main Directorate for Emergency Situations of the Ministry of Internal Affairs; the Transdniestrian Customs Service; and the State Institution "Registration Chamber" of the Ministry of Justice.

⁵ The first number 2,241 was listed in a written response to the questionnaire submitted by a representative of the Transdniestrian Regional Centre of Hygiene and Epidemiology on 23 September 2020. Another number, 2440, was reported by PMR on their official website: <http://mfa-pmr.org/ru/node/7765>. Moldovan experts reported the removal of 2,700 in [5], pp. 4-5.

⁶ The article uses Russian transliteration for these cities' names.

⁷ There were some discrepancies in information provided by the Moldovan side and Transdniestrian side, which could not be verified through other sources.

Nearly half of units – 1052 – were removed in 2016, but the most notable and well-recorded removal mission took place in October 2019. It involved the removal of the gamma irradiator *Issledovatel-1* (Researcher-1) containing 36 Co-60 IAEA category 2 sources⁸ from the Pridnestrovskiy Research Institute for Agriculture (hereinafter, Agriculture Institute) in Tiraspol. The initial request to remove this irradiator was made in 2008, which led to the series of other removal missions, even though the removal of the irradiator was one of the last removals in this multi-year campaign. Removal missions started with smaller devices to build up a reliable mechanism for more complex removals in the future. Hence, the first shipment involved the March 2012 removal of more than 100 devices, including Sr-90 and Cs-137 sources from the Sugar and Alcohol Plant in Rybnitsa. By contrast, the *Issledovatel-1* removal took more than a decade due to the complexity of a removal procedure. According to a former official of the National Agency for Regulation of Nuclear and Radiological Activities of the Republic of Moldova (NARNRA) – the national nuclear regulator – there were several, mostly political factors, which prolonged the process. The need to secure financial support may have been another factor. Both sides also lacked prior experience in performing such a task and had to work out a lot of details before embarking on this venture. In the meantime, they started conducting removals of low-activity sources. Experience gained during these early missions was used to plan the removal of the *Issledovatel-1* irradiator. Only after 2015, did parties begin addressing the removal of the irradiator more seriously after it became clear how to carry it out and how much it would cost. This removal also required the use of additional equipment and enhanced safety and security precautions due to the nature of the sources.

In addition to playing the role of a removal process facilitator, the OSCE provided funding for most removal missions through extrabudgetary funds. Other known funders of the removals included the Swedish Radiation Safety Authority and the IAEA.

The process of removing disused sealed radioactive sources and materials from Transnistria occurred in three stages, including (1) a working level initiative, (2) a political commitment, and (3) implementation.

Stage I: Working Level Initiative

As noted earlier, the discussion of removing radioactive sources from the Transnistria region began at the end of 2008. In November 2008, the Agriculture Institute in Tiraspol and NARNRA exchanged formal letters regarding the Soviet-era gamma irradiator *Issledovatel-1*, which was no longer in use. NARNRA responded promptly and positively and suggested organizing a visit of NARNRA experts to assess the technical condition of the *Issledovatel-1* to ensure that it met transportation safety requirements. At that time, the removal of any radioactive sources from the Transnistria region would not have been possible without political backing and financial commitment. Any interaction between officials and other parties from both sides requires a notification to the Joint Control Commission.

During the next 2.5 years, NARNRA continued exchanging additional letters with the leadership of the Agriculture Institute and communicated with other Transnistrian organizations and enterprises interested in the disposal of their disused radioactive sources. In early 2011, the previous exchange of correspondence resulted in the Agriculture Institute inviting NARNRA experts to conduct a technical assessment of the *Issledovatel-1* irradiator. NARNRA then informed the Moldova's

⁸ *Issledovatel-1* was originally a Category-1 device. However, it was last loaded with Cobalt-60 (half-life of ~5.3 years) and had decayed to a Category 2 level by the time it was removed in 2019-over 6 half-lives later.

Ministry of Environment of their intent to send a delegation to Transdniestria, and both entities subsequently reached out to the OSCE office in Tiraspol, which in turn, notified Transdniestrian authorities. That pledge led to the formation of a Working Group, which included representatives from both sides, including chief negotiators, Republic of Moldova's Ministry of Agriculture, Ministry of Environment, NARNRA and the PMR Security Service, and Sanitary and Epidemiological Service. The short-lived Working Group was instrumental in drafting an agreement that would lay a foundation for the removal of radioactive sources from Transdniestria.

Stage II: Political Commitment

As working-level communications with technical details advanced through the political hierarchy of this potential arrangement, political stakeholders from both sides became more actively involved, including PMR Chief Negotiator Nina Shevchuk (formerly, Shtanski) and Moldova's Deputy Prime Minister for Reintegration Evgen Carpov, who served as a chief negotiator of this arrangement from the Moldovan side. According to comments provided by Ms. Shevchuk to the authors, the idea to include the discussion of the removal of radioactive sources in the Permanent Conference (5+2) agenda belonged to Transdniestria and was based on a necessity to find a systematic solution to the disposal of radioactive sources which was not addressed since the collapse of the USSR, when radioactive sources were disposed of at centralized storage facilities in Moldova and Ukraine. She clarified that prior to engaging with the Moldovan side, she held consultations with officials from the OSCE Mission in Chisinau to secure their assistance and financial support.

The political foundation for this project was cemented by the signing of the *Protocol Decision on the order and procedures of the removal of ionizing radiation sources located on the territory of Transnistria* (hereinafter, 2012 Protocol Decision) [11] by both sides on March 14, 2012.

According to Ms. Shevchuk, signing this protocol was the first major accomplishment in the collaboration between two sides using the "tactic of small steps." This tactic involved putting aside the conflict's intractable military and political problems to focus on social and economic issues to mutually benefit and to advance the Transdniestria settlement process [12]. In her opinion, the main reasons which contributed to the "go-ahead" decision by PMR were environmental and radiation safety, as well as establishing interaction in the sphere where lack of such interaction would pose safety and security threats. Finally, this collaboration helped build an atmosphere of trust.

The removal process was well documented and publicized in Transdniestria by various outlets, from news reports to official statements and accounts of each removal mission on PMR Foreign Ministry's official website promoting this process as a successful effort in cooperation and building trust with Chisinau. Similarly, according to a note on the removal of radioactive sources from Transnistria sent to the authors by the OSCE, the Organization supports the notion of this project as a confidence-building measure which contributes to promoting cooperation between the two sides. Moldovan authorities may share this view but express a lesser degree of fervor through official channels. For a comparison, a quick search of the Republic of Moldova Foreign Ministry's website did not reveal any reports related to the removal of radioactive sources from the Transdniestria region.

One should not disregard another factor which benefits Tiraspol in particular - and this factor is economic. By engaging in a removal process facilitated and funded by international stakeholders, Transdniestria could solve the problem of disused radioactive sources without breaking the bank, as these removals come at no cost to the operators and authorities there. Moreover, disposing of disused

sources in a safe manner would also enable Transdniestrian facilities to import new radioactive sources for future use.

Stage III: Implementation

Despite the different types of sources and facilities involved in these processes, all participating entities followed the order and procedures as prescribed in the 2012 Protocol Decision. Subsequently, all missions complied with these procedures and followed guidelines and international regulations, such as those contained in IAEA Nuclear Security Series and Safety Standards Series. Often, one mission combined removals of radioactive sources from several locations.

Removal of disused radioactive sources was a multi-layered process: each mission required several months of planning and utilized a wide range of technical competencies, varying with the type of sources to be removed. The process included the following steps: (1) an initial contact, in the form of a letter or a phone call, between a source owner/operator and the Moldovan regulator; (2) the submission of an inventory of disused radioactive sources and other hazardous materials slated for removal prepared by the source owner/operator; (3) a technical visit, which involved expert assessment of these sources and their condition by experts of NARNRA, National Radioactive Waste Management Company and other experts responsible for the removal; (4) developing a decommissioning plan and a packaging and transportation plan, and submitting them to NARNRA for approval; and (5) dismantlement, packaging, transportation, and storage of radioactive sources.

Publicity and Promotion of the Removal Missions from the Transdniestria Region

The degree to which removals of disused radioactive sources were publicized and promoted through official channels differed between Chisinau and Tiraspol. The separatist PMR government regarded this event as a successful outcome of their diplomacy, the “tactic of small steps” initiative mentioned earlier, and as a means of bolstering its legitimacy. Each removal mission was reported and documented on the PMR Ministry of Foreign Affairs official website. These reports were quite helpful in that they provided a plethora of details about various removal missions, including number and types of radioactive source, and facilities from which they were removed.

By way of comparison, such information is not readily available at the website of the Ministry of Foreign Affairs of the Republic of Moldova, which likely did not want these measures—undertaken for safety and security reasons—to boost the legitimacy of the separatist authorities. Also, the removal of radioactive sources from what is considered by Chisinau as uncontrolled territory may be perceived as a potential radiation safety threat by the population of Chisinau-controlled territories. According to Moldovan experts, these removals were not widely publicized for security reasons and not to impede the process.

The OSCE Mission in Moldova, which supported and facilitated these processes, promoted this cooperation as a successful effort in the Transdniestria settlement process and as a step in building confidence between people and communities on both banks of the Nistru/Dniestr river.

As for media coverage, removals of radioactive sources were covered equally by Moldovan and Transdniestrian media, usually after a removal took place to preserve operational security.

LESSONS LEARNED AND CONCLUSION

The process of removing disused radioactive sources from the contested territory in the Republic of Moldova has demonstrated that cooperation between the two sides of the ongoing conflict is possible.

As a result, other countries addressing similar challenges within contested territories with radioactive materials can find useful lessons drawn from this experience.

(1) One of the tactics that made this endeavour successful was that both sides of the Transdnistria conflict used what they called a pragmatic approach to the removal of sources. While the ultimate goal was to secure and remove the *Issledovatel-1* irradiator with category 2 sources (Co-60), initial removals started with smaller and easier-to-handle radioactive sources. This allowed the parties to test the waters and build experience and mutual trust for the removal of larger, higher activity sources.

(2) Finding commonalities between both sides' underlying motivations to embark on the initiative is another important factor of success of the initiative. Both the Republic of Moldova and Transdnistria shared concerns about risks and threats posed by radioactive materials out of effective regulatory control. Transdnistrian operators are also dependent on NARNRA's authorizations to import new radioactive sources. Consequently, by properly disposing of disused radioactive sources, these operators will have a better chance for a continuous supply of radioactive sources.

There exist economic incentives to undertake the effort: the Republic of Moldova lacked adequate funding to support such removals whereas Transdnistria, which initiated the process, lacked sufficient economic and human resources or technical capabilities to handle radioactive sources disposal itself.

The cooperation between Chisinau and Tiraspol was also politically beneficial to both sides. Chisinau met its legal obligation to account for and secure all radioactive sources on its territory that includes the Transdnistria region (an important contribution to the implementation of the UN Security Council Resolution 1540) and undertook confidence-building efforts with Tiraspol. Tiraspol, in turn, clearly recognized the removal effort as a way of boosting its own legitimacy and contributing to a potential settlement of the conflict. According to comments provided by Ms. Shevchuk to the authors, the separatist republic saw the removals as part of its "tactic of small steps" believing that interaction on such a technical and relatively apolitical issue will help build trust that will contribute to tackling more politically challenging concerns.

(3) The financial support provided by international stakeholders, initially by OSCE and later by SSM and IAEA (with funds offered by one of its member states), ensured political support needed to undertake the removals and helped to bring political stakeholders to the negotiating table. The OSCE has not officially disclosed which countries ultimately financed the removal operation in Transdnistria. More transparent information about donor countries would help other countries facing similar challenges to approach these donors directly with requests for possible funding.

(4) Leveraging existing professional relationships and building confidence between experts on both sides facilitated cooperation. Some experts in Transdnistria may have been colleagues and friends with their Moldovan counterparts when Moldova was still a part of the Soviet Union. These past interactions and contacts could be valuable assets in setting up and implementing a process between two conflicting sides at the working level.

Prior to the removals, Moldovan experts were invited to Transdnistria to address technical problems stemming from radiological incidents in 2003 and 2004.⁹ Furthermore, the establishment of

⁹ The 2003 case occurred at a metallurgical plant, JSC Moldova Steel Works, when radioactive sources containing Cs-137 were melted causing radiation contamination and another case in 2004 when radioactive pipes were imported from Ukraine.

NARNRA in 2008 as an independent body insulated from politics also contributed to the removal process. According to comments provided by the former NARNRA director to the authors, this made it easier for Transdnestrian operators/source owners to reach out directly to the agency with the initial request for the removal of the *Issledovatel-1* device. Another example of cooperation between Moldova and the Transdnestria region is a 2018 training course to the staff of the metallurgical plant “JSC Moldova Steel Works” on *Nuclear and Radiological Security and Nonproliferation Challenges*, delivered by NARNRA experts. The course helped this Transdnestrian company meet authorization requirements by the Republic of Moldova, as Moldovan authorities do not recognize any PMR-issues certifications and documents, and further enhanced trust and confidence between sides in a conflict, especially when other channels of communication are limited or closed. This may be suited for countries dealing with an active military conflict on their territories. Such training could involve different stakeholders and, if necessary, could be organized and hosted by a party from a third country.

(5) Another important lesson is that all removal procedures adhered to IAEA and other international guidelines on the safety and security of radioactive materials, thus allowing for the execution of the removal operation in a safe and secure manner. Furthermore, an experienced regulator, NARNRA, issued necessary permits and authorizations, and its qualified technical experts carried out the removals.

(6) The involvement of an international facilitator – the OSCE – throughout the entire process contributed to the success of the removals of radioactive sources and materials from Transdnestria. The OSCE helped ensure both sides that the other side would hew to its commitments and limited politicisation. The OSCE’s contributions to reduce radiological risk for both sides also resulted in building broader confidence and advancing the Transdnestria settlement process. As noted earlier, similar challenges in securing nuclear and radiological materials are present in several other former Soviet countries, and the OSCE, which has offices and personnel on the ground, appears well positioned to serve as a supporter and interlocutor in some of those other cases as well.

The technical cooperation of Moldova and Transdnestria provides a successful example of how internal (or international) conflicts between contending authorities can be set aside in the mutual interest for protecting people from the risks posed by disused and unregulated nuclear and other radioactive materials. It is a lesson worth studying around the world and it can be applied not only to radioactive materials, but also to other dangerous materials, such as ammunition and other commodities, which are no longer in use but can pose grave dangers and threats if neglected.

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