

## DEPARTMENTAL PERFORMANCE MONITORING THROUGH DATA VISUALIZATION

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### Abstract

The Department is building a performance monitoring approach through a series of dashboards visualizing existing Departmental data, including from the MOSAIC apps. These dashboards support decision-making and provide insights from data. They are shared across Divisions to assist in monitoring indicators of Departmental performance that can be used for review by senior management and further investigation by staff. They span a wide range of safeguards activities and can quickly identify outlying data and behaviors, even if ill defined.

### 1. INTRODUCTION

The completion of the Modernization of Safeguards Information Technology (MOSAIC) project 2015-2018 and its continued improvement opened the door to Business Intelligence capabilities that were previously unavailable to the Department. In that project, custom applications were developed that allow Safeguards staff to easily collect or submit data, and store it using modern databases tools<sup>1</sup>. Building on existing efforts to create and monitor Key Performance Indicators within the Department, in 2019 the DDG and Directors approved a list of 36 performance metrics describing a wide range of safeguards information and activities, including statistics on the use of various in-field activities, timeliness of Departmental responses, and equipment failures.

With this list of 36 performance metrics, the Department created a series of dashboards and made them available through a web browser in the Department's secure Integrated Safeguards Environment (ISE). The dashboards are created using Power BI<sup>2</sup>, a tool that makes it easier to present organisational performance indicators and trend analysis in a single shared space. The tool brings with it many advantages for the Department; not only can it be used to connect and read from various database technologies, it can also be used to source data from spreadsheets, text files and a range of other data sources. This latter feature makes it particularly useful for non-IT professionals, who may often be collecting data locally in Excel. The dashboards can be updated automatically and stored in a single shared location, accessible via a web browser. Additionally, access and security are maintained through Authorisation Management, the Department's unified access and security framework introduced under MOSAIC. In addition to the approved metrics mentioned previously, Power BI is being used throughout the Department in many other areas as well, such as asset management and equipment performance monitoring and maintenance.

These dashboards are built on existing data from MOSAIC applications and do not invent new data or create requirements to add to inspector responsibilities in the field. Benefits to the Department of the application of Business Intelligence tools include improving efficiency and accuracy by automating many of the previously manual steps required to produce reports, providing real-time, instant analysis of data when previously static printouts were required and providing new types of analysis via intuitive, interactive single-page dashboards. By centralizing the dashboards in one location reports do not need to be created and collated by data requests from

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<sup>1</sup> This paper continues the work reported in "THE USE OF NEW ANALYTICAL CAPABILITIES ESTABLISHED UNDER MOSAIC TO SUPPORT THE DEPARTMENT'S USE OF PERFORMANCE INDICATORS" presented by G. Soudry at the 2018 Safeguards Symposium.

<sup>2</sup> It is not the purpose here to promote Power BI above other products – it should be noted that there are other competitors on the market with similar offerings, such as Tableau, Qlik, etc. Nor does this paper attempt to cover all the features of the product. The purpose here is to demonstrate how the Department is making use of Business Intelligence in general and Power BI in particular to enhance its analytical capabilities and monitoring of its performance.

different people in the Department. This reduces efforts to create the reports and increases consistency by sourcing the data from one location, rather than collating inputs from various parties in the Department.

Besides the primary function of monitoring trends and informing on status, the dashboards also provided the unexpected benefit of improving data quality. Utilization of the dashboards was expected to provoke questions and further analysis regarding levels of Departmental activity, but also frequently provoked questions of the correctness of the data. This, in turn, has led to an increased focus on accurate data entry at source and associated process improvements.

*The data depicted in this paper are entirely fictitious. Any similarity to real-world data is entirely coincidental.*

## 2. CURRENT APPLICATIONS

### 2.1. Reporting and Monitoring

The primary goal of the dashboards is to provide near real time reporting to senior management. This function supports the decision-making process by enabling senior management to rapidly assess a wide range of performance metrics and decide whether follow up action is necessary. To be clear, very often no action is necessary, but these dashboards quickly demonstrate that Departmental performance is acceptable and alleviate the need for time-consuming one-time reports addressing specific one-time questions on routine activities.

The dashboards utilize the Safeguards ANalysis Tool (SANT) project which was developed to minimise the time and effort required by the Department for the preparation of the annual State Implementation Report (SIR). The dashboards were built upon this platform because the SANT database was already developed for importing, aggregating and reporting safeguards data from a wide range of sources for the preparation of the SIR and using dashboards to display the data, such as the example in Fig.1.

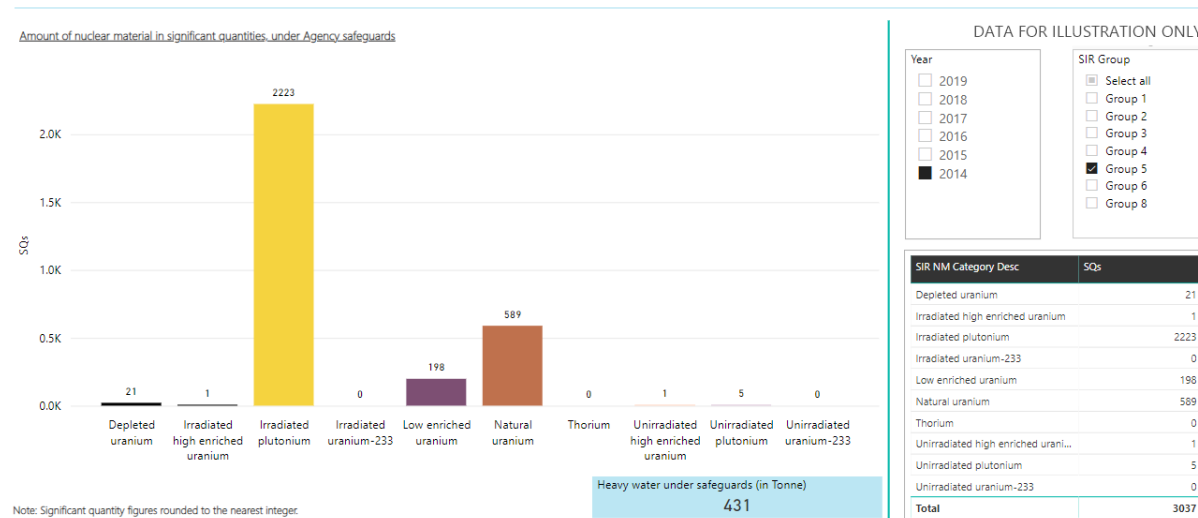


FIG.1. Sample-version of the internal online SIR

The new Departmental dashboards are designed to first provide a high-level “overview” landing page with additional focus placed on the visual aesthetics to make the data quickly understandable to the user. The dashboards focus on one particular topic each (with the exception of the “SG Dashboard” mentioned later), such as levels of in-field activities, CA’s, anomalies, or timeliness of reports.

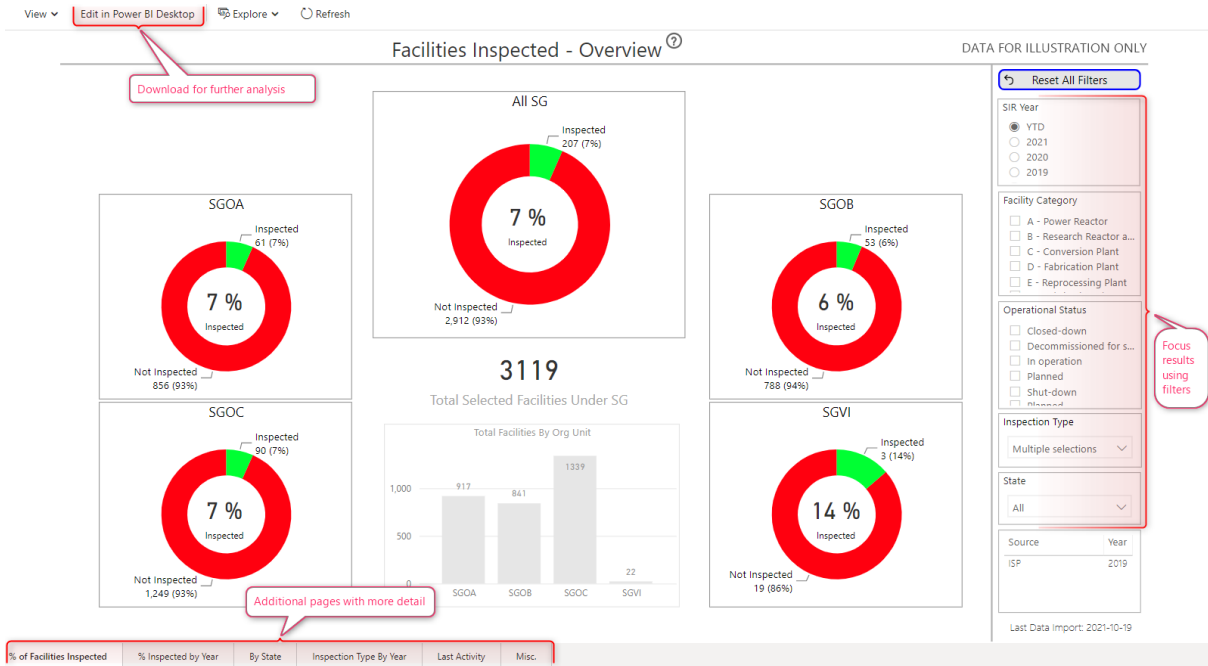


FIG.2. Facilities Inspected landing page, presenting the number of facilities inspected at a given point in time. Data shown is for illustration only.

The intent with such a dashboard is for either senior management to quickly view and understand the current status of an issue, or for a staff member to gather figures for a custom report for senior management. The visuals are straight-forward and clear enough that one can take a simple screenshot and incorporate them into a document.

## 2.2. Analysis

A key purpose of reporting and monitoring is to provide a rapid mechanism to either answer the question at hand, or to rapidly identify the outlying data or trends for further analysis. The initial homepage is at a high level and lacks sufficient detail for a thorough understanding of an issue. Should the user desire further information all of the dashboards therefore have a number of built-in features to allow for a further degree of immediate analysis. There are three primary features for further analysis.

The first feature is additional pages showing further detailed information on the issue. For example, the landing page of the dashboard describing Facilities Inspected (Fig. 2) shows the total number and percent of facilities inspected by division in this calendar year. This information provides a quick check on the level and distribution of coverage across the Department as an internal indicator of consistencies across divisions. There are additional pages which show the distribution by year, state and type of inspection.

Tables showing individual entries are also provided in these additional pages to allow the user to isolate specific events and more easily cross check with the data in other platforms. Any one dashboard only provides a narrow aspect, but the combination of these dashboards provides the user a way to perform a more thorough review of all data.

The second feature is multiple filters available on the right-hand side of the screen. These allow the user to filter, where applicable, by year, division and section, state of activity, type of facility, operational status, type of safeguards agreement, status of on-going activity, or other relevant dimension. Similarly, a feature known as cross-highlighting allows a user to select a field or column in one chart and instantly see the other visual components filtered by that item (Fig. 6). Through filtering and cross-highlighting, what previously took several pages using legacy tools now only takes one.

The third feature is the ability to download the file to allow selected users to create their own visuals. This feature is only available to selected users and requires a more advanced knowledge of the product. This feature is best suited to perform a deeper analysis for a specific question.

With the combination of these three features, the vast majority of questions can be answered relatively quickly to provide managers and staff alike with a deeper insight, leading to better decision-making.

### 2.3. User Success Story

The success of the dashboards is best demonstrated by an example. Again, the data presented is fictitious and was then modified for illustration purposes. It has no relation to actual figures.

Consider a member of staff interested in understanding and improving efficiencies in an area of the Department. A general starting point for staff member is the SG Dashboard (Fig. 3). This dashboard is an “overview of overviews”, and contains high level aggregations from a range of different performance indicators on a single page. At a glance, it gives an overview of several areas of Departmental performance at once, with one-click options to jump to the more targeted dashboards.

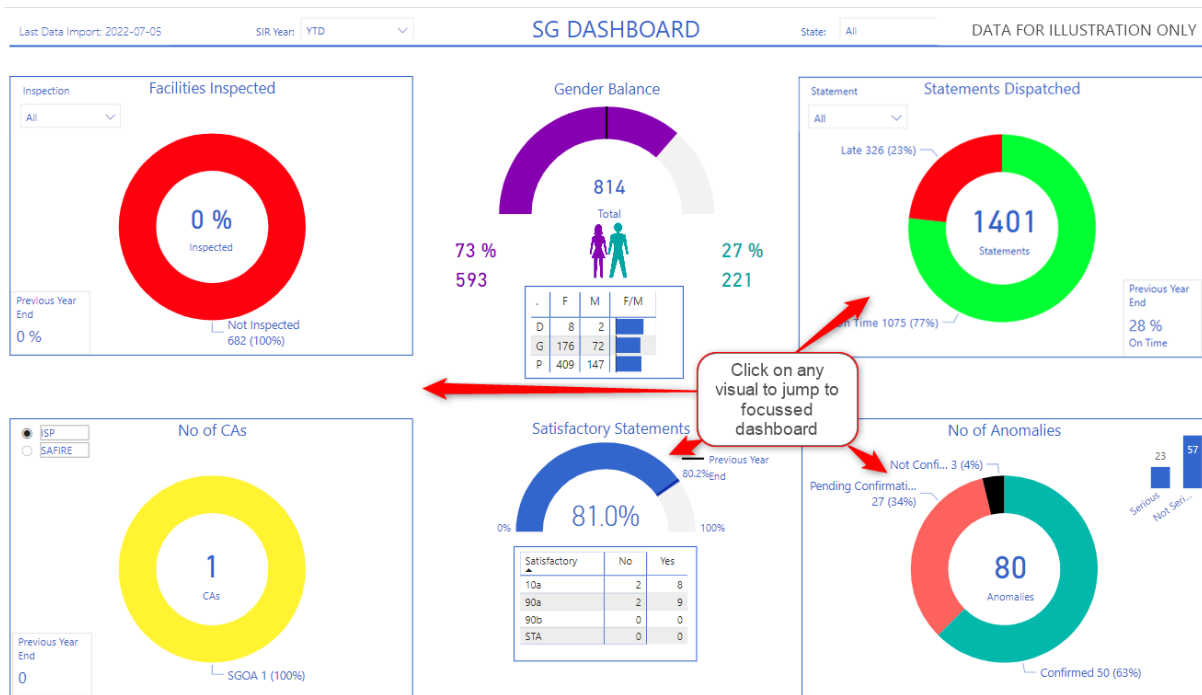


FIG. 3. SG Dashboard. “overview of overviews”, one-click jump to focussed dashboards. Mock-up data for illustration.

Today the individual is interested in the timeliness of Statements Dispatched figures (top right visual) so clicks on the visual itself to go directly to the Timeliness of Statements dashboard to find more information.

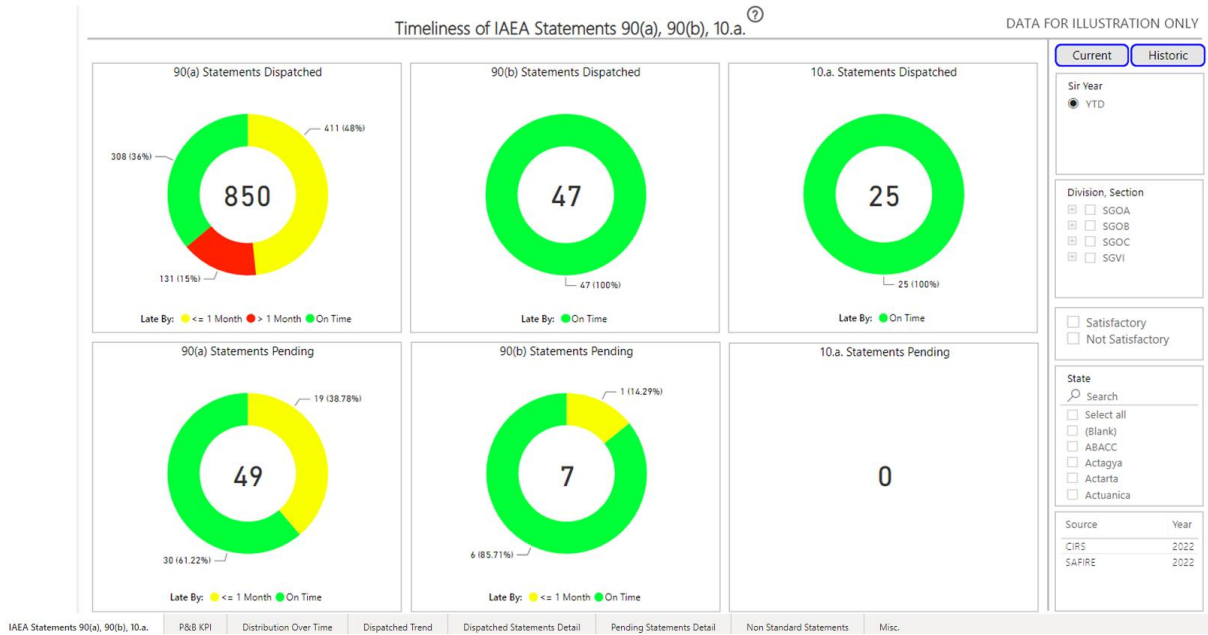


FIG.4. Timeliness of Statements Dashboard. Data shown is for illustrative purposes only.

In the Timeliness of Statements dashboard (Fig. 4), a more focused overview is presented on the landing page. The top row of charts displays the timeliness of 90(a), 90(b) and 10.a statements already dispatched, while the bottom row shows the same information for those still to be sent, or “pending”. The staff member quickly notices that the 90(a) statements (top left visual) are the least timely so moves to the next page of the dashboard to see the distribution over time of the statements dispatched (Fig. 5).

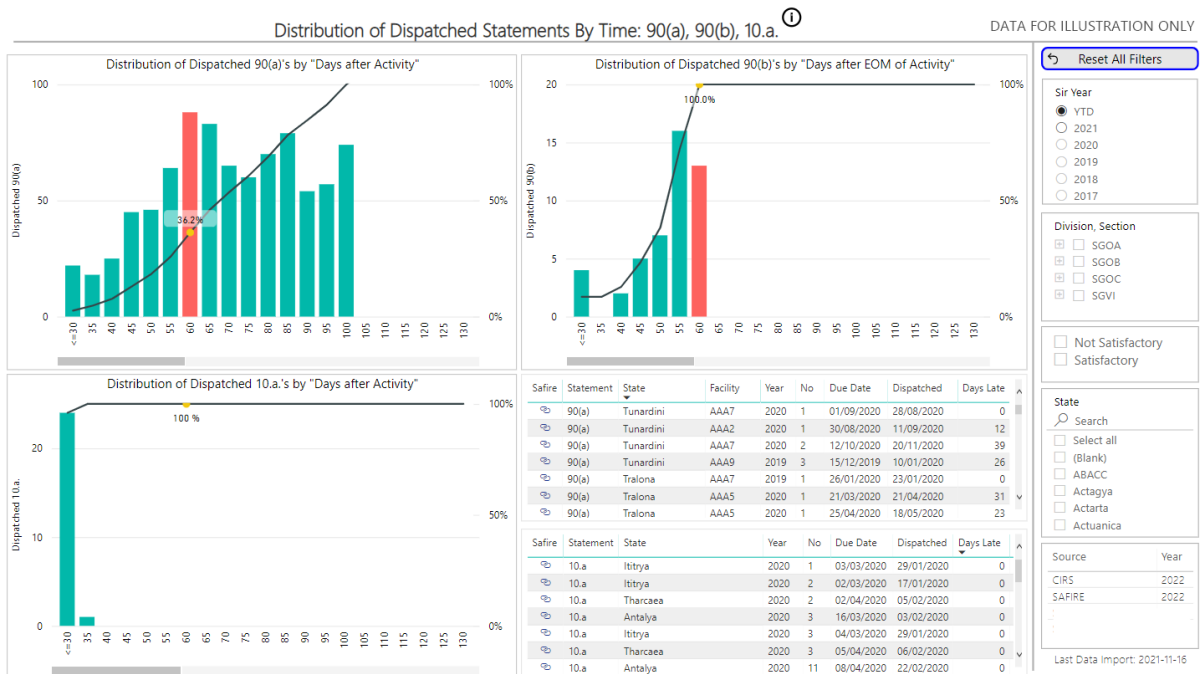


FIG. 5. Timeliness of Statements Dashboard, Distribution Page. Data shown is for illustrative purposes.

This dashboard adds more granularity and shows the distribution of the statement timeliness. This data set shows only 36% of 90(a) statements (red bar, top left visual) were sent on time, but most of the 90(a)s are late by less than a few weeks. Using the cross-filtering feature (Fig. 6), the staff member can highlight the later statements to find out exactly which ones they are, who is the coordinator responsible and even jump directly to the source application (SAFIRE) to find all the details for the activity. Using this technique, the staff member is able to focus on the late statements and identify past inefficiencies in Departmental processes and highlight areas for improvement.

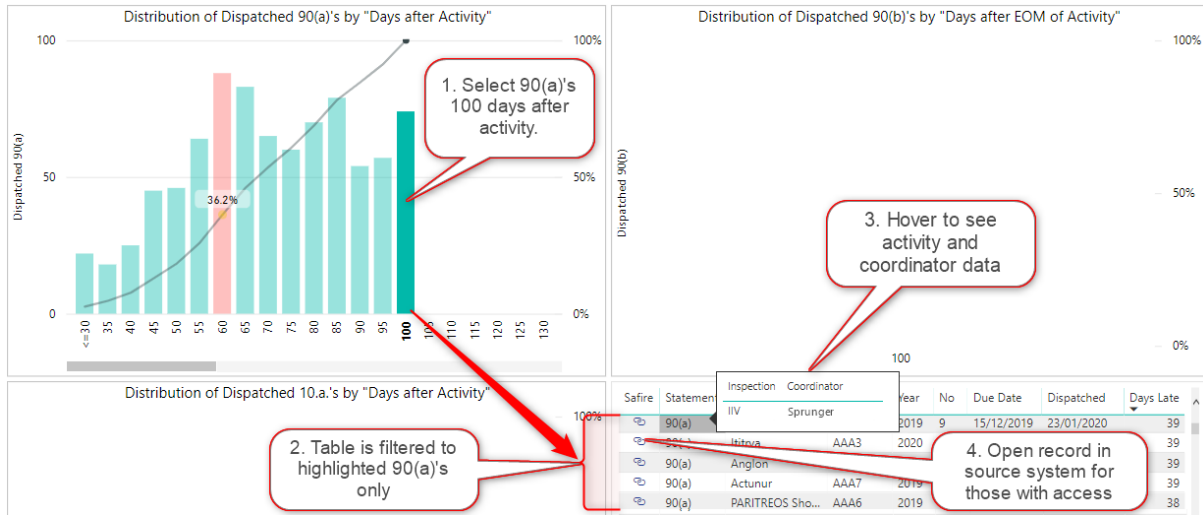


FIG. 6. Close-up of Distribution page with cross-highlighting: Data is narrowed down for deeper analysis.

Relatedly, "Pending Statements" (statements still to be sent, Fig. 7), may be monitored in detail to proactively identify statements falling due in the coming weeks as well as those beginning to fall behind, and track improvements.

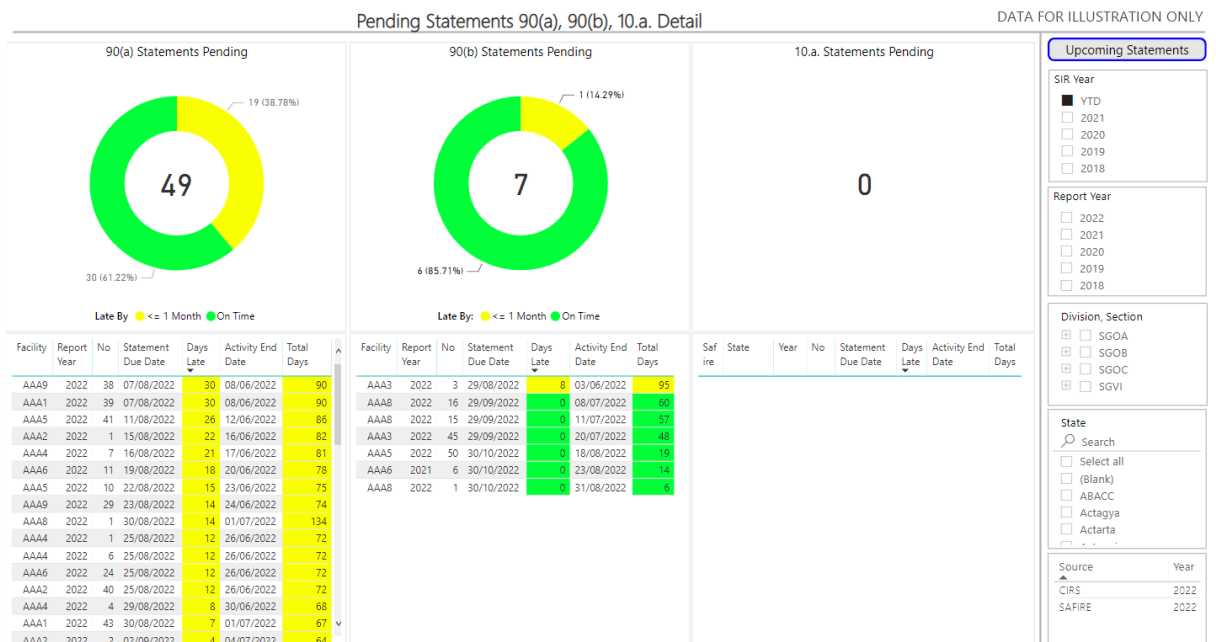


FIG. 7. Timeliness of Statements Dashboard, Pending Statements Detail Page

Similar analysis could be conducted on any of the topics shown in Fig .3. Before the availability of these tools, multiple people would be involved in collecting the data from various sources, collating and presenting this information. Furthermore, the specific area of interest was clearly defined in advance. On using these tools for the first time and conducting an analysis similar in depth to the one presented here, one staff member commented that what had just taken about 30 minutes to investigate “used to take me months!”

## 2.4. Data Quality and Limitations

A very useful feature of the dashboards is they quickly highlight poor quality data. Individual staff have an intuitive sense of the level of activity simply because they are immersed in the day to day activities. One of the first indications the dashboards were effective was the immediacy of staff questioning the correctness of the data. There are a number of reasons why the data might appear to be “incorrect”. Some of the reasons for this are listed below.

- 1) The dashboard is correct but not answering the right question or providing an incomplete answer. This can usually be solved by either adjusting the dashboard or adding another page with supplementary data.
- 2) The source data is not correct. The quality of the dashboards is ultimately constrained by the quality of data in the source systems. If the source is incorrect, the data shown in the dashboard will also be incorrect. Such errors may include incorrectly recorded dates which manifest themselves in the dashboards as timeliness outliers, or incorrectly labelled status manifesting themselves in incorrect levels of activity. This usually requires a simple update at the source, but can often take time to identify.
- 3) There is an error in the manipulation of the data between source and display. Certain assumptions about the data (conscious or otherwise) can be made and later found to be inaccurate. For example, it might be assumed that timestamps always fall in a logical order, when in fact there are rare occurrences when they can correctly be out of order. These errors can take time to understand and often require an extract of data from the original source to compare to the final product displayed on the screen.
- 4) Infrequent updating of the data in the root system can also make the data appear to be incorrect. There is a time lag between the actual date of an activity or event and when the event is recorded in the system. For example, an inspector cannot enter information into ISE until after their return to HQ which may be days or weeks after the event. It may be commonly known that an event happened through other communication channels, but it is simply not recorded in the source system yet.

It should be noted also that as usage of the Dashboards has been increasing, more attention has been focused on improving data quality. To be clear, a thorough yearly review takes place during the drafting of the SIR. But these dashboards help allow the Department to identify the inaccuracies earlier. As the impacts above become increasingly apparent to senior and junior staff alike, there is a general recognition of the importance of getting it right the first time. As a result, staff are gradually amending their working practices to ensure data is correctly entered and maintained at the source.

## 3. ACCESS

Access to the dashboards is governed by the Authorization Management System (AM). For Directors and Section Heads their access to data for states under their purview is propagated to the SANT database. The result is when a Director or Section Head opens the dashboards the data is already filtered to their respective Division or Section. Staff in the DDG’s office are given the SIR Analyst role which grants them access to the data for all states. To be clear, this is not *all* data for all states, but only the statistical data that may be included in the SIR.

For example, the data may show that a CA took place and include information about the state, facility or location, type, and date of the CA, but it does not include any information about the reasons for the CA or the results thereof.

Utilising AM, additional users can be granted time limited access through a controlled approval process, ensuring that classified data is not exposed to those without authorisation.

#### 4. CONCLUSION

The paper described a set of dashboards supporting the Department's use of Performance Metrics and driving efficiencies in several key areas. These novel dashboards provide access to a wide range of Departmental data in one single platform, thus providing a consistent monitoring and analysis tool. This is one of the subtle strengths of this approach in that it moves away from reporting piecemeal by Division and Section, thus supporting a comprehensive, unified Departmental approach. The dashboards are designed not only to provide quick statistical metrics to top level management, but to also provide layered capabilities to further analyse and drill down into the data. These dashboards promote data quality by making the data clearly visible in near real time. Not only does this prompt data corrections where necessary, but the dashboards also prompt data updates throughout the year rather than waiting until year end. Additionally, access and security of these new capabilities is maintained through Authorisation Management, the unified access and security framework introduced under MOSAIC. The result is a powerful, and relatively inexpensive, set of tools to support the Departments monitoring of internal performance metrics.