

**ANNEX A****STATEMENT OF WORK****STATEMENT OF WORK FOR R&D CONTRACT**

Individual Behaviour and Performance Section  
 Defence R&D Canada - Toronto  
 Thrust 14di

**TITLE OF WORK:**

*Field-Feeding for CF Land Military Operations – Basis of Guidelines for Standard and Incremental Allowances for Food Services Providers.*

**SHORT TITLE:**

Nutrition Guidelines for Field-Feeding.

**ABBREVIATIONS**

CF	Canadian Forces
DRI	Dietary Reference Intakes
EER	Estimate Energy Requirements
IA	Incremental Allowances
IMP	Individual Meal Packages
Kcal	Kilocalories
MECC	Mobile Expandable Configuration Container
MKT	Mobile Kitchen Trailer
NCRP	National Combat Ration Programme
PAL	Physical Activity Level
RTC	Re-locatable Temporary Configuration
TEE	Total Energy Expenditure

**OBJECTIVES:**

To provide a scientific basis for valid Standard and Incremental Allowances that will provide guidance to Food Services Providers for supporting the nutritional requirements of CF personnel operating under a variety of "field-feeding" conditions.

**BACKGROUND:**

CF Food Services Standard Allowances (1900-3600 Kcal per day) meet most basic requirements for feeding personnel in garrison. These allowances are based on the Dietary Reference Intakes (DRIs), the recommended average daily nutrient intake for healthy members of the public over time. However, the DRIs do not account for the different activities and conditions encountered by military personnel in demanding operations. Such conditions could undermine the health of personnel and therefore operational readiness and performance. Incremental food allowances are required to meet the extra nutritional needs of personnel in these situations (e.g. extremes of temperature, altitude). A scan of the

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military nutritional literature points to similar issues regarding nutritional requirements for many NATO allies. It is uncertain however, whether these available scientific findings are relevant to the CF operational environment, and thus, whether these best practices may be borrowed, adapted, or rejected for the CF.

The CF Food Services Manual describes that the various categories of allowances for fresh foods supplements during field-feeding applies when feeding on operations or on training exercise. The allowances provides for extra nutrition in support of increased levels of physical activity longer work days and in extreme climactic conditions.

The Incremental Allowances (IA) used in the Food Services Manual are based solely on the additional financial expenditures (over the basic food cost) needed to feed personnel in specific situations. A physiologic rationale for the various IA levels is lacking because energy expended and, therefore, caloric intake required to prevent a protracted energy deficit by personnel in CF operations is not available.

The objective of this contract concerns the nutritional needs of all personnel participating in a wide range of activities: from sedentary roles, to highly active military training or operational operations or periods that may range from several hours, to several weeks, and in a variety of harsh environments. As described below, these service personnel are required to work in a wide range of conditions that could increase their requirement for particular nutrients at levels above the DRIs.

- The intensity of the physical activities in the manoeuvres could range from just above sedentary to up to one's maximum physical endurance capacity. These activities may be intermittent or continuous, with variations in activity type and intensity of effort. For dismounted activities, the terrain may be clear ground or arctic tundra, or as difficult as swamp or coverage by loose sand, uneven rock, or deep snow. Heavy loads might be carried. There may or may not be rest periods and the working day(s) for these service personnel may be long enough to produce sleep deficits.
- The physical activities may be compounded by high cognitive demands, and psychological stress could be intense and chronic.
- The environment could be harsh. The temperature could vary between -40 to +50 °C (i.e., potential operations conducted in Afghanistan, Caribbean or Africa). Heat may be accompanied by very high humidity. Operations may occur at up to 4,500 m above sea level
- The recent Federal Government's policy of increased Arctic surveillance has placed new emphasis on the CF's presence in the North, and will place greater requirements to provide unique nutritional provisions and standards in extreme cold environments. Operations may take place at sustained temperatures of -25°C for weeks.
- Under the conditions of interest, the military personnel would receive their food in fresh food "field-feeding" type circumstances. Thus a field kitchen, or some other impermanent feeding platform would be used (e.g. Static Kitchen, Mobile Expandable Configuration Container (MECC), Re-locatable Temporary Configuration (RTC), Mobile Kitchen Trailers (MKT), Iso-Containers (aka Container Kitchen)). In other operational scenarios, personnel would be carrying their individual meal packages (IMP) during shorter-duration operations. It is possible that the interval between full meals could be up to 20 hrs, a delay that may or may not be expected.

## STATEMENT OF WORK

The work performed under this contract will consist of three parts, undertaken in principal, in the order of appearance in this SOW, the main part being a scientific recommendations report, and

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the other two parts which will be for Consultation and Collaboration as defined further in this document. In this Statement of Work, the Contractor will perform the following:

Part I: Develop/write reports:

- i. a summary final report;
- ii. a Main Report on Recommendations;

Part II: Provide consultation services to development of:

- iii. a Directory of Physical Activities;
- iv. a Survey of Feeding;

Part III: Provide collaboration services for collection of data on assessing energy expenditure by doubly-labelled water technique in:

- v. a laboratory investigation;
- vi. a field study.

### **PART I – PREPARE REPORT OF RECOMMENDATIONS**

1. The main part of this contract will consist of a comprehensive review and discussion of existing open-source peer-reviewed literature, government reports, and data that will lead to conclusions and recommendations about the nutritional needs of CF personnel participating in active military training or operational manoeuvres for periods of up to 30 days. The focus of the review and recommendations must be on the nutritional needs, above those specified by the DRIs, required for individuals to maintain health and proper mental and physical performance. In other words, do these personnel need more nutrients, of any type, and if so, how much more? As described in the Background, these service personnel are required to work in a wide range of conditions that may increase their requirement for particular nutrients.
2. Scope of Work. Towards meeting the objective described above, the report must address, however not exclusively, the following points:
  - a. The Norwegian, Australian, New Zealand, United Kingdom, and United States militaries have undertaken research relevant to nutrition and military environments. Much of this work is documented in reports and journal articles. The data, conclusions, and recommendations in these reports are applicable to the current Statement of Work. The contractor must discuss the extent of this applicability, that is, how comparable are the particulars described in those reports (e.g. physical environment, military activities, characteristics of personnel pertinent to nutrition and energy expenditure, etc) to the situation(s) of CF personnel, and how directly can any conclusions and recommendations in those reports be applied to the issues in this contract. Some of the research from allied countries and other information about nutrition and the military environment is available in a series of books by the Institute of Medicine of the National Academies. Furthermore, there is a wealth of nutritional science information available from the wilderness/outdoor medicine and sports nutrition and physiology research communities with regard to nutrition science enabling high-performance exercise/sports over a wide range of activities that are similar in physical demands, to many military operations (e.g., wilderness adventure racing, long distance running/triathlon). This literature will also be surveyed and validated as to relevance and applicability to the CF's nutritional requirements.

The focus of the review and recommendations will identify the energy and macronutrients and the amounts above those specified by the DRIs.

- b. In consideration of achieving daily energy balance for members of the CF population, discuss the merits of, limitations of, any ways to improve, and any possible substitutions

for, current ways for estimating their energy requirements (e.g. EER - Estimate Energy Requirement, TEE – Total Energy Expenditure, etc).

- c. Currently, the EER makes use of four physical activity levels (PAL). Discuss the merits and limitations of using PALs for an active military population, and provide reasons and recommendations for keeping PAL levels and/or why the number of PAL levels should be other than 4. Is there an alternate method to PAL that better meets the objectives of the contract and the intended purposes of the expected reports?
- d. The time course of evidence/symptoms due to deficiency in macronutrients (protein, fat, carbohydrate)
- e. Any special nutritional considerations to help withstand psychological and emotional stress.
- f. Discuss variations in nutritional requirements as a function of age and gender.
- g. Discuss the logistical impact of operations in areas where there is a limited availability of potable water that would used to re-constitute food products (e.g., for freeze-dried main portions, etc.).
- h. Discuss feeding strategies applicable to situations when regularly-timed meals might, or are expected to, be missed, or when the time since the last meal has been prolonged (e.g. up to 20 hrs).
- i. Discuss factors which result from the environment of military operations that might significantly impair in an individual the bioavailability of consumed macro-nutrients, and potential strategies to counteract these problems.
- j. Discuss if there are conditions for which nutritional supplements typically used by the outdoor/wilderness and athletic communities, including portable nutritionals (“energy bars”, “energy gels”, other immediate COS energy supplements should be part of the field-feeding nutritional program. If so, which supplements, and what is the strategy?
- k. Strategies for macro-nutrient composition for preserving lean body mass, reducing susceptibility to illness and injury, and enhancing recovery during and after sustained operations.

Discuss if any knowledge/data deficiencies exist in the literature that prevent complete fulfilment of the contract objectives.

The contractor should look ahead and discuss how any recent developments in nutrition technology could be applicable to maintaining the proper nutrition of CF personnel in field-feeding conditions. Discuss research that would be needed to demonstrate the practicality of emerging products (e.g. portable, nutrient-dense foods).

While the report is expected to include discussion of items listed in Scope of Work, it should not be limited to these. The Contractor should use their expertise to highlight/discuss any other potential problem sources (i.e. sources not identified in this entire Statement of Work) that could impair the proper nutrition of deployed personnel forced to use field-feeding procedures, and strategies to circumvent those problems.

### 3. Expected Characteristics of the Main Report.

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- a. The report is expected to be an authoritative source of information and recommendations, and will be used by departmental decision makers and consultants in the validation, or the basis for validating, incremental allowances for nutrition for the Canadian Forces. The report should be written in a style suitable for a professional readership, including the primary CF Client (Mat J4 Food Svcs) and other CF partners and leadership groups (FHP, Surgeon General, etc.).
  - b. The recommendations for nutritional feeding strategies should apply to a target population comprised of the range of the physically active members of a military unit deploying to conduct a joint-forces, land-based operation.
  - c. The report will provide full citation of all sources of information used.
  - d. Where there are opinions and conclusions, they should be well-founded. Recommendations and guidelines for incremental allowances should be in a form and level of completeness that makes possible their immediate implementation. Where strategies are proposed for resolving problems, they must go beyond general statements. The strategies must be able to be implemented; therefore, how to implement them needs to be provided. These recommendations should also include advice regarding possible collaboration and tie-in with the CF's National Combat Ration Programme (NCRP) which concerns nutritional content of combat rations.
  - e. While the client needs a single authoritative source of information and recommendations, and while it is expected that several/many other authoritative works will be referenced, the report must not substantially reproduce the content of other authoritative works, unless the necessary data is contained in a wide range of sources and significant analysis and synthesis is required to meet the objectives of this contract.
4. The review will be conducted across all relevant scientific databases (e.g. Medline), and across all relevant, English-speaking military research databases (e.g., Canada, United States, United Kingdom, Australia, New Zealand and the Norwegian countries). In addition to their own resources, the successful contractor will be expected to make arrangements with Director Research & Development, Knowledge and Information Management (DRDKIM of DRDC) to access the CANDID database.
  5. The contractor will complete PART I of the project work off-site from DRDC premises.
  6. Expert Reviewers – As the main report is expected to be an authoritative source of information and recommendations, it will likely be prepared by someone or a team with expertise in the necessary disciplines. However, even authoritative scientific works are peer-reviewed for thoroughness, technical accuracy, and clarity, and should be so when the conclusions and recommendations concern human health. Therefore, drafts of the Main Report will be reviewed, under the guidance of DRDC Toronto, by other experts in the field.

Depending on the results of the review and evaluation of the Work delivered in Part I, DRDC will decide at its discretion whether to continue with the Work in Part II.

## **PART II – SUPPORT TO DRDC – FIELD FOOD INTAKE SURVEY & CONSULTATION**

7. Directory of Physical Activities – It is expected that the Main Report produced under PART I of this Statement of Work will produce recommendations for dietary intake of nutrients that may vary

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according to different levels of daily energy expenditures – from sedentary to extremely high-intensity/duration physical activities representative of specified CF land operations. Daily energy expenditure is determined by the duration and intensity of physical activities. Some physical activities may be very different in nature but expend similar amounts of energy. For use by the CF in their dietary planning for missions, a directory of physical activities and energy expenditure will be produced by DRDC within the next three years, with the activities taken from CF training and operations, and from comparable non-military situations. The contractor must provide to DRDC and collaborators expert consultation in the collection, analysis, and presentation format of this directory. The duration of this consultation will be variable, and be agreed by the contractor and technical authority.

8. Survey of Feeding – In addition to provisions planned according to the recommended dietary intakes, maintaining nutritional health is dependent on actual nutrient intake. The Contractor will survey CF personnel for nutritional intake patterns during field-feeding conditions. The Contractor will consult with DRDC and Mat J4 Food Svcs during the planning, preparation, collection, analysis, judgments and decisions pertaining to this survey. The duration of this consultation will be dependent upon the requirements involved in the task, and mutually agreed upon jointly by the technical authority and Contractor.
9. The contractor will complete PART II of the project work off-site from DRDC premises.
10. Human Ethics Approval for Part II and III Collaborative Experiments: The contractor will draft a human ethics protocol submission according to DRDC Toronto guidelines and formats in the preparation and planning for in-house and/or collaborative off-site research studies. The Technical Authority will provide input into the content and drafting of this submission and assist with the presentation at the appointed Human Research Ethics Committee meeting.

### PART III – COLLABORATION WITH DRDC – DATA COLLECTION

This work is planned primarily, to take place after Parts I and II, above have been completed. However in the event of unforeseen operational reasons expressed by the Mat J4 D/Food Svcs and Land CF Client, this phase of the project (or related work) could be conducted in parallel (e.g., to support pre-planned or rapidly stood-up nutritional field trials). This requirement would be discussed with the contractor and CF client, and would require some measure of flexibility on the contractor's part.

11. Materials - The contractor, or representative, will be required to participate in two separate, week-long military exercises. Human energy expenditure will be measured by gas exchange and doubly-labelled water technique and the contractor will be responsible for purchase of the doubly-labelled water and analysis of the biologic specimens. Planning should consider 10 subjects per exercise, with each subject producing 12 biologic samples, for an overall total of 240 samples.
12. Energy Expenditure Assessment by Portable Gas-Exchange Metabolic/Calorimetry and Doubly-Labelled Water Technique – Towards assessing energy expenditure in personnel participating in a CF operation, DRDC, collaborators, and the contractor will design and conduct two studies for the purpose of developing procedures for the efficient use of the technique of doubly-labelled water ( $^2\text{H}_2\text{O}$ ,  $\text{H}_2^{18}\text{O}$ ). Study 1 will be conducted in the climactic and metabolic/exercise expenditure research facilities of DRDC Toronto in 2013. Study 2 will be conducted in the field in 2013/14, possibly during a CF training exercise or operational trial either in the Arctic, , Southern United States in March, and/or in southern Canada during the summer. For these two studies, the contractor will provide the human, financial, and logistics resources for:
  - a. Purchase and delivery of enough doubly-labelled water and consumable supplies to support these two studies, each involving 10 human volunteer participants studied for one

week durations;

- b. Purchase and delivery of two portable metabolic measurement systems (gas-analysis for metabolic rate measurement (intended to supplement the Doubly Labelled Water measurement technique) during the range of operational duties/activities)
  - c. One person to support DRDC personnel for the technical aspects of equipment setup, subject preparation, calculation/preparation/administration of doses, collection and shipment of biological samples, related primary and secondary measurements, and quality control;
  - d. Analysis of biological samples, calculation of energy expenditure, analysis of results, and consultation/collaboration in preparation of two technical reports for these two studies.
13. The contractor will complete PART III of the project work on and off-site from DRDC premises.
14. All publications, abstracts, or public presentations as a result of the contract must be co-authored by the contractor and DRDC Toronto investigators/scientific authority and their partners who contributed to the project, in consultation with the project leader. All co-authors must have the opportunity to review and approve the documents before they are submitted for publication or public presentation. All publications and public presentations of the work performed under this contract must have the approval of DRDC Toronto prior to submission of manuscripts or abstracts.

## OTHER INFORMATION

15. Other Data/Sources of Information – The following scientific, factual information may be required to complete the work in this Statement of Work and can be provided to the contractor, as deemed necessary by DRDC.
- a. Latest available demographic distribution of the CF population.
  - b. Current physical fitness standard for CF personnel potentially deployable for foreign operations.
  - c. Reports from allied countries not available publicly.
16. Government Funded Equipment & Services - To complete the work in this Statement of Work, DRDC will provide to, or make arrangements for, the contractor to use the following:
- a. Equipment – None.
  - b. Facilities - Pertaining to the work described in Paragraph 11 (Energy Expenditure Assessment by Doubly-Labelled Water), fixed and/or portable respiratory gas exchange energy expenditure equipment, DRDC will be responsible for technical aspects related to the research facility in Toronto, recruitment of human volunteers, instrumentation and supplies (except those that directly relate to preparation, storage, administration, analysis, etc of  $^2\text{H}_2\text{O}$  and  $\text{H}_2^{18}\text{O}$  which will be the responsibility of the contractor).
  - c. Services - Relevant data and reports as described under Paragraph 16 (Other Information).

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## CONTRACT DELIVERABLES

1. Final Reports
  - a. A covering, final report summarizing the work performed in this contract that addressed Parts I, II, and III under the Statement of Work.
  - b. The main report on Recommendations addressing Part I of the Statement of Work.
2. Presentation - To DRDC Toronto staff and CF Stakeholders, a 45 min, seminar-type presentation about the reports addressing Part I of the Statement of Work. An electronic copy of the presentation will be left at DRDC Toronto. The presentation will be given in August 2012.
3. Work on this contract will be completed by 31 March 2014. The final contract reports must be assembled and delivered no later than six weeks afterwards by 11 May 2014.
4. The final reports should be in the format of a DRDC Technical Report, prepared in Windows Microsoft Word (2003 or later).
5. The reports will be delivered as electronic copies on 2 duplicate compact discs and as 5 bound, paper copies.
6. All deliverables will be made to the Scientific Authority.
7. Contract progress reports, final reports, the presentation, and business correspondence will be in English.

## TRAVEL

1. Travel – One exercise/experiment will be conducted at DRDC Toronto. The second exercise will likely take place at one of the Canadian Forces Bases in Canada. The contractor should plan to send one person to these exercises to support research (see Paragraph 11). Funding for travel will be taken from the contracted amount indicated in (1), above.
2. The contractor, and any required associates, will attend four, half-day meetings at DRDC Toronto to discuss project plans, progress, presentation of final report, etc.