Keeping the Heat off the Street: RadSecLEXIS – a Tool for Tracking Radiological Material Security Legislation

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Abstract

Tens of thousands of radioactive sources are in use around the world for medical, commercial, and other beneficial purposes, vulnerable both to everyday mishaps and to the vagaries of conflict and war, as illustrated by recent headlines and the uncertain fate of radioactive material in Russian-occupied Ukrainian territory. The International Atomic Energy Agency (IAEA) has published a number of guidance documents on radiological material security best practices for states to enshrine in national implementing legislation. But studies indicate that implementation is far from comprehensive. To address this challenge, the Stimson Center undertook a project to measure countries' efforts to implement IAEA guidance in law, with the goal of making the measurements and the laws and regulations available to those seeking examples of national implementing measures. This paper will present how the project team identified relevant legal and regulatory measures and explore the practical and methodological challenges encountered in evaluating them against key elements of the IAEA's guidance. It will go on to describe a proof-of-concept Radiological Source Security Legal Index and Online Tool that the team created to share preliminary project datasets and results with national regulatory authorities for feedback and updates before making the final results more widely available.

Introduction

While the Russian invasion of Ukraine has rightly focused international attention on gaps in the international nuclear security regime due to the plight of the occupied Zaporizhzhia nuclear power plant, the conflict has also drawn renewed attention to the need for stronger national legal frameworks around the world for the physical protection of radioactive material. Widely used for a range of beneficial medical, agricultural, and industrial purposes, radiological sources under normal circumstances generate fewer headlines than nuclear facilities, but are more widely available around the globe and are more vulnerable to theft, loss, and misuse by malign actors, with potentially devastating results.[1] In just the first few months of 2023, incidents involving the loss of a tiny radioactive capsule in the Australian outback, disappearance of a camera with radioactive material near Houston, Texas, and theft of containers of radioactive material in Mexico are just some that made international news.[2] Given these headlines, the uncertain fate of

[1] Kenneth C. Brill and John H. Bernhard, "Preventing the Preventable: Strengthening International Controls to Thwart Radiological Terrorism," The Bulletin of the Atomic Scientists, 76, 4 (2020) 206-209. See also, Sam Myer, "CNS Global Incidents and Trafficking Database, 2020-2021 Report: Radioactive Materials Security in an Age of Instability," Nuclear Threat Initiative, February 22, 2023. https://www.nti.org/analysis/articles/overview-of-the-cns-global-incidents-and-trafficking-database/

[2] Tory Shepherd, "'Relatively Common': WA's Lost-and-Found Radioactive Capsule Not the Only Missing Material Around," The Guardian, February 2, 2023. https://www.theguardian.com/environment/2023/feb/03/relatively-

radioactive material in Russian-occupied Ukrainian territory should be an even greater cause for concern.[3] Unlike Ukraine, many other countries have yet to make political commitments to the IAEA's non-binding *Code of Conduct on the Safety and Security of Radioactive Sources* or adopt key elements of the *Code* and other guidance and best practices for creating such frameworks, which could perhaps facilitate tracing and regaining control of sources during times of crisis. With instability and conflict a risk in many areas of the world, putting comprehensive measures in place for the physical protection of radioactive material has never been more urgent.

This paper presents proof-of-concept work carried out by the Henry L. Stimson Center from April, 2021, to March, 2023, with funding from the United States Department of Energy Office of Radiological Security (ORS) aimed at assisting with analysis on such questions as: which elements of International Atomic Energy Agency (IAEA) guidance are least implemented in national legal frameworks for radioactive source security? Which countries need implementation support in which areas of guidance? What impact is implementation assistance having? The Stimson team compiled an initial database of UN member state legal measures addressing radioactive material security and assessed the measures against a list of key indicators of a strong legal framework for securing radioactive material. In addition to collecting national legal measures and creating a codebook of indicators drawn from IAEA guidance documents, the Stimson team developed a beta version online tool, which will facilitate national regulatory authority review of: 1) the collection of measures for completeness and 2) the team's preliminary analysis of the national frameworks.

Dataset

To identify UN member state measures addressing radioactive material security, the Stimson research team turned to tools developed and made publicly available by the UN 1540 Committee (the United Nations Committee Established Pursuant to United Nations Security Council Resolution 1540 (2004)). The UN 1540 committee posts and periodically updates on its website matrices for each UN member state on implementation of UN resolution 1540, which obligates all states to prevent chemical, biological, nuclear, or radiological weapons or weapons-related material from falling into the hands of non-state actors. The matrices list the names of laws, regulations, and decrees that, among other obligations, implement resolution 1540's requirement to ensure the security of such materials. The team hypothesized that some portion of the measures on securing nuclear weapons-related materials would also address the physical protection of radioactive material more broadly.[4]

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common-was-lost-and-found-radioactive-capsule-not-the-only-missing-material-around; April Rubin, "A Camera Containing Radioactive Material Is Missing in the Houston Area," The New York Times, March 12, 2023. https://www.nytimes.com/2023/03/12/us/radioactive-camera-missing-houston.html; Carlos Robles, "Alert in Central Mexico after Theft of Radioactive Material," BNONews, March 23, 2023. https://bnonews.com/index.php/2023/03/alert-in-central-mexico-after-theft-of-radioactive-material/

[3]International Atomic Energy Agency, "Nuclear Safety, Security, and Safeguards in Ukraine: February 2022-February 2023," Vienna, 2023. https://www.iaea.org/sites/default/files/23/02/nuclear-safety-security-and-safeguards-in-ukraine-feb-2023.pdf

[4] Richard T. Cupitt, "National Legal Frameworks for Radiological Security – Update and Assessment," paper presented at the IAEA First International Conference on Nuclear Law: The Global Debate, Vienna, 2022.

The Stimson team searched for the text of these legal measures in both the language of origin and in English using basic Internet search tools, consulting national regulator websites and civil society resources, such as the Nuclear Security Legislation Database compiled by the Verification Research, Training, and Information Centre (VERTIC). As the former project leader Richard T. Cupitt has noted in his previous papers on this initiative, this approach may create an acknowledged bias in favor of states that make their laws accessible online.[5] Where an English version was not supplied and the team did not read the original language well enough to conduct a review, Google, DeepL, or Microsoft Word applications were used to make unofficial translations of the measure into English.

Having located and, where necessary, translated the measure, the team conducted an initial review for relevance to the research project: did the law or regulation include a requirement to physically protect radioactive material? If not, the law was excluded as not relevant to the project scope. This assessment was complicated by semantics, as in many languages, the word for safety and security is the same. The team also assessed whether the law or regulation concerned special nuclear material only. If so, the law was excluded from the analysis. Using this methodology, the team compiled a list of 236 legal measures from 101 UN member states that included a requirement for the physical protection of radioactive material. The team was unable to identify relevant measures for 92 UN member states. As will be addressed in the Coding section of this paper, it may also be that the project's focus on measures that specifically reference the physical protection of radioactive material in some cases causes laws relevant to the analysis to be left out.

Codebook

The team reviewed IAEA guidance documents to develop a codebook of indicators of a strong legal framework for securing radioactive material. The guidance documents which ultimately supplied the key elements of these indicators included:

1. Code of Conduct on the Safety and Security of Radioactive Sources (IAEA, 2004)
2. Guidance on the Management of Disused Radioactive Sources (IAEA, 2018)
3. Security of Radioactive Material in Use and Storage and of Associated Facilities Implementing Guide (IAEA, 2019)
4. Security of Radioactive Material in Transport Guide (IAEA, 2020)
5. Nuclear Security Recommendations on Radioactive Material and Associated Facilities (IAEA, 2011)
6. UN Recommendations on the Transport of Dangerous Goods, Model Regulations, Rev. 22, Annex I, Part I.

Developing the criteria required comparing and integrating guidance elements across these documents that addressed common topics but varied in the specifics.[6] This approach created challenges in scoring, as addressed in the next section. One IAEA guidance document, *Guidance on the Import and Export of Radioactive Sources*, was initially considered as a source document but the team found its requirements to be so different to the Code and the other security-focused

[5] Ibid.
[6] Ibid.

guidance documents that it was impractical and unfeasible to include them in the same codebook.

The resulting codebook includes 46 key security indicators organized into six main categories:

1. Indicators related to the independence and responsibilities vested in the state regulatory body,
2. Indicators directly related to securing radioactive material, including disused sources and material in transport, transit, and transshipment,
3. Indicators related to the state's authorizing, licensing, and inspection system,
4. Indicators related to whether laws define offenses and differentiated penalties,
5. Indicators related to training, awareness raising, and information sharing,
6. Indicators related to international political commitments.

Together, these security indicators comprise the criteria against which a state's legal framework is assessed. The Stimson team then invited external legal specialists and experts in the security of radioactive material to review the codebook and addressed feedback to the maximum extent possible within the scope and schedule constraints of the project.

Measure Coding and Weighting

In conducting its analysis, the team reviewed each legal measure in its dataset against each of the codebook indicators, creating a "measure-level" analysis of each law. However, the team's ultimate goal was to create a national-level analysis of how well each state's legal framework overall met the set of indicators. The team found that many states have one legal measure which satisfies multiple security criteria. Likewise, some criteria are satisfied by multiple legal measures. For the purposes of the national-level analysis, therefore, if a state has one or more legal measures which satisfied a criteria, then that criteria was simply noted as a Yes. If the research team was not able to identify relevant legal measures that satisfied a given criteria, then that criteria was noted as a No. In a few rare cases, a criteria is noted Unknown, largely in situations where legal language was unclear, ambiguous, or the researcher was otherwise uncertain about how to code. No bonus was awarded for redundancy or efficiency: if a given state has three legal measures that satisfy one criteria, the state received a single Yes for the criteria. If one legal measure satisfies three criteria, then each criteria is coded as a Yes.

A state's score in a review is simply the aggregate number of criteria satisfied. While the criteria are organized into categories, they are not weighted; equal weight is assigned to each criteria and category.

There are several issues to be considered regarding the measure level coding and state-level scoring methodology. As noted above, the overlapping but not identical nature of the guidance in the five source IAEA documents created complexity in a number of the indicators that ideally would be addressed through a methodology for partial scoring.[7] For this project, the team assigned a Yes for indicators judged to have been partially met, but will give consideration in future phases of the project to how such a partial scoring system might be applied. Further, as

[7] Ibid.

noted above, the methodology of reviewing only legal measures with a specific requirement to secure radioactive material has a potential impact on the result. Potentially relevant measures, such as labor law addressing conflict of interest (an element in assessing the indicator related to independence of the regulatory authority) may be overlooked. Finally, Cupitt has also noted that the project methodology is biased towards "what one can measure through textual analysis rather than field observation."[8]

Preliminary Findings

While some initial observations can be made on the data collected and analysis conducted in this project phase, a note of caution is in order about the preliminary nature of the dataset. The complexity and scale of collecting and assessing relevant legal measures for all 193 UN member states in (or in unofficial translation to English from) a variety of languages, and against a comprehensive codebook of composite indicators integrated from similar requirements across several different guidance documents, cannot be overstated. The Stimson team intends to invite all national regulatory authorities to review the collection of legal measures and assessments and provide feedback on additional measures that may have been overlooked but should be reassessed for relevance and inclusion in the coding and scoring assessment.

With these caveats in mind, and with the understanding that the specific numbers below will likely change as feedback from national regulatory authorities is integrated, the following tentative findings of low implementation associated with voluntary political commitments are broadly in line with previous analyses and likely point toward firmer future conclusions:[9]

1. *Low implementation of guidance for securing radioactive sources*: Only one country's legal framework met all 16 indicators in the category for securing radioactive sources and only 8 countries meet 15 of those indicators, while 90 states met none of the 16 indicators.
2. *Low implementation of other areas of guidance*:
    a. Regulatory authority: The team found measures addressing at least 2 of 3 indicators in this category for 60 states and measures addressing all 3 indicators for 20 countries.
    b. Authorization and licensing: The team found measures addressing at least 8 of 9 indicators in this category for 16 states and measures addressing all 9 indicators for three countries.
    c. Offenses and penalties: The team found measures addressing at least 10 of 11 indicators in this category for 4 states and measures addressing all 11 indicators for one country.

[8] Ibid.

[9] Kenneth C. Brill and John H. Bernhard, "Preventing the Preventable: Strengthening International Controls to Thwart Radiological Terrorism," The Bulletin of the Atomic Scientists, 76, 4 (2020) 206-209; Nuclear Threat Initiative, "Radiological Security Progress Report: Preventing Dirty Bombs – Fighting Weapons of Mass Disruption," Nuclear Threat Initiative, Washington, DC (Mar 1, 2016), https://www.jstor.org/stable/resrep14268

d. Training and awareness raising: The team found measures addressing at least 3 of 4 indicators in this category for 29 states and measures addressing all four indicators for 15 countries.

3. *Implementation of security guidance lags political commitment*: As of May 2022, 140 of 176 IAEA member states, or approximately 80%, had made a formal political commitment to the Code of Conduct. This figure compared to about 77% of IAEA member states as of the date of a 2016 Nuclear Threat Initiative report.[10]
    a. The number of countries that had made some kind of political statement, including providing an IAEA point of contact, was even higher at 159. Among these, there were 54 countries for which the team found no measures addressing any other non-political indicators.

Tool Development and Key Features

The Stimson project team has also created a beta website that for now will be used to provide access for national regulatory authorities to review the Stimson team's collection of legal measures and assessments and provide feedback on additional measures that may have been overlooked but should be considered for relevance and inclusion in the coding and scoring assessment.

Key features of the tool, which the research team plans to make publicly available after adjudicating and integrating responses from national authorities, include a search function that allows users to click on a country of interest for access to the review of that country's legal framework against the codebook's list of security indicators. The tool shows the state's total preliminary score and scores in each of the six indicator categories. Users can expand the categories to see how each indicator was coded, as well as the legal measures that address each indicator, with links to downloadable PDFs and source URLs. Users can also find a complete list of relevant measures for each country, with embedded PDF and URL links.

Users can select two or more countries for comparison at a summary level or at a detailed, indicator level, and can also search for countries by scores within a given range. The tool also allows the user to immediately translate the site into any of the six official UN languages by clicking on a selection at the top of the webpage. The translation is conducted using a Google Translate service.

Conclusion

The risk of loss or theft of radioactive material, and the associated potential for its use by malicious actors to create a radiological dispersal device, or "dirty bomb," remains an enduring problem for policy makers and the law enforcement community. Strong national legal frameworks are vital to ensuring that the radioactive material so critical to daily life around the world is not diverted to destructive ends. Despite some methodological biases and the preliminary nature of the results, the Stimson Center's work demonstrates an approach to collecting and analyzing open-source data to help identify which international standards and best

[10] Nuclear Threat Initiative, "Radiological Security Progress Report: Preventing Dirty Bombs – Fighting Weapons of Mass Disruption," Nuclear Threat Initiative, Washington, DC (Mar 1, 2016), https://www.jstor.org/stable/resrep14268

practices are least implemented around the world and how best to direct and focus assistance efforts in strengthening legal frameworks for radioactive material security.

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