

## **Tools and Methodologies to Support Implementation of the IAEA's Additional Protocol**

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### **Abstract**

In 1997, the International Atomic Energy Agency's (IAEA's) Board of Governors approved the Model Additional Protocol (AP). As of May 19, 2017, 129 countries<sup>2</sup> have entered the AP into force, establishing the AP as an indispensable part of the IAEA's verification regime. Once a country enters the AP into force, it is required to provide its initial AP declaration to the IAEA within 180 calendar days, annual updates by May 15th of each year thereafter, and quarterly reports on exports of equipment and non-nuclear materials listed in Annex II of the AP. The IAEA and motivated States have provided training and support to countries to help them in implementing the AP and making their AP declarations. It is essential that a State understand what must be declared under the AP and then submit timely declarations to enable the IAEA to verify that a State's reporting is *correct* and *complete*.

A number of software tools and methodologies have been developed to help States identify potentially declarable activities, understand what must be declared under the AP, and then provide correct, complete, and timely declarations to the IAEA. One of the main tools is the updated Protocol Reporter 3.0, which was released in 2016. This redesigned software provides a robust platform that allows a State to capture and manage information about its declarable locations, material, and activities and submit this information to the IAEA. In addition, other methodologies and tools such as open source research and the AP Declaration Helper provide information to support identification of potentially declarable activities in the country and how to analyze those activities to determine if they should be declared under the AP. This paper describes how these methodologies and tools promote effective implementation of the AP.

### **Background**

The United States signed the Additional Protocol (AP) in 1998 and entered it into force in 2009. The U.S. AP contains the same text as the International Atomic Energy Agency's (IAEA's) model AP<sup>3</sup> - *Model Protocol Additional to the Agreement(s) between the State(s) and the International Atomic*

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<sup>2</sup> <https://www.iaea.org/topics/additional-protocol/status> - Status of the Additional Protocol.

<sup>3</sup> <https://www.iaea.org/sites/default/files/infcirc540c.pdf>

*Energy Agency for the Application of Safeguards* - but includes a provision to exclude information of national security significance. The U.S. commitment is to declare all civilian nuclear activities covered under the AP. During the time between the signing of the AP by the United States and its Entry Into Force (EIF)<sup>4</sup>, the U.S. Department of Energy (DOE) and other agencies performed a significant amount of work and training to effectively implement the AP. Because of this work, the U.S. developed its own set of tools and methodologies to support its efforts.

Effective AP implementation depends on a robust process that includes an understanding of what must be declared under the AP, how to identify potentially declarable activities, how to review and verify each, and how to report them to the IAEA. This process includes management of information and processes internal to the country to achieve a high level of confidence that all information has been provided and it is correct.

As part of the U.S. AP Implementation Act and Senate Resolution of Ratification<sup>5</sup>, the Executive branch of government is required to report annually to Congress on measures taken to achieve the adoption of the AP in non-nuclear weapon States, as well as assistance to the IAEA to promote the effective implementation of APs in those States. Therefore, as a follow-on to the domestic AP implementation effort, the DOE/National Nuclear Security Administration (NNSA) International Nuclear Safeguards Engagement Program (INSEP)<sup>6</sup> began working with international partners on AP implementation issues. Through these collaborations NNSA discovered that many countries needed assistance with process-related activities such as how to identify potentially declarable activities; how to communicate with stakeholders; how to collect, manage, and review the information; and how to report the information to the IAEA. As such, NNSA has developed a series of tools and methodologies that could be used by other countries in their AP implementation activities.

NNSA initiated a series of meetings with the IAEA to explore how NNSA could collaborate with the IAEA to improve safeguards reporting by States. The natural role for NNSA is to provide support to States focused on building capacity for effective AP implementation. The IAEA provides the safeguards requirements that must be fulfilled, but does not prescribe the process a State undertakes. However, NNSA works closely with the State's authority responsible for safeguards implementation to help them interpret the IAEA requirements and develop strategies and actionable plans for the State to effectively implement its safeguards obligations. Consequently, NNSA can bring resources to bear to complement the IAEA's international safeguards role and thus there is a natural synergy between them as both are mutually supportive of each other for the ultimate benefit of the State.

## **Tools and Methodologies**

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<sup>4</sup> Entry Into Force signifies that a State has deposited its instrument of ratification with the IAEA, which makes the AP operational.

<sup>5</sup> <https://www.congress.gov/congressional-report/109th-congress/senate-report/226/1> - S. Rept. 109-226 - U.S. Additional Protocol Implementation Act, 109th Congress (2005-2006)

<sup>6</sup> <https://nnsa.energy.gov/aboutus/ourprograms/nonproliferation-0/npac/safeguards> - National Nuclear Security Administration, Office of International Nuclear Safeguards

## AP Declaration Helper

One of the first tools developed in collaboration between NNSA and the IAEA was the AP Declaration Helper<sup>7</sup> (APDH) (Fig. 1). The APDH guides users through simple questionnaires that help them navigate through the declaration decision process without the need for intimate knowledge of the AP. The tool includes built-in guidance regarding AP requirements, so a user need only know the technical details about the nuclear-related activities being evaluated. By assembling and cross-referencing a wide array of information from, and related to, the Model Additional Protocol [INFCIRC/540 (Corrected)], the APDH breaks down the information in the AP into a form that is easy to use and understand. All that a user need do is answer a series of simple “Yes/No” questions that determine whether an activity is likely to be declarable.

The APDH also contains a robust hyperlinked help feature that allows users to drill down into the requirements of the AP and the definitions of specific terms and is cross referenced with the major safeguards texts (e.g., Non-Proliferation Treaty, IAEA Statute, INFCIRC/153, and INFRIRC/540).

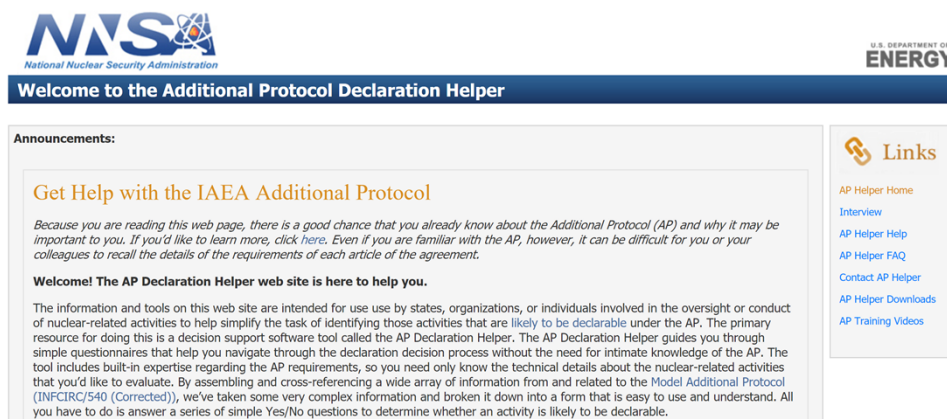


Figure 1 – AP Declaration Helper software helps users identify what activities may be declarable under the AP

## Open Source Search Methodology

Other than understanding the reporting obligations under the AP, one of the most daunting tasks for a country to perform is to identify all the potentially declarable activities and material occurring in their country. To identify all declarable activities and nuclear materials may require the State Authority<sup>8</sup> to reach out to entities in its country beyond traditional users of nuclear material. For example, a State with a research reactor may have a well-established protocol for accounting for and reporting the fuel in that reactor; however, the State may be unaware of a university research laboratory doing research on the nuclear fuel cycle or a private company producing components for a nuclear facility, which in both cases may be declarable under the AP.

<sup>7</sup> <http://www.aphelper.doe.gov/>

<sup>8</sup> An IAEA term denoting the State entity that is responsible for safeguards implementation.

The AP is designed to fill the gaps in reporting obligations under their Comprehensive Safeguards Agreements (CSAs), INFCIRC/153 (Corrected)<sup>9</sup> - *The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*. AP reporting requirements include research and development activities that do NOT involve nuclear material that may occur at universities and research centers (both government sponsored and private), mining and milling of uranium and thorium, imports, exports and holdings of pre-34(c) material<sup>10</sup>, expanded information on Locations Outside Facilities<sup>11</sup>, the export, import, and manufacturing of certain equipment that is “especially designed and prepared<sup>12</sup>” for the nuclear fuel cycle, and any general plans for the succeeding ten-year period relevant to the development of the nuclear fuel cycle (including planned nuclear fuel cycle-related research and development activities). As such, a country must be able to reach out to individuals both inside and outside the government to determine if any of these activities or materials need to be reported under the AP.

One very useful methodology for discovering additional declarable information, whether it is declarable under the AP or the CSA, is searching for open source information. Open source information is information that is publicly available and can often be found on the internet. Examples include company websites, news articles, or scientific publications. Performing open source research can help the parties responsible for the safeguards declarations (typically the State Authority) determine what activities are taking place in the country and what materials may exist. The goal of NNSA’s efforts in this area is to help partners develop a customized, repeatable process for collecting, analyzing, and evaluating open source information for safeguards reporting. The methodology can help in identifying organizations with known safeguards reporting responsibilities, identifying new organizations with possible safeguards reporting responsibilities, maintaining awareness of safeguards relevant activities in the State, and discovering activities within the State that are declarable under their international safeguards agreements.

An effective open source research methodology requires a thoughtful, repeatable process that covers the collection, analysis, and processing of open source information. This process can be summarized in five main steps. First, the State Authority should develop a list of entities that may be engaged in safeguards-relevant activities to the best of its knowledge. Beyond the known nuclear material users, such entities might include universities and hospitals that may either utilize nuclear material or be engaged in AP-related activities. Second, the State Authority should identify information sources that may contain safeguards-relevant information. These sources may include the websites of identified entities, but also trade publications, local news, or research journals. Third, the State Authority must develop search queries that help to extract useful information from relevant sources. This can include keywords related to nuclear materials or activities, but also keywords related to relevant entities in the country. Fourth, the State Authority must establish the process for conducting the research. This includes determining who is

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<sup>9</sup> <https://www.iaea.org/sites/default/files/publications/documents/infircs/1972/infirc153.pdf>

<sup>10</sup> Nuclear material that has is not of a composition and purity suitable for fuel fabrication or for being isotopically enriched, paragraph 34(c) of INFCIRC/153 (Corrected).

<sup>11</sup> [https://www.iaea.org/sites/default/files/iaea\\_safeguards\\_glossary.pdf](https://www.iaea.org/sites/default/files/iaea_safeguards_glossary.pdf) - Location outside facilities (LOF) — “any installation or location, which is not a facility, where nuclear material is customarily used in amounts of one effective kilogram or less” [540, Article 18.j].

<sup>12</sup> [https://www.iaea.org/sites/default/files/iaea\\_safeguards\\_glossary.pdf](https://www.iaea.org/sites/default/files/iaea_safeguards_glossary.pdf) - Pursuant to Article III.2, each State party to the NPT undertakes not to provide source or special fissionable material, or *equipment or material especially designed or prepared for the processing, use or production of special fissionable material*, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material is subject to the safeguards required by Article III.1.

responsible for conducting the research, when the research must be conducted, and how the information must be analyzed for credibility. For example, a State Authority might find it useful to review general news for nuclear-related developments in its country weekly, and it might perform more detailed research on scientific publications annually. Finally, the State Authority must develop a process for responding to and managing relevant information. For example, the State Authority must plan how it will respond to discoveries of potentially declarable information, and it must make a plan for storing collected information so that it can document what has been learned.

One outcome of this process is the discovery of entities and organizations that are potential stakeholders in the safeguards reporting process and should be contacted by the State Authority to explain the requirement of the relevant safeguards agreement. Educating these entities is a critical step in fulfilling the State Authority's responsibility in ensuring that the list of activities and materials are reported to the IAEA is complete. Since most, if not all, of these newly discovered entities will be unfamiliar with international nuclear safeguards and their reporting requirements, it is up to the State Authority to reach out and educate them and to develop a reporting process that is robust and that can be sustained.

## Protocol Reporter Software

The Protocol Reporter 3.0 (PR3) was released by the IAEA in 2016 and is an update to the software that the IAEA provides to States to support them in the creation of declarations under the AP and the submission of such declarations to the IAEA (Fig. 2). The PR3 allows States to enter declarable activities and materials under Article 2 and then to build the AP declaration submissions that States are obligated to send to the IAEA under Article 3 of the AP. It can also be used as a database to track and manage AP data over time. The development of the PR3 was a partnership between the IAEA and the U.S. DOE/NNSA.

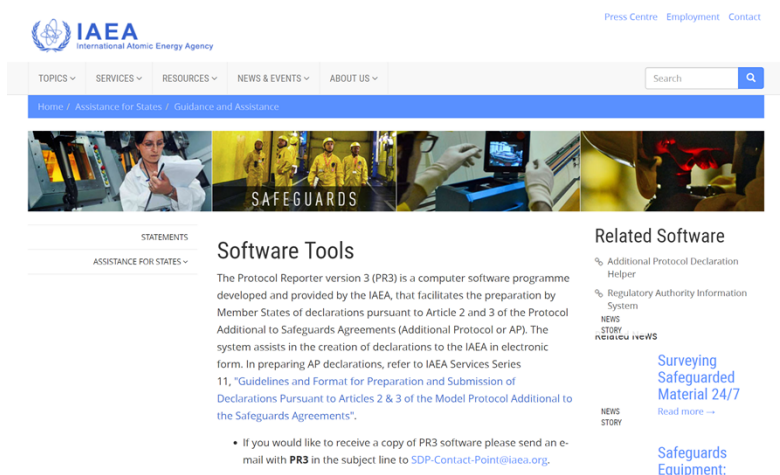


Figure 2 – The IAEA provides the PR3 software free to States to support making AP declarations

The PR3 was designed to be easy to install and to use. The installation package was developed to be comprehensive, installing all software components, pre-populated lookup tables and an integrated database engine, all in one process. Users are offered extensive, context sensitive help, and workflow guidance is available from a number of software assistants. The PR3 developers made efforts to increase the usability for State authorities and their contributors in addition to modernizing the software and updating the user interface. For the first time, PR3 provides the possibility to efficiently divide tasks

between information contributors (e.g. facility operators and locations outside facilities, site managers, etc.) and the State authorities as information aggregators/reviewers by introducing separate contributor and State Authority modes.

The PR3 accommodates workflows that require only users at the State Authority level, who are assembling and reviewing complete declarations and submissions, to have detailed knowledge of the AP and the submission development process. Subject matter experts at the contributor level can focus on the technical content of the entries they are drafting for their associated locations and activities, with little comprehensive knowledge of the overall submission process and the AP. This allows for effective distribution of the tasks involved in the process to the parties that are most qualified and authorized to complete those tasks. The design of the PR3 workflow process is both flexible and robust. It assists countries in effectively managing the information related to the AP – from the gathering, review, approval, and submission. To obtain a copy of the PR3, States must simply contact the IAEA’s Department of Safeguards and request a copy<sup>13</sup>.

### **Application of Tools and Methodologies**

The APDH and PR3 software tools and the open source research methodology, can be integrated into a process that can facilitate a country’s initial AP declaration or can be used to improve a country’s AP annual submission. Overall, this process can improve the quality of the data and can contribute to the sustainability of the AP declaration process.

The process can be described as follows (Fig. 3):

- Obtain information on the scope and content of the AP and the reporting requirements. The State Authority must have this knowledge because it underpins the entire process.
- Perform open source research using the methodology described previously. Compile and record the results. Also, identify the stakeholders that may need to be contacted regarding potentially declarable activities or materials.
- Use the APDH to review the output of the open source research and determine if any activities or material are potentially declarable. The determination that an activity or material is NOT declarable should also be captured and recorded. This is for both quality assurance of the analysis process and to answer any questions that may be raised in the future as to why an activity or material was not declared to the IAEA. It also prevents duplication of effort in subsequent AP declarations.
- Use the results of the “declarability” review to develop an initial AP submission or the next annual update<sup>14</sup>.

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<sup>13</sup> Requests for PR3 software should be addressed to: Section for Declared Information Analysis | Division of Information Management | Department of Safeguards | International Atomic Energy Agency | Vienna International Centre, PO Box 100, 1400 Vienna, Austria |  
Email: SGIMISD@iaea.org

<sup>14</sup> If a country is preparing its annual updated submission, any legacy data can be imported from the PR2 and validated in the PR3 software.



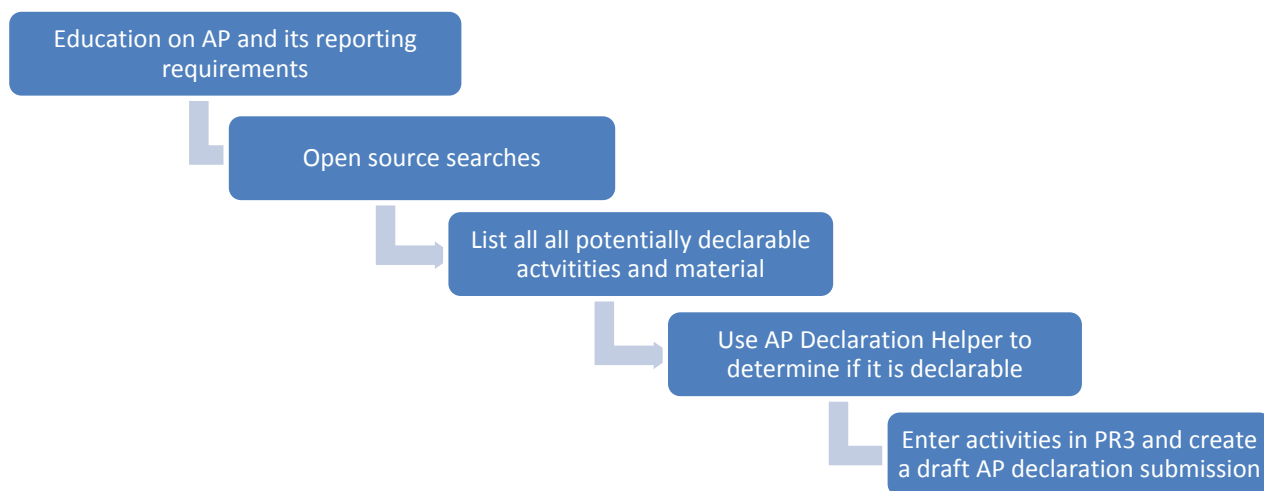


Figure 3 – The application of tools and methodologies

Once this process is complete, the country has a draft initial AP submission or a draft annual update submission. The country should then perform quality checks of the data input and the methodology used to gather the information and follow the normal process to submit the declaration for approval by the government and then to submit it to the IAEA<sup>15</sup>.

As an example of how the methodology works in practice, below is the description of a typical NNSA engagement with a country that has requested help in preparing its initial submission after entering the AP into force.

1. In coordination with the requesting country, an NNSA team consisting of subject matter experts in safeguards convenes a workshop for the State Authority and possibly other stakeholders to provide information on the requirements of the AP and how to develop AP declarations. Participants are also given information on how to perform open source research to identify potentially declarable activities as well as an exercise on the use of the AP Declaration Helper. They are also given information on the function of the PR3 and how to use it. The presentations are mixed with practical exercises that allow the participants to learn how to put into practice the concepts being discussed.
2. Participants then perform open source searches to identify potentially declarable activities. Depending on the size and composition of the group, they can be split into working teams and then share their results, which are captured on the main workshop screen and compared and discussed.

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<sup>15</sup> The process of obtaining government approval and providing the AP submission to the IAEA in a secure manner is not covered in this paper.

3. The participants then use the APDH to determine if the activities identified during the open source search are declarable under the AP. This allows them to understand how to use this tool in the future.
4. The country is expected to have requested an official version of the PR3 from the IAEA, which it can then install on the computer they will use to develop and submit the AP declaration. This computer can be used to project the entry screens, and the group then works together to enter declarable activities into the PR3. The result will be the draft initial declaration, which will be completed at the end of the workshop. The country can then use this to submit their final initial declaration to the IAEA after they have performed quality checks of the data input and get approval by the government to submit to the IAEA.
5. The result is that the country now has a suite of tools that can be used to identify potentially declarable activities, evaluate them to determine if they are in fact declarable, and enter the information in the IAEA's reporting software for eventual submission to the IAEA.

### **Conclusion**

Determining what activities and materials must be reported to the IAEA under the AP can be a daunting task for countries that are trying to understand what they need to do, when they need to do it, and how they can organize themselves to accomplish the necessary tasks. This includes determining what is potentially declarable; how to reach out to entities within the country that have relevant information; how to collect, organize, and review the information; and then how to securely transmit this information to the IAEA in a timely manner. This requires managing information and the flow of that information to ensure the quality of the data that is collected and reported. The tools and methodologies described in this paper provide an important resource to these countries in helping them with this process. These tools support information management, data quality assurance, and timely reporting to the IAEA under the AP. This helps the country provide the required reports to the IAEA that are correct and complete, which allows the IAEA to draw its safeguards conclusions to support the basis of international nuclear safeguards as well as international transparency and nuclear nonproliferation.

### **References**

1. Killinger MH, LH Hansen, DN Kovacic, M VanSickle, and KE Apt. 2009. "Department of Energy Efforts to Promote Universal Adherence to the IAEA Additional Protocol," Proceedings of the 50th Annual Meeting of the Institute of Nuclear Materials Management.
2. Rialhe A, R. Cain, K. Hannan, J. Idinger, W. Mandl, S. Purvis, I. Therios. 2014. – "IAEA Protocol Reporter Update: Scope, User's Requirements, Expectations, Collaborative Work," Symposium on International Safeguards, Linking Strategy, Implementation and People, Vienna, Austria.