Environmental reporting in the Norwegian defence sector for 2009

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English summary

The Norwegian Defence publishes an annual account of its environmental performance. The scope of these reports is to identify the most important defence activities where measures can be implemented to improve the overall environmental efficiency for the sector.

The overall environmental impact from the defence sector in 2009 was assessed based on information from the Norwegian Defence Environmental Database (NDED). The following environmental aspects were considered: (i) use of ammunition, (ii) generation of waste, (iii) energy consumption, (iv) use of chemicals, (v) fuel consumption, and (vi) water consumption. As for previous years the status for implementation of an environmental management system (EMS) in the Armed Forces were evaluated and a score based on performance was set.

The Ministry of Defence (MoD), the Armed Forces, the Norwegian Defence Estates Agency (NDEA) and the Norwegian Defence Research Establishment (FFI) have reported the environmental impact of their activities to the NDED, while the Norwegian National Security Authority (NoNSA) has utilised the NDED only to a minor degree. The reporting quality of the data for the different environmental aspects for the defence sector was improved or remained unchanged in 2009, with the exception of ammunition which was considerably poorer compared to 2008. The level of reporting was estimated to 48% compared to 56% in 2008. Use of lead-free ammunition increased by 33% compared to 2008. Only 19 tons of lead was deposited in 2009, compared to 56 tons in 2008 and 103 tons in 2007. This complies well with the target set in national environmental policy to reduce lead emissions to correspond with background levels by 2020.

NDEA's new energy reporting system "EnergiNet", local sources and the central accounting system from NDEA have been used to gather data on energy and water usage for 2009. It is estimated that almost 100% of the energy consumption is reported in the NDED compared to 60–80% for 2008. A total of 682 MWh of energy consumed and the usage of 2.5 million m^3 of water was reported in the NDED for 2009 (up 54% compared to 2008).

Reporting of solid waste in the NDED was estimated to account for 95–100% of the volume generated from the defence sector in 2009, compared to 75–80% in 2008. The sorting grade of solid waste reached 54% in 2009, which is below the target of 60% in the executive letter from the MoD. The rate of waste recycling in the defence sector was calculated to 78% in 2009, which is above the target of 75% established in the executive letter from the MoD. In total 13.5 million tons of generated waste was reported in 2009, compared to 12.9 million tons in 2008.

99% of the fuel consumption registered in the NDED is reported by the Armed Forces, but fuel consumption is also reported by the NDEA, FFI and the MoD. In 2009, fuel consumption from the use of private cars while on duty in addition to the numbers of flights (official journeys) has been included in the report. The estimated emissions to air from fuel and energy consumption from the defence sector show that the emission of greenhouse gasses is 933 tons lower than in 2008.

The reporting of chemicals usage in 2009 has been scanty as in the previous years. The use of de-icing chemicals has been reported at seven military air bases.

The estimates of the impact on the environment from defence sector activities improve from year to year. The estimates are gradually becoming more accurate as the degree of reporting to the NDED improves and the basis of experience increases. However, a significant degree of uncertainty over most of the estimates still remains. Recommendations are made on how the quality of the registration of the data in NDED could be improved, as well as suggestions by which the defence sector's environmental performance might be improved.

Sammendrag

Rapportene "Forsvarssektorens Miljøregnskap" utgis hvert år. Hensikten er å identifisere de mest betydningsfulle områder av virksomheten der tiltak kan settes inn for å redusere miljø-belastningene fra forsvarssektoren.

Informasjon samlet i forsvarssektorens miljødatabase (MDB) er benyttet for å vurdere miljøpåvirkningene fra sektorens virksomhet i 2009. Følgende miljøaspekter er vurdert for 2009: (i) forbruk av ammunisjon, (ii) avfallshåndtering, (iii) energiforbruk, (iv) drivstofforbruk (v), forbruk av helse- og miljøfarlige kjemikalier, og (vi) vannforbruk. I tillegg er det foretatt en vurdering av status med hensyn på bruk av MDB ved det enkelte etablissement i Forsvaret.

Forsvarsdepartementet (FD), Forsvaret, Forsvarsbygg (FB) og Forsvarets forskningsinstitutt (FFI) har rapportert egne miljøbelastninger i MDB, mens Nasjonal sikkerhetsmyndighet (NSM) i liten eller ingen grad har benyttet MDB i 2009. Kvaliteten på rapporteringen av data for de ulike rapporteringsområdene i 2009 fra hele forsvarssektoren samlet er forbedret eller uforandret sammenlignet med 2008, med unntak av ammunisjon hvor rapporteringen er betraktelig dårligere enn foregående år. Rapporteringsgraden av ammunisjon var på 48 % sammenlignet med 59 % i 2008. Andelen blyfri ammunisjon (7,62 mm, 5,56 mm og 9 mm) økte fra 55 % i 2008 til 71 % i 2009. Det er estimert at det deponeres 19 tonn bly fra bruk av ammunisjon i norske skyte- og øvingsfelt i 2009, mot 56 tonn i 2008 og 103 tonn i 2007. Dette er positivt sett i lys av nasjonalt miljøpolitisk mål om at utslipp av bly til miljøet skal reduseres til naturlig bakgrunnsnivå innen 2020.

Forsvarsbyggs nye energistyringssystem "EnergiNet", lokale kilder og FB sitt sentrale regnskap har blitt benyttet til innhenting av energidata for 2009. Rapporteringen for energi i år er estimert til omtrent 100 %, mot 60-80 % for 2008. Det ble registrert 682 MWh i MDB for 2009 mot 429 MWh for 2008. Registrering av vannforbruket økte med 54 % fra 2008 til 2009 (2,5 millioner m^3 i 2009 mot 1,3 millioner m^3 for 2008).

For rapporteringsåret 2009 er det importert avfallsdata til MDB fra alle markedsområdene i FB. Det er kun Andøya flystasjon som foretar manuell registrering av avfall i MDB. Dette fører til at sikkerheten i estimert rapporteringsgrad er større sammenlignet med foregående år, 95-100 % for 2009 mot 75-80 % for 2008. Sorteringsgraden av avfall i sektoren var 54 % i 2009, som er under målet på 60 % i iverksettingsbrev fra FD. Gjenvinningsgraden for forsvarssektoren var på 78 %, som er over målet i Forsvarets iverksettingsbrev om minimum 75 % for 2010. Totalt så ble det rapportert 13,5 tusen tonn avfall for 2009 mot 12,9 tusen tonn for 2008.

Hovedtyngden (99 %) av drivstofforbruket rapportert i MDB stammer fra Forsvarets aktivitet, men drivstoff er også rapportert for FD, FFI og FB. Storparten av etatene har i 2009 rapportert bruk av privatbil i tjeneste og antall flyreiser i forbindelse med tjenestereise. For første gang er bruk av privatbil i tjeneste inkludert i regnskapet med hensyn på forbruk av drivstoff og utslipp til luft. Estimert utslipp til luft fra drivstoff og energiforbruk i forsvarssektoren viser at utslipp av CO_2-ekvivalenter er 933 tonn lavere i 2009 sammenlignet med 2008.

Rapportering av kjemikalieforbruk er for 2009, som tidligere år, svært mangelfull. Det er rapportert forbruk av fly- og baneavisingskjemikalier på 7 av Forsvarets flystasjoner.

Totalt blir estimatene av forsvarssektorens miljøpåvirkninger forbedret fra år til år. Estimatene blir stadig mer nøyaktige som følge av at rapporteringen i MDB øker, og at erfaringsgrunnlaget bedres. Det er imidlertid fortsatt usikkerhet av betydning forbundet med de fleste estimatene. Rapporten gir anbefalinger om tiltak som bør iverksettes for å forbedre datakvaliteten i MDB, samt miljøeffektivitetsvurderinger for å bedre miljøprestasjonen i sektoren.

Contents

1 Introduction

1.1 Intention and scope

This report is the latest in a series of yearly FFI reports on ”Environmental Reporting in the Defence Sector” which are produced on an annual basis [1-5]. These reports contain an evaluation and analyses of data assembled in the defence sector’s environmental database over the course of the year and constitute a summary of annual developments in reporting to the Norwegian Defence Environmental Database (NDED). The entire defence sector is included in the assessment, from the MoD (MoD) to the four subsidiary agencies that are under its auspices – the Norwegian Armed Forces, the Norwegian Defence Research Establishment (FFI), the Norwegian Defence Estates Agency (NDEA) and the Norwegian National Security Authority (NoNSA).

In the environmental report, the status and historical development of the environmental impact of defence operations and activities is quantified for the entire defence sector. The methods of calculation are described and the degree of confidence in the estimates stated. Recommendations are made to implement measures to improve the quality of the data in the NDED, and to increase environmental performance in the sector.

1.2 Background

Norway’s environmental protection policy builds on the principle that every actor in society is responsible for the impact of his activities on the environment. In Report to the Storting (the Norwegian parlament) no. 58 (1996–1997) [6], the foundation was laid for a tracking system to gauge the results and effectiveness of national environmental policy. The various ministries were made responsible for following up on environmental protection efforts within their respective sectors of society.

The Norwegian Government has published Storting reports on ”The Government’s Environmental Policy and the State of the Environment” (RM) every other year since 1999, with the most recent coming out in 2007 [7]. This report to the Storting presents the government’s environmental protection goals and ambitions and is built up around the four result areas of environmental protection policy, along with four topics that transverse them (for details, see ref. 2.) National key figures are worked out to follow the development of changes in the environment in Norway. Corresponding key figures are also used in international environmental reporting. The authorities in each sector make annual reports on environmental changes in their particular sector to the environmental protection authorities. This reporting process in turn becomes an important part of the basis for the ensuing year’s RM.

The first plan of action for environmental preservation efforts published by the Armed Forces came out as early as 1992/1993. (Report to the Storting no. 21 (1992/1993)) [8]. Here the ambition was expressed that the Armed Forces would be a pioneering organisation in the matter

of environmental protection and preservation. New action plans were published in 1998 [9] and in 2003 [10], the latter of which was entitled ”The Environmental Preservation Work of the Norwegian Armed Forces”. To ensure systematic follow-up of the Armed Forces’ sectoral responsibility, the decision was made in 1998 to institute environmental management within the sector, with a goal of full and complete implementation of the program within the sector by the end of 2003. Among the projects that were part of instituting the Armed Forces’ environmental management program was the establishment of the Norwegian Defence Environmental Database (NDED). In 1999, FFI was commissioned by Defence Staff Norway to establish the NDED so that all relevant environmental information could be collected in one place and provide an overview of impact on the environment emanating from the Armed Forces’ own activities. In 2008, this was transferred to FFI as a long-term administrative task from the Ministry of the Defence.

The information gathered in the NDED is used primarily for two purposes:

1. To cover the Armed Forces obligation to report to the environmental authorities and other interested parties;
2. To form a basis for increasing effectivity in the environmental performance of the Armed Forces at all levels of the organisation.

2 Environmental Management in the Defence Sector

2.1 Description of operations

The Armed Forces constitute the largest unit of the subsidiary agencies underlying the MoD, followed by NDEA, FFI, and NoNSA. The organisation of the Norwegian defence sector and the number of employees per agency in 2009 is shown in the figure below.

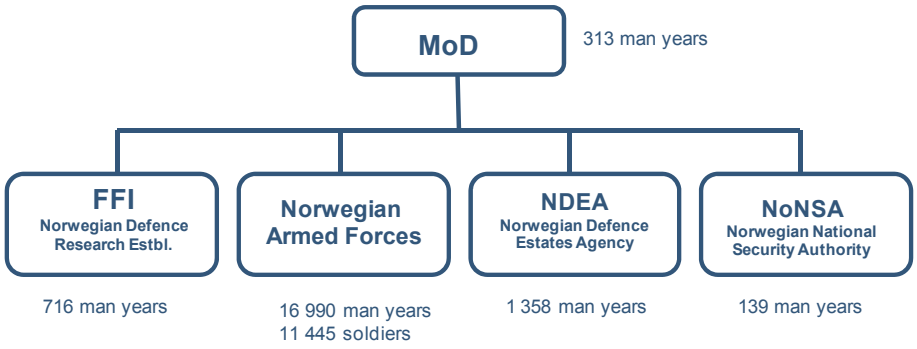


Figure 2.1: Organisation of the defence sector with approximate number of man years provided for each agency for 2009.

In 2009, the Norwegian defence sector comprised about 31 000 man years including soldiers carrying out compulsory military service, and managed a building inventory of 3 912 615 m^2 [11].

2.1.1 The Ministry of Defence (MoD)

The Ministry of Defence (MoD) is a department of government vested with the responsibility for shaping and implementing Norwegian security and defence policy. The department is responsible for the overall management and control of the subordinate agencies, the development of longterm defence policies and overall planning for the defence sector. The MoD is divided into four sections and had in 2009 about 313 civilian and military employees. The Executive Letter and the Allocation Letter from the MoD to its underlying agencies provide the framework within which each agency will carry out its assigned tasks and commissions.

2.1.2 The Armed Forces

The work of the Armed Forces is to assist in achieving Norway's security and defence objectives. The Armed Forces are also responsible for force production within the respective branches of the forces. In 2009, the Armed Forces had around 16 990 employees and about 11 445 conscripts in service. The total budget for the Armed Forces in 2009 was 33.5 billion Norwegian kroner, with 23.9 billion allocated for operations, and 9.5 billion kroner for investment [12]. Table 2.1 gives an overview of personnel and the important types of materiel in the Armed Forces in 2009, organised by branch.

Table 2.1: Overview of materiel according to branch.

Army	Navy	Air Force
Personnel 3 600 (norm.)	Personnel 2 200 (norm.)	Personnel 1 700 (norm.)
Equipment • 52 Leopard 2 A4NO (120mm) • 15 Leopard 1 A5NO (105mm) • 104 CV 9030 • 440 M-113 (various versions) • 75 SISU/PASI • 36 artillery pieces, • TOW, ERYX and M-72 • 36 mortars, type 81 mm BK • 31 Combat Engineer Vehicles • 25 IVECO armoured vehicles	Equipment • 2 Oslo Class frigates • 5 Nansen class frigate • 6 Ula Class submarines • 2 Hauk Class MTBs • 3 Skjold Class MTB • 3 Oksøy Class minehunters • 3 Alta Class minesweeper • 20 Combat boat 90 N • 14 coast guard vessels	Equipment • 57 F-16 combat aircraft • 12 Sea King • 6 P-3 Orion • 4 C-130J Hercules • 6 Lynx helicopters • 18 Bell 412 helicopters • 3 DA-20 Jet Falcon • 15 Saab Safari

2.1.3 Norwegian Defence Estates Agency (NDEA)

NDEA is an administrative department that answers to the MoD. Its primary work is the planning, building, and development of defence sector real estate and property. It also serves in an advisory capacity, as well as the renting out and selling or disposal of Armed Forces properties. NDEA manages several million quadratic meters of building/office space and real estate holdings of about 1.3 million decares. The Armed Forces constitute NDEA's largest and most important customer, but NDEA itself is not a part of the Armed Forces as an agency. NDEA is divided into six different areas of enterprise: Asset Management; Construction Management; Property and Facility Management; National Fortifications Heritage; Sales Management; Specialist Advisory; and Administrative Services. In 2009, the organisation had 1358 man years distributed between these six areas of operation.

2.1.4 Norwegian Defence Research Establishment (FFI)

FFI is a civilian research agency and is organised as an administrative agency charged with special responsibility and answerable directly to the MoD. FFI is the prime organisation for research and development directed towards meeting the needs of the Norwegian Armed Forces. FFI consisted of five divisions and in 2009, had 716 employees distributed between its two facilities.

2.1.5 Norwegian National Security Authority (NoNSA)

NoNSA is an administrative agency underlying the MoD. On behalf of the Ministry of Justice and MoD jointly, the authority acts as the executive agency concerned with protective security acoss both military and civilian sectors. In 2009, NoNSA had 139 employees.

2.2 Implementation of environmental management and environmental reporting in the Norwegian defence sector

2.2.1 Ministry of Defence (MoD)

The aims and subsidiary goals of environmental protection in the MoD's underlying departments are stated in the Executive Letter and the Allocation Letter. In 2009 the agencies were to:

- Further develop the environmental management system based on ISO 14001
- Utilise the NDED to monitor the effects of defence activities on the environment and utilise the database in making decisions for further improvement of environmental performance in the defence sector.

In 2006, the MoD published its first public environmental report on environmental protection efforts in the defence sector [13]. This report is published on an annual basis with a view to providing the defence sector's own employees, public enterprises and the general public with information about defence sector environmental impacts.

The Ministry of Defence provides the Ministry of the Environment with an annual report on environmental protection efforts within the defence sector. This reporting is based on the underlying agencies' environmental report, information that has been collected throughout the year in NDED, and information that has been retrieved from other systems. In certain areas, for example when arranging for special emissions permits, the MoD may make additional reports to other public authorities having special expertise, such as the Climate and Pollution Agency for example.

The MoD began its own implementation of an environmental management system in 2008. The Ministry has made a survey of its own environmental impacts and reported these into the NDED for 2009.

2.2.2 The Armed Forces

The Chief of Defence in conjunction with Defence Staff Norway is responsible for implementing environmental management at all levels of the Norwegian defence sector. The environmental protection section at the Training Center for Joint Support (FKL) supports the Chief of Defence by following up the NDED in the Armed Forces. In addition, FKL's environment protection section is responsible for following up on a general education system within the Armed Forces on environmental protection (cf. Chief of Defence's Plan of Operations for 2005 (FSJ VP 2005)).

Of the subsidiary agencies underlying the MoD, the Armed Forces is the organization that has worked the longest in implementing environmental management and has contributed the bulk of the reports in NDED. On August 1, 2009, the number of independent military management units (DIF's) was reduced from 70 to 21. The Chief of DIF is responsible for environmental management his own section's activities. The task of the regional support function (RSF) is to coordinate environmental protection efforts in the region and to serve in an advisory capacity, also in connection with implementing environmental management. The environmental

coordinator in the RSF cooperates with the individual DIF to arrive at a workable implementation of environmental management in their particular operations and in their region.

On August 1, 2009, the number of independent DIF's was reduced from 70 to 21. The DIF chiefs answer directly to the Chief of Defence and have the responsibility to report on the status of implementation and development of the environmental management system to FKL by February 15, 2010. In 2009, there was no requirement to publish environmental reports at the DIF level. Many localities publish their own environmental reports. According to the guidelines for the 2009 Annual Report of the Norwegian Chief of Defence, the environmental report of the Armed Forces should be sent to Defence Staff Norway by the middle of April. The purpose of this report is to give an account of the status of the Armed Forces environmental work.

2.2.3 Norwegian Defence Estates Agency (NDEA)

The NDED was first taken into use at NDEA in 2006, yet the agency has made little use of the database to report on the environmental impact of its activities. Property and Facility Management, the unit within NDEA in charge of sales management, and FFI started an initiative in 2008 to ensure reporting of waste in connection with NDEA disposal projects. The NDED has been further modified to accommodate the unit's needs, and work is in progress to set up an import procedure from Property and Facility Management's own digital system to NDED. The waste generated by Property and Facility Management projects in 2009 is registered in NDED. Construction Management, which is NDEA's construction unit, registered the waste that was generated in connection with its construction projects in 2009.

NDEA's environmental reports are prepared on an annual basis as a contribution to the defence sector's annual statement to the environmental authorities.

2.2.4 Norwegian Defence Research Establishment (FFI)

The work to implement environmental management at FFI began in 2007 and NDED was taken into use at the same time. The status of environmental management at FFI is included in the institute's annual environmental report to the MoD. FFI used NDED to report on the environmental impacts of its own activities in 2009.

2.2.5 Norwegian National Security Agency (NoNSA)

Implementation of environmental management into the organisation and the use of NDED at NoNSA had not yet been started by the close of 2009.

3 The Norwegian Defence Environmental Database (NDED)

3.1 Description

The NDED was established as the reporting and information system for environmental management in the Norwegian defence sector. Having the respective agencies within the defence sector make their own report of their environmental impact serves two purposes:

1. Covers the defence sector's requirement to report the following
   - Sector reports to the central authorities;
   - Environmental reports in underlying agencies and units;
   - Inquiries in connection with the Environmental Information Law (Act of 9th of May 2003 Relating to the Right of Environmental Information and Public Participation in Decision-Making Processes Relating to the Environment).
2. Provides a basis for assessments of environmental efficiency both locally and centrally.

Information registered in NDED and the level of detail is governed by:

- Compulsory requirements on the defence sector to report to the environmental authorities;
- Available information in other management systems, or established reporting procedures;
- Need for information in connection with running environmental management.

The software program TEAMS is used to enter data and print out reports from the NDED. A more detailed description of TEAMS and NDED appears in the Armed Forces environmental report for 2004 [4] and 2005 [5].

Box 1: Requirement to register data in NDED

Requirements concerning data to be reported by the units in NDED and assigned to the agencies by the MoD through the Executive Letters and the Allocation Letters. For the reporting year 2009 the following information was registered in NDED:

- Energy use (fuel and energy for the operation and maintenance of constructions and buildings);
- Use of ammunition;
- Use of chemical products (hazardous to health and the environment);
- Waste (total amount specified in fractions in accordance with NS 9431);
- Water use;
- Severe pollution;
- Green procurements

3.2 Commissions from the Ministry of Defence to underlying agencies

Like other assignments and commissions, tasks of an environmental nature are assigned to the underlying agencies and the defence sector as a whole through the MoD's Allocation Letter or Executive Letter.

3.2.1 Executive Letter for the Defence Sector (2009-2012)

This long term plan for the defence sector [14] emphasises use of the defence sector's environmental database as a means of monitoring the environmental impact of defence-related activities and as an decision-making aid when working out improvements in environmental performance and minimising the environmental impact of defence sector activities. Consideration of the environment shall weigh heavily in all defence sector activities, and all care is to be taken to ensure as minimal an impact on the environment as possible. The environmental management system based on ISO 14001 is to be further developed and will serve towards making consideration of the environmental impact of a given activity an integrated part of all planning and decision-making processes at all levels of operations in defence sector agencies.

Furthermore the following is stated: *"The operation or activity will endeavour to achieve a reduction in the release of greenhouse gases and nitrogen oxides, and energy efficiency and conversion to heating based on renewable energy is strongly emphasised.*

Emissions and the use of prioritised environmental poisons shall be halted or greatly reduced by 2010. The sector shall also step up its collection of hazardous waste and reduce the amounts of hazardous waste that are produced."

3.2.2 Executive Letter for NDEA 2009

An extract from the Executive Letter for NDEA that has relevance for environmental management:

Release of greenhouse gases: *"The goal is to improve upon the state of environmental protection in the defence sector by reducing greenhouse gas emissions by 5% a year."*
The controlling parameter for 2009 is to measure the total emissions of CO_2 equivalents from the combustion of fossil fuel to heating by constructions and buildings. The NDED is used as the basis for calculating emissions. The goal for 2009 is for an emissions ceiling of ≤ 37 500 tons of CO_2 equivalents.

Waste management: *"The aim is to gauge the state of environmental protection efforts in the defence sector – with respect to climate, environment and measures to further augment a culture for environmental protection within the organisation. The intention is to achieve improvements in minimising the sector's impact on the environment and on the climate through reductions in the amount of construction waste sent away for disposal."*

This is measured in two categories (A and B) and the defence sector's environmental database is used as the basis of information for the figures.

A. Sorting of all waste according to source material
   The proportion of construction and facility waste which according to NS9431 is not in category 9999 mixed waste should be a minimum of 60% at each reporting to qualify for green status.
B. Treatment and processing of all waste
   The proportion of waste to be recycled, that is, waste not being sent for waste disposal, should be a minimum of 70% for 2009 in order to qualify for green status.

Environmental and social reponsibility in procurements:
"The goal is to improve the level of environmental protection in the defence sector and to foster and improve attitudes of social responsibility and ethics by setting environmental and ethical stipulations on the purchase of goods and services."
This is gauged in two categories (A and B).

A. Framework agreements
   Concrete environmental and ethical stipulations will be made in all new and renegotiated framework agreements and in the purchase of goods and services. At least 95% of the agreements must have these environmental and ethical stipulations to qualify for green status.
B. Investment projects
   Concrete environmental and ethical stipulations shall be made in all investment projects. At least 95% of the agreements must have these environmental and ethical stipulations to qualify for green status.

3.2.3 Executive Letter for the Armed Forces 2009

The following extract from the Executive Letter to the Armed Forces applies to environmental management:

The Armed Forces is enjoined to "*further develop its environmental management system based on ISO 14001 and to make consideration of the environmental impact of defence activities an integrated part of all planning and decision-making processes at all levels of the organization.*

The Armed Forces will consider the prospect of certifying environmental management systems in the course of the period at the following prioritised operations and facilities: Airport operations (cf. Rygge), base operations at Haakonsvern, the Armed Forces heavy industry workshops, the operation of shooting ranges and exercise grounds that are subject to emissions permits, and the military academies.

The Armed Forces will systematically endeavour to reduce emissions of greenhouse gases and nitrogen oxides; the organisation will emphasise energy efficiency and conversion to heating systems that run on renewable sources of energy. Emissions and the use of prioritised substances that are hazardous to the environment will be halted or reduced by 2010. The organisation will also endeavour to increase the collection of hazardous waste and reduce the amounts of hazardous waste generated in its activities.

The Armed Forces will report on its energy use and its proportion of mixed waste as follows:

a. *The use of all types of energy for constructions and buildings converted to GWh. The defence sector's environmental database will be used as the basis for estimating usage. The target figure for 2010 is lower than 602 GWh.*
b. *The proportion of waste which according to NS 9431 is in the 9999 category of mixed waste should not exceed 40% in 2009. The calculations are to be made using data from the Armed Forces environmental database.*

The Armed Forces will reduce the CO_2 emissions from administrative vehicles and modify existing facilities so as to be able to accommodate electric cars. Preparations are to be made to replace the smallest vehicles with zero emissions technology (electric cars).

a. *Emissions from new administrative vehicles shall not exceed 140 g CO_2/km*
b. *For medium size cars and smaller vehicles, emissions should not exceed 120 g CO_2/km*

3.2.4 Allocation Letter for FFI 2009

Extract from the Allocation Letter to FFI with relevance for environmental management:

"*FFI will establish and implement a plan of action to reduce the use of chemicals that are harmful to health and the environment. All procurements of products containing harmful chemicals are to be registered in the Norwegian Defence Environmental Database (NDED). Products that are poisonous to the environment shall not be purchased; a suitable substitute shall be found.*

The emissions from new administrative vehicles should not exceed 140g CO_2/km. For medium size cars and smaller vehicles, the requirement is 120 g CO_2/km, but active effort should be made to replace the smallest vehicles with zero emissions technology (electric cars).

The NDED is to be kept updated on a continual basis, by the third quarterly report at the latest, and by January 31 in the following year.

3.2.5 Executive Letter for NoNSA 2009

As a unit within the defence sector and an agency underlying the Norwegian MoD, see paragraph 3.2.1.

3.3 Quantifying the environmental impact

The user's guide for registering data in the Norwegian Defence Environmental Database (NDED) was developed by FFI and is documented in "Registration of environmental impacts in the NDED" which is available on FISBasis [15]. The document states what should be registered and what information can be accessed from the defence sector's various information systems.

3.3.1 Waste

All waste that is generated in the defence sector is to be registered in the NDED. The different fractions of waste according to NS 9431 can be registered to one or more of the following recipients in NDED:

- Landfill
- Recovery of raw materials
- Energy utilisation
- Combustion
- Recycling
- Compost
- Waste disposal facility (unspecified treatment)
- Other (deviation from waste plan)

The recipient category "waste disposal" is only used when the main fraction of the waste consists of mixed waste and hazardous waste. In the case of waste generated from real estate property disposal projects through NDEA's subsidiary asset management company Property and Facility Management, the waste may now be registered to "waste disposal facility". This is done where information about the final method of treatment and disposal is not mapped out. However, as the actual waste facilities are charted, they will be used when registering in NDED.

Waste reports in connection with NDEA disposal projects are each registered separately. Any contaminated mass that must be disposed in connection with a sale of property undertaken by the Property and Facility Management division is to be reported in NDED.

The registered amounts of waste provide an overview of waste handling in the defence sector. This overview forms the basis both for measuring changes in the degree of reporting from year to year, as well as provides data for possible analyses of action plans in connection with the amount

and type of waste generated. The amount of waste that is registered to final processing also emerges in these statistics. Deviations in handling the waste are also registered. The term 'deviation' here means incorrect sorting of the waste or that the waste is stored in places other than approved waste storage facilities.

3.3.2 Consumption of energy and fuel

The defence sector registers the consumption of energy from various energy sources (heating fuel oil, biopellets, district heating, etc) or other material (consumption of propellant fuel) in the NDED. Energy consumption is connected to the running and maintenance of property, construction and buildings and the consumption of energy/fuel for transportation and the operation of Armed Forces materiel. This overview is used to compare the different energy sources, carry out analyses of action plans for energy efficiency and to make calculations of air emissions as a consequence of energy consumption.

As of today, NDED is set up to register the following sources of energy:

Management and maintainance of construction and buildings	Force production and mobile material
Electricity	Gasoline
District heating	Diesel
Fuel oil	Propane
Propane	Jetfuel/F-34
Diesel	Avgas
Bioenergy	Marin fuel
Kerosine	Natural gas

Emissions to the air are calculated on the basis of reported consumption figures for fuel and energy. The models are not materiel-specific, but are based on emissions factors for different kinds of combustion (steam/kettle, incinerator, automobile, etc) by the different types of fuel. These factors are set by Statistics Norway (SSB) in cooperation with the Norwegian Pollution Control Authority [16].

3.3.3 Use of ammunition

All use of ammunition and explosives in the Armed Forces are reported on Form 750: Shooting and Environmental Report on the Use of Ammunitions and Explosives (DBL 750). Reporting is done digitally on FISBasis, the internal network of the Armed Forces. For each individual shooting session, a report is made which states the particular shooting range where the session took place, the type of ammunition used, the number of shots fired, the date, and irregularities(if any) during the session.

The system is now set up whereby all use of ammunition at all Armed Forces shooting ranges can be registered, including civilian ranges which might see sporadic use in connection with exercises or under the auspices of the National Guard (HV). Ammunition consumption during international operations (INTOPS) is registered on the form DBL 750 just as it would be in Norway.

The reported figures for ammunition use are used to calculate how much heavy metal is deposited in Armed Forces shooting ranges and exercise grounds. The conversion from ammunition use to the release of heavy metals into the environment is made through the use of conversion factors developed by FFI on the basis of composition data for the different ammunition types obtained from FLO/S/SBL/AMS. Releases to the air from the use of gunpowder and explosives are also calculated, along with the weight of the cartridges that will be delivered to the waste disposal facility.

For ammunition types whose contents have not yet been fully surveyed, estimates must be made of the anticipated releases. Work is being done to improve the basis of information about those ammunition types whose contents are not sufficiently known.

3.3.4 Use of chemical products

The use of chemicals that are hazardous to health and the environment is to be registered in NDED. By setting up different registration windows in TEAMS, it is possible to register the utilisation rates for these chemicals at their place of use. Units that wish to register their consumption of chemicals report this to FFI. The Institute then sets up the registration screens for each individual unit.

Special registration screens have been made in the database for chemical products that are used in large quantities, and by several units, and which result in releases to the environment. As of today, this applies only to chemicals used as de-icing agents on aircraft and runways. These chemicals are registered by the amounts released to the following recipients: drains without cleansing agents, seas and oceans, or soil and land. Units can request that specially tailored registration screens be created for this purpose.

In the time ahead, assessments will be made of the interface between the Common Integrated Administration System (FIF) and NDED. This should improve both the ability to evaluate the use of chemicals in the Armed Forces with respect to the risk they pose to public health and the environment, as well as assessing the possibility to substitute these chemicals with something else.

3.3.5 Water use

The use of water at the various establishments has been registered in NDED since 2006. Ideally, the water use of each building should be registered and water consumption figures updated on a monthly basis.

3.3.6 Accidental releases of chemicals

Unplanned releases of chemicals, fuel or similar substances are registred through the use of a special registration screen in the NDED. The registration of the particular release into the database should specify what chemical has been released and the amount. The event and remedial action taken should also be described, as well as the cost of the remedial measures.

3.4 Estimating the degree of reporting

In the time since the first environmental report was put together in 2004 up to the present, use of NDED has steadily increased, both in the number of units reporting in the database and the number of imports from other systems to NDED. The quality of the reported data has therefore been significantly improved in this period.

Nevertheless, despite this positive development, there is still a considerable degree of underreporting to the NDED. The degree of underreporting varies organisationally, geographically, and also with respect to the different areas of reporting. This triggers the following when putting together the environmental reports:

- Estimate the degree of reporting in each reporting area;
- Calculate the assumed total burden for each area.

In this year's environmental report, three different methods are used to estimate the degree of reporting:

- **E1:** Compare the central account with reports from other systems, for example the quantity of ammunition issued from the logistic organization.
- **E2:** Estimate the Armed Forces total burden when extrapolating the environmental burden per man year based on calculations from units that have reported well and/or have established data imports
- **E3:** Evaluate current reporting compared to reports from earlier years or between establishments and units carrying out similar activity, as well as an assessment of the source data.

Regardless of which of the three methods is employed, an assumed degree of reporting is estimated for each reporting area. Proceeding from a subjective appraisal of the degree of certainty in the estimate, an interval is established by using the following categorisation:

- High (interval ± 2.5%)
- Medium (interval ± 5%)
- Low (interval ± 10%).

In the environmental report, the method utilised is given in curly brackets along with the degree of confidence in the numbers every time an estimated degree of reporting is given. An example might look like this:

> Estimated degree of reporting is 30-40% [E1, Medium].

3.5 Operation and development in 2009

3.5.1 Upgrade of NDED from TEAMS 4.7 to TEAMS SR

Considerable effort is being expended at this time to upgrade the current version of TEAMS, TEAMS 4.7 to a newer and more user-friendly version called TEAMS SR (Sustainability Reporting). An upgrade to this version will offer improved functionality according to Armed Forces needs. In order to meet the requirement of environmental reporting and carry out analyses

of Armed Forces activities in the coming years with the concomitant increased amounts of data and useage areas, an upgraded version of the program TEAMS 4.7 to TEAMS SR is needed.

This work has been ongoing since the turn of the year 2008/2009 and has been somewhat delayed in relation to the original plan for completion in the course of 2009. The goal is now that the new database can be taken into use in concert with 2010 reporting into NDED.

3.5.2 Digital form 750 (DBL 750)

Considerable changes have been made in the DBL750 reporting form as part of the upgrade to TEAMS SR. The nature of these changes is primarily with respect to functionality and user-friendliness. A new layout has also been designed, but this will not be available until the form is in operation on the new database. The changes in DBL 750 include the following:

a. The function ”shooting range not used” has been developed so that users do not need to fill out the form when the field is not used, even though it has been ordered.
b. Filtration of ammunition according to the ammunitions plan (amplan) for the applicable year such that only the ammunition allocated to the reporting division is available on the form DBL 750.

3.5.3 Data imports to MDB

For information that will be reported to NDED and that is also on other control systems, it would be practical to transfer the information digitally. This gives the possibility to transfer detailed information that is data of high quality without this leading to disproportionately much work.

In the course of 2009, a new import was opened from a local tank facility at Værnes and and a waste import for MO Hålogaland (except Andøya). NDEA has started the establishment of an energy monitoring system where the aim is to achieve a systematic reduction in the use of energy in the Armed Forces. All energy data is stored in a database at EnergiNet AS, and can be transferred to NDED. However, as of today, this has not yet been begun because the system does not yet work satisfactorily in certain localities. NDEA advises that the system is undergoing continual improvement and expects to be able to set up an energy import from EnergiNet for the whole defence sector over the course of 2010.

3.5.4 Data bank for environmental statistics

The data bank is a service that publishes environmental statistics from NDED (http://guru.ffi.mil.no/databank) for decision makers and users of NDED. The data bank may be found on FISBasis and the statistics presented there are broken down by organisation (the Armed Forces, FFI, NDEA, etc) and by geography (cf. RSF regions). During the upgrading process to TEAMS SR, the statistics bank has essentially not been expanded or developed further; however, this work will be set into motion as soon as the new database is made operational.

One of the main challenges in the time ahead is to connect the statistics to the DIF level. However, this requires that the environmental aspects are linked to DIF in the NDED. Such linking will be possible to implement after upgrading to TEAMS SR, which will facilitate the

sharing of environmental aspects. In 2009, statistics for the NDEA subsidiary unit Property and Facility Management were established in the database.

3.5.5 Framework for assessing environmental performance assessment in the defence sector

Assessing environmental performance is an internal administrative process. It is also a tool by which reliable information can be provided on a continual basis about whether an organisation's environmental performance satisfies the requirements set by that organisation's management. Environmental assessment can also be useful in identifying areas for improvement [17].

To be able to make an overall assessment of environmental performance in the defence sector, FFI in collaboration with the MoD and its underlying units should cooperate to construct a good framework within which environmental performance in the sector may be evaluated. Development of good environmental performance indicators for the defence sector could lead to the creation of a simple and effective instrument of communication about environmental performance in the sector. The goal is to be able to provide the best possible basis of comparison between historical data and development over time. These kinds of indicators can be useful in identifying the most important areas in which improvements in environmental performance should be implemented [18].

The guidelines from ISO 14031:1999, the Global Reporting Initiative (GRI) [19] and the recommendations from Ramos et al. (2007) [20] on environmental reporting in the defence sector are appropriate for depicting the numbers basis from NDED in the most informative and perspicuous manner. In order to measure the total environmental performance, causes and effects must be seen in perspective, i.e. what Armed Forces activities affect habitat and environment; what conditions does this cause, what are the effects of this and what can be done to prevent them. When this is seen within the context of the activities' effect on the society, the environmental performance can be evaluated in an appropriate manner. The indicators of activity, impact, condition, effects and responses are therefore used to arrive at quantifiable and comparable values concerning environmental performance.

ISO 14031 is a guide to selecting indicators, while the GRI framework is a set of standardised indicators. Ramos et al. (2007) introduce a framework that, with the help of a systems analysis approach, presents indicators that can be seen in context. Activity A produces X number of releases which affects nature with a condition of Y, such that effect Z arises. In this way the indicators will build upon each other and give a greater understanding of cause and effect. An endeavour will be made to develop elements of this line of thought and proposed indicators for future environmental reports. The Ramos report was intended to address central military activities with respect to their impact on the natural habitat and environment, and partially based on the work of the commission for the Portuguese Armed Forces [20].

Figure 3.1 shows a schematic depiction of the indicator framework for the defence sector.

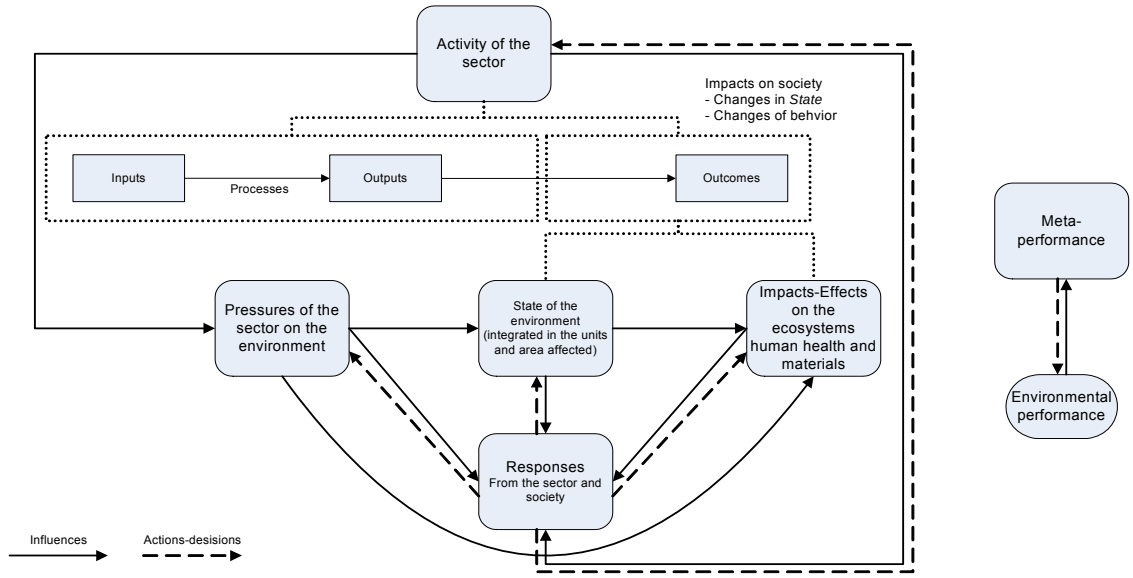


Figure 3.1: Framework of environmental performance indicators for handling and assessing the environmental performance of the defence sector (SEPI).

Taking this framework as a starting point along with the standards of environmental performance developed for the Portuguese Armed Forces [20], we have set up a table (Table 3.1) with an overview of the indicators belonging to the categories under consideration for use by the defence sector in future environmental reporting. This is a rough draft with proposals for indicators that must be developed and tailored over time to defence sector activities and needs. The last two columns show the indicators already in use in the current report, and those that might be appropriate for use in future environmental reports.

Table 3.1: Environmental performance indicators for the defence sector divided into categories and specification of unit of measurement.

Indicator categories for the defence sector	**Units**	**Established indicators**	**Current indicators**
ACTIVITY			
Personnel (military and civilian)	*Number*	x	
Total cost framework	*kNOK / year^{-1}*	x	
Travel expenses		x	
Car	*Km / year^{-1}*	x	
Air	*Number / year^{1}*	x	
Military organisation: number of units	*Number*		x
Acreage owned, leased or administered (especially exercises and training)	*Hectares*		x
Ammunition, missiles and explosives used or detonated	*Number / year^{-1}*	x	
EFFECTS			
Energy consumption (total and per source)	*MWh / year^{-1}*	x	
Fuel consumption (per matereriel type): total and per fuel type	*m^3 /year^{-1}*	x	

Accidental emissions/contamination - harmful chemicals	*Number; kg / year^{-1}*	x	
Emissions of fuel / energy stationary and mobile sources: greenhouse gasses, NOx, heavy metals, CO, NMVOC, SO_2, PM2,5/10, TSP, dioxins, PAH	*Tons / year^{-1}*	x	
Generation of waste	*Tons / year^{-1}*	x	
Operations waste		x	
Hazardous waste		x	
Other waste		x	
Construction waste		x	
Greenhouse gas emissions waste	*CO_2 equiv. (tons) / year^{-1}*		x
Water use	*m^3 / year^{-1}*	x	
Harmful chemicals	*Tons / year^{-1}*		x
Aircraft and runway de-icing chemicals	*Tons / year^{-1}*	x	
Disposal of ammunition	*Tons / year^{-1}*		x
Waste - shooting ranges and exercise grounds (scrap metal, brass cartridges, etc.)	*Tons / year^{-1}*		x
CONDITION			
Contamination of soil and ground (e.g. contamination from metals such as iron, aluminium, heavy metals)	*Number of contaminated places, hectares; m3*		x
Clean up of shooting ranges and exercise grounds and other contaminated localities	*Number; area*		x
Air quality (SO2; NOx; PM10; VOCs; CO; heavy metals) (inside and outside of Armed Forces areas)	*Number of days air quality standard has been violated / year^{-1}*		x
EFFECTS			
Health effects (employees and local population)	*Blood values for iron (ppm) and other health indicators*		x
Sound impact on society	*% of population negatively affected*		x
Damage to national cultural heritage including historic property, archaeological locales, traditionally cultural places	*Assessment of quality*		x
Disturbance to biotic communities	*Assessment of disturbances at community level*		x
RESPONSE			
Final treatment (recipients) waste	*%; tons / year^{-1}*	x	
Operations waste		x	
Construction waste		x	
Disposal of ammunition			x
Total number of man years for personnel having environmental protection in their job desciption	*Number*		x
Environmental education / training (all organisational levels)	*% of employees; hours of environmental training/attitude-forming initiatives / year^{-1}*	x	
Environmental assessments upon new procurements (e.g. new weapons systems or acquisitions according to the procurement plan)	*%; number of contracts with environmental assessments*		x
Environmental reports and communications on Armed Forces activities	*Number of reviews, reports, workshops, environmental and*		x

	defence internet websites / year^{-1}		
Effective internal and external meetings / activities with "stakeholders"	*Number of positive and negative inquiries/assessments, number of meetings / year^{-1}*		x
Environmental budgets, costs (reactive and proactive) and environment-related investmentsr	*NOK /year^{-1}*		x
Number of complaints in connection with exercises	*Number*		x
META-PERFORMANCE			
Evaluation of environmental performance: investmentse and expenses	*NOK year^{-1}*		x
Improve registration of basis data in the environmental database	*Number / year^{-1};qualitative assessments*		x
Implementation of new environmentally-friendly practices/routines based on assessments of environmental performance	*Number / year^{-1}; qualitative assessments*		x
Revisions of environmental performance indicators	*Number of revisions / year^{-1}*		x

4 The Defence Sector's Environmental Reporting for 2009

4.1 Reporting to NDED from the subsidiary agencies

For the reporting year 2009, usage and consumption figures were registered for the following areas in NDED:

- Waste
- Energy
- Fuel
- Ammunition
- Water
- Chemicals (aircraft and runway de-icing chemicals)
- Accidental contamination
- Environmental education (not compulsory)

Only three establishments in the Armed Forces reported in all seven reporting areas: Haakonsvern Naval Base, Ørland Main Airbase, and Rygge Airbase. Bardufoss, Rena Military Camp, Bodø Main Airbase, and Andøya Airbase reported in all of the areas except accidental contamination. A further eleven establishments reported in all areas except chemicals and accidental contamination. Reporting on harmful chemicals has been scanty or totally lacking, with the exception of aircraft and de-icing chemicals.

In 2009, the MoD used NDED to report the use of fuel in administrative vehicles (LeasePlan), fuel use in private cars being utilised for work travel, and the number of flights taken by MoD personnel in connection with work travel. As a general rule, waste and energy generated by the activity was also reported. Water use by the MoD was not gauged apart from other enterprises that also share the premises at Akershus Fortress. This is because there are common water gauges in a number of the buildings there.

In 2009, FFI reported on the use of water, waste, energy and fuel at both of its localities. No use of ammunition, accidental releases or use chemicals was reported. During 2009, FFI acquired a computer program for handling chemicals (EcoOnline) to facilitate keeping track of the use of chemicals from 2010 onwards.

NDEA registered its use of fuel in 2009 through an import from LeasePlan – use of fuel by private cars being utilised for work travel, and the number of flights carried out by NDEA personnel. All other reporting of NDEA's environmental impact (waste, energy, and water) is part of the data from the Armed Forces in that NDEA and the Armed Forces are co-localised to a large degree. In many respects therefore, the environmental impact of NDEA operations cannot be separated from other activities. The two NDEA subsidiary agencies Property and Facility Management and Construction Management registered waste in connection with disposal and construction projects carried out in 2009.

NoNSA has not taken NDED into use, but the organisation's use of fuel was registered through the LeasePlan import. There is probably some reporting at the Kolsås camp which incorporates NoNSA's operations (waste, energy, water), but NoNSA's contributions are not separated from other enterprises at Kolsås.

4.2 Assessing the reporting

4.2.1 Evaluating the status

The status of environmental reporting has been evaluated for every region according to the RSF structure in the Armed Forces, as well as for FFI, NDEA, NoNSA and the MoD. This evaluation consisted of a review of each individual establishment in relation to the organisation structure built into NDED, as well as an assessment of its environmental reporting in the following areas: (i) municipal waste, (ii) fuel, (iii) energy, (iv) ammunition, (v) water and (vi) chemicals. The grading of each particular establishment formed the basis for a collective grade for each region and the grade for the establishment was weighted against the number of man years in the region and relevance for ammunition. Grades for the organisational structure were calculated by using a detailed check list for each establishment.

Table 4.1: Grading system to evaluate organisation structure and the status of the reporting areas in 2009.

Organization structure	Reporting area
0= little or no structure built	0= no structure built
1= some structure built	1= some structure built
2= average quality	2= structure built and transactions registered this year
2= high quality	3= probably registered all usage for 2009

Due to scanty reporting concerning the use of chemicals at the various agencies, the status in this particular area was not evaluated the same way as the other reporting areas. The only evaluation made for chemicals was whether chemicals had been registered to the particular agency or not. Therefore no weighted score was calculated for this particular reporting area.

4.2.2 Evaluating reporting in the defence sector

Table 4.2 shows the status of reporting for the MoD, the different underlying agencies, and every region in the Norwegian military. A weighted score for the different reporting areas gives an indicator of the degree to which the units in each region reported in 2009; only to a limited degree does it indicate the extent to which reporting is complete. A green colour code does not therefore exclude the possibility that reporting for a certain reporting area might be lacking. As in previous years, the Armed Forces stood for most of the reporting to NDED.

Table 4.2: Comparison of average grades in 2009 for the various reporting areas in the Armed Forces, MoD, NDEA, FFI and NoNSA.

	Man years	Organization	Waste	Engine fuel	Energy	Water	Ammunition	Chemicals
Armed Forces								
Region Andøya	245	2,5	2,0	3,0	3,0	3,0	1,0	-
Region Bergen	2 439	2,9	2,9	3,0	3,0	2,9	3,0	-
Region Bodø	890	2,0	2,9	3,0	3,0	3,0	2,5	-
Region Rogaland Agder	753	1,9	3,0	2,5	2,8	2,8	2,0	-
Region Troms-Finnmark	3 016	2,2	2,9	2,9	2,9	2,8	2,0	-
Region Trøndelag	913	2,4	3,0	2,9	3,0	3,0	2,0	-
Region Viken	5 345	2,4	3,0	2,7	2,7	2,6	1,6	-
Region Østerdalen	1 742	2,0	2,9	3,0	3,0	3,0	2,1	-
Total Armed Forces	**16 990**	**2,4**	**2,9**	**2,8**	**2,9**	**2,8**	**2,0**	**-**
MoD	313	2,0	3,0	3,0	3,0	2,0	-	-
NDEA	1 358	2,0	2,5	3,0	-	-	-	-
FFI	716	3,0	3,0	2,5	3,0	3,0	-	-
NoNSA	139	-	-	2,0	-	-	-	-

Table 4.3 shows the average grades for the Armed Forces from 2004 to 2009. Compared to 2008, a drop may be observed in reporting on ammunition, an improvement on water and energy, and no change in the status with respect to reporting on waste, engine fuel and chemicals.

Table 4.3: Comparison of average grades for the Armed Forces in the different reporting areas from 2004 to 2009.

	Organization	Waste	Engine fuel	Energy	Water	Ammunition	Chemicals
2004	1,8	1,6	1,6	1,6	-	1,1	-
2005	1,6	2,0	1,9	1,9	-	1,6	-
2006	1,6	2,5	1,9	2,3	1,1	1,7	-
2007	1,9	2,7	2,3	2,7	1,8	1,7	-
2008	1,9	2,9	2,8	2,6	1,9	2,4	-
2009	2,4	2,9	2,8	2,9	2,8	2,0	-
	↗	→	→	↗	↗	↘	→

4.3 Waste

For the reporting year 2009, waste data was imported to NDED from all market areas in NDEA. Only Andøya Airbase registered waste into NDED manually. As a result, confidence in the estimated degree of reporting was greater for 2009 than for the years before. A total of 12 995 tons of waste were registered in 2008, with the degree of reporting estmated at 75-80% [E2, high]. In 2009, 13 526 tons of operations waste were registered and the estimated degree of

reporting lay betweeen 95 and 100% [E3, high]. There are no central numbers from other systems to make possible an assessment of how good the reporting of waste is. The degree of reporting is therefore based on an appraisal of the available source data and the historic context.

Table 4.4 shows the amount of waste registered in NDED from the defence sector in the period 2004-2009, along with the estimated degree of reporting. The table does not include waste generated from projects carried out by the NDEA subsidiary Property and Facility Management and Construction Management (Table 4.6). The degree of sorting for operational waste was 54% for 2009. This figure falls below the figure established in the regulations for the Armed Forces through the Executive Letter; this called for a minimum of 60% in the degree of waste sorting for 2009. In 2009[1] a figure of 437 kg of waste was registered per man year in the defence sector compared to 438 kg per man year in 2008. Operations waste per the defence budget in 2009 was calculated to be 0.40 kg waste/ thousand kroner (compared to 0.41 kg/thousand kroner in 2008) if the total defence framework for the sector is utilised. Table 4.5 shows the actual amount (kg) of waste from each main fraction distributed to different recipients.

[1] Waste per man year and the defence budget were calculated by using the following data for 2009: 13 526 tons of waste / 30 961 man years in the defence sector / total defence budget for the sector of 33 458 296 billion kroner. Calculations are based on data reported to NDED.

Table 4.4: Waste (tons) registered in NDED from 2004 to 2009 and estimated degree of reporting. The numbers include operations waste generated by the entire defence sector. Waste generated in projects under the auspices of Property and Facility Management and Construction Management are not included in the table.

	2004 *(ton)*	2005 *(ton)*	2006 *(ton)*	2007 *(ton)*	2008 *(ton)*	2009 *(ton)*
1100 Organic waste	437	594	849	1 320	1 805	1 829
1200 Paper and paperboard	1 170	861	1 575	1 681	1 965	1 266
1300 Glass	32	19	17	53	67	71
1400 Metal	456	540	744	755	983	824
1500 Electrical and electronic equipment	81	74	225	126	117	550
1600 Inorganic waste	10	13	6	195	59	386
1700 Plastics	21	34	19	28	23	94
1800 Rubber	< 1	33	< 1	0	6	41
1900 Textiles, furniture, leather and fur				29	39	122
6000 Medical waste	2	9	6	3	20	7
7000 Hazardous waste	2 829	1 311	1 969	1 560	1 969	2 118
8000 Toxic waste packaging		< 1			0	0,30
9999 Mixed waste	4 537	5 460	6 744	7 219	5 943	6 218
Total	**9 575**	**8 948**	**12 154**	**12 969**	**12 995**	**13 526**
Estimated degree of reporting (%)	25-45 %	30-60 %	40-50 %	72-77 %	75-80 %	95-100 %
Estimated total amount	27 357	19 884	27 009	17 408	16 768	13 873

Table 4.5: Waste (kg) registered in NDED in 2009 distributed between the different recipients. Waste registered in connection with Property and Facility Management and Construction Management projects are not included in the table.

	Waste plant *(kg)*	Landfill *(kg)*	Energy recovery *(kg)*	Combustion *(kg)*	Recycling *(kg)*	Compost *(kg)*	Reuse *(kg)*
1100 Organic waste			329 885	1 181 639	236 894	80 984	
1200 Paper and paperboard			200		1 265 678		
1300 Glass					71 382		
1400 Metal					823 892		
1500 Electrical and electronic equipment					550 000		
1600 Inorganic waste		241 647			5 500		139 345
1700 Plastics					94 028		
1800 Rubber			10 063		31 760		
1900 Textiles, furniture, leather and fur			92 200	30 120			
6000 Medical waste			4 040	3 140			
7000 Hazardous waste	38 526		295 262	1 129 142	655 187		
8000 Toxic waste packaging					252		
9999 Mixed waste		368 462	5 623 886		226 160		
Total	**38 526**	**610 109**	**6 355 536**	**2 344 041**	**3 960 733**	**80 984**	**139 345**

Figure 4.1 shows the distribution of waste in percentages, as depicted in the different main fractions registered in NDED in 2009.

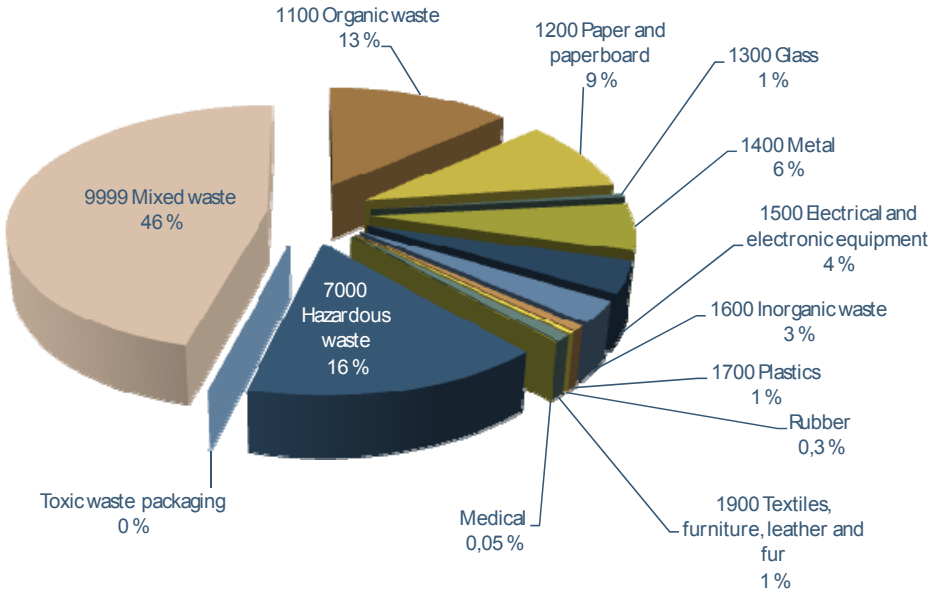


Figure 4.1: Relative distribution of waste between the fractions of waste registered in NDED in 2009. The numbers do not include waste data reported in connection with Property and Facility Management and FB Utvkling projects.

Table 4.6 shows the amount of waste registered in NDED for the reporting year 2009 from the Armed Forces, MoD, NDEA subsidiaries Property and Facility Management and Construction Management, FFI and NoNSA, distributed by different fractions, as well as the degree of sorting (%). The degree of sorting is computed as the portion of waste in other fractions than mixed waste. Waste generated in projects under the auspices of Property and Facility Management comprise 61% of the sector's total amount of waste and increase the sector's degree of sorting from 54% for operations waste to 78% when construction waste is included.

Table 4.6: Waste (kg) registered in NDED in 2009 distributed to the different departments, and degree of sorting (%).

	Hazardous waste *(kg)*	Other waste *(kg)*	Mixed waste *(kg)*	Total *(kg)*	Degree of sorting *(%)*
Armed Forces	2 100 273	4 926 996	6 040 976	13 068 245	54
MoD	8 922	147 298	100 287	256 507	61
NDEA					
Replacement Property	534 119	14 091 866	768 649	15 394 634	95
Defence Estates Development	474 440	4 737 105	470 288	5 681 833	92
FFI	8 922	103 890	79 415	192 227	59
NoNSA	–	–	–	–	–
Total	**3 126 676**	**24 007 155**	**7 459 615**	**34 593 446**	**78**

Figure 4.2 compares the degree of sorting for the different establishments in the Armed Forces, as well as for FFI, for the reporting years 2008 and 2009. The dotted line in the figure shows the target in the 2009 Executive Letter, namely a degree of 60%. In 2008, the target was to achieve a sorting grade of 50%.

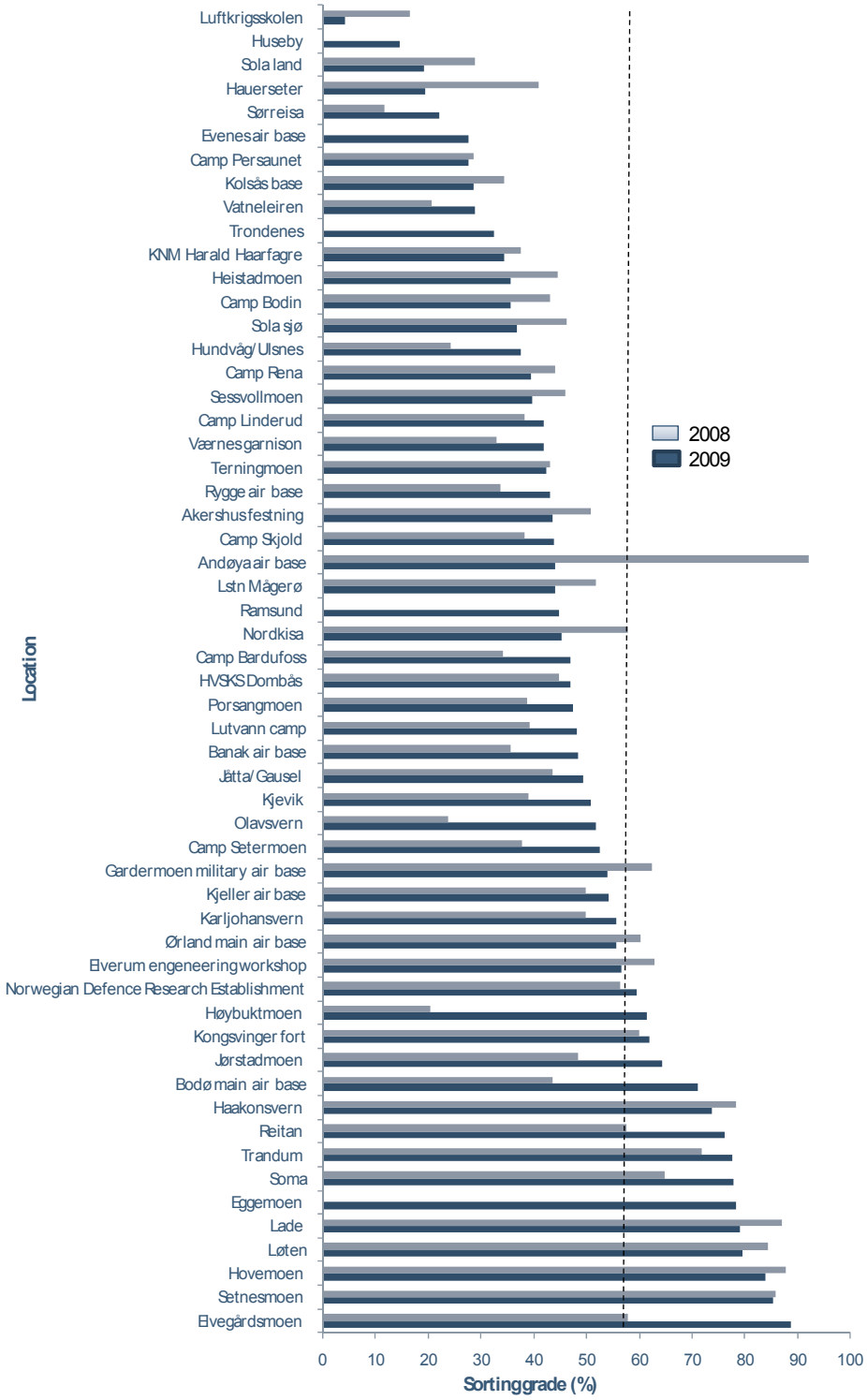


Figure 4.2: Degree of sorting (%) for the different establishments in NDED for the reporting years 2008 and 2009. The degree of sorting is estimated as the proportion of waste in other fractions than mixed waste.

Figure 4.3 shows the distribution of generated waste in the defence sector between the different recipients in 2009. The percentages for the most part resemble the distribution for 2008 with the exception of landfill and energy recovery. The proportion of waste in 2009 that went to recycling was 29%, while the proportion going to energy recovery was 47%. This gave a drop of 2% for the recycling and an increase of 12% for energy recovery compared to 2008. The combined recycling percentage (waste for incineration with energy recovery, compost, reuse and recovery of materials) thus exceeded the requirement of a minimum 70% in 2009 (cf. Executive Letter for NDEA in 2009).

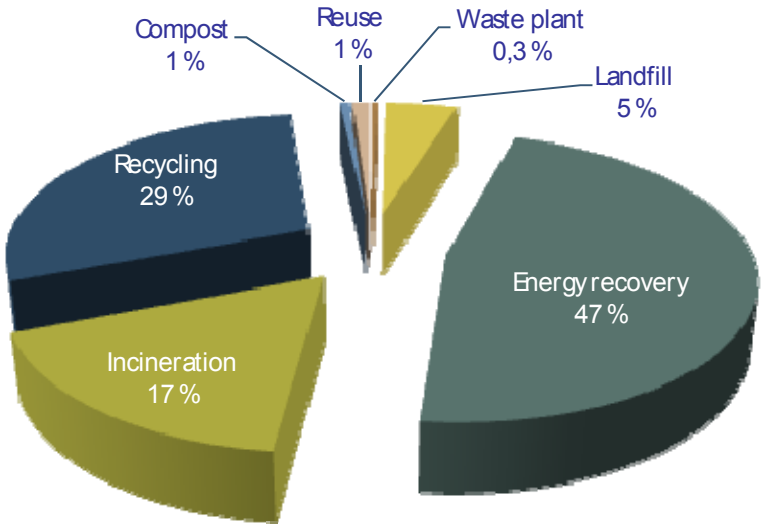


Figure 4.3: Distribution percentages between the different recipients of waste in 2009. The figure does not include waste data reported in connection with projects at Property and Facility Management and Construction Management.

Figure 4.4 shows the distribution of recipients for the different main fractions of waste.

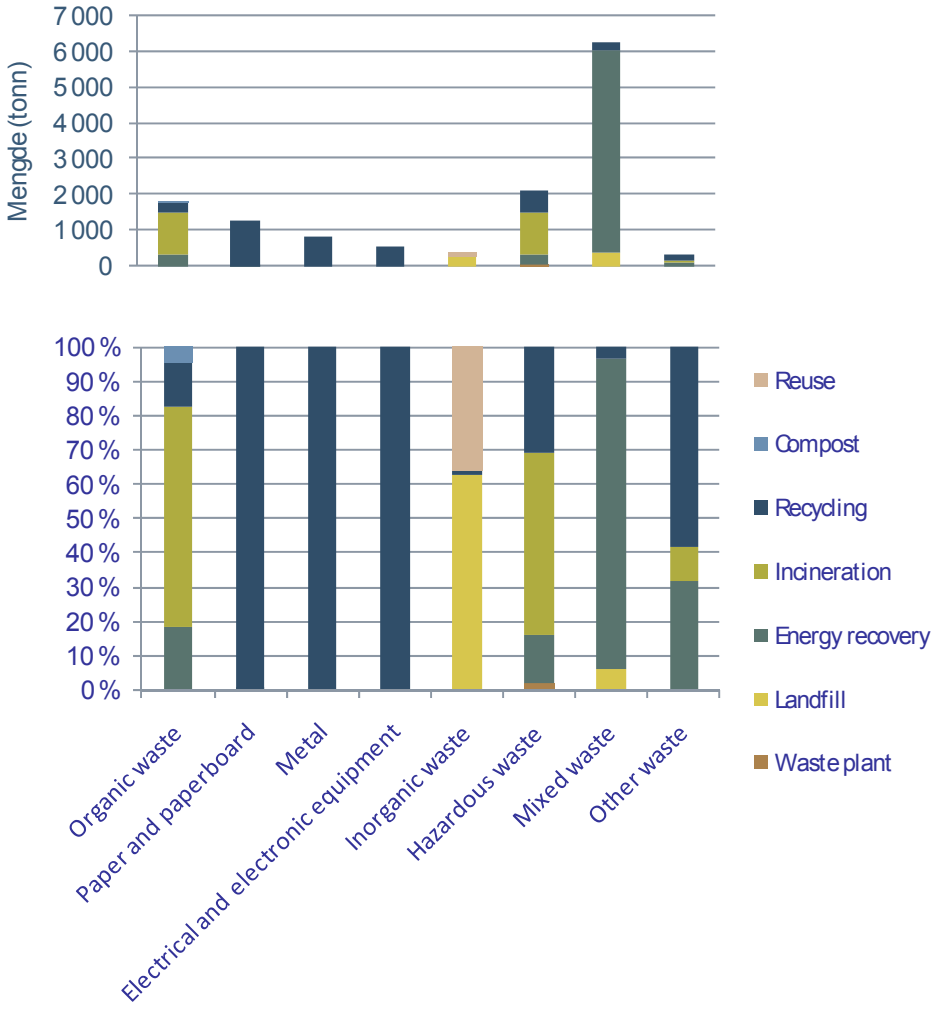


Figure 4.4: Distribution of waste between recipients in factual amounts (tons, uppermost) and percentage (lowest) of main fractions of waste registered in NDED in 2009).

The NDEA subsidiaries Property and Facility Management and Construction Management registered waste generated in projects that were carried out over the course of 2009. Table 4.7 shows the amount of waste distributed by main fraction for the two NDEA subsidiary concerns. The recipient distribution of waste from Property and Facility Management and Construction Management are not presented as this information was difficult to obtain and there was some uncertainty about the data. Removal of contaminated mass was also registered in connection with Property and Facility Management projects. In 2009, 29 541 tons of contaminated mass were registered to the landfill and 1 120 tons of mass were registered as recovered for reuse. Property and Facility Management and Construction Management have a degree of sorting of 95% and 92% respectively for waste generated in 2009. This degree of sorting grade is much better than the minimum requirement of of 60% sorting of building and construction waste, which was set in the Executive Letter for NDEA for 2009.

Table 4.7: Waste (kg) registered in NDED in 2009 from projects carried out by Property and Facility Management and Construction Management

	Amount (kg)	
	Replacement Property	Defence Estate Development
Organic waste	1 233 431	154 585
Paper and paperboard	3 740	5 593
Glass	25 350	1 168
Metal	887 438	905 231
Electrical and electronic equipment	249 417	1 733
Inorganic waste	11 690 070	3 666 302
Plastics	200	2 493
Rubber	1 260	
Hazardous waste	530 153	474 440
Mixed waste	768 649	470 288
Total	15 389 708	5 681 833

Box 2: Sorting of waste and distribution among recipients: greenhouse gas emissions and cost savings

In 2008, the emission of greenhouse gases from the waste sector comprised 1.3 million tons of CO_2 equivalents, of which 1.2 million tons came from waste plants [25]. As of today, green house gas accounting is not an integral part of the Norwegian defence sector's waste management program. However, several new regulations have been introduced in order to reduce the release of greenhouse gases, including a new regulatory framework for waste repositories, a ban against long-term storage of biodegradable waste, conditions on the withdrawal and utilisation or flaming of methane gas from waste disposal sites, final treatment charge on waste and packaging agreements.

Efforts to reduce greenhouse gases from waste generation in the public sector will entail better energy utilisation from waste incineration if this replaces energy from fossil energy carriers; increased recovery of materials through reductions in the releases generated by the production and the processing of raw materials, and reduced releases from the storage and incineration of waste.

What can the defence sector do to improve its performance?

With a degree of sorting of 54% there is a lot of residual waste from the defence sector that could have been sorted better. Of the 13 873 tons of waste generated by the defence sector in 2009, about 6 200 tons was delivered as residual waste. This is waste that falls outside of the existing waste sorting system in the particular area, but that nevertheless represents large streams of material and income for the waste management companies. Residual waste also makes a greater impact on the environment because waste sorting systems at the waste facility are much more limited than the finer degree of sorting that could be achieved at the location where the waste is actually generated.

The fate of residual waste depends on the amount, the company and the location. The main point is that it is roughly sorted by machines, crushed and used as fuel at district heating plants. The waste plants do manage to retrieve some of the resources in the waste, with the rest going to the incinerator with energy recovery. This is recycling by definition, but it is not to be preferred over the recovery of materials which is better for the environment compared to most of the fractions.

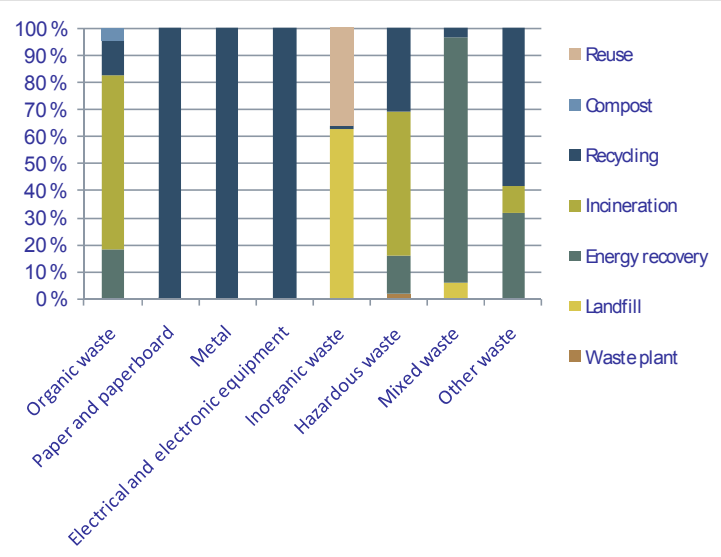
The enterprise Waste Norway (Avfall Norge) has presented an overview of the usual distribution of fractions in residual waste (see table below) based on waste sorting analysis and studies of the literature about waste incineration at Norwegian district heating plants. The numbers are based on the sorting of recycable rubbish according to its source material at the location where the waste is generated. The table shows the percentage contents of different fractions in the residual waste coming from the industrial sector. The results show that sorting mixed waste in the defence sector with a more favourable distribution between recipients would have resulted in greater reductions in greenhouses gas emissions. The numbers in the table were calculated using an American model which may give inaccurate numbers for Norwegian waste management; nevertheless the results illustrate the main point that sorting residual waste and a more favourable recipient distribution result in fewer greenhouse gas emissions.

The table shows the relative distribution of the various fractions which the residual waste in the defence sector consists of. It also shows the residual waste generated by the defence sector in 2009 (about 6 200 tons) distributed between the

different fractions. The negative values in the last column show reduced greenhouse gas emissions per main fraction in the sorting of residual waste, which gives a significant collective reduction in CO_2 equivalents.

Waste fraction	Distribution (%)	Amount (kg)	Greenhouse gas savings (tons CO_2 eqv.)
Organic material	30,3 %	1 860 984	-90
Paperboard, paper and cardboard	29,5 %	1 811 850	-1709
Electrical- and electronic waste	0,9 %	55 277	-34
Inorganic waste	6,2 %	380 796	2
Plastics	16,7 %	1 025 691	-427
Rubber	0,9 %	55 277	-21
Textiles	12,5 %	767 733	-302
Hazardous waste	0,8 %	49 135	0
Other	2,2 %	135 121	3
Sum sorted waste	**100,0 %**	**6 141 863**	**-2578**
Sum residual waste	**100,0 %**	**6 141 863**	**5**

According to Østfold Research (Østfoldforskning), a stronger focus on waste sorting would be the single largest individual improvement that could be made to Norway's waste management system today [21]. The figure below is for 2009 and shows the relative distribution of defence sector waste to recipients. The fraction entitled "Other waste" includes glass, plastic, rubber, medical waste, special packaging, textiles, leather, and furniture. The figure supports the the hypothesis that a change in the recipient distribution from energy recovery in the case of mixed waste to materials recovery through a greater degree of sorting in the defence sector would result in a more auspicious final processing thereby lowering greenhouse gas emissions.



Besides the negative effects on the environment, the generation of mixed waste and erroneous sorting also result in unnecessary expenses. The table below shows that improving the sorting of waste from about 50% to 80% could result in economic savings of up to 65% for the defence sector (source: Veolia Miljø AS). This difference is equivalent to savings of over 1.4 million Norwegian kroner. However, these figures are only estimates of waste generation from Veolia's market areas for 2010 and may therefore deviate somewhat from the true amounts of waste in question.

Table showing relationship between degree of sorting and costs

Current situation	**Tons (12 mo.)**	**Cost (NOK)**	**Percentage (%)**
Residual waste	2 744	2 236 360	45 %
Sorted waste	2 220		55 %
With 80 % sorting			
Residual waste	993	809 295	20 %
Sorted waste	4 964		80 %
Difference (NOK)		**1 427 065**	

4.4 Energy

For the reporting year 2009 it was determined that figures for consumption of heating oil on the Armed Forces should be retrieved centrally from NDEA, while the organisation's usage of electricity was primarily retrieved from NDEA's energy management system EnergiNet. The consumption of other energy sources, including consumption of electricity in MO Finnmark and MO Trøndelag, were collected locally.

Table 4.8 shows the consumption of energy reported to NDED from 2004 to 2009. The use of energy is distributed between different sources of energy and converted to MWh. The estimated degree of reporting is on the order of 100% [E1, high], compared to 60-80% for 2008 [E1, Low]. The degree of reporting is based on a comparison between the total use of energy stated by NDEA in its environmental report (688 065 MWh) [11], and a historic comparison.

Table 4.8: Energy use (MWh) registered in NDED from 2004 to 2009 distributed between various energy sources.

	2004 *(MWh)*	**2005** *(MWh)*	**2006** *(MWh)*	**2007** *(MWh)*	**2008** *(MWh)*	**2009** *(MWh)*
Electricity	236 455	431 685	304 107	352 698	288 996	517 588
District heating	2 745	2 249	11 413	9 679	11 154	6 848
Fuel oil, light	93 691	84 413	86 177	98 615	103 740	110 456
Fuel oil, heavy	5 020	13 377	6 029	5 549	4 278	
Propane	13 116	12 775	11 815	16 426	13 249	13 175
Natural gas						5 916
Kerosine						19
Bioenergy	3	622	12 362	4 146	8 261	27 904
Diesel/Gasoline	27	125	716	6 733		154
Sum	**351 057**	**545 246**	**432 619**	**493 846**	**429 679**	**682 060**
Degree of reporting	30-40 %	60-70 %	60-80 %	60-80 %	60-80 %	~ 100 %
Estimated energy usage	1 003 020	838 840	618 027	705 494	613 827	682 060

Since the bioenergy that is used at certain locales is only reported by output and not the amount of pellets/chips or similar that is used, some use of bioenergy will fall under the heading of electricity as the energy source, with no possibility to differentiate it as bioenergy. As a result, the figures for bioenergy presented in Table 4.8 are lower than the factual use of this energy source in the defence sector.

For the reporting year 2009, the Armed Forces FFI and the MoD all reported on their use of energy. The energy consumption figures for NDEA and NoNSA are for the most part contained within the numbers presented for the Armed Forces in that these two agencies are co-localised with the Armed Forces. NoNSA's energy use is contained in the report for Kolsås Camp, while NDEA's energy consumption is contained within the usage reported for most of the localities in NDED. Table 4.9 shows 2009 energy consumption registered in NDED distributed by energy carrier and organisation within the defence sector.

Table 4.9: Energy use (MWh) for 2009 reported in NDED, distributed by energy carrier, the MoD and its subsidiary agencies.

	Electricity *(MWh)*	**District heating** *(MWh)*	**Fuel oil, light** (*MWh)*	**Propane** *(MWh)*	**Natural gas** *(MWh)*	**Bioenergy** *(MWh)*	**Kerosine** *(MWh)*	**Diesel** *(MWh* **)**	**Gasoline** *(MWh)*	**Total** *(MWh)*
Armed Forces	506 762	6 848	109 216	13 175	5 916	27 904	19	149	5	669 994
MoD	4 426	–	–	–	–	–	–	–	–	4 426
NDEA	–	–	–	–	–	–	–	–	–	0
FFI	6 400	–	1 240	–	–	–	–	–	–	7 640
NoNSA	–	–	–	–	–	–	–	–	–	0
Total	**517 588**	**6 848**	**110 456**	**13 175**	**5 916**	**27 904**	**19**	**149**	**5**	**682 060**

Figure 4.5 shows the distribution between the different energy sources registered in NDED from 2004 to 2009.

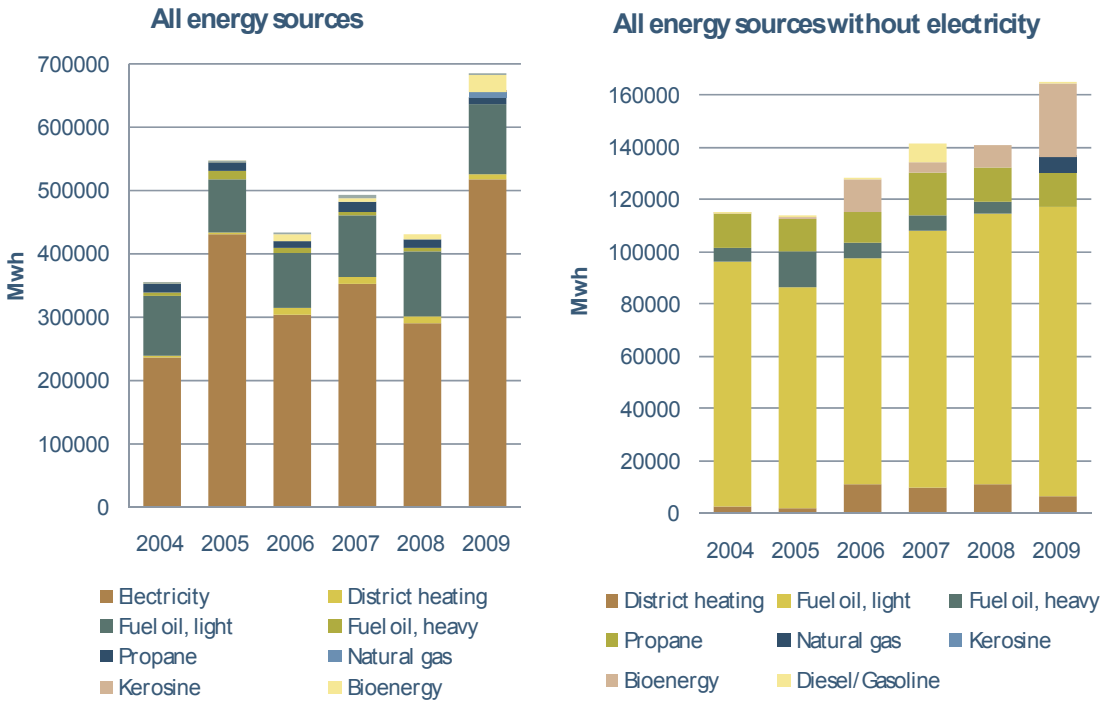


Figure 4.5: Relative distribution of different energy sources registered in NDED from 2004 to 2009. The figure to the left shows all energy sources while the figure to the right shows the distribution between all energy sources with the exception of electricity.

Figure 4.6 shows the relative distribution between the energy sources reported for the defence sector in 2009. The proportion of renewable energy (electricity, bioenergy and district heating) constitutes 81% of the energy use registered in NDED.

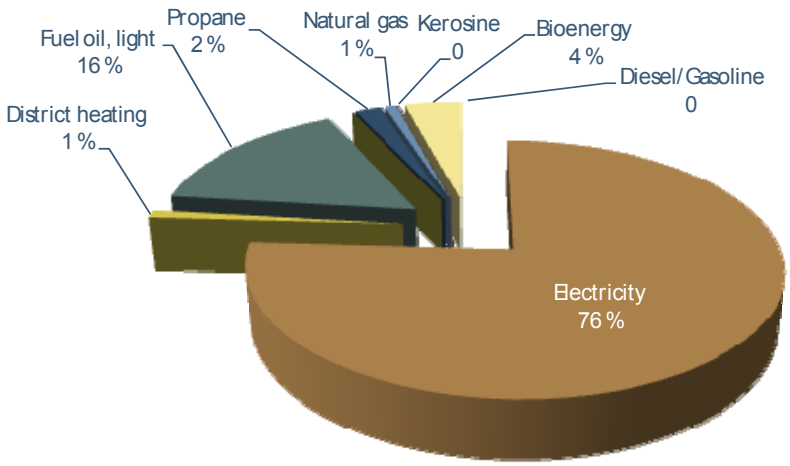


Figure 4.6: Relative distribution of energy use registered in NDED for the different energy carriers.

4.5 Fuel (propellant fuel)

Data on the consumption of propellant fuel was collected from a number of different sources, depending upon the type of materiel, the particular agency/organisation within the sector that was using it, and the type of fuel. For administrative vehicles that were leased or administered under the Lease Plan, data on fuel consumption was imported on a monthly basis into the NDED. FFI utilises administrative vehicles outside the Lease Plan, and here the figures for fuel consumption were obtained from the billing systems of Shell and Statoil respectively. For military vehicles, data was obtained from a number of local refueling depots, but in this case, some of the data was also registered manually. The use of aviation fuel distributed according to aircraft type was obtained from sentral sources within the logistic organization. The use of marine fuel was entered in manually by environmental officers at Haakonsvern. Data on the use of fuel in connection with work travel (private cars and air travel) was obtained centrally from the different organisations. Table *4.10*Table 4.10 shows the quantity of fuel registered in NDED from 2004 to 2009.

Table 4.10: Comparison of fuel quantities (m3) registered in NDED in the period 2004-2009.

	2004 (m^3)	2005 (m^3)	2006 (m^3)	2007 (m^3)	2008 (m^3)	2009 (m^3)
Gasoline	378	920	778	596	343	825
Diesel	4 819	6 243	5 430	6 852	6 614	6 641
Propane	9	8	10	2	4	
Marine gas oil	18 998	42 274	38 383	37 945	38 485	40 163
Jet fuel	29 204	40 364	42 439	45 478	39 183	39 567
Natural gas	–	–	–	–	–	490
Avgas 100 LL	3	–	–	1	1	–
Total	**53 411**	**89 809**	**87 040**	**90 874**	**84 630**	**87 686**

Figure 4.7 shows the relative distribution of various types of propellant fuel utilised in 2009. The fuel used in military vehicles and aircraft accounts for 91% of the sector's fuel consumption.

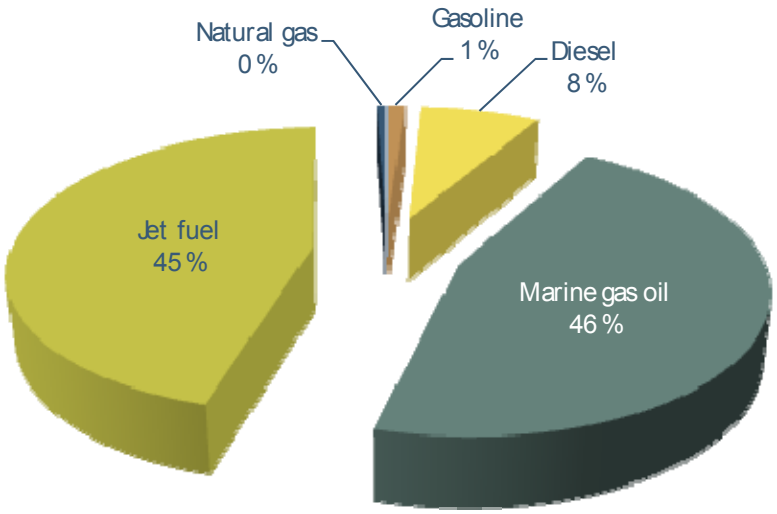


Figure 4.7: Relative distribution of different types of fuel registered in 2009.

Table 4.11 shows the quantities of different types of propellant fuel registered in NDED in 2009 distributed by organisation, materiel and fuel type. Armed Forces fuel consumption constitutes over 99% of the use that is registered in NDED. The use of fuel in administrative vehicles is imported from the Lease Plan for the Armed Forces, MoD, NDEA and NoNSA. Fuel use figures for FFI were obtained from the fuel suppliers (Statoil and Shell respectively.) MoD also registered 433 km by electric car in 2009. Fuel figures for private automobiles utilised for work travel (travel expense record) were obtained locally at the individual organisation or agency. The use of fuel was calculated by examining the registered number of kilometers that were driven. The Armed Forces also registered fuel consumption on ships, aircraft and military vehicles. For 2009, the Armed Forces, MoD and NDEA registered air travel and the number of flights undertaken within the auspices of the individual organisation, distributed by the categories domestic, and long and short international (Table 4.14).

Table 4.11: Quantity of fuel (l and m3) registered in NDED in 2009, distributed by organisation, materiel and fuel type.

	Diesel (l)	Gasoline (l)	Marine gas oil (l)	Jet fuel (l)	Natural gas (m^3)
Armed Forces					
Vehicle, non-tactical	2 256 245	137 079	–	–	–
Vehicle, tactical	3 621 678	69 837	–	–	–
Vehicle, official journey	185 119	513 444	–	–	–
Vessel	–	–	38 962 550	–	490
Aircraft	–	–	–	39 566 893	–
Fire testing	137 426	200	–	–	–
Total armed Forces	**6 200 468**	**720 560**	**38 962 550**	**39 566 893**	**490**
Defence Estates Agency (NDEA)					
Vehicle, non-tactical	379 649	23 843	–	–	–
Vehicle, official journey	17 332	48 071	–	–	–
Total NDEA	**396 981**	**71 914**	–	–	–
Defence Research Establishment (FFI)					
Vehicle, non-tactical	6 766	7 652	–	–	–
Vehicle, official journey	5 892	16 344	–	–	–
Total FFI	**12 658**	**23 996**	–	–	–
National Security Authority (NoNSA)					
Vehicle, non-tactical	29 033	–	–	–	–
Vehicle, official journey	–	–	–	–	–
Total NoNSA	**29 033**	–	–	–	–
Ministry of Defence (MoD)					
Vehicle, non-tactical	–	5 133	–	–	–
Vehicle, official journey	1 393	3 863	–	–	–
Total MoD	**1 393**	**8 996**	–	–	–
Total	**6 640 533**	**825 466**	**38 962 550**	**39 566 893**	**490**

Military vehicles use diesel/F-34; aircraft use jet fuel/F-34/

A calculation was made of the degree of reporting for 2009. The estimates are based on a comparison with central data, comparison to historic data and an assessment of the source data (Table 4.12).

Table 4.12: Estimated reporting of fuel use distributed by the different types of materiel.

Materiel	Estimated degre of report (%)	Fuel type	Method for estimation
Vehicle, non-tactical (LeasePlan)	100	Gasoline, diesel, propane	[E1, high]
Vehicle, tactical	55-65	F-34, diesel, gasoline	[E3, low]
Vessel	85-95	Marine gas fuel	[E3, average]
Aircraft	85-95	Jet fuel/F-34, avgas	[E1, average]

The degree of reporting varies somewhat for the different types of materiel. For vehicles administered under the Lease Plan, the degree of reporting was 100%. Figures for the use of fuel in military vehicles is somewhat lacking as we did not have a complete overview of usage at the local fuel depots. The assessment of the source data and comparison to historical data indicated

that the degree of reporting was quite good. The figures for aviation fuel do not include the fuel delivered from airports in Norway and such places abroad where the Armed Forces had no fuel depot or tanking facility of its own. Information is also lacking about fuel delivered to helicopters from local tankfarms during maneuvers and training. Figure 4.8 shows the use of fuel distributed according to the type of activity carried out in the Armed Forces. The activity is determined by the type of materiel the fuel was used for, as well as by the unit that used the materiel. Compared to 2008, in 2009 there was a reduction of 23% in fuel usage connected to operations while the consumption of fuel in association with maneuvers and training increased by 21%.

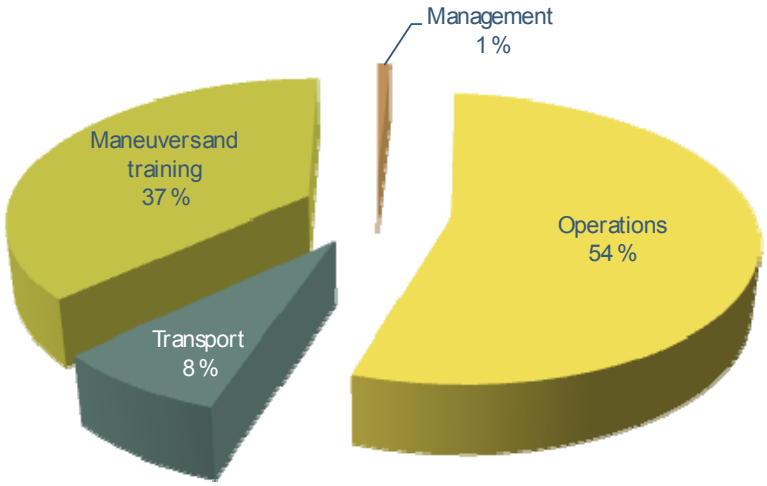


Figure 4.8: Fuel consumption in 2009 distributed according to the different activities.

One of the principle goals for the defence sector is to reduce emissions of greenhouse gases and nitrogen oxides. For new procurements, some of the subsidiary agencies in the sector have also set goals to buy or lease more environmentally-friendly cars. Table 4.13 gives an overview of the car fleet belonging to the different subsidiary agencies. Only 1.9% of the cars used in the defence sector can be operated on alternative fuel such as natural gas.

Table 4.13: Number of cars utilised by subsidiary agencies in the defence sector that fall into the categories electric cars, electric cars, hybrid cars and biofuel cars

	Electric motor cars	Hybrid motor cars	Biofuel motor cars	Total number of cars used by the agencies
Armed Forces	–	24	–	1521
MoD	–	–	–	3
NDEA	–	13	–	463
FFI	–	2	–	15
NoNSA	–	–	–	–
Total	**–**	**39**	**–**	**2002**

In order to estimate fuel consumption figures for air travel, the flights are divided into three different categories: domestic, short international and long international. The distance for the different flight categories is set to 361 km for domestic flights, 1 357 km for short international and 8 663 km for long international flights [22]. Table 4.14 shows the number of flights in each category, as well as the total estimated use of aviation fuel for each subsidiary agency in 2008 and 2009.

Table 4.14: Number of flights and consumption of jet fuel carried out by the different subsidiary agencies in 2008 and 2009 in connection with work travel.

Agency	Domestic		Short international		Long international		Jet fuel (l)	
	2008	2009	2008	2009	2008	2009	2008	2009
MoD	541	355	1 614	766	250	238	216 532	148 366
Armed Forces	47 887	56 541	7 450	6 692	2 087	2 253	2 371 569	2 575 601
NDEA	4 750	5 115	204	173	44	75	138 429	155 822
FFI	–	–	–	–	–	–	–	–
NoNSA	–	–	–	–	–	–	–	–
Total	**53 178**	**62 011**	**9 268**	**7 631**	**2 381**	**2 566**	**2 726 530**	**2 879 789**

The estimation for jet fuel is based on a report by TØI [22] where the average values for consumption of fuel per kilometer are defined. This same report also defines the three average distances for air travel according to Norwegian travel patterns. The table shows the aggregated figures based on travel reports registered into the NDED.

4.6 Air emissions

Air emissions are calculated on the basis of the reported figures for energy and fuel use. The estimated emissions to the air as a consequence of defence sector activity are calculated using the degree of reporting for the various materiel types as a starting point.

Table 4.16 shows respectively the estimated emissions of CO_2 equivalents and NOx from 2004 to 2009. The data in the tables whereby emissions have been a consequence of heating are somewhat altered in relation to the data presented in earlier environmental performance reports (2004-2008). This is because the degree of reporting used in earlier reports was based on the total degree of reporting for energy, including electricity. This resulted in emissions figures that were too high for earlier years because the degree of reporting for energy sources connected to emissions has generally been higher than for electricity.

Table 4.15: Estimated total releases of CO_2 equivalents (CO_2, CH_4, and N_2O) from 2006 to 2009, distributed by materiel type. Figures for the heating of buildings are also included.

	CO_2 -eqv (tons)					
	2004*	**2005***	**2006***	**2007**	**2008**	**2009**
Vehicle, non-tactical	–	–	–	8 932	7 303	10143**
Vehicle, tactical	–	–	–	23 804	23 161	17 493
Vessel	–	–	–	110 557	114 978	116 353
Aircraft	–	–	–	120 045	112 181	113 232
Total	**240 000**	**299 000**	**295 000**	**263 338**	**257 623**	**257 222**
Heating of buildings	–	24 800	38 500	31 630	34 612	34 080
Total	**–**	**323 800**	**333 500**	**294 968**	**292 235**	**291 302**

*The mean value of the interval is presented.
**The numbers include for the first time the emissions from the use of private automobiles for work-related travel (travel bill).

Table 4.15 shows emissions of 34 080 tons of CO2 equivalents as a consequence of heating. These emissions fall below the requirements set in NDEA's Executive Letter for 2009 (≤ 37 500 tons CO2 equivalents).

Table 4.16: Estimated total emissions of NOx from 2006 to 2009, distributed according to materiel type and heating.

	NOx (tons)					
	2004*	**2005***	**2006***	**2007**	**2008**	**2009**
Vehicle, non-tactical	–	–	–	26	15	27**
Vehicle, tactical	–	–	–	191	165	137
Vessel	–	–	–	2 180	2 030	2 294
Aircraft	–	–	–	442	371	416
Total	**2300**	**3060**	**2884**	**2 839**	**2 581**	**2 874**
Heating of buildings	57	22	6	27	51	34
Total	**2357**	**3082**	**2890**	**2 866**	**2 632**	**2 908**

*The mean value of the interval is presented
** The numbers include for the first time the emissions from the use of private automobiles for work-related travel (travel bill).

Tabell 4.17 shows the estimated emissions of carbon monoxide (CO), non methane volatile organic compounds (NMVOC), sulphur dioxide (SO_2), particulate matter (PM10 and PM2.5), total suspended particles (TSP), dioxins and polycyclic aromatic hydrocarbons (PAH) from defence sector vessels, vehicles, and aircraft as well as emissions from the heating of buildings. A description of the various compounds is given in the defence sector's environmental report for 2007 [2].

Tabell 4.17: Estimated total emissions in 2009 of CO, NMVOC, SO_2, particulate matter (PM10 and PM2.5), TSP, dioxins and PAH from defence sector vehicles, vessels and aircraft, and from heating of buildings.

Material	NMVOC (kg)	SO_2 (kg)	CO (kg)	Dioksin (kg)	PAH (kg)	PM10 (kg)	PM2.5 (kg)	TSP (kg)
Vehicle, non-tactical	13 933	492	100 086	0,0003	11	3 641	3 489	3 641
Vehicle, tactical	17 099	730	58 783	0,0000	19	9 306	8 814	9 306
Vessel	83 640	65 457	80 307	0,1456	58	18 182	17 456	18 216
Aircraft	153 123	10 683	744 253	0,0021	10	249	249	249
Heating of buildings	11 556	8 462	108 604	0,0070	1	2 857	2 857	4 092
Total	**279 352**	**85 824**	**1 092 034**	**0,1550**	**99**	**34 235**	**32 865**	**35 503**

* For the first time, these figures include emissions emanating from the use of private automobiles for work-related travel (travel bill).

The pie chart in Figure 4.9 shows the relative distribution of emissions of CO_2 equivalents between the various types of materiel and the heating of buildings in 2009. The block chart shows the CO_2 equivalents distributed by materiel type and heating of buildings, and indicates that in the period from 2007–2009, there was little variation in the emissions of CO_2 equivalents in these categories.

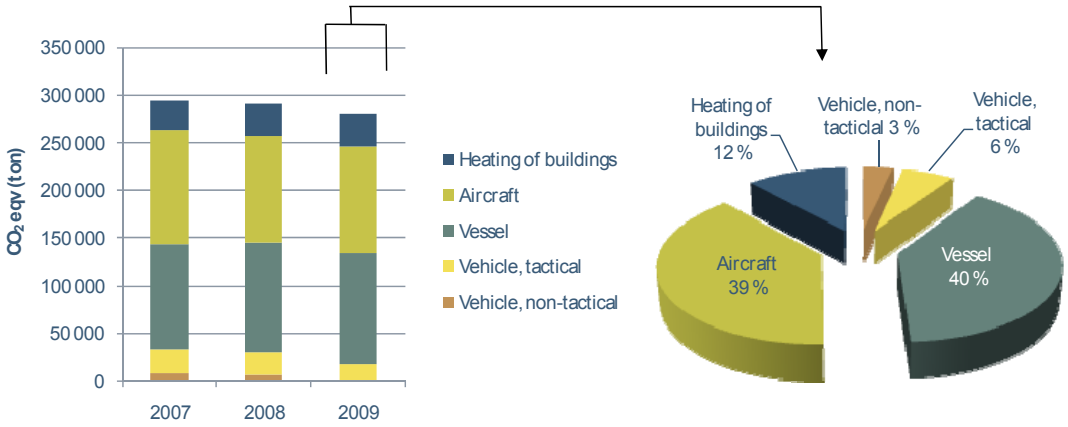


Figure 4.9: The block diagram shows the distribution of CO_2 equivalent emissions from 2007-2009 distributed by materiel and heating of buildings. The pie chart is for 2009 and shows the relative distribution of emissions of CO_2 equivalents between the various types of materiel; it also shows the heating of buildings.

With respect to air travel, the different flight categories have their own CO_2 emissions factors that are used when calculating the emission of CO_2 to the air. The factors are as follows: Domestic – 158 g CO_2 per km; Short international – 130.4 g CO_2 per km; Long international – 105.6 g CO_2 per km [22]. In the table below, CO_2 emissions are calculated for flights carried out by the MoD, the Armed Forces and NDEA in 2009.

Table 4.18: CO_2 emissions as a result of air travel distributed by subsidiary agency

Agency	Domestic *(tons)*	Long international *(tons)*	Short international *(tons)*	Total *(tons)*
MoD	20	218	136	374
Armed Forces	3 243	2 063	1 185	6 491
NDEA	293	69	31	393
FFI	–	–	–	–
NoNSA	–	–	–	–
Total	**6 586**	**4 312**	**2 856**	**13 754**

4.7 Ammunition

Reporting requirements with respect to ammunition safety and the environment are observed through the use of digital blank 750 (DBL 750) when reporting to NDED. There was a drop in the number of registrations on DBL 750 in 2009 (9 520) compared to 2008 (12 833 transactions), where, except for March, there was a drop in the number of transactions for all months. By comparison, there were 11 191 registrations for the year 2007. Figure 4.10 shows the number of registrations per month in DBL 750 from July 2006 to the end of the reporting year 2009.

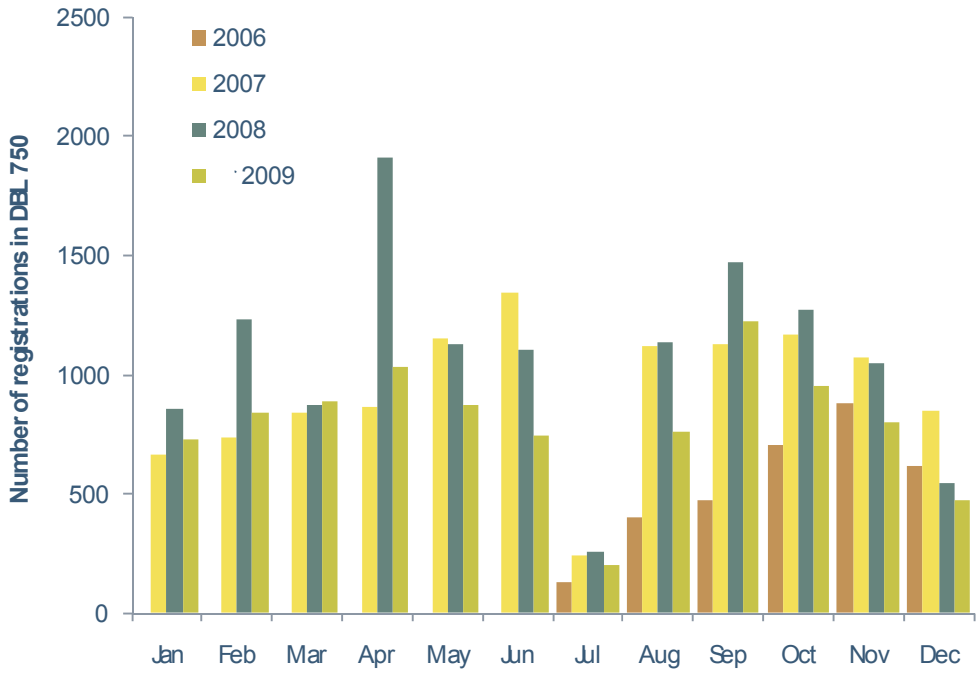


Figure 4.10: Number of registrations in DBL 750 from the launching of the digital blank in 2006 to the end of the reporting year 2009.

Just over 14 million shots were registered in the NDED in 2009, compared to 19.2 million shots in 2008, distributed between more than 340 different types of ammunition. In Tabel 4.19 a comparison is made between reporting to NDED and the number of shots delivered from FLO for every category of ammunition. The degree of reporting for ammunition in 2009 was calculated at 48% [E1, Low], compared to 56% in 2008 [E2, Low].

Table 4.19: Number of shots reported to the main category in NDED compared to the number of shots delivered from FLO in 2009. The ratio between delivered and reported ammunition gives the degree of reporting (%).

Ammunition	Reported in NDED (number)	Delivered (number)	Degree of reporting (%)
Artillery	6 088	22 575	27 %
Mortar	2 073	4 473	46 %
Various weapons	21 917	33 699	65 %
EOD	14 392	51 634	28 %
Air-deliverd	50 863	81 848	62 %
Hand grenades	3 550	62 847	6 %
Handguns 12.7 mm	334 747	737 351	45 %
Handguns 5.56 mm	5 786 988	12 000 270	48 %
Handguns 7.62 mm	4 485 036	5 092 311	88 %
Handguns 9 mm	2 732 426	5 085 898	54 %
Handguns other	68 859	755 195	9 %
Handguns 40x46 mm	7 124	39 700	18 %
Handguns, shotgun	2 638	19 885	13 %
Handguns, loose ammunition	150 210	5 271 959	3 %
Medium caliber	11 151	22 210	50 %
RFK and PV	4 040	11 094	36 %
Smoke grenades	152	202	75 %
Marine-deliverd	3 354	6 646	50 %
Static weapons	38	70	54 %
Tanks	451	3 358	13 %
Other ammunition*	354 311		
Total	**14 040 408**	**29 303 225**	**48 %**

*"Other ammunition" is ammunition that is registered without the correct NATO number and therefore cannot be distributed by main category.

Table 4.20 shows the estimated total use of ammunition, as well as the estimated total amount of substances deposited in Armed Forces shooting ranges and exercise grounds in 2009. The estimates were calculated using the assumed degree of reporting for the different categories of ammunition as a starting point (Table 4.19).

Table 4.20: The estimated total use and releases of various substances distributed according to main category. The estimates were calculated on the basis of the degree of reporting for the various ammunition categories.

			Use *(kg)*			Releases *(kg)*									
Ammunition category	**Total use *(kg)***	**Unknown *(kg)***	**Gun-powder**	**Explosives**	**Smoke source (WP, TTC, HC)**	**Aluminium and other light metals**	**Steel**	**Lead (Pb)**	**Copper (Cu)**	**Antimony (Sb)**	**Zinc (Zn)**	**Other heavy metals**	**Synthetic material**	**Other**	**Other metals**
Handguns 12,7 mm	25 620	211	4 847	16	-	-	4 847	231	5 582	2	571	-	1 073	-	5 713
Handguns 5,56 mm	67 733	1 219	19 854	283	-	-	25 413	935	18 752	104	2 052	-	-	-	-
Handguns 7,62 mm	60 566	388	14 575	3 036	-	-	5 974	17 738	11 963	2 051	1 308	-	44	-	-
Handguns 9 mm	38 306	7	2 143	-	-	-	11 998	30	17 544	656	30	-	-	-	-
Handguns annet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Handguns 40x46 mm	6 900	90	156	-	-	-	-	-	-	-	-	-	6 133	-	322
Handguns, shotgun	83	11	38	-	-	-	-	71	-	-	-	-	-	-	-
Artillery	308 759	895	68 181	38 944	-	2 052	198 267	-	4 456	-	230	2 470	-	889	-
Mortar	20 491	533	572	3 257	-	1 617	14 391	-	-	-	-	252	-	-	-
Various weapons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air-delivered	7 574	1 265	1 232	868	-	569	4 839	2	29	-	-	-	-	-	-
Hand grenades	13 650	51	-	3 650	483	1 317	3 650	-	-	-	-	-	4 350	-	-
Medium caliber	11 882	509	3 732	-	-	-	-	-	50	-	-	-	-	-	7 592
RFK and PV	13 758	-	1 972	1 636	294	8 306	1 756	-	261	-	-	-	-	-	-
Smoke grenades	324	-	-	-	5	-	-	-	-	-	-	-	5	-	-
Marine-delivered	12 258	4 021	926	15	-	-	3 515	-	-	-	-	315	-	-	-
Tanks	17 962	11	9 085	800	-	1 600	6 000	-	-	-	-	154	-	-	-
EOD	4 946	223	5	1 283	-	-	-	-	-	-	-	-	18	6	-
Handguns, loose ammunition	4 100	-	4 100	-	-	-	-	-	-	-	-	-	-	-	-
Static weapons	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other ammunition*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**614 913**	**9 432**	**131 418**	**53 788**	**783**	**15 461**	**280 648**	**19 006**	**58 637**	**2 813**	**4 190**	**3 191**	**11 624**	**895**	**13 628**

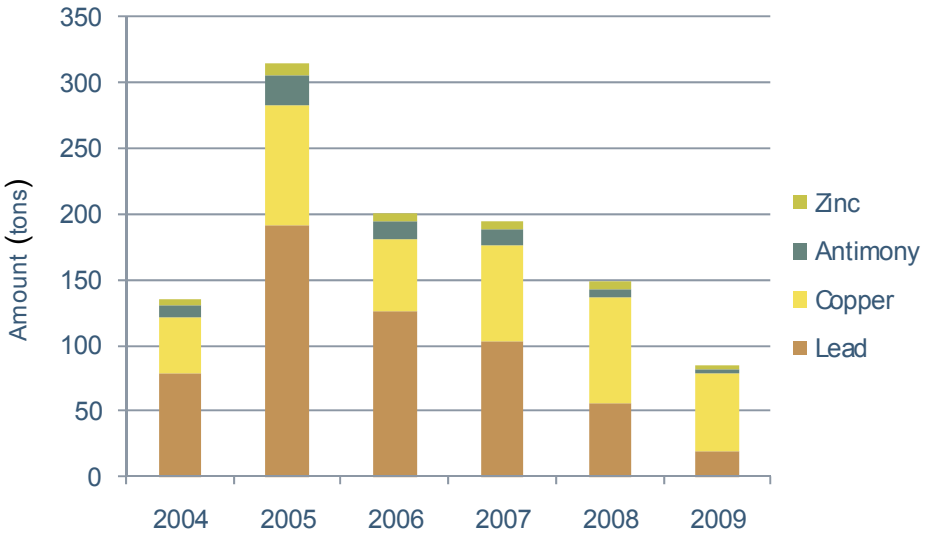


Figure 4.11: Estimated heavy metals deposits in Armed Forces shooting ranges and exercise grounds from 2004 to 2009.

In 2008, a higher use of unleaded handgun ammunition was reported for the first time compared to ammunition containing lead. In 2009, about 3.5 million lead-containing shots were reported versus 8.8 million that were lead-free (see Table 4.21).

Table 4.21: Use of unleaded and lead-containing handgun ammunition registered in NDED from 2006 to 2009.

	Rounds fired			
	2006	**2007**	**2008**	**2009**
Cartridge 7.62 mm	6 090 016	7 878 538	1 489 909	2 675 446
Cartridge 5.56 mm	275 550	179 888	4 700 967	360 021
Cartridge 9 mm	2 688 460	2 364 214	1 399 858	552 620
Total leaded	**9 054 026**	**10 422 640**	**7 590 734**	**3 588 087**
Cartridge 7.62 mm, unleaded	51 933	899 339	2 645 917	1 509 015
Cartridge 5.56 mm, unleaded	474 332	893 798	4 322 801	5 235 335
Cartridge 9 mm, unleaded	42 550	1 177 940	2 286 198	2 099 263
Total unleaded	**568 815**	**2 971 077**	**9 254 916**	**8 843 613**

4.8 Water

Water consumption was first reported in the NDED in 2006. For the reporting year 2009, the number of reporting institutions increased from 23 to 54, and this resulted in an estimated degree of reporting of 90–100%. There are no central numbers available to assist in gauging the degree of reporting with respect to water use in the defence sector. The degree of reporting is therefore based on an assessment of the available source data and historic comparisons [E3, medium]. There is some degree of uncertainty in the numbers for water use because water gauges have not been installed in certain locations, and hence water use is only calculated on the basis of cost. Water use during international operations is not included in this statistic.

Table 4.22 Water consumption (m3) for the respective institutions in the period 2006 to 2009 registered into NDED.

	Water consumption (m3)			
	2006	2007	2008	2009
Akershus fort	106 397	103 125		125 079
Andøya air base	17 773		11 442	18 661
Banak air base				32 160
Camp Bardufoss	181 670	235 483	316 786	425 084
Camp Bodin	7 289	9 626	17 700	5 584
Bodø main air base	93 963	28 935	27 380	37 902
Drevjamoen				349
Eggemoen				427
Elverum engeneering workshop	1 195	786	884	942
Evenes air base		5 232		1 000
Norwegian Defence Research Establishment		3 319	4 472	12 775
Gardermoen military air base	9 084	8 370		14 068
Hauerseter	19 835	8 955		4 417
Heistadmoen	7 132	11 360		2 996
Hovemoen		1 274	1 274	1 274
Hundvåg/Ulsnes			315	19 470
Huseby	208 142	185 461		66 467
HVSKS Dombås	2 674	2 466	2 279	2 715
Haakonsvern	515 417	501 564	363 753	302 576
Høybuktmoen				87 160
Jørstadmoen	22 761	21 054		21 869
Jåtta/Gausel			5 913	39 466
Karljohansvern	52 450	17 847	17 365	12 389
Kjeller air base				42 606
Kjevik			20 032	16 933
Kolsås base				30 777
Kongsvinger fort				1 311
KNM Harald Haarfagre			55 724	264 194
Lade				8 900
Camp Linderud	21 264	20 863		21 988
Lstn Mågerø	1 344			11 410
Luftkrigsskolen				20 500
Camp Lutvann	15 543	10 478		8 591
Nordkisa	1 609	2 549		1 634
Camp Persaunet				7 400
Porsangmoen				67 725
Ramsund		1 009		580
Reitan		1 689	10 150	9 089
Camp Rena	50 519	57 958	63 770	62 153
Rygge air base	39 000	44 969	42 733	113 258
Sessvollmoen	23 320	38 491		36 385
Camp Setermoen	199 468	162 373	187 571	181 037
Setnesmoen				5 000
Camp Skjold		63 885	73 555	74 801
Sola land				59 675
Soma				11 992
Sortland				15 837
Terningmoen	20 668	20 668	20 668	20 668
Trandum	6 455	4 084		3 530
Trondenes	55 774	29 210		14 002
Camp Vatne				240
National Service Administration, Hamar	1 311	1 118	1 573	989
Værnes garrison			64 000	130 000
Ørland main air base		65 270	70 600	57 000
Total	1 682 057	1 669 471	1 379 939	2 535 035
Estimated degree of reporting	–	55-65 %	50-60 %	90-100 %

The reported water use for 2009 was 82 m^3 per man year[2] compared to 47 m^3 in 2008.

[2] Water use per man year was calculated by using the following data for 2009: 2 535 035 m^3 water / 30 961 man year in the defence sector. The calculations were based on data reported to NDED.

4.9 Chemicals

4.9.1 Aircraft and runway de-icing chemicals

Six of the Armed Forces' air bases registered the figures for their use of aircraft and runway de-icing chemicals in 2009. Urea and Aviform are the chemicals used for de-icing runways and the area in front of aircraft hangars, whereas Aircraft De-icing Fluid, Kilfrost, Propylenglycol and Octaflo EP type I are used to de-ice aircraft. Table 4.23 shows the amount (kg) of aircraft and de-icing chemicals registered in NDED from 2004 to 2009, distributed by the different types of chemicals that are used.

Table 4.23: Amount (kg) and type of aircraft and runway de-icing chemicals registered in NDED from 2004 to 2009.

	Amount (kg)					
	2004	**2005**	**2006**	**2007**	**2008**	**2009**
Aircraft de-icing fluid E- max Type II	31 673	23 690	10 300	2 876	6 737	9 801
Aviform	58 051	30 383	31 100	98 700	83 456	112 517
Kilfrost		941	6 425		13 481	18 654
OCTAFLO EP TYPE 1 .	6 392	5 824		11 138	3 016	104
Propylenglykol	5 128	7 304	2 590	5 118	3 261	11 930
UREA	539 000	482 000	572 000	509 000	674 000	734 000
Total	640 244	550 142	622 415	626 832	783 951	887 007

Aircraft and runway de-icing at Gardermoen Military Airbase is carried out by the civilian branch of airport operations and is therefore not reported into NDED. Table 4.24 shows the amount (kg) of aircraft and runway de-icing chemicals that are used at certain Norwegian military airbases.

Table 4.24: Use of de-icing chemicals (kg) at selected military airbases

Location	**Aircraft de-icing fluid (kg)**	**Runway de-icing fluid (kg)**
Andøya air base	10 450	200 000
Camp Bardufoss	9 118	364 000
Bodø main air base		184 634
Kjeller air base		3 783
Rygge air base	11 930	44 900
Ørland main air base	8 992	49 200
Total	**40 490**	**846 517**

Figure 4.12 shows the development in the use of aircraft and runway de-icing chemicals. A steady increase may be seen in the reported use of these chemicals at Norwegian military airbases.

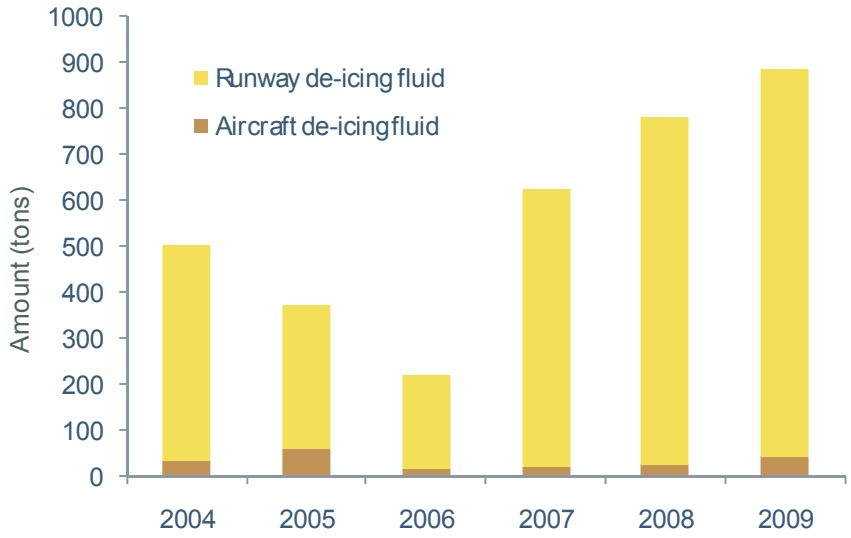


Figure 4.12: Development in the use (tons) of aircraft and runway de-icing chemicals registered in NDED from 2004 to 2009.

Figure 4.13 shows the relative distribution of aircraft and runway de-icing chemicals to various recipients for usage registered in 2009. Compared to 2008, an increase may be seen in the release of these chemicals to the ground and soil, while there has been a decrease in the distribution to ocean and sea. Compared to 38% in 2008, in 2009 there was a reduction in the amount of run-off from aircraft de-icing chemicals going into drains connected to purification plants (22%).

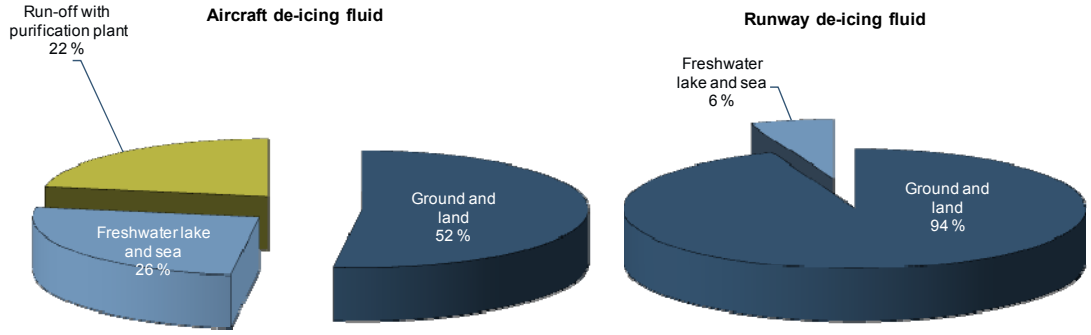


Figure 4.13: Use of aircraft and runway de-icing chemicals attached to various recipients for 2009.

Box 3: Aircraft and runway de-icing chemicals in the Armed Forces – time for an environmentally-friendly alternative?

The purpose of de-cing products is to lower the freezing point of water so that ice and snow can be removed from aircraft fuselages and runways. This is generally done through the use of chemicals as they currently constitute the most effective method. There are alternatives that are environmentally-friendly, but these are still at the testing stage in Norway (infrared radiation, for example).

The table below shows the aircraft and de-icing chemicals in use at Norwegian military airbases in 2009, their area of use and the active ingredients.

Name of chemical	Utilization	Active ingredients
Aviform TM L50 og (S) 50	Runway de-icing	Formiate
Clearway 6S	Runway de-icing	Acetate
SAFEWAY SD RUNWAY DE-ICER	Runway de-icing	Formiate
UREA TEKNISK UKONDISJONERT	Runway de-icing	Urea
Aircraft de-icing fluid E- max Type II	Aircraft de-icing	Glycol
Kilfrost ABC II Plus and DF Plus (80)	Aircraft de-icing	Glycol
Propylene glycol	Aircraft de-icing	Glycol
OCTAFLO EP TYPE 1	Aircraft de-icing	Glycol

Today's de-icing chemicals are for the most part non-toxic in normal use and in the concentrations found around airports, but some have very high oxygen consumption as they decay. This can have negative environmental consequences for aquatic organisms living in nearby freshwater since all oxygen can be consumed in the water column, leaving uninhabitable surface water.

Avinor introduced a total ban on UREA at all its airports for the 2008–2009 season. This was because UREA has much higher oxygen consumption than alternative chemicals during the decay process. In 2008, Avinor's total use of UREA was 7 tons. Avinor's total use of de-icing chemicals for 2008 was 2 144 tons, versus 887 tons for the Armed Forces wherein UREA accounted for 734 tons (83%) in 2009.

UREA is used in large quantities because it is the most affordable de-icing chemical available. Perhaps the Armed Forces should set a goal to replace UREA with other, more environmentally-friendly chemicals in keeping with Avinor's policy?

4.9.2 Use of chemicals

Registration of the defence sector's consumption of chemicals was in 2009 as it was the year before: altogether lacking or else extremely spotty. This goes for all of the organisations within the sector. In the Armed Forces, only Haakonsvern Naval Station, Soma, Bardufoss and Rena Camps registered their use of chemicals over and above de-icing chemicals for aircraft and runways. FFI also registered chemicals, but not even this constituted a complete overview of the organisation's usage.

4.10 Accidental releases of effluents

Only Haakonsvern Naval Station and Ørland Main Air Base have established routines in place for reporting accidental releases of effluents. This may be seen very clearly in Table 4.25 which shows the number of events registered at various localities from 2004 to 2009.

Table 4.25: Accidental releases of effluents registered in NDED from 2004 to 2009.

Location	Accidental effluents					
	2004	2005	2006	2007	2008	2009
Evenes air base		1				
Haakonsvern		22	19	16	27	34
Kjeller air base			1			
Rygge air base	1					6
Setermoen camp			1			
Ørland main airbase				3	1	6
Total	1	23	21	19	28	46

4.11 Reporting during operations, exercises and maneuvers

4.11.1 Operational activity

Participation in international operations (INTOPS) is a central part of Norway's defence and security policy. In 2009, the consumption of water, fuel, ammunition and waste was reported from different localities in Afghanistan. Ammunition use at a shooting range in Chad was also registered. In the camps at Nidaros and Meymaneh, water consumption of 7240 m^3 and 10 355 m^3 was reported in 2009. Figures are lacking for water consumption at Camp Nidaros during the second half of 2009.

Waste was only reported at Camp Nidaros in 2009, as waste from all of the camps in Afghanistan is collected here prior to be sent home to Norway. Ordinary waste is sorted for recycling and reuse, while EE waste (electric and electronic waste) and hazardous waste is sent home to Norway.

Table 4.26: Waste generated in different camps in Afghanistan.

Location	Fraction	Amount (kg)
Camp Nidaros	Electrical and electronic equipment	7 367
	Hazardous waste	35
	Oil filters	230
	Paint, vanish, adhesive, solvent based	5
	Spray boxes	150
	Car batteries	4 667
	Small barreries	150
	Lithium batteries	250
	KFK-gas	1
Total		**12 855**

Consumption of gasoline and/or diesel was reported at both Nidaros and Meymaneh Camps. Fuel connected to energy production, that is, the use of fuel to power generators is reported as well as fuel for motor vehicles and helicopters. However, information is lacking about the types of motor vehicles the fuel is used for.

Table 4.27: Fuel consumption during international operations registered in NDED in 2009.

Location	Material	Gasoline (l)	Diesel (l)	Jet fuel (l)
Camp Meymaneh	Generator		1 493 400	
	Helicopter			323 800
	Light vehicle	5 800		
Camp Nidaros	Generator - Diesel		1 366 566	
	Helicopter(NAD)			256 500
	Light field vehicle		39 562	
	Light vehicle	5 040		
Total		**10 840**	**2 899 528**	**580 300**

Ammunition use was reported from six shooting ranges in Afghanistan and one range in Chad. Table 4.28 shows the total number of shots registered at the individual ranges. Handgun ammunition is defined here as ammunition up and to 12.7 mm. All other kinds of ammunition used at the camps may be found in the category entitled ”Other”. The consumption of ammunition reported in 2009 was considerably lower than that of 2008. (Table 4.29).

Table 4.28: Consumption of ammunition at various shooting ranges during international operations, registered in NDED in 2009.

Country	Shooting range	Types of weapons (number)		
		Handgun	EOD	Other
Chad	Abeché	7 818		
Afghanistan	DEH DADHI	10 037	69	28
	Jordaniare	36 332		
	Meymaneh	7 810		6
	Operations	600		8
	Vasle Mauken	12 599		
Total		75 196	69	42

Table 4.29: Consumption of ammunition registered in NDED for international operations from 2007 to 2009.

Country	Shooting range	Consumption (number		
		2007	2008	2009
Afghanistan	Christiania	4 193	8 111	
	DEH DADHI	48 673	152 755	10 192
	Jordaniare			36 332
	Meymaneh	87 959	35	7 818
	Operations			608
	Vasle Mauke	119 073	29 529	12 599
Spain	Ferrol	6325	5222	
Chad	Abeché			7818
Total		266 233	195652	75 367

4.11.2 Exercises

In 2009, the waste generated during the exercise Cold Response and the fuel utilised by motor vehicles and aircraft during the exercise were all reported. Aviation fuel delivered to allied divisions and natons was also reported. Table 4.30 shows the amount of waste registered from 2006-2009 as a result of Armed Forces exercise activities. Table 4.31 shows the amounts of fuel that were registered as a result of exercise activities from 2006 to 2009.

Table 4.30: Waste (kg) registered in NDED from 2006 to 2009 as a result of exercise activity.

	Amount (kg)			
	2006	**2007**	**2008**	**2009**
Organic waste	15 730	780		2 910
Paper and paperboard		870		2 040
Metal	32 240			
Hazardous waste	2 700	2 608	87 482	1 587
Mixed waste	125 320	76 564	88 927	83 600
Total	175990	80822	176409	90137

Table 4.31: Fuel (liters) used during exercises from 2006 to 2009 distributed by the different fuel types.

	Amount (l)			
	2006	**2007**	**2008**	**2009**
Gasoline	90 000	67 400	5 391	65 877
Diesel	660 100	756 070	121 004	1 187 610
Jet-fuel, maneuvers	1 586 400	3 150 445	845 321	2 445 589
Jet-fuel, allied				10 173 085
Marine oil gas	500 000	1 027 000	2 238 700	1 200 000
Total	2 836 500	5 000 915	3 210 416	15 072 161

Table 4.32 shows the number of complaints and damage to property registered in connection with exercises from 2006 to 2009. The number of complaints is taken from the environmental report from the winter exercises for the respective years. Some of the damage was not discovered until after the conclusion of the exercise and hence does not appear in the figures presented in the table.

Table 4.32: Complaints and incidents of property damage reported in connection with exercises from 2006 to 2009.

Type of damage/complaint	Incidents of property damages			
	2006	2007	2008	2009
Complaint			3	15
Infrastructure	29	4	11	11
Drinking water				1
Crop land	7	44	7	9
Sports facility	5	8		4
Energy and telecommunication		2		1
Material		20		13
Outlying field and forest	10	23	5	27
Road		38	3	34
Fish and fish farming equipment			1	
Undesirable incidents in connection with sanitation and waste disposal	1	2		5
Contamination		16	2	5
Total	**52**	**157**	**32**	**125**

4.12 Environmental education in the Armed Forces

There is no requirement to register environmental education in NDED. Nevertheless a total of 336 course participants and 69 hours of course instruction time were registered in 2009, compared to 47 participants and 72 hours of course instruction time in 2008. The degree to which this increase may be ascribed to an increase in environmentally-oriented instruction or an increase in reporting is uncertain. Only instruction at Sessvollmoen was reported in 2009, and Table 4.33 shows the nature of the environmental instruction that was registered.

Table 4.33: Environmental instruction in the Armed Forces in 2009, number of hours, number of participants and course organizer.

Topic of course and organiser	Level of course	Course Participants (number)	Length of course (hours)
Training Center for Joint Support (FKL)			
Environmental management	Basic	32	40
Environmental management; Environmental protection , operative activity	Basic	40	2
Environmental protection, general	Basic	32	2
Environmental protection, general, operative activity	Basic	7	22
Logistic organization, region Viken			
Environmental management	Basic	175	1
Environmental protection, operative activity	Basic	50	2
Total		**336**	**69**

5 Discussion and conclusion

5.1 Use of NDED in the defence sector

The quality of the reporting of data in 2009 for the various reporting areas in the entire defence sector was improved or else remained unchanged compared to 2008. The exception was ammunition, where reporting was much worse in 2009 than in the preceding year. The MoD, the Armed Forces and FFI reported their environmental impacts to NDED, whereas NoNSA hardly used NDED at all in 2009. NDEA reported to NDED some of its environmental impacts emanating from its activities, but still failed to report on certain parts of its own operations. The Armed Forces stood as in earlier years for the bulk of the reports that were made to NDED during the year. NDEA's subsidiary divisions Property and Facility Management, Sales Management and Construction Management reported waste from demolition and building projects to NDED in accordance with waste regulations which required a waste plan for 2009.

Furthermore, resources were used in 2009 to establish data imports to NDED from other digital systems. This has contributed to providing data of better quality and improving the degree of reporting; it has also led to greater savings of resources compared to manual registration. The data quality in NDED has improved greatly in recent years and a historical account spanning over several years gives greater confidence in the reliability of the estimates (See Figure 5.1 and 5.2). The database today is thus of a scope and structure that is better suited to more comprehensive assessments of environmental performance and efficiency.

5.1.1 Waste

A total of 13 526 tons of operations waste was registered in 2009, compared to 12 995 tons in 2008. The degree of reporting for 2009 is estimated at 95–100% considering that waste imports have been set up from all the market areas through framework agreements with NDEA. The only locality reporting manually was Andøya Airbase in region Hålogaland. The degree of reporting in 2009 showed improvement compared to the previous year, but there was still uncertainty over waste generated by activities not directly related to "daily operations". This category of waste fell outside the framework agreements with waste companies, and an overview of its scope is lacking. NDEA's subsidiary divisions Property and Facility Management and Construction Management reported large volumes of waste in connection with projects carried out in 2009, and in the course of the year began to work in digital imports of waste data from Property and Facility Management to the NDED. If the numbers from Property and Facility Management and Construction Management are included in the waste account, the total reported waste in 2009 was 34 593 tons in 2009 compared to 22 013 tons in 2008. The figure below shows the estimated total amount of waste generated from 2004 to 2009. The degree of uncertainty in the estimates is considerably lowered (blue part of the column) from 2004 to 2009, and the amount of waste has stabilised as a result of better estimates of the total amount. The estimates for 2004 to 2006 stand out as highly uncertain and far too high.

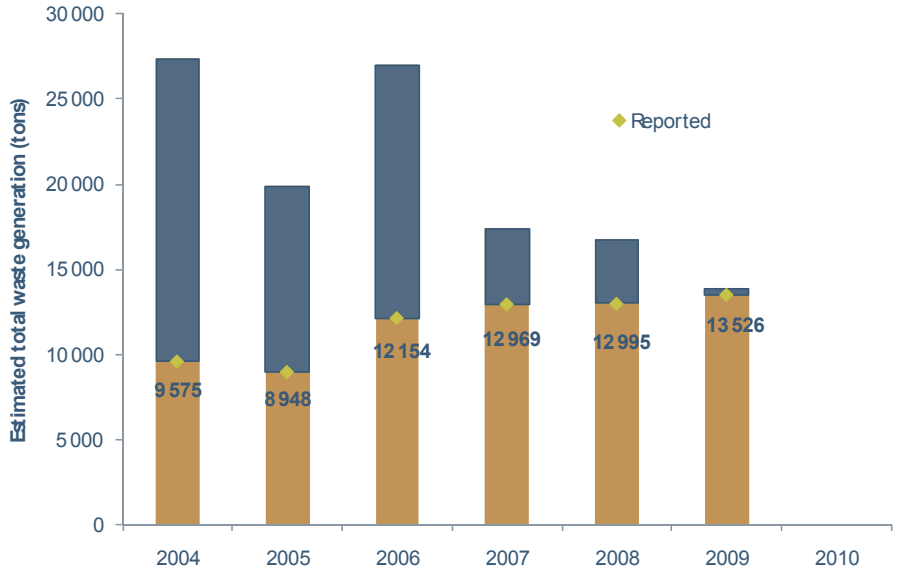


Figure 5.1: Total estimated waste (tons) in the defence sector from 2004 to 2009. The lower part of the column shows the waste reported to NDED, while the upper part shows the estimated total with 100% reporting. The mean value for the estimated degree of reporting is utilised for estimating the total amount.

With the exception of its subsidiaries Property and Facility Management and Construction Management, NDEA has reported waste from its activities only to a small extent. Some of NDEA's operations waste is covered by the imports from the various framework agreements in that NDEA in many instances is co-localised with the Armed Forces. The MoD and FFI have reported waste from operation of their own organisation. As in the preceding year, NoNSA did not report its waste into the NDED.

Operations waste in the defence sector in 2009 accounted for about 0.1% of all waste generated in Norwegian businesses and households compared to 2008. From 2007 to 2008, the amount of waste in Norway increased by 2%, while the degree of recycling increased from 70 to 71% at the same time [23]. The total amount of waste registered in NDED increased by 4% from 2008 til 2009, but here the estimated degree of reporting is not taken into consideration. The true increase in the amount of waste generated in the defence sector is therefore probably somewhat smaller since waste reporting was significantly improved in 2009 compared to preceding years. The degree of recycling in the defence sector also increased from 68% in 2008 to 78% in 2009, thereby representing an improvement over national figures. This increase is due in large part to the ban on depositing organic waste in landfills, which was introduced in 2009. It is also due to the fact that incineration with energy recovery has become more widespread. The amount of waste from the defence sector going to landfills has fallen compared to 2008, from 13% to only 4.5% in 2009, compared to 7.4% for Norway in 2008. Cement is not included in these figures, but hazardous waste, glass, plastics and organic waste are [23].

With respect to the main fractions of the waste, the distribution for the defence sector remains largely unchanged compared to earlier years. Mixed waste accounted for 46% of the total amount of waste in 2009, that is, 54% of the waste is sorted. The percentage of hazardous waste as part of the total waste amount increased from 15% (1 969 tons) in 2008 to 16% in 2009 (2 118 tonn). This latter figure constitutes 0.2% of the total amount of hazardous waste generated in Norway for 2008 (1.1 million tons). It means that the Armed Forces' goal for 2009 to achieve 60% sorting in waste disposal and reduced amounts of hazardous waste emanating from the defence sector was not attained (cf. Executive Letter for the Armed Forces, Appendix g, Executive Letter for the Defence Sector 2009-2012).

There is some uncertainty over the data with respect to recipient distribution for waste generated in the defence sector. This applies particularly to waste registered for incineration without energy recovery or recycling. The landfill ban might also have altered the recipient distribution somewhat in 2009 without this ever having been discovered. A new inquiry will be made of some of the waste companies in the course of 2010 in order to obtain a complete and accurate picture of waste distribution to recipients.

Armed Forces disposal projects comprise materiel that is suitable for sale to private individuals and associations, etc as well as the disposal of heavy materiel such as vehicles and weapons systems. Much of this materiel has gone for reuse, and does not appear in the Armed Forces' waste statistics. From an environmental perspective, reuse is the most advantageous manner by which disposal can be undertaken. However, thus far no assessment from an environmental perspective has been made of the benefits of this form of diposal. Such asssessments should be made in order to gain experience for future disposal projects of a similar nature.

An overview is needed of the association between waste points and the building inventory so as to be able to attach the generation of waste to organisational units. In this way, a poor degree of waste sorting can thus be connected directly to the user of the building, thereby increasing the possibility for local waste management. This would also make it possible to separate the waste generated from NDEA's own operations.

An overview is presented below of measures implemented in 2009 and recommendations for further improvements in the handling of waste in the defence sector.

Implemented measures:

- A waste import function has been established from the waste management company to NDED for MO Hålogaland with the exception of Andøya airbase.
- Efforts are underway to establish an import from the digital system of NDEA's Property and Facility Management subsidiary which keeps track of the waste generated by various projects, to NDED.

Recommendations:

- Implement measures to improve the degree of sorting, as it currently lies below 60%. This would provide a recipient distribution that is both environmentally-friendly and more favourable economically.
- Obtain a better overview of recipient distribution in association with waste processing carried out by the individual waste management companies.
- Work out a greenhouse gas account for waste handling to comply with the recommendations to the Norwegian public sector in the report "Climate Cure 2020".
- Gain an overview of waste generated from Armed Forces disposal projects.
- Gain an overview of the waste points as they connect to the inventory of buildings, thereby enabling a connection between the generation of waste and specific organisational units.

5.1.2 Energy consumption and air emissions

A total energy consumption of 682 060 MWh was registered in the NDED in 2009 for the defence sector, compared to 429 679 MWh in 2008. Compared to the energy data from NDEA's environmental report for 2009, 688 065 MWh, it may be seen that there is on the order of 100% reporting of energy use in the NDED. The goal to achieve a total energy use of ≤ 601 GWh for the Armed Forces in 2009 has therefore not been reached (cf. Executive Letter for The Armed Forces 2009). When distributed between the total numbers of employees in the defence sector (including conscripts carrying out their military service), this corresponds to 22 MWh/person/year. To compare, private households in Norway used a total of 34 512 GWh in 2008 [24], corresponding to about 6.9 MWh/person/year. If this is distributed to the total number of square meters m^2 of building space managed by NDEA (3 912 615 m^2), it corresponds to an energy consumption of about 174 kWh/m^2/year.

The figure below shows the estimated total use of energy from 2004 to 2009. The uncertainty in the estimates (blue part of the columns) is considerably reduced from 2004 to 2009 and the amount of energy has stabilised as a result of greater confidence in the estimates of the total amount.

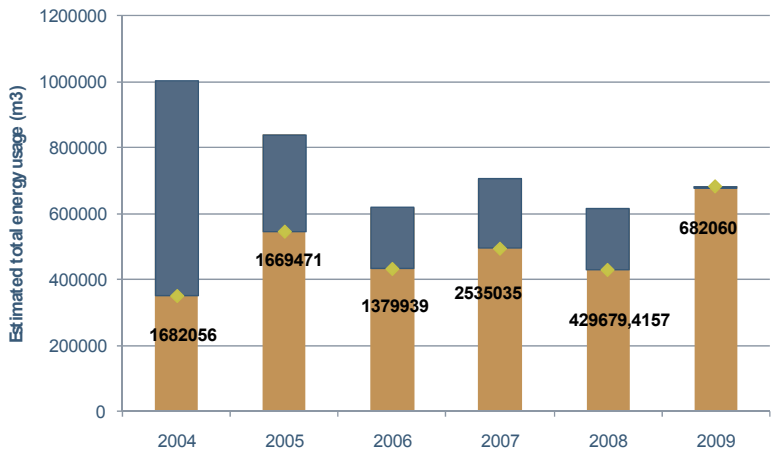


Figure 5.2: Total estimated energy use (MWh) in the defence sector from 2004 to 2009. The lower part of the column shows the amount of energy reported to NDED while the upper part shows the estimated total use with 100% reporting. The median value for the estimated degree of reporting is used for estimating the total amount.

The consumption of heavy heating oil was not registered for 2009, but a small increase may be observed in the use of light heating oil. The use of fossil fuel can be reduced by converting to heat pumps of bioenergy, or alternatively, by making buildings more energy efficient. The longevity of buildings means that measures introduced today will have effect far into the future. Today fossil fuels account for about 7% of the total national consumption of energy in buildings [25], compared to about to about 19% in the defence sector. Energy consumption in buildings in Norway has resulted in emissions corresponding to about 2.5 million tons of CO_2-equivalents in 2008 [25]. The defence sector thereby accounts for about 1.4% of the total national greenhouse gases from running buildings.

The use of bioenergy increased from 8 261 MWh in 2008 to 27 904 MWh in 2009. This means that 4% of energy consumption in 2009 was bioenergy, versus 2% in 2008. The amount of bioenergy presented is lower than the actual consumption because figures on the use of bioenergy have not been available for certain localities, only on the use of power measured in KWh. It has not been possible to separate this use of energy from other energy use. The proportion of renewable energy (electricity, bioenergy, and district heating) comprises 81% of the energy consumption that is registered in NDED. Norway imports about 5% of its electricity and this is produced primarily from European coal plants. If these figures are included, 76% of energy use in the Armed Forces would be based on renewable energy.

Of the energy carriers reported in Table 4.8, heating oil, propane, natural gas, paraffin and diesel/gasoline for generators contribute to the emission of greenhouse gasses and other forms of pollution. All activity has bearing directly or indirectly on emissions to the air. Only direct emissions from operations, the use of ammunition, waste, fuel and fossil energy are reported in this report. For example, electricity in Norway is based primarily on hydropower, but about 5% of our electricity needs are still covered by importing electricity from EU countries where power

production is based primarily on coal-fired plants with their ensuing higher greenhouse gases. In a lifetime perspective, hydroelectric power would also give off greenhouse emissions in connection with buildings and the operation of the facilities, whereas energy carriers based on wood would come out favourably because they bind CO_2 during growth and are therefore considered climate neutral.

NDEA's energy monitoring system was intended to form the basis for reporting energy data for 2009 via EnergiNet. Since this system still does not cover the use of all types of energy carriers or the electricity figures for all localities, we have primarily used data on the consumption of electricity in our study. Data on energy use has therefore been collected from local sources or from NDEA's central account.

An overview is presented below of measures implemented in 2009 and recommendations for further improving energy efficiency and energy reporting in the defence sector.

Implemented measures:

- Established a closer cooperation with NDEA concering source data on energy use.
- Energy data collected from "central systems", which has resulted in an increased degree of energy reporting and better quality of energy data.

Recommendations:

- Gain oversight of the factual use of bioenergy and other forms of renewable energy at the localities where this is only reported as power used.
- Establish a common import of energy data from EnergiNet for all localities in the defence sector and for all energy carriers that may be tracked by the system.
- Replace the use of fossil energy carriers with renewable energy sources for heating needs.

5.1.3 Fuel consumption and emissions to the air

Reporting on fuel consumption is generally good for most types of materielmateriel with the exception of military vehicles. In the course of 2009, a new import was established from a local tanking facility at Værnes; however, a complete overview of the fuel consumption at such facilities is still lacking. Over 99% of fuel consumption registered for 2009 was for Armed Forces activities, but fuel use was also reported for the MoD, FFI and NDEA.

Most of the agencies reported on the use of private cars for work-related business in 2009. For the first time, the use of private cars for work travel and the number of flights taken for work travel was included in the environmental report in view of their contribution to air emissions. It is important to make the number of journeys by air for work-related business visible in that the government has laid down that carbon offsets are to be paid for all work travel abroad undertaken by public employees. Making air travel and the use of private automobiles for work travel more visible could lead to the introduction of necessary technological solutions for running meetings so that the use of aircraft and cars for work-related transport could be reduced.

The total emission of greenhouse gases from the Norwegian transport sector in 2008 was about 1.7 million tons of CO_2 equivalents [25]. To compare, about 257 222 tons of CO_2-equivalents were released from automotive vehicles, aircraft and marine vessels in the defence sector. This corresponds to about 15% of national emissions. NOx emissions from the Norwegian transport sector (railways, other land transport, air transport, domestic sea travel) in 2008 was at 54 567 tons [26], while the total emissions from the defence sector was 2 874 tons in 2009. NOx emissions from the defence sector thereby comprised over 5% of national emissions. Ships stood for the majority of these exciseable emissions, and concrete efforts made here will play an important role in reducing fuel consumption and NOx emissions in the long term.

The Armed Forces can reduce its consumption of fuel in ships, aircraft and automotive vehicles through systematic environment-energy efficiency assessments of procurements and upgrades in accordance with the long term investment plan. Examples of this might entail solutions on existing materiel that could result in short term gains, as well as more systematic solutions in connection with future procurements or upgrades. The investment costs of high tech, energy-efficient solutions are often relatively high, but seen in a lifetime perspective, these investment costs can pay off in the form of reduced operations costs. It is therefore vital to think long term when planning environmental measures in connection with the Armed Forces' longterm investment plan. Then the higher investment costs can be recovered by reduced operations costs over time. Furthermore, by adopting environmentally sound approaches when the materiel is in for maintenance anyway, the costs are reduced compared to taking these approaches independently of the existing maintenance schedules. Examples here are the upgrading of engines on the Coast Guard's Nordkapp class vessels, where returns on the investment sums were made in a few short years through lower fuel consumption, lower operations and maintenance costs, and lower NOx emissions.

According to the report "Climate Cure 2010", it is possible for the Norwegian transport sector to attain a collective reduction in emissions of 3–4.5 million tons of CO_2 equivalents by 2020. Greenhouse gas emissions from Armed Forces military vehicles accounted for about 17 500 tons of CO_2 equivalents in 2009. The largest reductions in emissions can be attained by increasing the use of biofuels and phasing in more vehicles with lower emissions per driven kilometer [25]. The potential associated with biofuel increases sharply if large volumes of climate neutral "second generation" biofuels come to market at a competitive price. This would give substantially higher climactic benefits than the fuel of the present day. Future production of "second generation" biofuels would enable the Armed Forces to substitute the use of fossil fuel for vehicles (F-34) and potentially, also for aircraft in a longer time perspective. The materiel of the present day will have a long service life, and the substitution of climate-neutral "second generation" biofuel for today's fossil fuel will probably be the most effective means of reducing greenhouse gas emissions in the defence sector in a 10–20 years perspective. If climate-neutral fuel is to be introduced to the Armed Forces, one of the conditions would be that the new fuel should hold the same specification as the fossil fuel it is intended to replace. Thus in theory it would be possible to alternate between the use of fossil fuel and climate-neutral fuel without having to adjust and modify the engines. This is key seen from a supply safety perspective. Nevertheless, while

phasing in new fuel such as this, some years of testing would still be necesary to ensure that the new fuel did not result in reduced performance of the materiel or cause abnormal wear and tear. The Armed Forces desire to be a pioneer agency in enviornmental stewardship, and should therefore start an evaluation process to assess the phasing in of second generation biofuel.

An overview is given below of the measures implemented in 2009 along with recommendations on how reporting fuel use and attaining greater fuel efficiency within the defence sector might be improved.

Implemented measures:

- Began work to facilitate reporting of LNG consumption on vessels in the Barentshav Class.
- Established an import from the local tanking facility at Værnes.
- Calculated consumption of fuel and air emissions as a consequence of air travel carried out by the various agencies.

Recommendations:

- Gauge the scale of fuel consumption from local tanking facilities to improve the degree of reporting for military vehicles.
- Report releases of heavy metals to the air as a consequence of burning fuel.
- Initiate the process for phasing in second generation climate-neutral biofuel in the Armed Forces.
- Assess measrues for environment preservation and energy efficiency in new procurements and upgrades in the Armed Forces investment plan.

5.1.4 Ammunition

There was a drop in the number of registrations on the DBL 750 in 2009 (9 520) compared to 12 833 transactions in 2008. This represents a significant drop of 27% from 2008 to 2009, while there was only a drop of 14% in the number of shots delivered from FLO. The degree of reporting for 2009 was calculated to be 48% compared to 56% in 2008. The low degree of reporting was due to generally low reporting across the board in the various ammunition categories, but reporting was extremely poor with respect to loose ammunition, hand grenades and ammunition for the ”Other” category in the handgun section. Only 8 of 21 ammunition categories had reporting of 50% or higher.

The year 2008 was the first time in which registration showed a higher consumption of lead-free hadgun ammunition compared to ammunition containing lead. This trend is on the increase and in 2009, 3.6 million shots of ammunition containing lead were registered compared to 8.8 million shots that were lead-free. The use of ammunition containing lead in military shooting ranges and exercise grounds in 2009 was concomitant with an estimated release to the environment of about 19 tons of lead from Armed Forces acitivity. This is quite a drop compared to 2008 when the estimated deposit of lead to the environment from shooting activities was 56 tons.

There are significant deposits of lead on civilian and military shooting ranges, and these are considered today to be the largest remaining source of lead deposits in Norway. Lead shot was banned in Norway from 2005. A national goal of environmental policy is to achieve substantial reductions in releases of lead to the environment by 2010, and with the further objective of reducing it to natural background levels by 2020. The increased use of ammunition that is more environmentally friendly will in the long run reduce the need to implement special measures in the Armed Forces's shooting ranges and exercise fields, as well as being in better keeping with the regard for preserving thenatural environment.

An overview is give below of measures that were implemented in 2009 along with recommendations for the continuing work on reporting ammunition use in the defence sector.

Implemented measures:

- Improved user-friendliness of the digital form 750 in connnection with the upgrading to TEAMS SR.

Recommendations:

- Continue to work on improving user-friendliness of digital form 750.
- Decide what shooting range reservation system should be used in the Armed Forces and ensure that it is integrated with other relevant data systems, as well as ensure that the localities that lack a reservation system gain access to this.
- Training of range offisers with a certification system to ensure quality in the reporting.
- Develop guidelines for reporting on the use of ammunition.
- Establish a central professional office for shooting range administration.
- Improve the flow of information regarding reporting on ammunition use in order to increase understanding of and motivation for registering.
- Follow up on divisions who routinely fail to report their use of ammunition in accordance with requirements.

5.1.5 Water use

Reporting on the use of water was good in 2009 compared with earlier years. The year 2009 was the first time that water use figures were retrieved from NDEA centrally, and the degree of reporting for the year is estimated to be 90–100% compared to a reporting degree of 50–60% in 2008. Nevertheless there remains some uncertainty in the numbers for water use in that certain localities do not have water gauges installed and the consumption of water there can therefore only be calculated on the basis of cost.

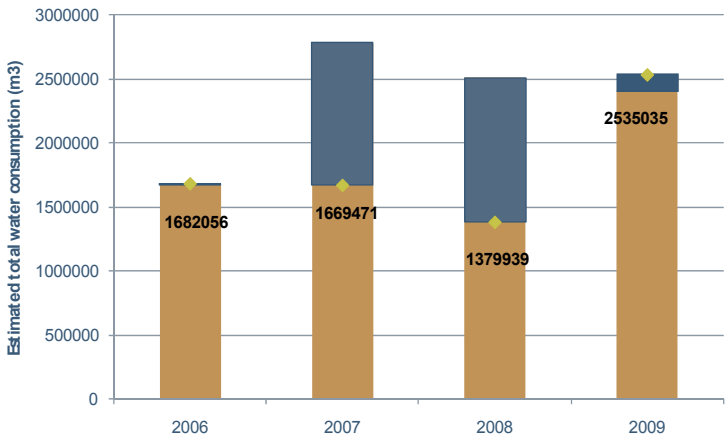


Figure 5.3: Total estimated water consumption from 2006 to 2009. The lower part of the column shows the amount of water use reported, while the upper part shows the estimated use of water with 100% reporting. The median value for the estimated degree of reporting is utilised to estimate the total amount.

An overview is given below of the measures implemented in 2009 along with recommendations on how reporting water consumption in the defence sector may be further improved.

Implemented measures:

- Consumer data retrieved for the first time centrally from NDEA, resulting in a degree of reporting of 90–100%.

Recommendations:

- Utilise EnergiNet as a source by which to import data about water use once water gauges have been installed at all Armed Forces localities.

5.1.6 Chemicals

Reporting to NDED on chemical use was spotty in 2009 as it was for the preceding year. The only chemicals registered as being used in large volumes are aircraft and runway de-icing chemicals. The amount of registered de-icing chemicals has increased by 13% from 2008 (784 tons) to 2009 (887 tons). In 2009, aircraft de-icing chemicals were registered at six airbases. Compared to 2008, an increase may be seen in the distribution of these chemicals to the ground and soil and a decrease in their distribution to the ocean and the sea. The amount of de-icing chemicals that wash out into drains with purification facilities was reduced from 38% in 2008 to 22% in 2009.

As much as 83% of the Armed Forces use of de-icing chemicals is in the form of UREA. In 2008, Avinor introduced a total ban on the use of UREA at all of its airports for the 2008-2009 season due to poor environmental performance. On the other hand, the use of UREA in the Armed Forces increased by 9% from 2008 to 2009.

An overview is given below of the measures implemented in 2009 along with recommendations for how reporting the use of chemicals in the defence sector may be further improved.

Implemented measures:

- The work towards FIF progressed forward from 2008 and efforts are ongoing to develop the possibility to import data about chemicals fromFIF to NDED.

Recommendations:

- UREA should be replaced by other (formiat-based) runway de-icing chemicals to remain in keeping with the rest of the aviation industry in Norway.

5.1.7 Accidental releases

Only Haakonsvern Naval Base and Ørland Main Airbase have established routines for reporting accidental releases. This comes through very clearly in the statistics from 2004 to 2009 (Table 4.25). The routines for reporting such incidents must be implemented in the entire defence sector.

Recommendations:

- Reporting of accidental releases must be prioritised and standardized routines established for reporting such incidents to NDED.

5.1.8 Reporting during international operations and exercises

5.1.8.1 International operations

Norwegian forces serving in operations abroad are expected to abide by the same environmental requirements as in Norway, as well as complying with the host nation's own environmental requirements. In those areas where the environmental requirements of Norway and the host country do not correlate, Norwegian forces are to abide by those regulations that are the strictest. The implementation of environmental management during international operations is carried out with the help of environmental protection officers carrying out their foreign service. A method of calculating the degree of reporting from INTOPS has not yet been established.

In 2009, the consumption of water, fuel, and ammunition and the amount of waste at the various localities in Afghanistan were all registered. In Nidaros and Meymaneh camps, the registered consumption of water in 2009 was 7240 m^3 and 10 355 m^3 respectively. However, figures for water consumption at Nidaros camp are lacking for the second half of 2009.

Waste was only reported in Nidaros camp in 2009. The reason for this is, all of the waste from all Norwegian camps in Afghanistan is collected in this camp prior to being transported back to Norway. Ordinary waste is sorted for recycling and reuse of local resources, while EE waste and hazardous waste are sent home to Norway.

The consumption of fuel and/or diesel was reported for both the Nidaros and Meymaneh camps. Fuel related to energy production, that is, fuel used to power generators, was reported along with the use of fuel in motor vehicles and helicopters. However, information is lacking about the type of vehicles the fuel was used for; figures are likewise lacking for other localities besdies Nidaros and Meymaneh camps. A usage of 2 899 m^3 diesel in connection with international operations

was reported in 2009. This corresponds to 44% of the total consumption of diesel in the Norwegian defence sector. Hence there is great potential to improve environmental performance and increase energy efficiency in international operations.

The use of ammunition was reported at six shooting ranges in Afghanistan and one range in Chad. Considerably less use of ammunition was reported in 2009 compared to 2008.

An overview is given below of the measures implemented in 2009 along with recommendations by which registration of impacts on the environment from INTOPS may be further improved.

Implemented measures:

- FFI receives regular information about the use of energy to power generators, as well as figures on the use of water and electricity from NDEA in connection with Armed Forces activities in Afghanistan.

Recommendations:

- The greatest potential for improving environmental efficiency at bases in INTOPS in the short term is to reduce the use of energy in camp. Several approaches can be considered to attain this, and they should be examined and evaluated through a study that can provide answers as to what action to take that will yield a high degree of benefit for the environment while simultaneously being cost-effective. Examples of pertinent options are:
  - Lowering the temperature day and night in tents and buildings.
  - Additional insulation and sun screening of tents and buildings.
  - Alternative sources of energy to fossil fuel to heat tents and buildings, for example, solar cell technology, solar capture technology to heat water, and reuse of heat from generators.

5.1.8.2 Exercises

Information from military exercise activity was retrieved from the environmental reports from winter exercises in the period from 2006 to 2009. No method has been established for calculating the degree of environmental reporting from military exercises. An overview of this will in time be able to serve as a tool for assessing the impact of military exercises on the environment. In 2009, there were 125 complaints/incidents of damage registered in connection with military exercises. These complaints ranged from damage to property, buildings and the cultural landscape to pollution.

An overview is given below of measures implemented in 2009 along with recommendations for how to further improve reporting of environmental impacts emanating from the Armed Forces' exercise and maneuvers activities.

Implemented measures:

- In 2009, a number of complaints and claims of damage were reported as a result of military exercises from 2006 to 2009.

Recommendations:

- Obtain an overview of the Armed Forces exercise and maneuvers activities nationally and internationally to be able to evaluate the impact on the environment emanating from such activities.

5.2 Conclusion

5.2.1 Environmental management in the Armed Forces

In order to be able to make a thorough evaluation of environmental performance in the Norwegian defence sector, FFI in conjunction with the Norwegian MoD and its underlying subsidiary agencies should collaborate to construct a good framework for the purposes of evaluating environmental performance in the sector. Anchoring the framework and developing good environmental performance indicators for the defence sector should be implemented as part of the control system for environmental management in the sector.

The reporting of accidental releases must be prioritised with standardised routines established in the environmental management system for reporting such incidents to NDED.

The year's reporting on ammunition use in the defence sector stands out in a negative way and is low compared to previous years. The Armed Forces should therefore introduce improved routines as part of a control system, for example in the form of guidelines for reporting on ammunition, train up range offisers , and establish a uniform reservation system for shooting ranges in which the reporting system DBL 750 and other relevant data systems are well integrated.

5.2.2 Environmental efficiency in the defence sector

The Armed Forces desire to be a pioneering organisation in environmental preservation and should therefore focus on longterm and purposeful measures that will improve environmental performance in the unit. Initiatives should be directed towards the existing materiel as well as to future procurements in order to make gains over a longer time perspective. The use of second generation biofuels will have the greatest potential in reducing greenhouse gas emissions over a long time perspective, and a process should therefore be started to evaluate the phasing in of climate-neutral biofuel in military materiel. Systematic environmental and energy efficiency assessments in relation to the long term investment plan are also recommended. Seen from a lifetime perspective, the higher investment costs of the materiel in the short term are recovered through reduced costs of operations in a long term perspective.

5.2.3 Further operation of NDED

Further development of NDED in the next reporting year will focus on upgrading to a new database platform (TEAMS SR, sustainability reporting). The new functionality of TEAMS SR and a continued focus on centralised import routines will permit reporting in a greater degree of detail and heightened quality of data in NDED: The high degree of detail of the data in NDED will form the basis for analyses of environmental performance and assessments of environmental efficiency. Much greater emphasis will be made on carrying out such assessments in 2010.

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