INUOG-2018/002, REV.0

Guideline for establishing obsolescence indicators.

INUOG, International Nuclear Utilities Obsolescence Group.

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1. Introduction

According to NX-1037 Rev.3, an effective management of obsolescence should consider performing an assessment and developing metrics.

Currently some utilities already have a proactive obsolescence program established within the organization and use KPI's for monitoring the process, other utilities are in the process of developing a proactive obsolescence program and KPI's.

Whether your site already has defined KPI's or is in the process of defining them, it is recommended to use only a limited number of indicators that are required to monitor the process effectively. The more indicators defined and measured, the more information about each part of the process you will have. However, too many indicators can result to be cumbersome and not be operative.

2. Purpose

The purpose of this guideline is to provide nuclear utilities with a basis for establishing metrics that can be used to monitor a sites obsolescence program and easily benchmark amongst other utilities. Each utility should adapt the metrics to the software used at their site for data collection, metric calculation, and sharing with the industry.

3. Scope

3.1. Type of indicators

The processes that are implemented at each site are monitored with the final intention of controlling the process, analyzing the efficiency, and improving the process. For each of these three actions, both, what we need to measure and the type of output we need will be different.

There are numerous classifications for such indicators, but the division will be only in 2 groups. These are: Leading and Lagging.

- Leading indicators are output orientated; these indicators will measure normally the end of a process. For example, the number of obsolescence cases solved.
- Lagging indicators are input oriented; these indicators will measure the aspects that affect to the process. For example, the number of man-hours expended in obsolescence issues.

Usually it is easy to measure a leading indicator, on the other hand, it can be difficult to influence. Lagging indicators are the opposite, normally they are easy to influence but measuring it can be difficult. If we take a look at some examples:

- Ex.1: Number of obsolescence cases solved. It's reasonably easy to determine how many obsolescence issues have been solved, but if we wanted to increase the number, several aspects would influence the result.

- Ex.2: Number of man-hours expended in Obsolescence issues. It is easy to say that if you need more man-hours for people to work on obsolescence issues you just need to hire, but it's difficult to determine how many hours are required for a specific issue, since people perform multiple tasks and may have emergent work that requires their attention.

For the case of a proactive obsolescence program, it will be necessary to set metrics for the general process and metrics for each phase of the plan including identification, prioritization, analysis, and solution.

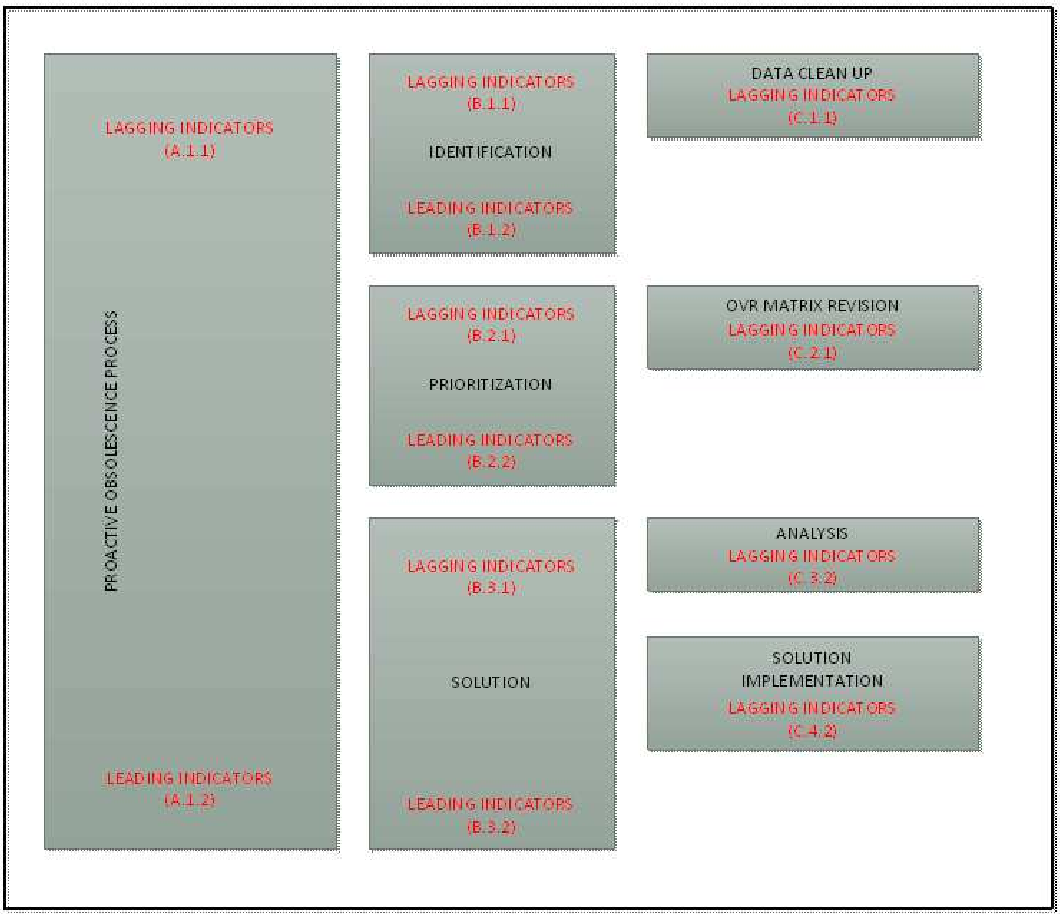


Figure 1. Leading and Lagging Indicators.

A simple classification can help clarify the different groups of indicators. For the obsolescence process, see the example above, the indicator code is as defined below.

(X.Y.Z) where each position means,

X. Letter character, starting with the letter "A" for the most general level of the process and each detail level receives the next consecutive letter.

Y. Numerical character, correlated to a phase of the plan.

Z. Numerical character, 1 for lagging indicators and 2 for leading indicators.

3.2. Sources

One of the most important aspects of establishing an indicator is to know where and what data is available and extractable for the indicator algorithm.

Normally the data is stored in software that the company owns which will typically be designed or adapted for the company's necessities. This software will have information about plant elements, work orders, procurement, spares, ER, etc. All this information can be readily available and would only require a "data mapping" to be performed with the IT department. Then it will be easy to collect this information.

Common information used for establishing indicators may be obtained from the following sources:

Criticality: AP-913 classification for equipment (Ex., Critical, Non-Critical, Run-to-Maintenance)

SPV (Single Point Vulnerability): "Yes" or "No": Classification of any component in a plant whose failure can lead to a reactor trip, a turbine trip or an output power reduction greater than 5 percent.

Environmental Qualification: "Yes" or "No": Indicates if the component is subject to environmental qualification regulations.

Seismic Category: Category based on the function a component must perform during and after a seismic event (E.g., I, II, III)

Man/Model Install Count: A summation of all EQ tags that have the same Manufacturer / Model pair installed in the plant

WO Task Type: Indicates the type of work order (Ex. Preventive Maintenance, Corrective Maintenance, etc.).

Future Demand WO Count: A summation of future demand Work Orders that are in the site's system for a specific component

Outage Number: Identifies the outage that the work is to be performed (Ex 024)

Lead Time: The sum of Order, Manufacturer and dock-to-stock Lead Time

Stock Level: Quantity on hand for a stock number

There are some industry tools that can help sites effectively manage their obsolescence process; the most used are POMS and RAPID/OIRD. These programs may have outputs that are directly an indicator or that can be used as an indicator or as a data input.

3.3. Algorithm implementation

After understanding the necessary types of indicators and the data sources available, the next step would be to carefully define the program indicators and the algorithm required to obtain each indicator.

Proper selection of data inputs will ensure a correct measure of the program parameters of interest. If the indicator results don't seem to properly represent the program, it is recommended to reevaluate the data inputs used for the algorithm.

If the indicators will be automatically calculated through a third part system it is important to issue the algorithm specification to the IT department.

3.4.Data analysis

To ensure a proper representation of the program, the relevant data or information for a specific indicator should be analyzed. If needed, data filters can be applied to the fields needed for the algorithm.

Setting data filters can reduce the amount of information and, if the data filters are common, it would allow different plants and even different companies to compare their results.

3.5.Metric output and acceptance criteria

The last step for establishing obsolescence indicators is to understand what the outputs mean. Since the output of the indicators may solely provide a number, a score scale or scoring ranges should be defined to better understand if the output means "good work" or if it means that you have to improve the program in some aspect. A scorecard with the potential outputs of the calculations would allow sites to clearly identify if their process is going in the right direction.

Along these lines, it is important to define the thresholds with precaution in order to monitor whether you are reaching that ultimate target and not just a progression compared with previous months.

3.6.Periodicity

There are indicators that will give more information if you set a period to check data or have an accumulative result.

Depending on the aspect you are measuring, one type or the other will be conceptually more correct.

The periodicity is typically set as "per month", but it is also good practice to have the chance to get an annual report.

4. Standard metrics

There are 3 levels of indicators, report level, management level, and benchmark level.

- Report Level: There can be as many indicators as needed at this level. The user of this level would be the champion of the obsolescence program at each plant, whom is responsible for the process and for analyzing the report to see if there is a specific problem.

- Management Level: These must be a limited number of indicators, leading indicators specifically, that must be comprehensible for the whole organization and provide an overview with the highlights of the process.
- Benchmark Level: It is important for the industry to define the key indicators that allow plants to clearly contrast the results. The users of these indicators are also plant champions of the obsolescence program.

4.1.Report Level indicators

At this level, the champion/coordinator of the site obsolescence process can measure as many indicators as thought useful to control the process at any point. Each coordinator may consider more or less indicators according to their experience.

Some high level report indicators could be:

1. Single Point Vulnerabilities
    a. What is obsolete?
    b. What is obsolete with no solution?
    c. What is not obsolete?
    d. What % data is being reviewed?
2. Critical Equipment
    a. What is obsolete?
    b. What is obsolete with no solution?
    c. What is not obsolete?
    d. What % data is being reviewed?
3. Total Obsolescence at site
    a. What is obsolete?
    b. What is obsolete with no solution?
    c. What is not obsolete?
    d. What % data is being reviewed?

Annex A provides a list of reference documents with more examples of indicators that could help a process coordinator get an idea of which aspects of the process are interesting to measure.

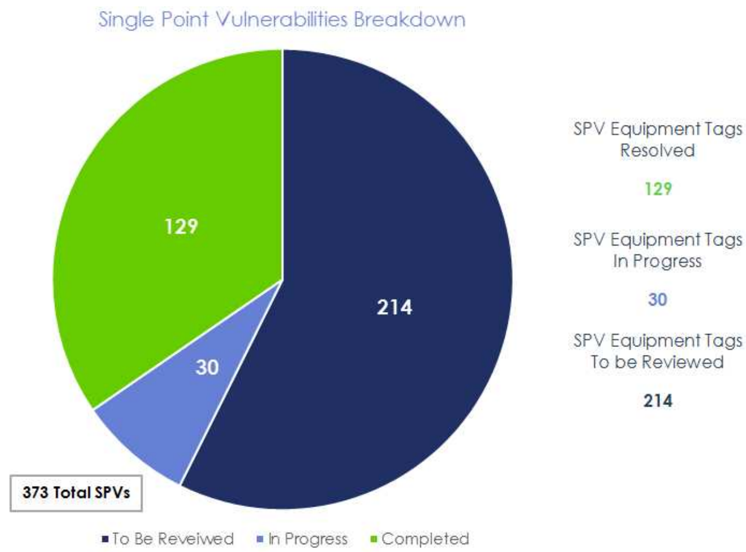
4.2.Management Level indicators

At this level, the indicators that are used must be clearly output indicators, mainly indicators that show how many cases have been solved, type of solutions, money spent, etc.

Annex B, provides Management indicators used in the industry.

The output of these indicators must be focused on objectives, so the results have to be presented in a score card and the different thresholds must be defined according to a sites available resource, management strategy, etc.

Ideally, the management indicators would eventually become the benchmark indicators. The below images are examples of how the information can be presented.



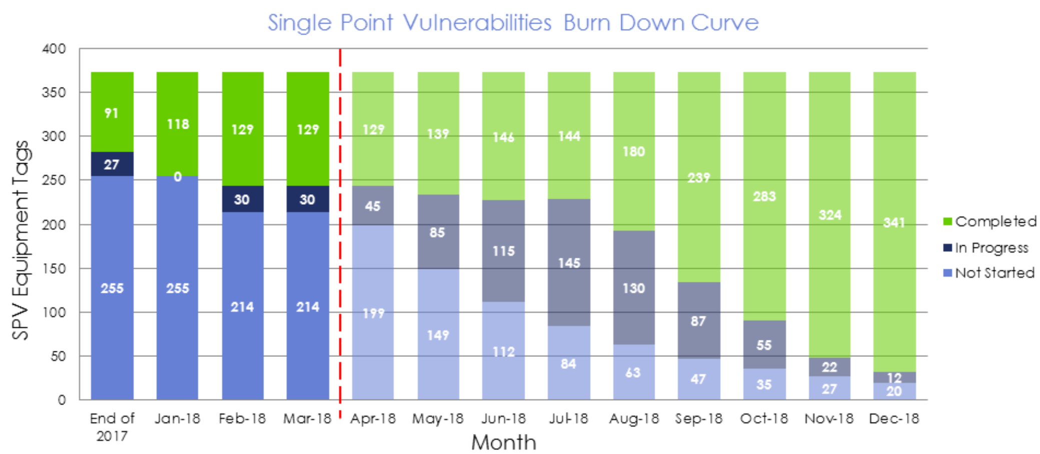


Figure 2. SPV Obsolescence Overview.

4.3.Benchmark Level indicators

The indicators used to compare the situation between plants have to show the results in a format that quickly gives you the context of the industry. The results shown in the following graphic provides information about:

- The maximum value that this indicator has reached in the industry
- The average value of the indicator
- The site specific value for this indicator
- The minimum value that this indicator has reached in the industry

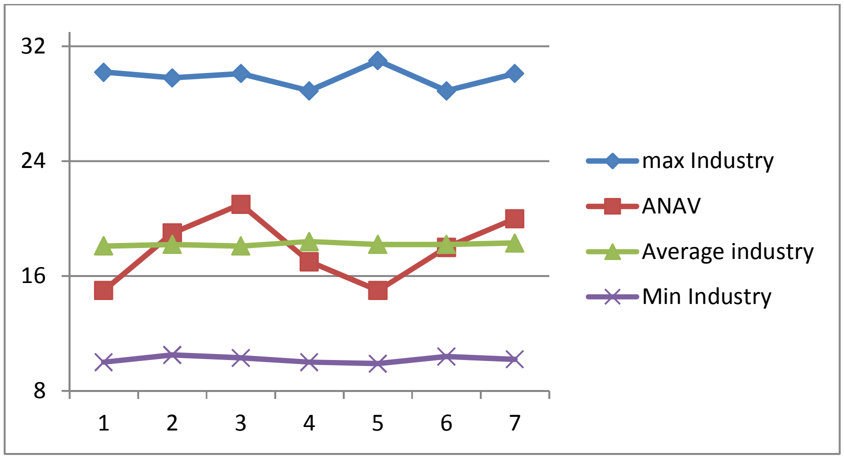


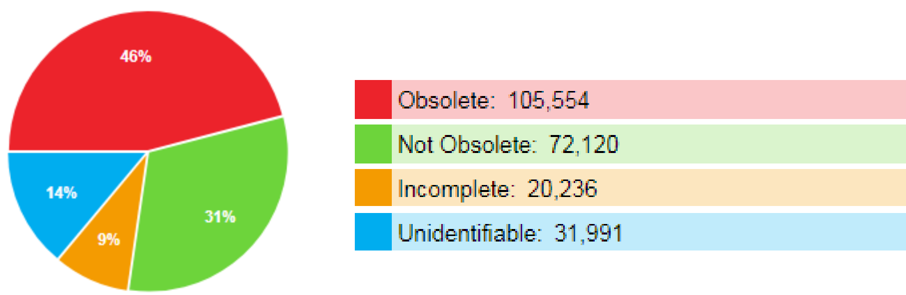
Figure 3. Sample results of an INUOG benchmark level indicator.

The indicators that INUOG will use to benchmark the industry are stated in Appendix C of this document.

Another way to compare your site data to the industry:

Examples

Site View



Industry Average

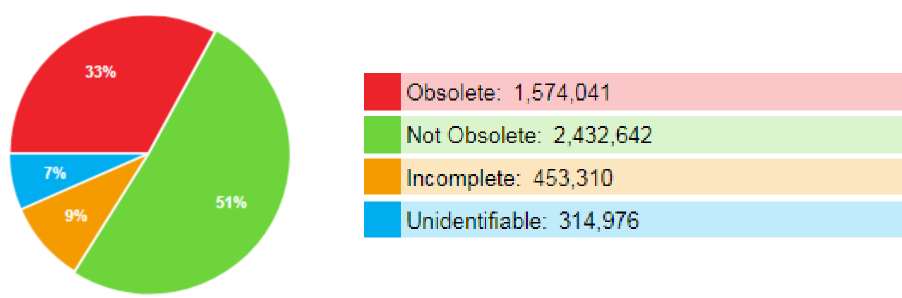


Figure 4. Sample industry benchmark.

5. Definitions

NUOG: The Nuclear Utility Obsolescence Group, an organization dedicated to solving problems related to obsolete plant equipment. NUOG's obsolescence-related informational web page contains guidelines, equipment studies, Obsolescence Program Business Case, survey results, INPO AFI summaries, NUOG meeting minutes, reports and papers, database instructions, and other NUOG-related information, available at http://www.nuog.org.

INUOG: INUOG has been formed to drive the International Nuclear Industry's effort to further collaborate in the area of obsolescence. Developing synergies across the industry and a platform for nuclear utilities to openly share thoughts, ideas and successes in relation to obsolescence, INUOG is a forum for development of process, tools, measures, and techniques to mitigate risks at a station level with the goal of supporting and improving Equipment Reliability and Availability.

POMS: The Proactive Obsolescence Management System is a service that determines what installed equipment is no longer supported by the manufacturer, and contains tools for obsolescence prioritization and resolution, available at *http://www.pkmj.com.*

OIRD: The rapidpartsmart® Obsolete Item Replacement Database.

Rapidsmart®: a comprehensive database of utility equipment inventory and industrial supplier catalogs, operated by SCIENTECH, a business unit of Curtiss Wright Flow Control Company, available at *http://www.rapidpartsmart.com*.

Metric / indicator: A business metric is a quantifiable measure businesses use to track, monitor and assess the success or failure of various business processes. The main goal of measuring business metrics is to track cost management, but the overall point of employing them is to communicate a company's progression toward certain long- and short-term objectives. This often requires the input of key stakeholders in the business as to which metrics matter to them.

KPI: Key Performance Indicator. A quantifiable measure used to evaluate the success of an organization, employee, etc., in meeting objectives for performance.

Lagging indicator: Indicator that gives information about the input of one process.

Leading indicator: Indicator that gives information about the output of one process.

Annex A: Reference Documents

As a guide for establishing indicators for report level, this annex provides reference documents that include indicators that can be used by the site.

Annex A.1 NX-1037 Rev.2.

INPO, Nuclear Utility Obsolescence Group (NUOG) Obsolescence Guideline. NX-1037, Revision 2, March 2013.

Annex A.2 EPRI 1019161.

ELECTRIC POWER RESEARCH INSTITUTE, Plant Support Engineering: Proactive Obsolescence Management: Program Implementation and Lessons Learned (EPRI 1019161), EPRI, Palo Alto, CA, December 2009.

Annex A.3 NUOG Obsolescence Metrics Desktop Guide

NUOG Obsolescence Metrics Desktop Guide document.

Annex B: Industry Management Indicators

As a guide for establishing indicators, some plants have provided their site metrics for other utilities to use for inspiration.

Annex B.1 ANAV management level metrics

- Obsolete Components
- Obsolete Critical Components
- Obsolete SPV Components
- Components Requiring Clean Up
- MSPI Systems with Systems Average OVR Red Range
- Action Plans completed by Site
- Obsolete parts
- Usable data
- Action plants ongoing
- Finished action plans.

Annex B.2 Engie-Electrabel management level metrics

- Average time to solve file
- Number of solved files per year (running average).
- Number of NCR (Non-Conformity Reports) due to obsolescence
- Number of “Potentially obsolete” parts below the safety stock
- Number of “Obsolete, searching for alternative” parts below the safety stock

Annex B.3 EDF Energy

- Obsolete Components
- Obsolete Critical Components
- Obsolete SPV Components

Subsets of data for: Possible solutions, Solutions with action plans, Completed action plans
Data trending captured with month to month progress and percentage change

Annex C: INUOG Benchmark Indicators

Annex C.1: OBS-IND-01 – Unsolved Obsolete Components

This indicator represents the fraction of **Unsolved Obsolete components** (installed obsolete plant equipment that is obsolete and has not a solution) compared to **Total Components** (total plant equipment in scope of obsolescence program).

Algorithm:

$$\frac{Unsolved\ Obsolete\ Components}{Total\ components}$$

Scorecard:

Range (%)	Points
0 ≤ Green < 7	10
7 ≤ White <10	8
10 ≤ Yellow < 15	6
15 ≥ Red	4

Annex C.2: OBS-IND-02 – Unsolved Obsolete SPV components

This indicator represents the fraction of **Unsolved Obsolete SPV components** (installed obsolete single point vulnerability (SPV) plant equipment that is obsolete and has not a solution) compared to T**otal SPV Components** (total plant single point vulnerability (SPV) components in scope of obsolescence program).

Algorithm:

$$\frac{Unsolved\ Obsolete\ SPV\ Components}{Total\ SPV\ Components}$$

Scorecard:

Range (%)	Points
0 ≤ Green < 8	10
8 ≤ White <15	8
15 ≤ Yellow < 20	6
20 ≥ Red	4

Annex C.3: OBS-IND-03 – Critical Component requiring Clean Up

This indicator represents the fraction of **Critical components requiring cleanup** (sum of all components in scope of obsolescence program that are not usable to determine obsolescence status; unknown, incomplete…) compared to **Total Critical Components** (total critical components according AP 913 in scope of obsolescence program).

Algorithm:

$$\frac{Critical\ Components\ Requiring\ Cleanup}{Total\ Critical\ Components}$$

Scorecard:

Range (%)	Points
0 ≤ Green < 25	10
25 ≤ White <35	8
35 ≤ Yellow < 50	6
50 ≥ Red	4

Annex C.4: OBS-IND-04 – Action Plans Completed by Site

This indicator shows the number of action plans closed (is how industry refers to each solution to the obsolescence problem that has been studied and solved)

Algorithm:
The number of action plans closed per period

Scorecard:

Range (%)	Points
6 ≥ Green	10
3 ≤ White <5	8
1 ≤ Yellow < 2	6
0 ≥ Red	4

Annex C.5: OBS-IND-05 – Obsolete Parts

This indicator shows the percentage of obsolete spare parts identified in the warehouse. A high number of obsolete spare parts increase the risk of spare parts unavailability.

Algorithm:

$$\frac{Number\ of\ Obsolete\ Parts\ in\ Warehouse}{Total\ Number\ of\ Parts\ in\ Warehouse}$$

Scorecard:

Range (%)	Points
0 ≤ Green < 15	10
15 ≤ White <30	8
30 ≤ Yellow < 45	6
45 ≥ Red	4