Radiological Security in Contested Territories:

The Successful Case of the Removal of Disused Radioactive Sources and Materials from Transdniestria

By Margarita Kalinina-Pohl, Artem Lazarev, Miles Pomper, George Moore, and Edward Kendall

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The views, judgments, and conclusions in this report are the sole representations of the authors and do not necessarily represent either the official position or policy or bear the endorsement of CNS or the Middlebury Institute of International Studies at Monterey.

Cover image: Experts from the National Agency for Regulation of Nuclear and Radiological Activities of the Republic of Moldova (NARNRA) verify the submitted inventory of sources at the JSC Moldova Steel Works in November 2014. Courtesy of Ionel Balan.

Contents

Preface

Radioactive materials, such as cesium-137 and cobalt-60, are located in more than 100 countries and in every region of the world. They are used widely for medical, scientific, and industrial purposes—but can also be used maliciously as key ingredients in radiological dispersal devices (RDDs), the most notorious type of which is known as a "dirty bomb" which disperses radiological material using explosives.

Though responsibility for the development and enforcement of regulations pertaining to the safety, security, and full cycle management of radioactive sources rests with state authorities, thousands of radioactive sources today exist in areas without the clear presence of a state. Such areas are often characterized by conflict and rampant criminal activity as a result of weak or nonexistent governance.

Radioactive material located in these contested or poorly governed territories poses a serious risk for regional and global security, as they could be trafficked illegally and used in an RDD or for other malicious purposes anywhere in the world.

International and regional organizations face a range of political and legal challenges in helping secure radioactive materials in contested territories since the sources in question are often found beyond the de facto or de jure control of UN-recognized states. Addressing the safety and security of these materials requires stakeholders to navigate uncharted legal issues and play creative roles to secure or transport these materials into safer areas.

This report covers one of the few success stories involving the removal or elimination of dangerous radioactive sources from a contested territory. It describes and assesses the lessons learned from the Republic of Moldova's removal of approximately 2,700 disused radioactive sources and materials from the breakaway region of Transdniestria. Though these materials were located in a territory that is not de facto governed by an International Atomic Energy Agency member state, creative diplomacy by the Republic of Moldova, the Pridnestrovian Moldovan Republic (the unrecognized authorities in Transdniestria), the Organization for Security and Cooperation in Europe (OSCE), and other key stakeholders contributed to the success of this removal operation. The report describes these diplomatic efforts and analyzes the significant political, legal, and technical factors that contributed to the success of this multiyear mission. While recognizing that each country and conflict is unique, we hope that this case study can serve as a successful model of cooperation and confidence building for reducing radiological risks in contested territories around the world.

The program described in this paper may have particular implications for the current conflict in Ukraine. Even before the Russian invasion, the regulator in Ukraine reported that their control over many radioactive sources in conflict areas of eastern Ukraine and Crimea had been lost and that sources could be out of regulatory control. The Russian invasion has raised the probability of such a loss of control and has broadened the geographic area of concern in Ukraine.

In the postwar period, radiological control will need to be reestablished over radioactive materials in the conflict areas in Ukraine even though the controlling parties in these areas may still be hostile toward each other. The Transdniestria model may provide some guidance as to how organizations such as the OSCE may help to establish cooperation among the stakeholders in the region and effect return of control either by reinstating control and/or removing radioactive materials from areas where the establishment of permanent control is unlikely.

Executive Summary

The governance of radioactive materials in "contested territories"[1] has proved highly challenging for local, state, regional, and international authorities. This is especially true for countries of the former Soviet Union, many of which have experienced conflict, including ethnic strife and armed clashes, but still retain large stockpiles of radioactive materials. There is often no clear path for security, accounting, or removal of these radioactive materials from contested territories.

There are, however, examples of successful cooperation between former Soviet republics and their breakaway regions to address radiological risks. One such success story is the Republic of Moldova's[2] removal of disused radioactive sources and material from the disputed Transdniestrian region. Since 2012, the Republic of Moldova has conducted more than 20 missions to remove approximately 2,700 disused radioactive sources from nearly two dozen sites in Transdniestria. Almost all known radioactive sources have now been securely removed from this breakaway region. The Organization for Security and Cooperation in Europe (OSCE) facilitated these removals to ensure a smooth transfer of these materials to a secure disposal and storage facility near Moldova's capital, Chisinau.

This report analyzes a wide range of political, technical, and other factors that contributed to the success of this removal operation. It also derives several lessons that other governments, practitioners, and international organizations may find useful as they address radiological security challenges in other contested territories:

1. Start small with technical matters at a working level and then bring in leading political authorities on both sides of the conflict to sustain the effort.
2. Take advantage of economic, security, and political/diplomatic incentives and cooperate to make the outcome a win for both sides.

[1] In this report, the authors use the term "contested territories" as defined by Leon Ratz et al.: "geographical areas, the political jurisdiction of which is contested between two or more parties." See L. Ratz, J. Bufford, C. Gustavson, I. Iliopulos, and L. Rockwood, "Radioactive Sources in Contested Spaces: Assessing the Political and Legal Dimensions of International Response to Radioactive Sources in Areas with Weak or Non-Existent Regulatory Controls," paper presented at the 60th Annual Meeting of the Institute of Nuclear Materials Management, Palm Springs, CA, July 14-18, 2019. Similar safety, security, and end-of-life management challenges can be found in geographic territories without any clear governance structures, as well as territories with high rates of crime, corruption, and conflict.

[2] "Republic of Moldova" is generally used by the authors when they wish to describe actions taken by the government of the Republic of Moldova and to distinguish the government from the geographical territory of Moldova, the size of which is disputed by several parties.

3. Leverage pre-conflict professional relationships between experts on the two sides to facilitate cooperation, through activities such as joint training or technical consultations if such arrangements are feasible.
4. Secure financial assistance from external entities for removals of disused radioactive sources and materials, if possible, to avoid either side citing a lack of funding as a reason not to engage in the removal process.
5. Apply international (for example, International Atomic Energy Agency) standards and the national regulator's expertise in implementing technical guidance and requirements.
6. Utilize a respected and independent international facilitator. In the case of Moldova, the OSCE played this role and assisted both sides in establishing confidence-building measures and depoliticizing contentious issues. Although the radiological security activities carried out by the OSCE were part of a broader agenda, its local presence in Chisinau and in Tiraspol, the capitals of Moldova and Transdniestria respectively, positioned it well to successfully serve as a supporter and interlocutor throughout the operation.

Introduction

According to the International Atomic Energy Agency (IAEA), the responsibility for nuclear security primarily rests with states. These responsibilities, which encompass the security of nuclear and other radioactive material and associated facilities and activities, include ensuring the security of such material in use, storage, or transport; preventing illicit trafficking and the inadvertent movement of such material; and responding to a nuclear security event.[3] However, there is a lack of clarity about how to carry out these responsibilities when it comes to "contested territories"—that is, areas where political authority is unclear because of "frozen" or active conflicts aggravated by territorial, religious, or political disputes; separatist movements; illegal annexations; or other animosities between neighboring states or ethnic or political groups within a state.

These territories can be ungoverned or be administered by quasi-state authorities, which, while recognized by a few states, are deemed illegitimate by many nations, and are not formally recognized by the international community. Such contested territories pose a wide array of challenges and threats due to potentially nonexistent or weak regulatory mechanisms. Existing with the trappings of a state but without the international responsibilities of the typical state, they can serve as fertile ground for criminal activities, such as illicit trafficking in arms, illegal commodities, and nuclear and radioactive materials. The materials in the latter category create challenges in contested areas of the former Soviet Union, such as Abkhazia, South Ossetia, Nagorno-Karabakh, Transdniestria, and most recently, the Donbas region of eastern Ukraine.

State authorities and international experts worry about the presence of Soviet-era legacy nuclear and radioactive materials in these contested territories. Of particular concern are radioactive materials contained in sealed sources due to their abundance, wide application, and lax security arrangements. After the collapse of the Soviet Union, many medical, commercial, military, and other devices containing radioactive sources went missing or were abandoned or stolen. From 1993 to 1997 in Moldova alone, radiological incidents involving cesium-137, plutonium-239, and cobalt-60 sources were documented in factories, border checkpoints and even supermarkets.[4] The most notable cases involving nuclear and other radioactive material—most commonly, highly enriched uranium (HEU) and cesium-137—took place in or near disputed

[3] IAEA, "Nuclear Security Recommendations on Radioactive Material and Associated Facilities," IAEA Nuclear Security Series No. 14, 2011, www-pub.iaea.org/MTCD/Publications/PDF/Pub1487_web.pdf.
[4] I. Bahnarel "The Prevention Of The Local Nuclear Accidents In the Republic Of Moldova," IAEA-CN-70/88, in IAEA, *Safety of radiation sources and security of radioactive materials* (contributed papers for a conference held in Dijon, France, September 14-18, 1998), IAEA-TEC-DC-1045, September 1998, pp. 177-80, https://www-pub.iaea.org/MTCD/Publications/PDF/te_1045_prn.pdf.

territories or involved material that allegedly came from these territories. For example, in 2015, three men were arrested in Moldova for attempting to sell cesium to an undercover police officer "posing as a middleman for the Islamic State group."[5] Prior to that, national authorities made several seizures of HEU on the Bulgaria–Romania border in 1999; in Georgia in 2003, 2006, and 2010; and in Moldova in 2011.[6] The 2011 Moldova case was especially emblematic of the relevance of disputed territories, as it allegedly involved the attempted sale of uranium-235 between a Russian citizen living in the Transdniestria region and an intermediary for a buyer in Sudan.[7] Forensic analysis of material intercepted in this case was, troublingly, almost identical to that in the 1999 Bulgaria–Romania incident and a geographically disparate 2001 French case, indicating the scope, persistence, and depth of this issue.[8]

Many post-Soviet countries with breakaway regions—Azerbaijan, Georgia, Moldova, and Ukraine—have made significant progress, with the help of donor countries, in securing and protecting nuclear and radioactive materials on their territories. However, these countries' authorities are largely unable to provide security or accounting for such materials in contested or breakaway regions of their territory. The absence or insufficiency of nuclear and radiological regulators, the shortage of technical equipment and technical capacities in these contested territories, and the lack of dialogue between the state authorities and the authorities associated with the contested territories make the task of securing and accounting for radioactive materials extremely difficult.

There are, however, examples of successful cooperation between former Soviet republics and unrecognized authorities in their contested territories. One such success story is the Republic of Moldova's removal of disused radioactive sources and materials from the Transdniestria region. Since 2012, the Republic of Moldova has conducted more than 20 missions to remove approximately 2,700 disused sealed radioactive sources and

[5] Kelsey Davenport, "Smugglers Arrested in Moldova," *Arms Control Today,* November 2015, www.armscontrol.org/act/2015-11/news-briefs/smugglers-arrested-moldova.
[6] Lyudmila Zaitseva and Friedrich Steinhäusler, "Nuclear Trafficking Issues in the Black Sea Region," EU Non-Proliferation Consortium Non-Proliferation Papers No. 39, April 2014, www.sipri.org/sites/default/files/EUNPC_no-39.pdf.
[7] Petru Urasche, "Dosarul nr. 4-1re-172/2014," Supreme Court of Justice of the Republic of Moldova, May 2014, http://jurisprudenta.csj.md/search_plen_penal.php?id=395.
[8] S. Baude et al., "The French Response in Cases of Illicit Nuclear Trafficking: Lessons from a Real Case," IAEA-CN-154/062, in IAEA, Illicit Nuclear Trafficking: Collective Experience and the Way Forward, proceedings of an international conference, Edinburgh, November 19-22, 2007, https://www-pub.iaea.org/MTCD/publications/PDF/Pub1316_web.pdf; S. Niemeyer and I. Hutcheon, "Forensic Analysis of Smuggled High Enriched Uranium Interdicted in Bulgaria," IAEA-CN-98/16, in *Advances in Destructive and Non-Destructive Analysis for Environmental Monitoring and Nuclear Forensics,* proceedings of an international conference, Karlsruhe, Germany, October 21-23, 2002, https://www-pub.iaea.org/MTCD/publications/PDF/Pub1169_web.pdf; Michael J. Cristo et al., "Nuclear Forensic Science: Analysis of Nuclear Material Out of Regulatory Control," *Annual Review of Earth and Planetary Sciences,* Vol. 44 (2016), https://www.annualreviews.org/doi/10.1146/annurev-earth-060115-012309.

devices (primarily smoke detectors) containing radioactive materials, including radioactive sources out of regulatory control and sources previously unaccounted for (commonly referred to as "orphan sources"), from 25 sites in Transdniestria.[9] The Organization for Security and Cooperation 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.

This report analyzes a wide range of political, technical, and other factors that have contributed to the success of this initiative. The report starts with a general overview of the history of the Transdniestria conflict and the current status of the contested territory. The authors then seek to identify the legal and regulatory structure in the Transdniestria region that has enabled its unrecognized authorities to oversee activities involving radioactive sources and materials. Such activities include issuing licenses, controlling, and monitoring radioactive sources, and following guidelines for the management of disused radioactive sources. The report then proceeds with a summary of removal cases, including types of sources, their quantity, and their date of removal. In writing this section of the report, the authors reviewed channels of communication between various stakeholders as they prepared for, launched, and implemented the removal initiative. The penultimate section of the report includes a summary of technical details concerning identification, packaging, transportation, and disposal of radioactive sources and materials from a particular facility housing a high-activity radioactive source.

The paper concludes with an analysis of lessons from this removal process. The report also devotes a special appendix (Appendix I) to describing all the entities involved in this process, as it was a multilateral effort involving international, national, and industry stakeholders—each with a special function and role to play at various stages of the removal processes. The authors believe that the Republic of Moldova's experience with the removal of disused radioactive sources and materials from the Transdniestria region can serve as a successful model of cooperation and confidence-building measures for other countries grappling with the issue of radioactive materials in contested spaces. While recognizing that each country and conflict is unique, the authors believe that such lessons can be adapted and applied to their own national mechanisms to secure radioactive and other dangerous material in contested territories.

[9] I. Gisca, "Technical proposal (Rev. 1): Dismantling and transportation of Disused Sealed Radioactive Sources in the Republic of Moldova," Platform for the Management of External Assistance for the Government of Moldova, June 21, 2019, pp. 4-5, http://amp.gov.md/contentrepository/downloadFile.do?uuid=f3351cae-b664-40e4-8acb-b3e435fa4b9f.

History of the Transdniestria Conflict

MOLDOVA/TRANSDNIESTRIA MAP

To appreciate the multidimensional complexity of the removal of disused sealed radioactive sources and materials from Transdniestria, one needs to understand the recent history of the conflict over this separatist region.

This report uses the commonly accepted definition[10] of Transdniestria as a separatist enclave or region in Moldova located on the eastern bank of the Dniester River. Other sources offer a less restrained description; one article called it "an unrecognized quasi-state slivered between Moldova and Ukraine and marketed by its tourist board as the place where the USSR never ended. Transdniestria is characterized by the presence of Russian peacekeepers, brutalist statues, streets named after communist heroes, and a steady stream of sightseers snapping shots of them all."[11] Regardless of how one characterizes the region, its history, which has included invasions by the Ottoman Empire, czarist Russia, Romania, and then the Soviet Union, is neither simple nor peaceful.

In the late 1980s, political instability foreshadowing the eventual collapse of the USSR was beginning to impact the constituent republics of the Soviet Union, including the Moldavian Soviet Socialist Republic (MSSR), which would later become the modern-day Republic of Moldova.[12] For various historical reasons, during the Soviet era, Transdniestria enjoyed a position of privilege in Soviet political life, with the MSSR's leaders often coming from Transdniestria's largest city, Tiraspol, rather than the de jure capital, Chisinau, to the west.[13] However, the strong forces overtaking the Soviet Union in the late 1980s and early 1990s would not only quickly turn the MSSR into a fully independent republic, but would also increasingly dismantle Transdniestria's privileged position in Moldovan political life. As the Soviet Union began to crumble, the center of political life in Moldova began to shift from Tiraspol to

[10] Language is intensely political in this part of the world; even the name one uses to describe this contested territory is divisive. Commonly used names include the "Transnistria region," "Transdniestria," "Pridnestrovie," and "Pridnestrovskaia Moldavskaia Respublika" ("Pridnestrovian Moldavian Republic," or "PMR"). Such diversity in naming often reflects the political sensibilities of the speaker and their views on the question of statehood/recognition for the disputed territory. For instance, official government documents authored by the government of the Republic of Moldova often refer to the disputed territory as the "Transnistria region," and the government of that region as the "unconstitutional authorities on the left bank of the Nistru River." Using this specific language, the Moldovan government avoids implying the separateness of the contested territory from government-controlled territory. Additionally, the Moldovan government chooses to derive the English translation of geographic names, such as the Nistru River, directly from their Romanian language names (Ro: râul Nistru). In contrast, the de facto authorities in Transdniestria will refer to their government as the "PMR" and its territory as "Pridnestrovie." The PMR's use of this language is meant to imply the contested territory's independence from the central government. The PMR also chooses to derive the English translation of many geographic names from transliterations of their names in Russian rather than from Romanian translations, and thus instead of calling the river separating the two sides the Nistru River, as the Moldovan government does, would instead call this river the Dniestr or Dniester River deriving from the Russian name (Ru: река Днестр). Without taking a position on the recognition of this disputed territory, the report will use the OSCE term "Transdniestria" to refer to the disputed territory itself, "Dniester River" to refer to the river separating the sides, and "PMR" to refer to the de facto authorities of Transdniestria. The capital of the Republic of Moldova is Chisinau. The self-proclaimed capital of the PMR is Tiraspol.

[11] Hannah Lucinda Smith, "The Shady Currency Boom on the Post-Soviet Frontier," *Wired,* October 29, 2019, www.wired.com/story/cryptocurrency-boom-post-soviet-frontier/.

[12] The borders of the former MSSR are essentially identical to those of the modern-day Republic of Moldova.

[13] Charles King, *The Moldovans: Romania, Russia, and the Politics of Culture* (Stanford, CA: Hoover Inst Press, 2000), p. 142.

Chisinau. In Chisinau, the local elites who were often denied authority under the former Soviet system began to consolidate power, often utilizing language, culture, and history to argue for the new republic's right to statehood outside the Soviet Union and for the Chisinau elite to have the main role in leading this new republic.[14] This increasingly led to conflict with the old center of power in Tiraspol, which moved to oppose the MSSR's exit from the Soviet Union and later, when this seemed inevitable, argued for the Transdniestrian population's separateness and right to self-determination in order to mount a competing claim for authority in the Transdniestria region (often using historical and linguistic arguments).[15] Peaceful confrontation through competing laws and referenda eventually gave way to direct armed conflict, which began as a series of blockades and armed skirmishes throughout 1990, with neighboring towns, cities, and districts often declaring competing allegiances to either Chisinau or Tiraspol.[16] This was ultimately followed by the declaration of independence of the new Republic of Moldova (encompassing the territory of Transdniestria) from the USSR in August 1991, and a counter-declaration of independence of the PMR from the Republic of Moldova in December 1991.[17] In 1992, fighting intensified greatly as ill-equipped police forces and Ministry of the Interior troops loyal to the Republic of Moldova faced off with increasingly well-armed PMR forces (who often received materials or gained defecting officers from the Soviet 14th Army, which had been stationed in Transdniestria).[18] Bridges were mined, air and artillery bombardment became more common, and house-to-house fighting occurred in major cities.[19]

Conflict erupted into full-fledged war from February to July 1992 between Republic of Moldova forces and PMR separatists who were eventually backed in full by the remnants of the 14th Soviet Army at Moscow's direction.[20] By 1992, the Transdniestria conflict had resulted in the loss of 1,000 lives and

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[14] King, The Moldovans, p. 160.
[15] The language issue, while in many ways artificial in a society where people on both sides often spoke three languages interchangeably, rose to almost mythical status in the Transdniestria conflict.
[16] Rebecca Haynes, "Moldova, Bessarabia, Transnistria" Occasional Papers in Romanian Studies, No. 3 (2003), p. 192, School of Slavonic and East European Studies University College London, https://discovery.ucl.ac.uk/id/eprint/10078368/3/SSEES0027.pdf.
[17] King, *The Moldovans,* p. 190.
[18] Thomas de Waal, *Uncertain Ground: Engaging with Europe's De Facto States and Breakaway Territories* (Washington, DC: Carnegie Endowment for International Peace, 2018), p. 39; Florin Abraham, *Romania Since the Second World War* (New York: Bloomsbury Academic, 2017), p. 209.
[19] King, *The Moldovans,* p. 194.
[20] The endurance of the Transdniestrian issue on the Russian agenda was initially related to championing of the conflict by nationalists in the incipient Russian Duma, who, among other things, claimed a genocide of Russian speakers by the Republic of Moldova. The issue gained further prominence in Russian politics as Alexander Lebed, the commander of the Soviet 14th Army's assault against Republic of Moldova, later had a prominent political career in Russia. Current Russia-PMR relations are likely driven by pragmatic geostrategic considerations, and the relationship between Moscow and Tiraspol is more complicated than either government often indicates, sometimes bordering on adversarial (even if on the surface Tiraspol casts itself as an outpost of "the Russian world").

the displacement of more than 100,000 people, including 56,000 who fled to Ukraine and another 51,000 individuals displaced within Moldova.[21]

On July 21, 1992, the Republic of Moldova and Russia signed the first durable cease-fire agreement of the conflict, known as the Agreement on Principles of Peaceful Settlement of the Armed Conflict in the Dniester Region of the Republic of Moldova.[22] Under Article 2 of the agreement, the parties established the Joint Control Commission (JCC) to implement the cessation of hostilities. Initially composed of representatives of the Republic of Moldova, Russia, and the PMR, the JCC now also includes representatives of Ukraine and the OSCE.

Political settlement of the conflict over Transdniestria was also advanced through the Permanent Conference for Political Questions in the Framework of the Negotiating Process on the Transdniestria Settlement. The conference produced an ongoing diplomatic process, also known as "5+2" negotiations, which includes representatives of both sides, as well as mediators and observers in the negotiation process—the Republic of Moldova, the PMR, the OSCE, Russia, 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 Transdniestria within Moldova."[23]

Transdniestria's protracted conflict is considered unique among the so-called frozen conflicts in the former Soviet Union. Many of the other conflicts that emerged during or after the collapse of the USSR stemmed from grassroots ethnic tensions. In the Transdniestria conflict, the conflict emerged in a top-down manner, primarily as a conflict between the elites of the PMR and the Republic of Moldova and was justified to the broader population with obscure academic arguments of history and linguistics. While tensions remain between the governments in Tiraspol and Chisinau, people-to-people relations between residents of Transdniestria and Moldova proper are regarded as amicable. Currently, the population of Transdniestria is evenly divided among three large ethnic groups: Russians, Ukrainians, and Moldovans. The Russian language serves as a lingua franca among ethnic groups. Residents of Transdniestria can effortlessly travel within Republic of Moldova territory and receive medical treatment and other services. Laws of the Republic of Moldova and of

[21] University of Central Arkansas, Dynamic Analysis of Dispute Management Project, "Moldova/Transnistria (1990-Present)," n.d., https://uca.edu/politicalscience/dadm-project/europerussiacentral-asia-region/moldovatrans-dniester-1990-present/.
[22] UN Security Council, "Note Verbale Dated 31 July 1992 from the Permanent Mission of Moldova to the United Nations Addressed to the Secretary-General," S/24369*, August 6, 1992, https://peacemaker.un.org/sites/peacemaker.un.org/files/MD%20RU_920000_AgreementPrinciplesPpeacefulSettlementDniestrConflict.pdf.
[23] OSCE, "Press releases and statements related to the 5+2 negotiations on the Transdniestrian settlement process," n.d., www.osce.org/mission-to-moldova/119488.

Russia do not proscribe residents of Transdniestria from concurrently holding Republic of Moldova, PMR, and Russian passports. Tensions usually arise around elections, voting, and referenda, but they are mainly exhibited in the form of verbal attacks[24] and mutual accusations from Chisinau and Tiraspol rather than acts of armed violence.

There have been no significant violent military incidents between Republic of Moldova and PMR forces since 1992. Nonetheless, Russian forces have remained in Transdniestria. The continuing Russian military presence in the region remains a contentious issue. In addition to an average of 400 Russian peacekeepers authorized by the JCC,[25] Russia deploys about 1,200-1,500 unauthorized troops[26] of its former 14th Soviet Army (now called the Operational Group of Russian Forces), ostensibly to guard former Soviet military equipment at the Cobasna military dump. Many on the Republic of Moldova side view these troops as illegally stationed in Transdniestria in violation of numerous agreements to remove them, including the 1999 Istanbul Summit Decision.[27] Even before the Russian invasion of Ukraine, there had been a considerable increase since 2017 in Russian military activity in the region. In 2018, Russian troops held a military exercise jointly with PMR troops in which they simulated an attack across the Dniester River, which serves as the de facto border with the Republic of Moldova controlled territory.[28]

Promo-LEX, a Moldovan nongovernmental organization that works on human rights, calls the Russian peacekeeping operation in Transdniestria "inappropriate, inefficient, and dangerous to people" and reports several abuses by peacekeeping forces in the Security Zone,[29] a buffer zone between PMR and Republic of Moldova controlled territory. In turn, PMR officials argue the Russian peacekeeping force is vital to preventing the Republic of Moldova from invading Transdniestria and accuse the government of the Republic of Moldova of various political

[24] Helena Rutovuori-Apunen, *Power and Conflict in Russia's Borderland: The Post-Soviet Geopolitics of Dispute Resolution* (London: I. B. Tauris, 2019).
[25] Irina Tabaranu, "What is the security zone of the Republic of Moldova and what are the rules of the game when you are there" [in Romanian], Zona de Securitate, October 28, 2020, https://zonadesecuritate.md/ce-este-zona-de-securitate-a-republicii-moldova-si-care-sunt-regulile-de-joc-odata-ce-te-afli-acolo-harta/.
[26] Estimates of Russian troops vary from 1,200 to 1,500 in various sources.
[27] Cristi Vlas, "Operative Group of Russian Troops conducted another shooting exercise in Transnistria," February 2, 2018, Moldova.org; Kennan Institute "Occasional Paper #284: The 1999 OSCE Istanbul Summit Decision on Moldova and Georgia: Prospects for Implementation," Woodrow Wilson International Center for Scholars, October 24, 2002, https://www.wilsoncenter.org/sites/default/files/media/documents/publication/op284_1999_osce_instanbul_summit_conference_2002.pdf.
[28] Madalin Necsutu, "Russian Military Games on Dniester Anger Moldova," *Balkan Insight,* August 15, 2018, https://balkaninsight.com/2018/08/15/russian-soldiers-forced-the-dniester-river-from-transnistria-08-15-2018/.
[29] Maria Dulgher, "Promo-LEX: 'The peacekeeping operation in Transnistria continues to be inappropriate, inefficient and dangerous,'" Moldova.org, August 15, 2018, www.moldova.org/en/promo-lex-the-peacekeeping-operation-in-transnistria-continues-to-be-inappropriate-inefficient-and-dangerous-for-people/.

statements and actions that they view as provocative and undermining the peacebuilding process and other initiatives.[30] Despite these political frictions, which are evident in statements by both sides, the Republic of Moldova and PMR maintain dialogue on several important social, economic, and security issues.

Experts point out that territories under the control of separatist groups or governments deemed illegitimate by the international community can serve as safe havens to various criminal groups involved in transnational crimes such as money laundering and illicit trafficking in arms and dangerous materials.[31] Contested territories face a common challenge—a lack of regulatory systems and enforcement mechanisms—that creates "ripe conditions for transnational organized crime and terrorist activity to operate and to grow" and poses threats to regional and international security.[32]

Transdniestria is not an exception, and it was a hotbed of criminal activities throughout the 1990s. Although criminal activities in Transdniestria have receded in recent years and the region is no longer a "smuggler's paradise," there remain concerns over porous borders, corrupt officials, and hundreds of miles of uncontrolled frontiers, which continue to attract smugglers and other criminal elements engaging in trade-based crime.

[30] For specific examples of such statements, see the "Statements and Comments" section of the PMR Ministry of Foreign Affairs website, http://mfa-pmr.org/en/statements?page=1.
[31] In addition to Ratz et al., "Radioactive Sources in Contested Spaces," see, for example, Alexander Kupatadze, "Radiological Smuggling and Uncontrolled Territories: The Case Of Georgia," *Global Crime,* Vol. 8, No. 1 (2007), pp. 40-57, https://www.tandfonline.com/doi/abs/10.1080/17440570601121852 ; Alexandre Kukhianidze, Alexander Kupatadze, and Roman Gotsiridze, "Smuggling Through Abkhazia and Tskhinvali Region of Georgia," Transnational Crime and Corruption Center (Georgia Office), 2004, https://traccc.schar.gmu.edu/wp-content/uploads/2020/09/Kukhianidze_Kupatadze_Smuggling_Georgia_Eng._2004.pdf; and Louise I. Shelley, "Trafficking in Nuclear Materials: Criminals and Terrorists," *Global Crime,* Vol. 7, No. 3-4 (2006), pp. 544-560, https://www.tandfonline.com/doi/full/10.1080/17440570601073335.
[32] Ratz et al., "Radioactive Sources in Contested Spaces."

Radiation Safety and Security in Transdniestria

After the collapse of the Soviet Union, many Transdniestrian commercial and industrial enterprises contained Soviet-era legacy devices[33] and disused radioactive sources that were taken out of commission and were unsuitable for further use. There was also a considerable number of radioactive sources over which the PMR government had lost control or never had it, commonly referred to as "orphan" sources. Disposition of these sources in Transdniestria was impossible, as the breakaway region lacked the required technical capacities and facilities.

The PMR's inability to manage the full life cycle of dangerous materials (such as radioactive materials contained in sealed radioactive sources), especially the lack of proper storage and disposal capacities, increased the risk of their misuse. These materials could have been lost or stolen and consequently ended up in the hands of individuals or groups with malicious intent. To assess the probabilities of such risks, one needs to understand the capabilities of regional regulatory authorities to oversee the management of radioactive sources and materials.

The PMR has established radiation safety measures, including regulations on radiation protection for its population. They are reflected in legislation "On sanitary and epidemiological welfare of the population," "On radiation safety of the population," and on other issues, and in several orders by the PMR Ministry of Health on radiation safety, including one "On hygienic requirements for ensuring radiation safety in procurement and sale of scrap." A notable implementing order by the PMR Ministry of Health covers radiation monitoring of scrap metal. This order establishes general procedures for the organization and radiation monitoring of scrap metal and outlines step-by-step instructions intended for use by authorities of the state sanitary and epidemiological service, radiation monitoring laboratories, and authorized services at organizations engaged in the procurement, processing, and sale of scrap metal. The order lists devices using specific radionuclides that may end up in scrap metal, including smoke detectors, level gauges, densitometers, flaw detectors, and ice-level gauges (sensors), as well as contaminated containers used for storage and transportation of radioactive sources cobalt-60, strontium-90, cesium-137, thulium-170, iridium-192, plutonium-239, and

[33] Legacy sources are defined as "disused or abandoned sealed sources which pre-date effective regulatory requirements and which may not have been disposed of, either at all or in an appropriate manner" in Mark Alexander and Allan Murray, "Managing the Risks of Legacy Radioactive Sources from a Security Perspective," International Radiation Protection Association (IRPA) Conference, Buenos Aires, Argentina, October 2008, https://inis.iaea.org/collection/NCLCollectionStore/_Public/40/108/40108766.pdf

americium-241. The presence of this stand alone document in the PMR legislation on radiation monitoring of scrap metal may be indicative of the importance of addressing the problem of accidental contamination of facilities that process scrap metal.

In the early 2000s, there were several cases of scrap metal contamination in Transdniestria, mainly at the metallurgical plant JSC Moldova Steel Works in Rybnitsa, about 100 kilometers from Tiraspol. In 2003, the OSCE organized a fact-finding mission to assess the radiological situation at the plant.[34] This action was prompted by three melting accidents involving radioactive sources containing cobalt-60 and cesium-137 that took place at this plant over a three-year period.[35]

Contaminated metal with cobalt-60 and cesium-137 slag at the JSC Moldova Steel Works in Rybnitsa, Transdniestria, in 2003. Courtesy of Ionel Balan.

There are several ministries and state institutions in Transdniestria that carry out radiation control, monitoring, response, and licensing functions, including:

- the Republic's Center for Hygiene and Epidemiology (a part of the PMR State Sanitary and Epidemiological Service) under the PMR Ministry of Health, including its Laboratory of Radiological Control and the Radiation Safety Department;

[34] Vilmos Friedrich and Gustavo Massera, "OSCE Radiological Fact Finding Mission: Metallurgical Plant, JSCC 'Moldova Steel Works,' Rybnitsa" (December 1-4, 2003), OSCE, n.d., https://www.osce.org/files/f/documents/5/a/21249.pdf.

[35] Ion Apostol, "Statement by the Republic of Moldova at the 63[r]d IAEA General Conference, Vienna, September 16-20, 2019," IAEA, www.iaea.org/sites/default/files/19/09/gc63-republic-of-moldova.pdf.

- the Main Directorate for Emergency Situations of the PMR Ministry of Internal Affairs;
- the PMR Customs Service; and
- the Registration Chamber of the PMR Ministry of Justice.

As noted earlier, there are several Soviet-built facilities and enterprises in Transdniestria that have legacy radioactive sources requiring proper handling and disposal. 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 Transdniestria region pose a major challenge.

According to the breakaway region's former foreign minister, Nina Shevchuk, the PMR does not have the technical capacity to dismantle and dispose of disused radioactive sources. She noted that during the Soviet period, such processes were carried out at special centralized enterprises[36] located outside of Transdniestria, presumably at the disposal facility in Chisinau.

One of many challenges that separatist states face—along with the lack of international recognition, insecure borders, and elevated risks of illegal trafficking—is a broken or incomplete infrastructure that lessens their ability to carry out certain activities. As competent as its legislative and oversight system of radiation control and monitoring may appear, the PMR's lack of technical capacity to securely dispose of its disused radioactive sources and materials undercuts its ability to implement these laws and regulations.

There is no prior record of a precise inventory of radioactive sources having been carried out in Transdniestria, but it is believed that there are radioactive sources of different types and categories there, from low-activity ones such as those used in smoke detectors to more powerful sources used in research and in commercial applications. As indicated earlier, Transdniestria does not have a disposal and storage capacity, nor technical specialists to assess and conduct an expert inventory of these sources. Contributing to the complexity of this situation is that from a legal standpoint, these sources and materials belong to the Republic of Moldova.

The lack of these technical and human resources, combined with certain political and economic factors, laid the foundation for an initiative that resulted in the successful removal of many disused radioactive sources from Transdniestria to safe and secure disposal at the facility near Chisinau.

[36] On the removal of sources of ionizing radiation from the territory of the PMR, see the website of the PMR Ministry of Foreign Affairs, https://mid.gospmr.org/en.

Removal of Disused Sealed Radioactive Sources and Materials from Transdniestria

Since 2012, Republic of Moldova authorities have successfully removed about 2,700 disused and orphaned radioactive sources and devices containing radioactive materials (such as smoke detectors with plutonium-239) from Transdniestria. Physical removal procedures were preceded by rounds of technical and political exchanges and negotiations between Chisinau and Tiraspol, initially between working-level technical experts and later between politicians from the two sides. The OSCE facilitated these discussions. As a result of these efforts, Republic of Moldova representatives, in cooperation with their PMR counterparts, conducted more than 20 missions to assess, dismantle, package, and transport between 2,241 and 2,700[37] sources from current sites in Transdniestrian to the designated storage facility, "Special Facilities 5101, 5102" of the National Radioactive Waste Management Company (RWMC)[38] of the Republic of Moldova's General Inspectorate for Emergency Situations in Chisinau.

For operational security reasons, most news reports and statements provide limited data on the technical specifications of the removed sources and materials (such as their type, category, and applications). A handful of documents and technical reports provide more details, including stating that radioactive sources slated for removal were in Categories 2-5, under the IAEA's system,[39] containing such isotopes as plutonium 239, cobalt-60, and cesium-137. Applications of these sources varied and ranged from smoke detectors to industrial and research equipment. Some of the sources were stored in areas with public access.

[37] The first number, 2,241, was listed in a written response to the questionnaire submitted by a representative of the Transdniestrian Republic's Center for Hygiene and Epidemiology on September 23, 2020. The other number, 2440, was reported by PMR on its official website, http://mfa-pmr.org/ru/node/7765. Moldovan experts reported the removal of 2,700 in I. Gisca "Technical proposal."

[38] The official name of the enterprise in Romanian is "Institutia de Stat cu Destinatie Speciala 'Obiectele Speciale 5101, 5102.'" However, there are various versions of English translations used in public documents and official correspondence, such as "Radioactive Waste Management Company`s Special Facilities 5101 and 5102" (SSM Report 2021:03), "'Special Items 5101 and 5102' Special Destination Enterprise" (The Republic of Moldova's Third National Report under the Joint Convention), and "The national radioactive waste management company, Special Facilities 5101 and 5102" (IAEA Statement of Work). The report uses the name from the official correspondence with the RWMC's director and the IAEA.

[39] The IAEA uses a risk based ranking of radioactive sources and practices in five categories. Sources in Category 1 are considered to be the most dangerous because "they can pose a very high risk to human health if not managed safely and securely," while sources in Category 5 are the least dangerous but still need to be properly controlled. See IAEA, "Categorization of Radioactive Sources," IAEA Safety Standards Series, Safety Guide, No. RS-G-1.9, IAEA, Vienna, 2005, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1227_web.pdf.

As noted previously, these removal operations involved a comprehensive effort by several entities, which are listed in Appendix I.

SUMMARY OF THE TRANSDNIESTRIA REMOVAL EFFORTS (2012-2019)

Between 2012 and 2019, more than 20 removal missions took place, and up to 2,700 objects containing various isotopes and materials were removed. These removals are summarized in Table 1 , which was compiled with the help of secondary data. Secondary data collection included online searches and academic and technical literature reviews, including technical reports, conference proceedings, technical specifications, contracts, and international standards. The report primarily relies on qualitative data from open and publicly available sources. Additional clarifications and technical details were gathered during interviews and email exchanges with Republic of Moldova experts. A detailed description of the research methodology is provided in Appendix II.

As Table 1 illustrates, the removed sources encompassed a wide range of isotopes, including cesium-137, strontium 90, americium-241, and plutonium-239. While it was not possible to find specific data about activity levels for many of the sources, the sources are widely believed to be categorized as IAEA Category 2-5 sources. It is also known from technical reports and consultations that 36 cobalt-60 sources from the Issledovatel-1 gamma irradiator were Category 2 sources, and two medical cobalt-60 sources were Category 4 sources at the time of their removal. The largest number of sources removed were low-activity radioactive sources containing plutonium-239.

Table 1. Summary of isotopes removed from the Transdniestria region, 2012-2019[i]

Source type (isotope)	Number of removed units	
	According to Moldovan experts and open research	According to Transdniestrian experts
Cs-137 and Sr-90 (estimated number)[ii]	125+	61
Co-60	41	52
Am-241	10	11
Pu-239	2,137	2,262
Ra-226	3	12
Miscellaneous	4	18[iii]
Unknown	200+	5
Total	2,520+	2,421

[i] These isotopes and numbers of units (sources) are approximate and based on open-source research and information received during consultations/interviews with Moldovan experts and the head of the Radiation Monitoring Laboratory (RML) at the Regional Center for Hygiene and Epidemiology in Transdniestria. Given some substantial discrepancies between data provided by Moldovan and Transdniestrian experts as to the isotopic composition of the sources and recognizing that it may not be feasible to engage both parties to compare and verify data, the list presents technical details provided by the two sides in separate columns. The actual total numbers of removed sources are likely to be higher, about 2,700, as found in technical reports by Moldovan experts.

[ii] Devices containing these two isotopes were listed together making it impossible to identify specific numbers of each isotope removed. It is likely that the majority of them were caesium-137, as devices using that element are more commonly used.

[iii] The head of the RML provided information on the following sources that the authors of the present report included in the "miscellaneous" category: one dust particle measuring device containing promethium-147, one dust particle particle measuring device containing C 14 and 16 thickness gauges with Kr-85. It should also be mentioned that an expert that was reached out to by the authors shared some doubts as to the feasibility of use of the latter two isotopes for the reported purposes.

As detailed in Table 2 , the largest number of units, 1,052, were removed in 2016, but the most notable and well-documented removal mission took place in October 2019. It involved the removal of the Issledovatel-1 (Researcher-1) irradiator, containing 36 cobalt-60 IAEA Category 2 sources[40] from the Pridnestrovskiy Research Institute for Agriculture. This removal will be used as a case study in the remainder of this report. It involved a high-activity source that required special transportation and other arrangements, such as dismantling of a portion of a building where it was stored.

Table 2: Summary of removals by year, including information about funders[i]

Date	Number of Units	Funder
March 15, 2012	100+[ii]	OSCE
April, July 24, 2013	924[iii]	OSCE
April 28-29, 2015	198[iv]	OSCE
March 25, 2016	1,052	OSCE
July 17, 2018[v]	15	Swedish Radiation Safety Authority (SSM)
August 21-22, October 17, 2019	250	SSM, IAEA

[i] As with the previous table, the information used for composing this table was obtained through open-source research, as well as interviews with Moldovan experts and the head of Transdniestria's Radiation Monitoring Laboratory (RML). Given some discrepancies in information supplied by the latter two sources, the table features information provided by the Moldovan side and footnotes data from the RML if it differs from what was reported by the Moldovans. PMR authorities additionally indicated that 194 smoke detectors containing plutonium-239 were removed to Special Facilities 5101 and 5102 in 2008. This information was not verified with Moldovan authorities.

[ii] RML reported 10 units.

[iii] RML reported 914 units.

[iv] RML reported 195 units.

[v] RML does not mention this removal mission.

It is noteworthy that the initial request to remove this irradiator from the agricultural research facility in Tiraspol was made in 2008. This request led to the series of other removal missions that occurred between 2012 and 2019 even though the removal of the irradiator was one of the last in this multiyear campaign. Removal missions started with smaller devices to build up a reliable mechanism for more complex removals in the future. Hence, the first shipment was the March 2012 removal of more than 100

[40] Issledovatel-1 was originally a Category 1 device. However, it was last loaded with cobalt-60 (which has a half-life of about 5.3 years) and had decayed to a Category 2 level by the time it was removed in 2019—more than six half-lives later.

devices, including strontium-90 and cesium-137 sources from the Sugar and Alcohol Plant in Rybnitsa. By contrast, the Issledovatel 1 removal took more than a decade (2008-2019) due to the complexity of its removal procedure. According to a former official from the National Agency for Regulation of Nuclear and Radiological Activities of the Republic of Moldova (NARNRA) who participated in earlier stages of this endeavor, there were several—mostly political—factors that prolonged the process. The need to secure financial support may have been another factor. Both Republic of Moldova and PMR authorities lacked prior experience in performing such a task and had to work out multiple 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 once 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 facilitator, the OSCE provided funding for most removal missions through extrabudgetary funds.[41] Other known funders of radioactive source removals included the Swedish Radiation Safety Authority (SSM), which funded removals of 11 cobalt-60 and four cesium-137 sources from Rybnitsa in 2018 and of about 200 orphan sources in 2019. According to a Swedish representative, in 2019 the authority provided a one-time payment of 3,025 euros for the removal of radioactive sources from Transdniestria in 2019. The IAEA helped with the removal of the Issledovatel-1 irradiator. The cost of this four-month-long project was 66,350 euros,[42] and it is believed that Germany funded this project through the IAEA.

[41] OSCE annual reports offer general estimates of the organization's assistance programs by its missions and offices, without a direct reference to the funded project. OSCE declined to identify to the research team the specific donor countries that contributed to this project.
[42] "Contract No. 201906687 between the International Atomic Energy Agency, and ISDS Obiectele Speciale 5101, 5102 concerning the Disassembly of Disused Sealed Radioactive Sources and their transport to a central storage facility in Moldova," Aid Management Platform, November 21, 2019, p. 6, http://amp.gov.md/contentrepository/downloadFile.do?uuid=1f3ef7e0-57d7-4659-8394-134ee4c9f9e4.

Stages of the Transdniestria Removal Effort

The process of removing disused sealed radioactive sources and materials from Transdniestria occurred in three stages: a working-level initiative, a political commitment, and implementation.

STAGE I: WORKING-LEVEL INITIATIVE

As noted above, the discussion of removing radioactive sources from the Transdniestria region began at the end of 2008. In November 2008, the State Enterprise Pridnestrovian (Transdniestrian) Research Institute for Agriculture ("Agriculture Institute") in Tiraspol and NARNRA exchanged formal letters regarding the Soviet-era gamma irradiator Issledovatel-1, which was no longer in use. The correspondence was initiated by the institute's director, Dr. Yefim Demidov, who contacted NARNRA leadership with a formal request for assistance to dispose of the institute's Issledovatel 1 irradiator's disused radioactive cobalt-60 sources at the RWMC, the specialized facility for disposal of radioactive sources.

NARNRA responded promptly and positively with a letter signed by the agency's deputy director, Dr. Artur Buzdugan, who suggested organizing a visit of NARNRA experts to assess the technical condition of the Issledovatel-1 irradiator to ensure that it met safety requirements for the transportation of radioactive materials and did not leak radiation. At that time, the removal of any radioactive sources from Transdniestria would not have been possible without political backing and financial commitment. Any interaction between officials and other parties from the right and left banks of the Dniester River (the Republic of Moldova and the PMR, respectively) requires a notification to the Joint Control Commission. Equally, the idea of removal of radioactive sources from Transdniestria required political endorsement by both sides.

During the next two and a half years, NARNRA continued to exchange additional letters with the leadership of the Agriculture Institute and communicated with other Transdniestrian organizations and enterprises interested in the disposal of their disused radioactive sources. In the meantime, in early 2011, the previous exchange between the research institute and the regulatory body resulted in Director Demidov of the Tiraspol Agriculture Institute inviting NARNRA experts to visit his institute for a technical assessment of the Issledovatel-1 irradiator.

Having secured a pledge from the Agriculture Institute to receive a delegation of Republic of Moldova experts, NARNRA informed the Republic of Moldova Ministry of Environment of its intent to send a delegation to Transdniestria. NARNA and the ministry then reached out to the OSCE

office in Tiraspol, which in turn notified PMR authorities. That pledge led to the formation of a working group. The working group included representatives from both sides, including Republic of Moldova and PMR chief negotiators, the Republic of Moldova Ministry of Agriculture, the Republic of Moldova Ministry of Environment, NARNRA, the PMR Security Service, and the PMR Sanitary and Epidemiological Service. The short-lived working group was instrumental in drafting an agreement that would lay the 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 the potential arrangement, political stakeholders from both sides became more actively involved, including PMR chief negotiator Nina Shevchuk and Republic of Moldova Deputy Prime Minister for Reintegration Evgen Carpov, who served as the chief negotiator of this arrangement from the Republic of Moldova side.

According to the former PMR chief negotiator, Nina Shevchuk (formerly Shtanski)[43] the idea to discuss the removal of radioactive sources in the Permanent Conference (5+2) came from PMR officials and was based on the need to find a systematic solution to the disposal of radioactive sources. This issue had not been addressed since the collapse of the USSR, when radioactive sources were disposed of at centralized storage facilities in Moldova and Ukraine.[44] In her capacity as the PMR chief negotiator (2012-2015), Shevchuk was involved in the negotiations of removal processes with Carpov, her Chisinau counterpart. She clarified that prior to engaging with the Republic of Moldova side, she had 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 (IRS) located on the territory of Transnistria"[45] by both sides on March 14, 2012.

According to 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 that would benefit both sides and would advance the Transdniestrian

[43] Currently, Dr. Nina Shevchuk is a professor in the Department of International Relations at the Russian Academy of National Economy and Public Administration under the President of the Russian Federation.
[44] Nina Shevchuk, former PMR chief negotiator, email to authors, August 17, 2020.
[45] Government of the Republic of Moldova, "Protocol decision on the order and procedures of the removal of ionizing radiation sources (IRS) located on the territory of Transnistria" [in Russian], March 14, 2012, https://old.gov.md/public/files/bpr/doc/2012-03-14-Ru_-_Protocol-Decision-Evacuation-Radioactive_elements.PDF.

settlement process.[46] "Interaction on these issues that do not require complex decisions, but call for political will, would help build trust. Such trust could become the foundation for the next stages of the negotiations," Shevchuk wrote.[47] In her opinion, the main reasons for the PMR's decision to proceed with the project were environmental and radiation safety, as well as establishing interaction in a sphere in which the lack of such interaction would pose safety and security threats. Finally, this collaboration helped build an atmosphere of trust.[48]

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 the PMR Foreign Ministry's website promoting this process as a successful effort in cooperation and building trust with Chisinau. Similarly, the OSCE supported the notion of this project as a confidence-building measure that promoted cooperation between the two sides.[49] Republic of Moldova authorities shared this view but expressed less enthusiasm through official channels. For a comparison, a quick search of the Republic of Moldova Foreign Ministry's official website did not reveal any reports related to the removal of radioactive sources from Transdniestria, as the PMR is not recognized by the Republic of Moldova.

One should not disregard another factor that benefited Tiraspol in particular—the economic factor. By engaging in a removal process facilitated and funded by international stakeholders, the PMR could solve the problem of disused radioactive sources without incurring significant financial costs, as these removals came 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 "Protocol Decision on the order and procedures of the removal of ionizing radiation sources (IRS) located on the territory of Transnistria." Subsequently, all missions were carried out in compliance with these procedures and followed certain regulations and international guidelines as set by the IAEA. Often, one mission combined removals of radioactive sources from several locations.

Removal of disused radioactive sources was a multilayered process: each mission required several months of planning and utilized a wide range of technical competencies, varying with the type of source(s) to be removed.

[46] Nina Shevchuk, ed., *Pressing Issues of the Pridnestrovian Foreign Policy (2012-2013),"* 1st ed., (Bender, PMR: Poligrafist, 2013).
[47] Shevchuk, email to authors.
[48] Ibid..
[49] Ibid..

These included:

- an initial contact, in the form of a letter or a phone call, between a source owner/operator and the Republic of Moldova regulator;

- the submission by the source owner/operator of an inventory of disused radioactive sources and other hazardous materials slated for removal;

- a technical visit, involving an expert assessment of these sources and their condition by NARNRA and National Radioactive Waste Management Company “Special Facilities 5101, 5102” experts and other experts responsible for the removal; and

- dismantlement, packaging, transportation, and storage.

The OSCE's Approach to the Transdniestria Removal Effort

The OSCE divided the removal process into two general phases: 1) assessment of the radioactive sources to be disposed of and 2) removal implementation.[50] The following section uses the OSCE's categorization and describes tasks and stakeholders involved in each phase, including their roles and responsibilities.

PHASE 1: ASSESSMENT OF THE RADIOACTIVE SOURCES SLATED FOR REMOVAL

This section includes several activities and deliverables illustrated by concrete examples of tasks that were carried out during the assessment phase of the removal of the Issledovatel-1 irradiator. This process is described in remarkable detail in the *Technical Proposal (Rev. 1): Dismantling and Transportation of Disused Sealed Radioactive Sources in the Republic of Moldova,* prepared by the RWMC leadership for the IAEA.[51] This document also lists prior removals of disused radioactive sources on the territory of the Republic of Moldova.

After the procedure for removing radioactive sources from Transdniestria was established in 2012, each removal mission followed a similar protocol, with variations depending on types of sources involved. A removal usually was initiated by a source owner/operator from Transdniestria either by a letter or by a phone call. This was followed by the series of activities listed below:

1) Submission of an inventory of disused radioactive sources

Along with a request for a removal of disused radioactive sources and materials, a Transdniestrian entity (a source owner) requesting a removal had to submit an inventory of radioactive sources/materials to be disposed of. Thus, for the Issledovatel-1, the Agriculture Institute (source owner) informed NARNRA that the device contained 36 sources with a total activity of less than 45 curies.[52]

2) A technical visit and assessment

a) Scheduling of visits. Upon receipt of the request and inventory, Republic of Moldova experts from NARNRA scheduled a technical visit to the facility/organization where sources were located. Before an actual visit took place, NARNRA obtained approval for

[50] OSCE, email to authors, August 5, 2020.
[51] I. Gisca, "Technical proposal."
[52] Forty-five curies is 1.665 terabecquerels. A curie is 3.7 E10 disintegrations per second and a becquerel is one disintegration per second.

the visit from other Republic of Moldova authorities, including the Reintegration Bureau and related authorities about a date and crossing point across the Security Zone into Transdniestria.[53]

b) Inspection. During the visit, the Republic of Moldova delegation inspected radioactive sources for their surface contamination levels, usually with a swipe test, and labeled them with information including the date, time, and location of the swipe. The delegation also verified sources' technical features, such as type, category, quantity (number of sources contained in a particular device), and identification number (if available), as well as the condition of the containers where sources were stored. If a disused radioactive source slated for removal had not been previously registered, it was entered in the Republic of Moldova national source registry.[54]

A NARNRA expert conducts a swipe test to check a source for a possible radiation leak at the JSC Moldova Steel Works in November 2014. Courtesy of Ionel Balan.

A source tagged by NARNRA awaits removal from a facility in Tiraspol, the Transdniestrian capital, in November 2014. Courtesy of Ionel Balan.

c) Technical assessment. Republic of Moldova experts prepared a technical assessment report, which included guidelines for packaging and transportation. For example, in the case of the Issledovatel-1 irradiator, after having established that the dose rate of the device surface was at the background level and no contamination had been found, NARNRA recommended mounting the device on a truck's platform, followed by another set of measurements to make sure the device was not damaged during this step.

[53] Dr. Artur Buzdugan, former director, NARNRA, email to authors, August 22, 2020.
[54] Buzdugan, email to authors.

d) Issuing of removal permits. NARNRA issued all necessary authorizations, certificates, and permits for the removal, including inspections at the time of source removal, transportation, and transfer to the storage facility in Chisinau.

Once inspected and assessed, radioactive sources remained at the same locations until their final removal.

This phase usually included representatives from Transdniestrian facilities/organizations where removals would occur along with representatives from NARNRA. At least one official from the OSCE Mission to the Republic of Moldova was present throughout the entire process, performing tasks such as escorting Republic of Moldova experts through the Security Zone to a visit and inspection site, facilitating all contacts between the sides, and monitoring Republic of Moldova experts performing their tasks.

Participants meet during a technical visit to the JSC Moldova Steel Works in 2014. Featured in the photo are five representatives from The Republic of Moldova—three from NARNRA and two from the National Radioactive Waste Management Company. The Transdniestrian side includes representatives from the plant, the Sanitary and Epidemiological Service, the Security Service, and the Ministry of Foreign Affairs. Courtesy of Ionel Balan.

PHASE 2: REMOVAL

The second phase, removal, consists of a set of procedures and activities that are described in detail in the technical proposal. While procedures listed in this document are specifically for the removal of the Issledovatel-1 irradiator, they are consistent with procedures followed during other removals and comply with IAEA guidelines and Republic of Moldova national regulations.

The second phase required another series of activities and responsibilities:

1) Developing a decommissioning plan. This task was usually carried out by the parties responsible for the removal process. In the case of the Issledovatel-1 irradiator removal, this plan was prepared by RWMC and the technical support organization INOTEH (Center for Scientific Technical Development).

2) Submitting the decommissioning plan to a regulatory agency. In the case of the Issledovatel-1 irradiator removal, the plan was submitted to both NARNRA and the IAEA, which funded this removal. In other instances, the plan was usually submitted only to NARNRA.

3) Renting a truck and preparing it for certification (required for large sources). In the case of less dangerous and smaller sources, RWMC uses its own vehicles for cargo under 400 kilograms, usually a Dacia (Renault) Dokker van. For the removal of Issledovatel-1 irradiator, a safety certificate was received for the use of a 14-ton-capacity truck.[55]

4) Developing a packaging and transportation plan for approval by NARNRA.

5) Making formal arrangements, issuing notifications, and signing paperwork with all relevant stakeholders and the OSCE. These include the Republic of Moldova Reintegration Bureau, the Joint Control Commission, and relevant authorities on both sides.

6) Preparing for decommissioning, including conducting a final radiological survey of the building where a source was stored.

7) Packaging the source and transporting it to the long-term centralized storage facility. Republic of Moldova storage facility experts packaged all sources slated for removal. Once delivered, devices were unloaded and placed in the facility, and the truck was inspected for radiological contamination. Storage facility personnel prepared papers for transferring ownership of the source. After the source was transferred, it was added to the RWMC database and taken off the operator's books.

8) Submitting a final report to NARNRA (and to the IAEA in the case of the Issledovatel-1 irradiator removal). The post-removal report also included a written confirmation of the transfer from RWMC.[56]

[55] Alexandru Calancea, deputy director, Special Facilities 5101 and 5102, email to authors, August 30, 2020.
[56] Buzdugan, email to authors.

Removal Arrangements for the Issledovatel-1 Gamma Irradiator (2019)

This section offers an overview of some unique removal arrangements, including special transportation arrangements, made for the Issledovatel-1 gamma irradiator, with a focus on the device's physical removal from the site and its packaging and transportation. The aforementioned procedures are illustrative of what a full-scale removal process of a more radioactive source entails.[57] The procedure is carefully designed and executed with safety and security precautions that minimize the risk of accidental radiation leaks and contamination or the potential for theft or sabotage.

Since NARNRA did not detect elevated levels of radiation on the device's surface or leakage during its initial assessment of the Issledovatel-1 irradiator, the agency did not require the use of the additional lead shielding or transport containers that are typically required for transporting radioactive sources.

The type, size, and weight of the device called for the use of additional equipment—a crane and a cargo truck, which were provided by contractors (INOTEH and Energotel Grup) to perform such tasks. This was the only removal that required the engagement of external parties. This process required lifting a roof off the building storing the device, extracting the device through the roof opening, and then replacing the roof, as directed by the Agriculture Institute, to restore the building to its original condition.

A source tagged by NARNRA awaits removal from a facility in Tiraspol, the Transdniestrian capital, in November 2014. Courtesy of Ionel Balan.

This process was described in the technical proposal as "special

[57] The discharge of the sources from the device was not part of the removal process.

arrangement transportation" consistent with the IAEA's *Regulations for the Safe Transport of Radioactive Material.*[58] The clause on special arrangements in this document states that the "competent authority may approve special arrangement transport operations for a single consignment or a planned series of multiple consignments. The overall level of safety in transport shall be at least equivalent to that which would be provided if all the applicable requirements in these regulations had been met. For consignments of this type, multilateral approval shall be required." NARNRA, as the competent authority in this removal process, usually issued permits for, and authorized activities under, this arrangement. It also conducted a radiological survey of the building before the device was packaged and transported and then conducted a contamination check of the truck after the device was unloaded. In addition to that, the technical proposal noted that RWMC organized the necessary insurance for civil liabilities and other contingencies.

Lifting the the Issledovatel-1 gamma irradiator. Photo: mid.gosmpr.org. https://novostipmr.com/ru/news/19-10-18/v-nii-selskogo-hozyaystva-demontirovali-gamma-ustanovku.

[58] IAEA, *Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series,* 2018 edition, "Specific Safety Requirements," No. SSR-6 (Rev.1) (Vienna: IAEA, 2018), p. 17, https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1798_web.pdf.

Transportation is one of the most vulnerable stages in handling radioactive sources and materials and requires strong safety and security measures. In addition to the required safety procedures, stringent security measures were implemented during the entire transportation stage by both sides and the OSCE. The convoy was escorted by PMR law enforcement and the PMR's Civil Defense Department to the Security Zone and afterward by Republic of Moldova patrol police, the Republic of Moldova General Inspectorate for Emergency Situations, and other relevant agencies. The OSCE accompanied the convoy for the entire route, from the Agriculture Institute in Tiraspol to the specialized storage facility near Chisinau.

Personnel from the National Radioactive Waste Management Company mount the Issledovatel-1 irradiator onto the platform of a truck at the Pridnestrovian Research Institute of Agriculture in Tiraspol in October 2019. Photo: mid.gosmpr.org https://novostipmr.com/ru/news/19-10-18/v-nii-selskogo-hozyaystva-demontirovali-gamma-ustanovku.

The truck used for the transportation of the of the Issledovatel-1 irradiator. Photo: mid.gospmr.org https://novostipmr.com/ru/news/19-10-18/v-nii-selskogo-hozyaystva-demontirovali-gamma-ustanovku.

Publicity and Promotion of the Transdniestria Removal Efforts

The degree to which removals of disused radioactive sources were publicized and promoted through official channels differed between Chisinau and Tiraspol. The PMR's unrecognized government regarded this event as a successful outcome of its 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 website. These reports were quite helpful to the authors in that they provided a wealth of details about various removal missions, including the number and types of radioactive sources and the facilities from which they were removed.

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

The OSCE Mission in the Republic of Moldova, which supported and facilitated these processes, promoted this cooperation as a successful effort in the Transdniestrian settlement process and a step in building confidence between people and communities on both banks of the Dniester 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 and Conclusions

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, under certain conditions. As a result, other countries of the former Soviet Union, such as Armenia, Azerbaijan, Georgia, and Ukraine,[59] that are addressing similar challenges within contested spaces with radioactive materials can draw some useful lessons from the experience, as summarized below.

Technical matters may sometimes serve as a catalyst for collaboration between the parties to a conflict, especially if the parties have a shared concern about risks and threats. This was the case with the risk from radiological materials that were out of effective regulatory control by the Republic of Moldova and the lack of a disposal facility in Transdniestria. This combination led to the successful removal of 2,700 radioactive sources from the breakaway region to a centralized storage facility in Chisinau. What started as a working-level exchange between the source operator in Tiraspol and the Republic of Moldova national regulator evolved into a sustained effort that was supported by leading political authorities on both sides of the Transdniestrian conflict and was facilitated and funded by international stakeholders. The early spadework at the working level ensured that cooperation continued unhindered amid political turbulence.

One of the tactics that made this endeavor successful was the use by both sides of 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 (cobalt-60), initial removals started with radioactive sources that were smaller and easier to handle. This allowed the parties to test the waters and build a more solid foundation for the removal of larger, higher-activity sources. Experts from both sides began with solving simple issues, then moved to more complex ones, gradually accumulating experience, building mutual trust, and jointly working on the technical issues involved in such removals. When a trusting relationship between the two sides was established, it was much easier to resolve all technical issues, which ultimately made it possible to remove the Issledovatel-1 irradiator.[60]

When drawing other lessons from the success of this endeavor, it is important to factor in, and find commonalities between, the two sides' underlying motivations to embark on the initiative. For example, both sides ended up having economic incentives to undertake the effort.

[59] If areas of the internationally recognized territory of Ukraine remain outside central government control at the conclusion of the current Russian-Ukrainian conflict, lessons from this report may be especially relevant for understanding how any cooperation on mutually beneficial issues (such as radiological security) might be conducted in the resulting heavily contested environment.
[60] Dr. Ionel Balan, deputy director, NARNRA, emails to authors, March 2021.

Transdniestrian enterprises, which initiated the process, lacked sufficient economic resources or technical capabilities to handle the disposal of radioactive sources by themselves, especially given that the PMR has no plans to build a storage facility for its disused radioactive sources. The financial support provided by international stakeholders such as the OSCE, the SSM, and the IAEA meant that Transdniestrian operators (source owners) did not incur expenses associated with the removal of disused sources, including their transportation and dismantlement.

Similarly, the Republic of Moldova lacked adequate funding to support such removals. In fact, NARNRA identifies lack of resources for addressing problems associated with disused and orphan radioactive sources as one of its main challenges, especially given the financial commitment required for transportation and long-term storage of the sources.[61] For example, the cost of packaging and transporting the Issledovatel-1 irradiator was 12,000 euros and its long- term storage fee was 18,300 euros, together representing nearly half of the total cost of the removal project.

By providing initial assurances of financial support, the OSCE paved the way for political support needed to undertake the removals. With financial support in hand, neither side could claim that funding was an obstacle. Securing early international financial support helped to bring political stakeholders to the negotiating table.

The OSCE has not officially disclosed which countries ultimately financed the removal operation in Transdniestria, though the authors believe that that several governments helped provide direct assistance to pay for the removals of radioactive sources from Transdniestria in 2018 and 2019. More transparent information about donor countries would help other countries facing similar challenges to approach these donors directly with requests for possible funding.

The cooperation between the Republic of Moldova and the PMR was politically beneficial to both sides. The Republic of Moldova met its legal obligation to account for and secure all radioactive sources on its territory, including in Transdniestria. As an OSCE and IAEA member, the Republic of Moldova also won plaudits from other members of the international community for improving radiological security (an important contribution to the implementation of UN Security Council Resolution 1540) and undertaking confidence-building efforts with the PMR.

The PMR, in turn, clearly recognized the removal effort as a way to boost its own legitimacy and contribute to a potential settlement of the conflict. The PMR saw the removals as part of its "tactic of small steps," believing

[61] Presentation by Ion Apostol, NARNRA, *Regional Workshop on Code of Conduct on the Safety and Security of Radioactive Sources and its supplementary Guidance on the Import and Export of Radioactive Sources and on Management of the Disused Radioactive Sources* (Bucharest, 7-11 May 2018)

that interaction on such a technical and relatively apolitical issue would help build trust that would contribute to tackling more politically challenging concerns.[62]

That effort to work through technical cooperation was built on earlier experience when Moldovan experts helped the PMR address technical problems stemming from radiological incidents in 2003 and 2004.[63] In both cases, Republic of Moldova experts were invited to help with the assessment and investigation. These earlier engagements helped establish contacts and build confidence between experts on both sides.

The establishment of NARNRA in 2008 as an independent body insulated from politics also contributed to the removal process, making it easier for Transdniestrian operators/source owners to feel comfortable reaching out directly to the agency with the initial request for the removal of the Issledovatel-1 irradiator.[64] Transdniestrian operators are dependent on NARNRA's authorizations to import new radioactive sources since many of their operational industrial facilities require the resupplying of radioactive sources. Consequently, by properly disposing of disused radioactive sources, these operators will have a better chance for a continuous supply of fresh sources.

There is another example of cooperation between the Republic of Moldova and the PMR that is worth noting in this report: In November 2018, NARNRA experts delivered a training course to the staff of the Moldova Steel Works on "Nuclear and Radiological Security and Nonproliferation Challenges." The course helped the company meet authorization requirements by the Republic of Moldova, as Republic of Moldova authorities do not recognize any PMR-issued certifications and documents. The training, approved by the Joint Control Commission, was offered free of charge with the Transdniestrian side covering Moldovan experts' expenses in Rybnitsa.

Personnel from the JSC Moldova Steel Works display their certificates of completion from a training by NARNRA in November 2018. Courtesy of Ionel Balan.

[62] Shevchuk, email to authors.
[63] The 2003 case occurred at a metallurgical plant, JSC Moldova Steel Works, when radioactive sources containing cesium-137 were melted causing radiation contamination. There was another case in 2004, when radioactive pipes were imported from Ukraine.
[64] Buzdugan, email to authors.

This course offered an outstanding example of building trust and confidence between sides in a conflict, especially when other channels of communication are limited or closed. This may be appropriate for countries dealing with an active military conflict on their territories. Such training, facilitated and hosted by a third party, could involve different stakeholders and, if necessary, could be organized and hosted by a party from a third country.

Many post-Soviet countries, including Moldova and its breakaway region of Transdniestria, share another important feature: previous connections among the participants from the two sides. In this case, some experts in Transdniestria may have been colleagues and friends with their Republic of Moldova counterparts when Moldova was a single political entity as part of the Soviet Union. They may have worked at the same facilities or the same agencies in the previously unified country. These past interactions and contacts could be valuable assets in setting up a process between two conflicting sides at the working level. Although many of these practitioners may have already retired, they can serve as points of contacts for each side to promote initial connections and communications if all other channels are ineffective. Retired experts can be brought in to facilitate these working-level interactions.

Another important lesson that the Transdniestria case presents is that all removal procedures adhered to IAEA and other international guidelines on the safety and security of radioactive sources and materials and that permits and authorizations were issued by an experienced regulator, NARNRA. Relying on widely accepted international standards and practices and on experienced personnel allowed for the safe and secure execution of the removal operation.

Finally, 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 Transdniestria. The OSCE's contributions to building confidence and advancing the Transdniestrian settlement process also resulted in a reduction of radiological risk for both sides. "Not only does this project reduce the risk of radioactive sources leaking out and causing harm to human health and the environment, but it is also an example of good co-operation between authorities and organizations on both banks of the Dniestr/Nisru," said Jan Plešinger, acting head of the OSCE Mission to the Republic of Moldova after the first removal mission in March 2012.[65] He added, "This project can pave the way for continued co-operation on this issue… Now that we have established methods to work together, we can ensure that other remaining potentially harmful materials are handled in a secure, safe and efficient way."[66]

[65] OSCE, "OSCE helps Chişinău and Tiraspol remove and store radioactive waste," March 16, 2012, https://www.osce.org/moldova/89008.
[66] OSCE, "OSCE helps Chişinău and Tiraspol."

As noted earlier, similar challenges in securing nuclear and radiological materials are present in several other former Soviet countries, and the OSCE appears well positioned to serve as a supporter and interlocutor in some of those other cases as well. This organization has offices and personnel on the ground, including in countries with conflict zones. This allows it to better understand and evaluate the situation and the degree of engagement between sides.

More broadly, the cooperation between the Republic of Moldova and the PMR provides a successful example of how internal (or international) conflicts between contending government authorities can be set aside in the mutual interest of 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 pesticides or ammunition, that are no longer in use but can pose grave dangers and threats if neglected.

Appendix I: Stakeholders and Their Contributions to the Removal Process

As stated above, the removals of radioactive sources from Transdniestria required the efforts of a wide range of stakeholders on the technical, political, and international levels. This section summarizes the roles and responsibilities of entities that were involved in this complex and politically sensitive removal process.

REPUBLIC OF MOLDOVA

By working to remove the sources, the Republic of Moldova not only reduced its radiological security risks but also won recognition from the international community for its efforts. The Organization for Security and Cooperation in Europe (OSCE) lauded the Republic of Moldova government's commitment in assigning its chief negotiator (the prime minister for reintegration) to this process. It also pointed to how Chisinau's efforts "directly confirmed Moldovan commitment to implementation of United Nations Security Council Resolution 1540, on Non-Proliferation of Weapons of Mass Destruction."[67]

Particular Republic of Moldova government organizations involved in the removals included the following:

National Agency for Regulation of Nuclear and Radiological Activities of the Republic of Moldova

Established in 2008, the National Agency for Regulation of Nuclear and Radiological Activities of the Republic of Moldova (NARNRA) is the regulatory body of the Republic of Moldova in the sphere of nuclear and radiological activities. It is under the jurisdiction of the Republic of Moldova Ministry of the Environment but enjoys considerable independence. NARNRA has several statutory functions, including the authorization and control of nuclear and radiological activities and maintenance of the National Register of Ionizing Radiation Sources. NARNRA keeps track of all radioactive sources—from their entry into the Republic of Moldova and use through dismantlement, storage, or export. NARNRA conducted assessment visits and issued all necessary permits for the removal of the radioactive sources from Transdniestria. NARNRA specialists closely coordinated, monitored, and participated in the removal process.

[67] OSCE, "Note on Removal of Radioactive Sources from Transnistria," email to authors, August 5, 2020.

General Inspectorate for Emergency Situations

The General Inspectorate for Emergency Situations is part of the Ministry of Internal Affairs of the Republic of Moldova. Following the provisions of the law on civil defense, the inspectorate is responsible for protecting people and property in emergency situations. A special team of the inspectorate escorted trucks that transported radioactive sources and materials from Transdniestria to the RWMC's special storage facility, which is also administered by the inspectorate.[68]

"Special Facilities 5101, 5102" of the National Radioactive Waste Management Company (RWMC) of the General Inspectorate for Emergency Situations

The State Radioactive Waste Management Organization, State Institution of Special Purpose "Special Facilities 5101, 5102" (referred to as "RWMC" in this report) is a state-owned company under the administration of the General Inspectorate for Emergency Situations (Ministry of Internal Affairs). It is the sole licensed company in the country responsible for safe management of radioactive waste, including disused sealed radioactive sources. Established in 1960 as an entity operating a Soviet RADON-type near-surface disposal facility,[69] it has participated in dismantling and decommissioning radiological facilities and devices, transporting radioactive materials, storing radioactive waste, and conducting assessments and surveys of radiological facilities and sites. The company carried out "the assessment, repacking and transportation of the waste from Transdniestria" to Chisinau[70] and placed it in its storage facility.

The Republic of Moldova Bureau for Reintegration of the State Chancellery assists the deputy prime minister responsible for implementing the policies on the reintegration of Transdniestria into the Republic of Moldova. The bureau, among other things, develops and promotes strategies, plans, and mechanisms for reintegration of the country and for post-conflict development, including confidence- and

[68] Iulian Gisca, Semion Nedealcov, and Victor Chirica, "A Collaboration Agreement among ISDS 'Obiecte Speciale 5101, 5102,' AO CDST 'INOTEH,' and SRL 'ENERGOTEL GRUP' regarding dismantling and transportation of Installation ISSLEDOVATEL from Transnistria to National Storage facility for radioactive waste" [in Romanian], February 27, 2019, p. 9, http://amp.gov.md/contentrepository/downloadFile.do?uuid=b5b909b5-ba8d-4cbd-9ca1-d6818b85465b.]

[69] The RADON system was established in the Soviet Union in the1950s and 1960s for the collection, transport, processing and near-surface disposal of "low and intermediate level institutional radioactive waste including disused sealed radioactive sources." See Alexander Smetnik, "The Safety Case and Safety Assessment for Radioactive Waste Retrieval from Historical RADON-Type Storage," in IAEA, *International Conference on Radioactive Waste Management: Solutions for a Sustainable Future. Book of Abstracts,* CN-294, Vienna, 2021, p. 177, https://www.iaea.org/sites/default/files/21/10/cn-294_book_of_abstracts.pdf.

[70] OSCE, email to authors, August 5, 2020.

security-building policies in the context of the Transdniestrian conflict settlement and reintegration.[71] The latter includes coordination of working groups created for this purpose. The bureau coordinated the activities of the governmental bodies of the Republic of Moldova involved in the removal of radioactive sources from Transdniestria.

TRANSDNIESTRIA

PMR authorities contributed to project implementation by facilitating access to storage sites. They officially requested the assistance, assigned a chief negotiator (the PMR foreign minister) and supported the program through to the end. The following stakeholders were involved from the PMR:

Republic's Center for Hygiene and Epidemiology of Transdniestria

The Republic's Center for Hygiene and Epidemiology (a part of the PMR State Sanitary and Epidemiological Service) is responsible for the development, implementation, and enforcement of policy and regulations in the field of public health and epidemiology. It comprises six departments including the Department of Radiation Protection.[72]

Ministry of Foreign Affairs

Established in 2000 to substitute for the Office of the Secretary General of Transdniestria and the Regional Directorate of External Affairs, the Ministry of Foreign Affairs is the de facto central body that promotes and implements the policy of the PMR in the area of external relations. The ministry, in particular the PMR chief negotiator, was responsible for establishing the Interagency Working Group on the removal of sources of ionizing radiation for disposal outside of Transdniestria, which coordinated activities of the PMR authorities with respect to the removal of radioactive sources. The ministry was also responsible for all communication with the Republic of Moldova and the OSCE.

Civil Protection Command Center

The Civil Protection Command Center of Transdniestria is part of the General Directorate of Emergency Situations within the Ministry of Interior. This entity is responsible for the fulfilment of civil protection tasks as stipulated in the Civil Defense Regulation. PMR law enforcement and the Civil Defense Department escorted convoys with radioactive sources to the Security Zone.

[71] Government of the Republic of Moldova, "Bureau for Reintegration," n.d., http://www.old.gov.md/slidepageview.php?l=en&idc=614.
[72] The website of the Republic's Center for Hygiene and Epidemiology is http://tir-ses.org/gos-uslugi-dejatelnost.html.

Interagency Working Group on the removal of sources of ionizing radiation for disposal outside of Transdniestria

The Interagency Working Group was created for the supervision and coordination of the removal of sources of ionizing radiation for disposal outside of Transdniestria. It comprised representatives of various PMR authorities, such as the Ministry of Foreign Affairs, the Civil Protection Command Center, and the Republic's Center for Hygiene and Epidemiology.

ADDITIONAL STAKEHOLDERS

Joint Control Commission

The Joint Control Commission (JCC) is a supervisory body for the Joint Peacekeeping Forces, which were established after the cessation of hostilities in Moldova in July 1992. These forces include Republic of Moldova, Russian, and PMR troops and operate in the Security Zone. Since September 2005, the commission also has included US and EU representatives as observers. In addition to monitoring the activities of the peacekeeping force, the JCC is responsible for brokering confidence-building measures. The commission was notified of each removal of radioactive sources and devices from Transdniestria. As members of the JCC, Russia and Ukraine may be also regarded as potential ancillary stakeholders in the removal process.[73]

Organization for Security and Cooperation in Europe

The OSCE Mission to the Republic of Moldova was established in 1993 to help facilitate a comprehensive and sustainable political settlement of the Transdniestrian conflict "based on the independence, sovereignty and territorial integrity of the Republic of Moldova within its internationally recognized borders with a special status for Transdniestria that fully guarantees the human, political, economic and social rights of its population."[74] For that purpose, the mission engages in diplomacy to facilitate negotiations and dialogue between authorities on both sides of the Dniester river. While the mission's main office is in Chisinau, it also has an office in Tiraspol.

The OSCE mission in Chisinau was the primary international stakeholder that participated in every phase of the removal process and escorted Moldovan

[73] Russian and Ukrainian officials were not contacted with questions about removal procedures as they are not directly involved in the process beyond their representations in the JCC.
[74] OSCE, "Organization for Security and Co-operation in Europe: Mission to Moldova," July 9, 2019, www.osce.org/files/f/documents/0/a/425141_2.pdf.

experts in Transdniestria. The OSCE describes its role as follows: "The OSCE Mission to Moldova facilitated the necessary contacts between the sides, and monitored that Moldovan experts were able to perform their tasks and effectively perform the removal. The OSCE Mission had no responsibility or obligation regarding the process and was effectively just a facilitator in the confidence-building measure process."[75] It also coordinated the project and "provided financial resources to ensure the implementation of the project's activities. The Mission administered technical, financial and procurement aspects of the project according to OSCE Rules, Regulations and Instructions. The OSCE Mission to Moldova maintained active communication with the project counterparts on the progress and outcomes of the activities under the Project. The Mission Project Team carried out frequent monitoring of implementation and regularly submitted progress reports to the Head of Mission, donors and the OSCE Secretariat."[76] The OSCE's long experience in the region and on-the-ground presence made it an invaluable facilitator trusted by both sides. Its role as a confidence-building forum made it a natural body through which to channel funds to carry out the mission.

INTERNATIONAL FUNDERS

International funders of this project to date have included the OSCE and the International Atomic Energy Agency (IAEA), as well as the Swedish Radiation Safety Authority.

International Atomic Energy Agency

The IAEA's Department of Nuclear Safety and Security works to improve security and safety conditions in member states by assessing inventories of disused sealed radioactive sources and performing conditioning and removal projects. The department was responsible for channeling funding allocated for the one-time removal of the Issledovatel-1 disused Category 2 radioactive sources from Transdniestria and monitoring the technical side of that specific removal.

Swedish Radiation Safety Authority

The Swedish Radiation Safety Authority (SSM) reports to the Ministry of the Environment and has mandates from the Swedish government within the areas of nuclear safety, radiation protection, and nuclear nonproliferation. The authority manages development cooperation projects in Central and Eastern Europe. In Moldova, SSM has aided Republic of Moldova

[75] OSCE, email to authors, August 5, 2020.
[76] OSCE, email to authors, August 5, 2020.

regulators in regaining regulatory control over orphan radioactive sources by "facilitating inspections and the collection of radioactive sources at various sites."[77] In particular, during 2019, SSM helped the Republic of Moldova recover more than 300 orphan radioactive sources, a large portion of which were located in Transdniestria.[78]

CONTRACTORS

The Republic of Moldova authorities engaged contractors to help with removals. These contractors included the following entities:

Center for Scientific Technical Development

The Center for Scientific Technical Development ("INOTEH") is a nongovernmental organization. It provides methodological and information support in several areas, such as the development of a legal framework for nuclear organizations, nuclear and radiation safety, protection of the population and the environment during nuclear and radiological activities, and radiological monitoring of the environment.[79] The company's online description defines it as a technical support organization for N ARNRA. INOTEH participated in the removal of the Issledovatel-1 gamma irradiator from Transdniestria.[80]

Energotel Grup

Energotel Grup is a construction company in Moldova. The company also provides road shipping services. It participated in the removal of the Issledovatel-1 gamma irradiator from Transdniestria.

TRANSDNIESTRIAN REMOVAL SITES

Disused and orphan radioactive sources and devices were removed from 25 sites located in four sites in Transdniestria: Rybnitsa, Tiraspol, Bender, and Dnestrovsk. 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 center, and medical facilities. Most of these facilities were established during the Soviet era, and all but one of them are currently operational.

[77] SSM, "Nuclear Security, Safety and Non-Proliferation: Sweden's International Cooperation in 2019," pp. 16-17, https://www.stralsakerhetsmyndigheten.se/
[78] SSM, "Nuclear Security, Safety and Non-Proliferation."
[79] INOTEH's online presentation can be found at https://slideplayer.com/slide/751220/.
[80] I. Gisca, "Technical proposal," pp. 4-5.

Appendix II: Research Methodology

The research for this report involved a combination of primary and secondary sources. Primary data was collected through interviews and email correspondence with stakeholders who were directly or indirectly involved in various stages of the removals of radioactive sources from Transdniestria, as well as through technical consultations with various experts. Secondary data collection included online searches and reviews of academic and technical literature, including technical reports, conference proceedings, technical specifications, contracts, and international standards. The report primarily relies on qualitative data from open and publicly available sources.

PRIMARY DATA

Interviews, e-mail correspondence, and consultations were conducted under the Chatham House Rule in instances when respondents preferred to stay anonymous or be identified only by their professional affiliation.

Interview subjects were individuals who were directly involved in removal processes; were indirectly involved, through facilitation and funding; or were identified by other responders. Interviews, conducted either in writing or using online platforms, included a set of prepared questions (in English and in Russian) comprised of three main parts—planning, implementation, and impact—followed by an additional session containing specific questions for technical personnel involved in the process.

Initial requests for interviews were submitted to the following organizations:

- National Agency for Regulation of Nuclear and Radiological Activities (NARNRA), Republic of Moldova
- National Radioactive Waste Management Company, Republic of Moldova, State Institution of Special Purpose “Special Objects 5101, 5102” (RWMC)
- Organization for Security and Cooperation in Europe (OSCE)—headquarters in Vienna and OSCE Mission in Chisinau
- International Atomic Energy Agency (IAEA)

The CNS research team also reached out to individuals who were directly involved in various stages of removals in their professional capacities. Some

of these individuals agreed to be interviewed by the CNS research team and some provided written statements or clarified some questions related to the removal process. These include the following individuals:

Mr. Ion Apostol, Director, NARNRA, Republic of Moldova

Dr. Ionel Balan, Deputy Director, NARNRA, Republic of Moldova

Mr. Iulian Gisca, Director, RWMC, Republic of Moldova

Mr. Alexandru Calancea, Deputy Director, RWMC

Dr. Artur Buzdugan, former Director, NARNRA

Dr. Nina Shevchuk (née Shtanski),
Chief Negotiator/former PMR Foreign Minister

Ms. Viviana Sanberg,
Program Manager, Swedish Radiation Safety Authority

Mr. Alexander Kushnir,
Head, Radiation Monitoring Laboratory,
PMR Republic's Center for Hygiene and Epidemiology

Mr. Mihail Tcaciuc, Project Officer, OSCE Mission to Moldova

SECONDARY DATA

Secondary data for this project included online resources and reviews of technical literature, as well as legal documents (decrees, laws, etc.) and reports by various stakeholders involved in the removal processes. The availability of news reports, official statements by various regional (particularly Transdniestrian) and international stakeholders, and other online resources made the research into the history and background of removal cases, as well as many technical details of those cases, less challenging.

Of particular value to this research project was information found on the Aid Management Platform—a public portal of the Government of Moldova that provides annual reports on external assistance to the Republic of Moldova, as well as a list of projects, donors, and financial commitments. One of the reports included the IAEA-funded project, "The Disassembly of Disused Sealed Radioactive Sources and their Transport to a central storage facility of radioactive waste in Moldova,"[81] which discussed the removal of a gamma irradiator from Tiraspol in 2019 with the help of the Republic of Moldova government.

[81] Government of the Republic of Moldova, "The Disassembly of Disused Sealed Radioactive Sources and their transport to a central storage facility of radioactive waste in Moldova," Aid Management Platform, December 8, 2021, http://amp.gov.md/aim/viewActivityPreview.do~public=true~pageId=2~activityId=13488~language=en.

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