Quality Management System for Software Development

Software development processes

Planned development or modifications to software arising from requests or software issues are subject to a quality assurance plan that includes the following items:

- There is a set of documents to which developers are referred for guidelines on writing high quality code.
- Source management software is employed to control the entire development process; CERC uses Subversion. This system tracks all changes made to a project, thus ensuring a complete audit trail. It also helps manage group development by guiding the merging of code changes, and guaranteeing that only one developer at a time may change any given code module where required.
- Where possible code that carries out the same function is shared between applications using whatever technology is most appropriate.
- Development and changes to code are controlled by a documentation system of Change Requests, Technical Reports, Code Reviews and Inspection Summaries.
    - **Change Request:** Changes to code are planned with at least one other person and must be agreed and approved by the line manager before work can commence.
    - **Technical Report:** The developer writes a Technical Report describing the changes made including a listing of all code module revisions affected. There is a section for describing all testing carried out to validate the changes.
    - **Code Review:** A code review with at least one reviewer and sometimes with a moderator is carried out. Necessary and advised changes are made, the Technical Report revised and, if necessary, another review of the code is carried out.
    - **Inspection Summary:** An Inspection Summary is written after the code review recording major and minor issues, comments and further actions.
- Any testing data and files are stored with the reposts so that retesting is possible.
- The final version of the Technical Report is signed off. Electronic copies of all these documents are stored.
- A Change Request Log records the Change Requests started with dates of their completion and signing off.
- The Change Request Log allows for centralised tracking of all completed and signed off code changes, which is used as part of the process for building final versions of all components for a release of a product.
- Issues raised, either by customers or internally, are logged electronically. Changes to the code to resolve issues are thoroughly tested at the time the change is made.
- Before release of a new product version the results from the new code are compared with results from an older code version for the example files supplied, standard validation cases and other model runs.
- The installation program and results from the example files are tested on a test machine. The test machine can be networked or operated as standalone machine. It uses Norton System Commander and Norton Ghost to produce clean installations of various operating systems for testing which currently include Windows 8 and Windows 10.

Handling of issues and quality improvement

Bugs, issues and suggestions for improvement may arise from internal or external users or as part of the development and review process. All contact from users is recorded in a *Helpdesk log*, each helpdesk contact with a unique number. If after a developer has looked into helpdesk queries and they consider there is a bug, issue or suggestion for improvement, this is recorded in the *Issues* spreadsheet, each matter with its own unique number. Associated files and documents used in the investigation of the matter are stored under the unique number. Matters arising from the development and review process would be entered directly into the *Issues* spreadsheet and would not appear in the *Helpdesk log*.

The *Helpdesk log* and *Issues* spreadsheet are both reviewed at the weekly meeting of developers so that any helpdesk matters that should be transferred to the *Issues* spreadsheet are transferred and to check whether any item needs urgent attention in the form of issuing advice, clarification or a software patch. At this point the cause of the matter arising is discussed and if it is due to a failure of the review or other internal process action is taken following the meeting. If necessary, similar code changes will be checked and the software development advice documents updated.

When a model release is planned, the *Issues* spreadsheet is the starting point for identifying the necessary and desirable model improvements. We involve users in shaping the development of new scientific or user features, holding consultations at the annual User Group Meeting. The feedback sheets and consultation responses from each User Group are analysed within a week of the meeting and matters taken up as helpdesk matters, entered in the *Issues* spreadsheet or not pursued further. We also carry out regular User Surveys which provide another mechanism for users to provide feedback on the software.

Experience transfer

Software development is carried out by staff who are appropriately trained by virtue of their qualifications, attendance at internal and external training courses and mentoring by senior colleagues. An annual review is the formal opportunity to track a member of staff's development and set appropriate written targets for training, development and achievement. These matters can also be addressed between reviews and at the start of a new piece of work the member of staff's skills and training needs are considered. Staff are expected to develop from making straightforward changes as part of a pre-determined development plan to making more complex developments, contributing to the determination of the development plan and reviewing the work of others.

The standards to which we work and the processes are documented, held centrally and explained to new developers. Holding centrally information not just on plans, inputs and outcomes but also the methodology is important in ensuring that knowledge is shared. As a company with staff with family responsibilities working flexible hours we continually pay attention to ensuring that every skill is held by more than one member of staff and hence skill and experience is transferred.

The standards are reviewed regularly and updated as required.