1. **Summary**

In line with the project plan task B.2 – Criticality Assessment, this document details the outcomes of the criticality assignment and review for required Raven and Giza Fayoum location tags in line with the following procedure:

* EG001-OP-PRO-00-3051 Rev A02 – WND Maintenance Build Criticality Assessment Decision Paper

The above procedure was adapted following discussions with the WND team in response to initial criticality findings, as discussed further in section 3.1 below. Initial criticalities were assigned by Add Energy following this modified approach, prior to a multi discipline workshop where criticalities were agreed by BP appointed discipline engineers, or revised with justification.

Supporting documents used in the criticality assignment are as follows:

* GOO-RL-GLN-00002 – BP Guide – Functional Location Criticality for SAP PM
* BP-000030 – BP Policy – Risk Management

The criticality assignment process undertaken by Add Energy is guided by the Reliability and Maintenance Self-Verification for Maintenance Builds requirements, as shown in Appendix A.

Criticality assignment is a key deliverable in the maintenance build, the completion of which allows for the assignment of maintenance, the validation of SCE/ECE registers, and the identification of Production Critical Equipment.

1. **Basis of Assignment**

Of the 37,000 valid tags in the GFR hierarchy, 25,000 tags were to be assigned a criticality by Add Energy following the WND Maintenance Build Criticality Assessment Decision Paper procedure. The remaining 12,000 tags consist of equipment classes identified as being only Integrity scope, and as such criticalities are to be assigned by the Integrity Engineer.

1. **Criticality Assignment Procedure**

Each functional location was assigned a criticality following a two-step procedure:

1. An initial criticality for functional location was developed based on its system and failure code.
2. Initial criticalities were reviewed by ECOs in a workshop setting, and agreed or revised with justification.

**3.1 – Initial Population**

As each functional location inherently has both a system, and an equipment class, initial criticality was set at a system and failure code level, as outlined in EG001-OP-PRO-00-3051. Tables were defined for System criticality and Failure Classes. This allows for a high-level assignment without having to review each functional location individually, while still making use of key drivers for criticality.

Each system and failure code was assessed in the four risk categories, considering Safety, Environmental, Production and Business risk factors respectively. This gave each system and failure code 4 alphanumeric impact levels in alignment with BP Risk Management Policy 000030. Each category was translated into an A/B/C score using the matrix in Annex D of Functional Location Criticality for SAP PM.

As an agreed deviation to the original WND procedure, a voting matrix was then used to combine System and equipment class for each tag. The original ‘highest wins’ approach defined in EG001-OP-PRO-00-3051 Rev A02, was found to cause ‘criticality inflation’, leaving most tags an ‘A’ or ‘B’ after the first pass, with very few ‘C’ rated functional locations, which was considered a poor starting point for the workshops. Figure 2 shows an equivalent voting matrix for the original defined approach, which shows, given an even distribution of inputs only 1/9 of results would be expected to be a ‘C’, compared to 1/3 using the voting approach.

The Failure Code and System criticalities for each of the four categories were voted using the matrix shown in Figure 1 with the highest combined criticality across the 4 categories being taken as the overall criticality for each system/failure code combination. Each functional location then inherited a consolidated criticality based on its equipment type and the system it occupies.



Figure 1 System/Failure Code Voting Matrix

|  |  |  |  |
| --- | --- | --- | --- |
| **Highest Wins** | **A** | **B** | **C** |
| A | A | A | A |
| B | A | B | B |
| C | A | B | C |

Figure 2 System / Failure code matrix for defined 'highest wins' approach

A number of ‘Special Cases’ were identified whereby the criticality derived from the above procedure was overwritten due to factors not considered by the system/failure code approach:

* Tags which have a shutdown function – A
* Fire & Gas Detectors – A
* SIL inputs/outputs – A
* Aircraft Warning Lights – A
* Essential Lighting – B
* Normal Lighting – C
* PSVs – A on hydrocarbon systems, B on non-hydrocarbon systems

The initial distribution of criticality codes for the in-scope equipment is illustrated in the chart below to illustrate the effect of changing from ‘highest wins’ to ‘voted’ according to the matrix in Figure 1

The ‘voted’ initial population was used as the starting condition for the workshop.

**3.2 – Workshop Process**

The workshops were multi-discipline to encourage discussion between ECOs, as well as generating a common approach to equipment criticality determination.

Criticality was reviewed in the workshop on a system-by-system, failure code-by-failure code basis, allowing for rule sets to be developed which were subsequently applied across all applicable functional locations. In some cases, these workshop rule-sets over-rode the special cases listed above. Systems were reviewed in order, with the initial criticality for each tag in a system agreed upon, or revised based on the knowledge and experience of ECOs. Where ECOs disagreed with the initial criticality population provided by AE for a given tag, the justifications were recorded against that tag. A ‘before’ and ‘after’ criticality was captured for each to provide a summary of changes.

Guidelines determined and applied as the workshop progressed included:

* All gauges would be C
* Motors should align to their parent equipment criticality (i.e. pump, fan, blower etc)
* Hand valves should be C (unless defined as Safety Related Device (SRD))
* Blow down valves and associated equipment would be A
* Limit switches for open/closed indication should be C
* All junction boxes should be C
* SIS related devices would normally be A
* Corrosion coupons would be C
* ‘Shutdown’ tags which are PAS but not SIS would be B
* Check valves would be C – unless SRD dual check valve barriers.
* All needle valves would be C
* All instruments would typically be C, but with exceptions where a SIS role.
* Fiscal metering associated equipment should be A, allocation metering could be B (both excluding hand valves and gauges)
* Analysers would normally be a criticality level below their system
* Basket strainers / filters would be C
* Deluge system (principally associated solenoid valves) would be B

Exceptions to the above could be defined and recorded on individual basis, but these guidelines were used to allow determination of a lot of equipment criticalities without detailed individual review due to the limited workshop time available.

The alphanumeric risk inputs in the Safety, Environmental, Production and Business categories to align with the desired component and overall final criticality were assigned after the event to avoid delaying the progress of the workshop.

1. **Summary Criticality Assignment**

As a general guide, overall criticalities were generally reduced, with only a few escalations identified as required. The final equipment criticality distribution is illustrated in Figure 2.

Of the 3993 functional locations allocated A prior to the workshop, 10% were demoted to B and 35% were demoted to C.

Of the 8125 tags initially B, 85% were demoted to C, 1.5% were promoted to A.

Of the 12266 tags initially C, 1% were promoted to A and 2% were promoted to B.

Figure 3 Workshop Output Equipment Criticality Distribution

The final criticality assignment is included in the embedded .csv file below with the following column headings

| Column Heading | Contents |
| --- | --- |
| Functional location | The functional location / tag being assigned |
| Function Location Description | Description of the tag |
| Failure\_Code | Failure code input used to define initial pre-workshop criticality. To align with the self-verification requirement, integrity only tags awaiting criticality assignment from risk based analysis have been removed from this list, as well as ‘system level hierarchy’ codes which are not physical equipment. |
| STATUS | Functional location status code – only VALID or DUP status codes have been allocated in this assignment |
| SystemSelector | System code assigned to the tag, used as input for initial criticality assignment |
| Pre-Review Criticality | The initial overall criticality assigned for the tag following the methods outlined, prior to the workshop |
| Workshop\_Revised\_Criticality | The updated criticality recorded in the workshop. Note that blanks are present for roughly half of the locations, which indicate the pre-review criticality was accepted. Entries indicate post workshop re-calculation of the criticality, usually but not always different from the pre-review. (e.g. ‘align with parent’ may have been assigned before the parent criticality was reviewed). |
| Reason For Change | Justification for changing from the Pre-review criticality. This was recorded during the workshop. |
| S\_WS | Risk input as per GOO-RL-GLN-00002 Rev B08 Annex D to define the Safety criticality component |
| E\_WS | Risk input as per GOO-RL-GLN-00002 Rev B08 Annex D to define the Environment criticality component |
| P\_WS | Risk input as per GOO-RL-GLN-00002 Rev B08 Annex D to define the Production (financial) criticality component |
| B\_WS | Risk input as per GOO-RL-GLN-00002 Rev B08 Annex D to define the Business (non-financial) criticality component |
| Safety | Safety category criticality calculated from S\_WS – A,B or C |
| Environment | Environmental category criticality calculated from E\_WS – A,B or C |
| Production | Production category criticality calculated from P\_WS – A,B or C |
| Business | Business category criticality calculated from B\_WS – A,B or C |
| Comment on Post-workshop changes | Note on how changes were made to change from Pre-Review to final criticality, identifying where changes were made from the default S\_WS, E\_WS, P\_WS, B\_WS inputs to meet the workshop intent. |
| Final Overall Equipment Criticality | Final overall criticality rating defined for the tag. |



**Appendix A – BP Criticality Self-Verification Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Questions** | **Covered** | **Comments / Actions** | **Id Ref** |
| Does each functional location have an A, B or C value entered in the ‘CRITICALITY’ field? | Yes | Integrity only (‘Excluded’) and system level herarchy functional tags have been deleted from the final listing | 5.194.B.07.01 |
| Does the assigned criticality value conform to **BP Guide** Functional Location Criticality for SAPPM (GOO-RL-GLN-00002) Annex A table? | No | Guidance from BP personnel during the workshop was to move away from the Annex A default criticalities as too strict, and assess on merits, as applying this criteria was believed to have generated overly high criticalities in previous exercises. | 5.194.B.07.02 |
| Where site specific requirements have altered criticality assignment from standard Annex A table is a suitable, approved, variation justification in place for each deviation? | No | Guidance from BP personnel during the workshop was to move away from the Annex A default criticalities as too strict, and assess on merits. For example, the workshop agreed to general assignment of ‘C’ to non-critical instruments, where Annex A does not allow instrument criticality assignment below a B. This is not formally approved outside this document, as WND has been ‘live piloting’ a modified approach. | 5.194.B.07.03 |
| Once all assets have been criticality assessed has a full data file been passed to BP WND R&M for further statistical analysis? |  | Not a SUAR requirement |  |