

Metrology of environmental exposure and cardiac strain in equipped operators of heavy fuel products clean-up



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ABSTRACT

Aim: to organise an assessment of the physical strains and environmental exposure to hydrocarbon derivatives in persons involved in shoreline clean-up of heavy oil products, in order to investigate the dangers of oil spill clean-up.

Materials and methods: 43 healthy volunteers wearing protective equipment cleaning up an artificial shoreline underwent cardiac strain measurements, as well as a study of thermal stress (approximate WBGT index, water loss, measurement of internal body temperature before and after physical activity). A subjective assessment of perceived exertion was correlated to articular strain indicators recorded for the weight of loads lifted, movement frequency and the range of movement. Environmental exposure was determined by using portable hydrocarbon detectors.

Results: For adult subjects in good physical condition, in neutral temperatures, oil spill clean-up is considered non-arduous. However, in sedentary, stressed subjects exposed to difficult climatic conditions, clean-up can be considered hard to extremely hard. In terms of environmental exposure, slight traces of toluene appeared once out of a total of 18 analysed samples.

Conclusion: The sample studied was subject to physical articular strains and presented variable cardiac strain; environmental exposure was, on the other hand, slight when involving cleaning up heavy petroleum products. The subjects liable to carry out this activity are more tolerant to the efforts required when they are healthy, fit, young adults, in the non-arduous thermal conditions recorded in this study.

STUDY, SETTING, and DESIGN

Hazards and painfulness of oil spill clean up

Fitness of operators

Three organisation meeting, between CEDRE, CAP, and CPEP to :

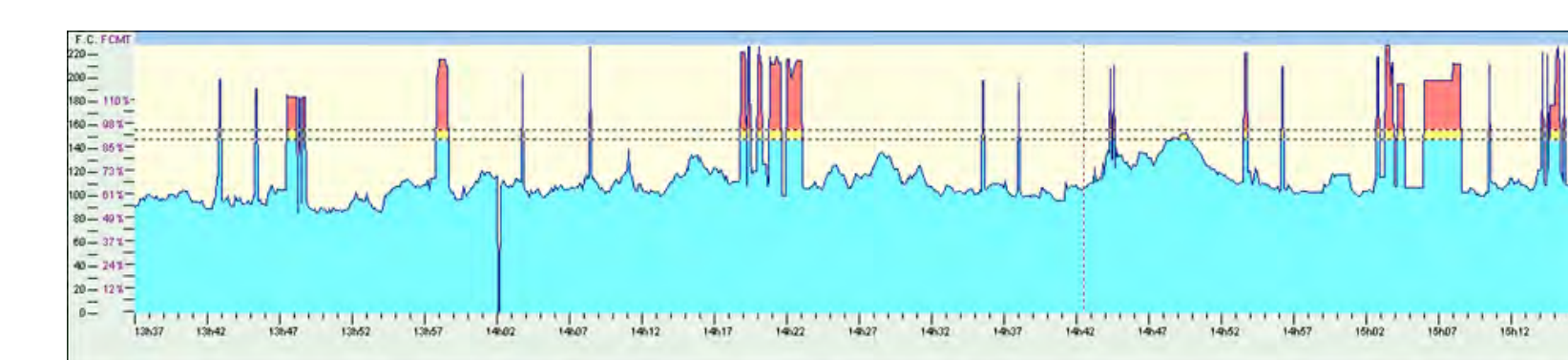
- * Select measurement tools
- * identify personal protection equipment (PPE)
- * prepare study methodology
- * look for referencies (bibliography)



Centre of Documentation, Research and Experimentation on Accidental Water Pollution (Cedre)

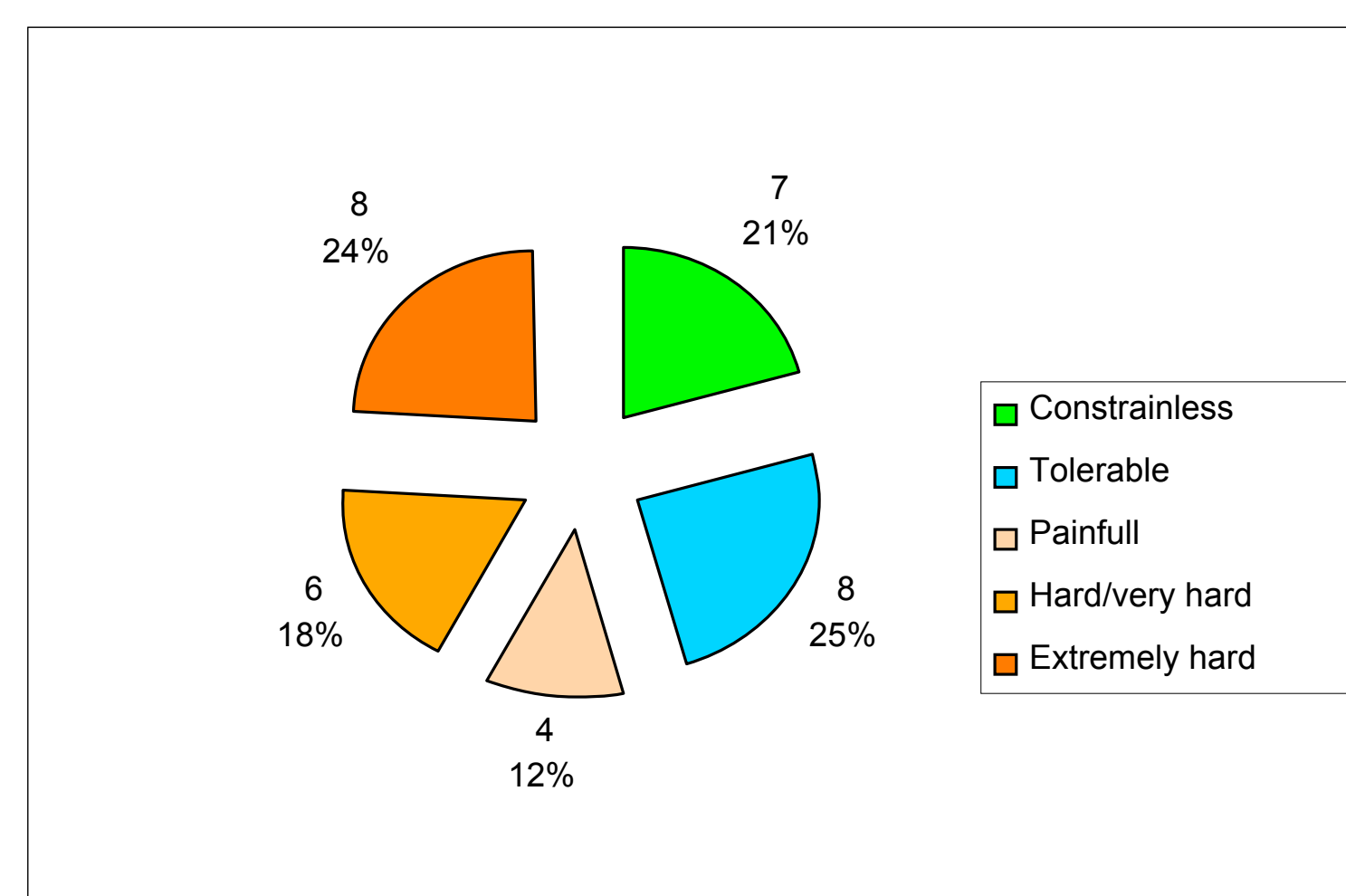


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Results of development of a heart rate file

Activity levels repartion into the "galets"



- 43 subjects, of which 40 were men and 3 women.
- Average age of this sample was 39 (ranging from 25 to 58 years old).
- Average weight was 80 kg (56 kg-120 kg).
- Average theoretical maximum heart rate of this sample was 181 beats per minute (162-195 beats per minute).
- 11 equipped with heart rate monitors, recordings could not be entirely used for the whole of the practical session.
- Nevertheless, of these 11 recordings, some were able to cover a whole activity, such as the buried pollutant removal exercise or the stones or riprap clean-up exercises. The results from the correlation with the Frimat scale are presented below.

FINDINGS

- study should therefore be considered in accordance with a certain knowledge of occupational physiology and of the normal working conditions of these individuals.
- Arduous when volunteers are not spotives and not acclimated

OBJECTIVES, PURPOSE and BACKGROUND

Assess cardiac strains

- ergonomic and posture during all moments of pratical pollution
 - determine whether the personal protective equipment used by the operators.
- Next study research the factors ability to carry out this type of activity.

METHODOLOGY, DATA, COLLECTION and ANALYSIS

- Research volunteers for the study
- medical examamination, to filter out all clinical pathologies or treatments that may affect cardiac activity
- Assessment of the corporal temperature, of weight
- Quantification of hydric inputs
- Atmospheric samplingVolunteers study candidate

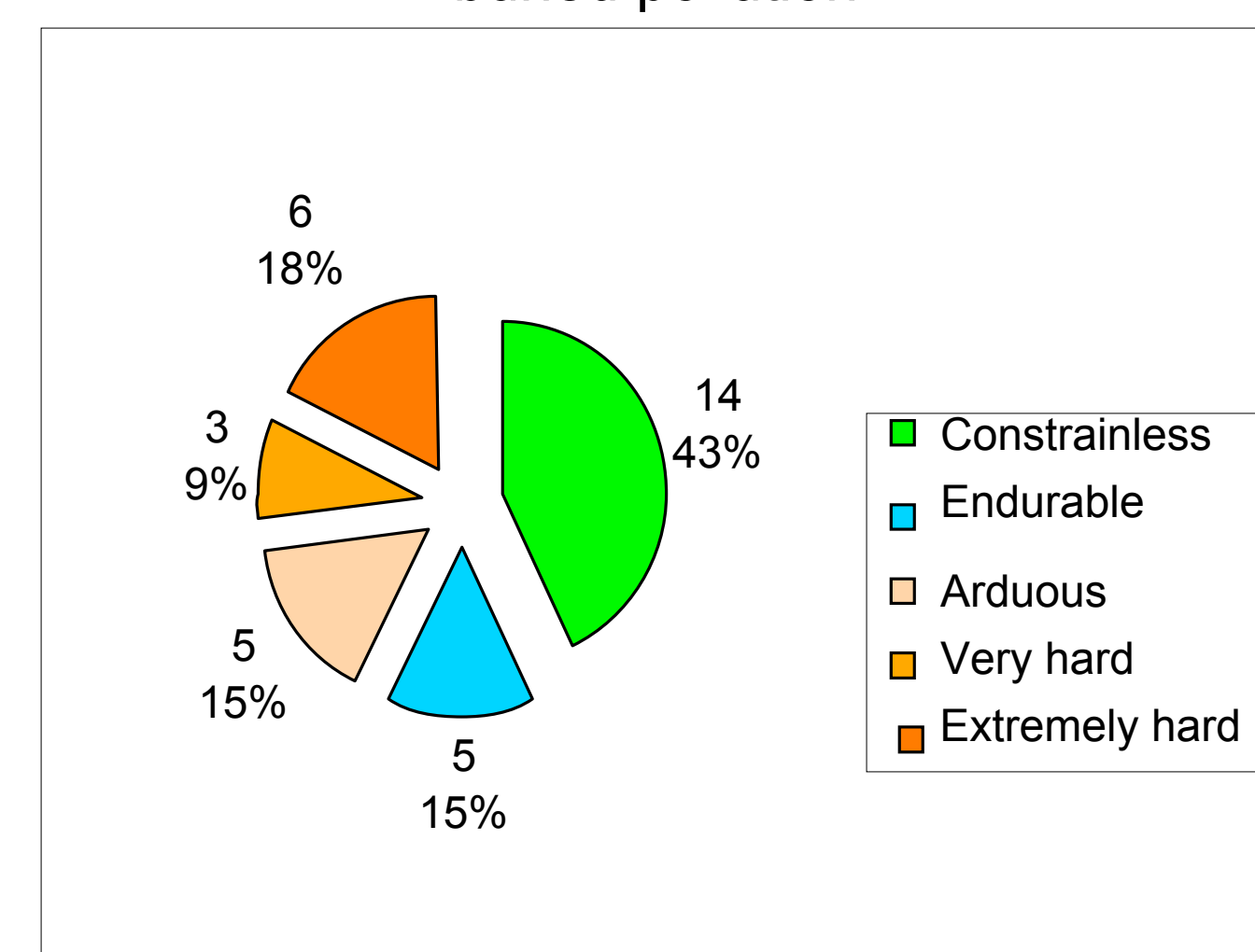


Thermometre, hygrometre, black globe, anemometre used to obtain the thermal index *Wet Bulb Globe Temperature (WBGT)

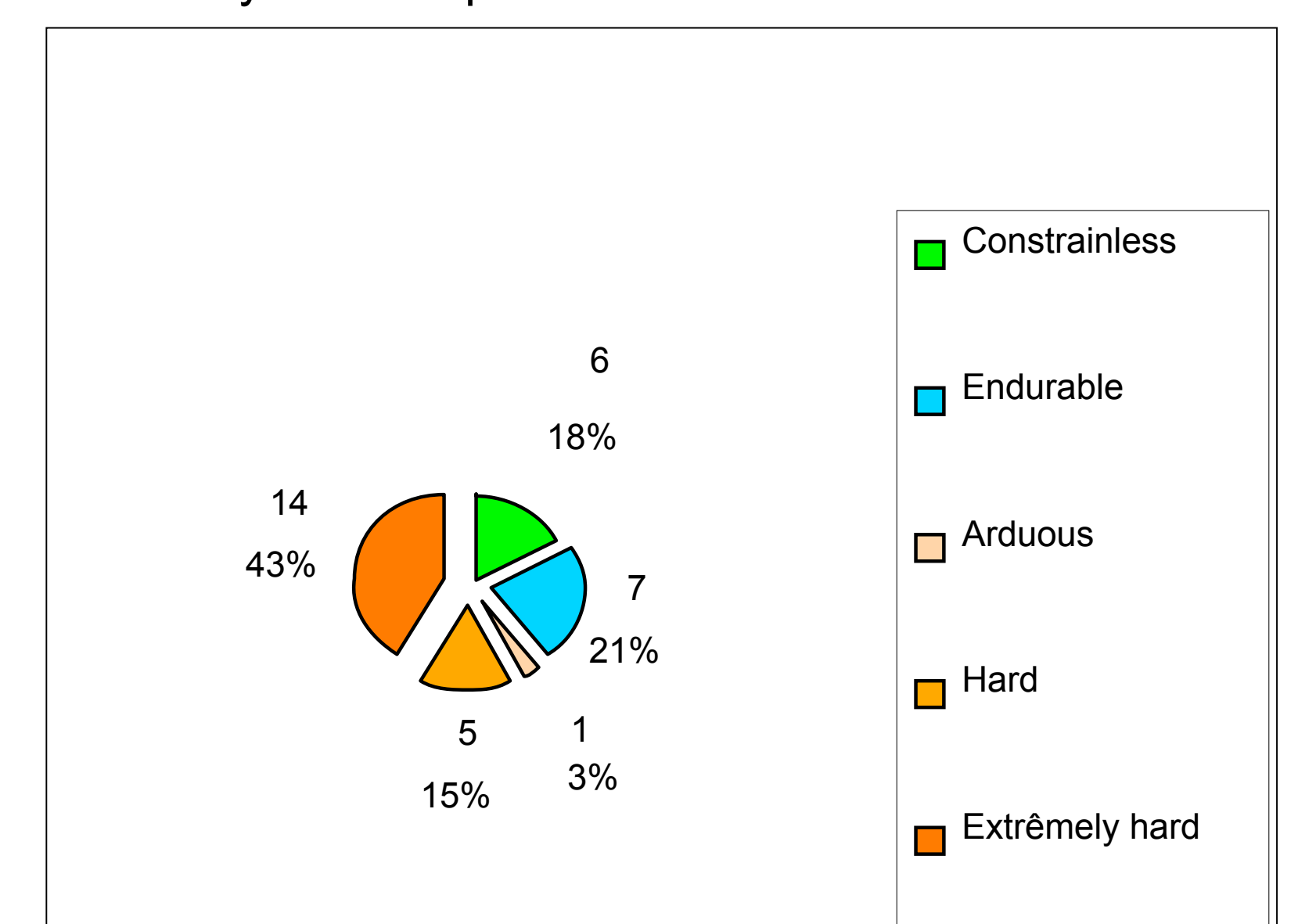


RESULTS

Activity levels repartion into the "buried pollution"



Activity levels repartion into the "enrocherement"



DISCUSSION and CONCLUSION

Even if professionals or volunteers wear adequate equipment they are subject to develop articular confines and cardiac constraint when they realize activities of depollution of litoral oil spill. However, when these people clean up oil products, environmental exposure is weaker. Workers who practice this activity tolerate better the required efforts when young grown-up, healthy and well trained. For the other people, it would be necessary to do more experiments, in order to have a better knowledge of the physical constraints characteristics