TERMS OF REFERENCE FOR A SOLICITED WRC PROJECT

KEY STRATEGIC AREA	**3: Water Use and Waste Management**
THRUST	**4&5: Integrated Industrial and Mine Water Management**
PROGRAMME	**3: Minimization of Waste Production and Impact on the Water Environment**
TITLE	**Revision of the 1996 South African Water Quality Guidelines: Volume 3 - Industrial Water Use**

Objectives:

General:

To revise the 1996 South African Water Quality Guidelines: Volume 3 – Industrial Water Use and develop a software-based decision support system able to provide both site-specific and generic risk-based South African water quality guidelines for industrial water use.

Specific:

1. To establish a working committee whose function is to provide expert advice during the guideline development process.
2. To carry out a systematic review of relevant literature to identify and critically appraise best available evidence.
3. To develop an intermediate 'technology demonstrator' that demonstrates the most important features.
4. To engage with stakeholders to elicit comments and recommendations.
5. To maximise synergy with parallel projects on the development of water quality guidelines for other water users.
6. To develop a fully-functioning decision support system for industrial water uses.

Rationale:

The South African water quality guidelines comprise one of the most widely-used tools in water quality management. However, they are now significantly out of date. A Phase 1 DWA project was completed in 2008 that performed a needs assessment, developed a general philosophy and described the general specifications of a decision support system (DSS) for revised water quality guidelines for South Africa. The new guidelines will be different in a number of fundamental ways. Firstly, they will be risk-based – a fundamental change in philosophy from the 1996 guidelines. Secondly, they will allow for much greater site-specificity – a widely-recognised limitation of the generic 1996 guidelines. Thirdly, they will be made available in both as general reference and in a software-based decision support system that allows specificity. This Terms of Reference (ToR) addresses water quality for industrial water use only.

General Methodology and Specifications:

The work must be based on the recommendations of Phase 1 and the requirements of the overall DWA ToR for all water users. These are summarised below:

The DSS must be aligned with selected contexts, projects and programmes, *inter alia*, waste discharge charge system, the water resource classification system, drinking water standards, other domestic water user standards, and the design of water quality monitoring networks. The methodology must achieve the maximum possible synergy and compatibility with other projects that may run in parallel with this one which will develop the guidelines for other water users. The primary tool for determining the guidelines should be a software-based DSS with three tiers:

- **Tier 1** is equivalent to 1996 generic guidelines and is made available in the DSS and possibly in hard copy manuals. This Tier communicates the minimum requirements to the user, highlighting potential problems if these are not met.
- **Tier 2** allows for site specificity in specified contexts and is facilitated by the DSS. It allows for user access to deeper levels of guideline generation.
- **Tier 3** allows for site specificity in other *ad hoc* contexts, using modules of the DSS and possibly requiring significant expertise.

The DSS must provide for quantitative fitness for use assessments and water quality objective setting for identified industrial water uses. The concept of "acceptable risk" and its implementation must be communicated and debated with stakeholders. A clear distinction between the resource management decision domain and the supporting science should be maintained. For example, application of the precautionary principle (like in "safety factors") must be transparent.

Considerations need to be given to the appropriate informatics for the disciplines involved as well as methods or approaches for updating databases and algorithms. For example, both precise mathematical and more qualitative/vague expert information may have to be integrated in decision support. How, and to what extent uncertainty is conveyed to the decision maker, and how feedback from appropriate studies are accommodated and used in the DSS need to be considered.

The water quality variables for which guidelines are required will use the following as the point of departure:

- The variables list in the 1996 SAWQG.
- The USEPA priority pollutant list as captured in "Recommended National Water Quality Criteria 2009".
- Variables that might be particularly pertinent to South African conditions
- Variables that might be considered as problematic in South Africa's trade relations.
- Output from direct biotic assessment methods such as toxicity testing, biomonitoring and biomarkers.

The protocols, guidelines and supporting documentation should be submitted for international peer review.

An open source approach is preferred. The DSS must be integrated into a Windows environment and be consistent with that developed for other water users. Data in the dynamic database will either be supplied by the project team or referenced. The data handling facility will be developed by the team and graphic user interface of the overall DSS made user-friendly. Importantly, the DSS must also be developed in a sufficiently modular way to effectively support a variety of possible Tier 3 applications.

An intermediate 'technology demonstrator' must be developed with the following characteristics:

- It should demonstrate both fitness for use assessment and objective setting.
- It should contain at least 5 water quality variables including:
    - A relatively 'data rich' variable;
    - A relatively 'data poor' variable;
    - One that requires measurements such as pH, hardness, etc. to perform an assessment;
    - An inorganic variable;
    - An organic variable; and
    - A biotic variable.

Deliverables:

Deliverables should include at least the following:

1. **Inception report** - Detailed work plan including a description (that demonstrates the deep understanding of the team) of the fundamental nature of risk-based guidelines for both fitness for use assessments and objective setting; review of relevant literature; identification of the specific industrial water uses; identification of water quality variables; protocols for maximising synergy with projects focussed on other water users; identification of the tasks necessary for data collection and capturing and/or referencing; and the associated software development.
2. **Technology demonstrator report** - A brief report describing a preliminary software system that demonstrates the most important features, including user help within the DSS and in hard copy form that can be used to assess progress and elicit comment from potential users.
3. **User interaction report** - Report on user interactions and feedback with detail on any modifications to the subsequent work plan.
4. **Draft final DSS** - A fully-functioning complete decision support system available for final testing and comment.
5. **Draft final reports** - Complete final reports available for comment, including a Research Report (summarising the work performed and the reasoning behind the DSS design decisions, lessons learned, and recommendations for future research) and User Manual(s) associated with the DSS.
6. **Final DSS** - The refined fully-functioning decision support system.
7. **Final reports** - Final refined reports and manuals based on comments received.

Impact Area: Water and Health

Time Frame:	**2 years**
Total Funds Available:	**R 2 000 000**
First Year Budget:	**R 1 000 000**