

INVESTIGATIVE COMMISSION ESTABLISHED BY THE ITALIAN MINISTRY OF DEFENCE ON THE INCIDENCE OF
MALIGNANT NEOPLASIA AMONG MILITARY PERSONNEL INVOLVED IN OPERATIONS IN BOSNIA AND IN
KOSOVO

PRELIMINARY REPORT

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PRELIMINARY REPORT OF THE INVESTIGATIVE COMMISSION ESTABLISHED BY THE ITALIAN MINISTRY OF DEFENCE ON THE INCIDENCE OF MALIGNANT NEOPLASIA AMONG MILITARY PERSONNEL INVOLVED IN OPERATIONS IN BOSNIA AND THE KOSOVO

INTRODUCTION

The Investigative Commission established by the Italian Ministry of Defence on 22 December 2000 - Chairman: Professor Franco MANDELLI, members: Professor Carissimo BIAGINI, Professor Martino GRANDOLFO, Dr. Alfonso MELE, Dr. Giuseppe ONUFRIO, Dr. Vittorio SABBATINI and General Med. Insp. Antonio TRICARICO - presents its first preliminary report.

The task of the Commission was to examine all the medical-scientific aspects of cases of tumoral pathologies affecting military personnel which had come to light and received attention in recent times, in particular cases involving military personnel who had participated in operations in Bosnia and the Kosovo, in order to verify if there exists a connection to the depleted uranium munitions utilised in this area, or if other causes can be identified for these pathologies.

This first report lists the figures for the incidence of malignant neoplasia with a confirmed diagnosis, comparing them with the data in the Italian Tumour Registers (Appendix 1).

With regard to the role of depleted uranium, a number of preliminary considerations are made, based on the data available in the literature and on the results of measurement campaigns carried out by Italian and international organisations.

The role of other causes was not addressed, since this would require - if held to be useful - an additional study. It is suggested, however, that accurate monitoring be carried out over time, both as regards possible new cases among military personnel and controls to be extended to other populations at risk.

The time that it took to draw up this report was tied to the need to collect all the data on military personnel who had participated in operations in Bosnia and the Kosovo and to confirm the diagnoses of malignant neoplasia.

EPIDEMIOLOGICAL ASPECTS

POPULATION STUDIED, SOURCES OF THE DATA AND METHODS

The population considered to calculate the incidence of neoplasia consists of military personnel and defence civilian personnel engaged in at least one mission in Bosnia and/or the Kosovo in the period between December 1995 and January 2001. The list of these individuals was provided by the Army, Air Force, Navy Staffs and the Carabinieri Corps to the General Department of Military Health, which sent it to the Superior Institute of Health within the Ministry of Public Health.

For each individual the following information is currently available: place and date of birth, place of residence, service and rank, unit and unit home base location, location where the missions were carried out, dates of the beginning and end of the missions.

All cases, in part from voluntary unsolicited reports, were communicated to the Commission by the Defence Ministry. For each report, steps were taken to obtain diagnostic confirmation utilising certificates and copies of clinical charts supplied by diagnostic and treatment units within universities and hospitals, or by haematology and oncology units.

Cases without a documented diagnosis as well as those whose diagnosis did not involve neoplasia were not taken into consideration. Similarly, reported cases for which the documentation received did not prove sufficient for determination of the diagnosis were not included in the study.

In calculating the incidence rate, the numerator is the number of cases for each of the pathologies reported while the denominator is the sum of the observation time for each individual (from the date of the first mission to 31 January 2001, the date on which the data were obtained by the Superior Institute of Health, or to the date on which the cases were diagnosed).

Calculation, on the basis of five age groups, was made for the specific rate of the following pathologies: Hodgkin's Lymphoma (HL), Non-Hodgkin's Lymphoma (NHL), Acute Lymphatic Leukaemia (ALL), the total of the haemo-lympho-proliferative illnesses observed, the total of solid tumours, and the overall total of malignant tumours registered.

For each rate, confidence intervals of 95% were assumed (CI 95%); this means the range within which estimates of rate of incidence can fluctuate as the result of chance.

The rates of incidence of the population being studied were compared with those of the male populations covered by the Italian tumour registries. The tumour registries collect data for incidence on the basis of confirmed diagnoses. Use was made of the 9 registries for which updated data were available (see Appendix 1). The data utilised refer to the period 1993-1997.

The rate between the number of tumour cases “observed” among the military population assigned to Bosnia and/or the Kosovo and the “expected” number of cases in that same population, based on the rates shown by Italian tumours registries, was used as an indicator: the rate between “observed” cases and “expected” cases provides an idea of the magnitude of risk (SIR, Standardised Incidence Rate). When there is no difference between the cases observed and those expected, this rate is equal to 1, while a higher figure indicates that more cases were observed than expected, or vice versa, in the event that the value is less than one. Intervals of confidence were also calculated for the SIR.

In order to render the population being studied more homogeneous, and to facilitate comparison with the data taken from the tumour registries operating in Italy, the analysis was restricted to the age groups falling between 20 and 49 years, which, in any event, cover 97.1% of the entire group of Italian military personnel who went on missions to Bosnia and/or the Kosovo (no cases were recorded for the age groups not included). Given that the excluded age groups contained a small number of individuals, the number of expected cases in those groups was zero, as was the number of observed cases, meaning that the calculation of the SIR is in no way influenced by the selection process employed.

In calculating the rates and the SIR, consideration was also given to the period of latency between exposure and the observation of the pathology. Given that there is no confirmed data in the literature regarding latency, a minimum latency of 12 months has been assumed. All individuals with periods of observation of less than 12 months were excluded from the calculation process (both in the numerator (cases) and in the denominator(time)), while for all individuals the first 12 months of observation were not considered (minimum latency).

RESULTS

Tables 1 and 2 describe the population under study by age and geographic area of birth. We have analysed a total of 39,450 military and civilian personnel, of whom 38,343 fall within the 20-49 age group; the total observation time was 81,460 individual/years. The majority of the population (84.5%) came from the Army.

Table 1. Distribution of the population being studied by actual age and Service.

SERVICE							
	Army	Air Force	Navy	Carabinieri	Civilians (Army)	Total	
Age							%
19	120	0	0	0	0	120	0.3
20-24	13383	275	75	195	0	13928	35.3
25-29	11677	394	216	701	0	12988	32.9
30-34	2493	740	53	576	0	3862	9.8
35-39	2299	589	12	787	7	3694	9.4
40-44	1670	306	5	529	3	2513	6.4
45-49	929	281	2	141	5	1358	3.4
50-54	511	135	1	45	3	695	1.8
55-59	189	32	0	10	1	232	0.6
60-64	50	7	0	3	0	60	0.2
Total	33321	2759	364	2987	19	39450	100.0
%	84.5	7.0	0.9	7.6	0.0	100.0	

Table 2. Distribution of the population under study by Service and geographic area of birth.

Date of Birth	SERVICE											
	Air Force		Carabinieri		Army		Navy		Civilians (Army)		Total	
		%		%		%		%		%		%
North	12	18.2	--	--	4116	12.4	19	5.2	0	0.0	4147	12.3
Centre	22	32.8	--	--	4951	14.9	9	2.5	5	26.3	4987	14.8
South and Islands	33	50.0	--	--	22906	68.9	325	89.3	13	68.4	23277	69.1
Abroad	0	0.0	--	--	1271	3.8	11	3.0	1	5.3	1283	3.8
Total	67	100.0	--	--	33244	100.0	364	100.0	19	100.0	33694*	100.0

* The area of birth was not known for all the individuals

69.1% of the individuals come from southern Italy (**table 2**).

Table 3 shows that approximately 60% of the individuals went on their first mission to Bosnia and/or the Kosovo between 1999 and the year 2000.

Table 3. Distribution of the population under study by Service and year of 1st mission.

Year of 1 st Mission	SERVICE						
	Army	Air Force	Navy	Carabinieri	Civilians (Army)	Total	
							%
1995	249	14	0	48	0	311	0.8
1996	6065	29	0	76	2	6172	15.6
1997	4393	46	102	71	2	4614	11.7
1998	4159	67	262	434	0	4922	12.5

1999	9475	675	0	1119	10	11279	28.6
2000	8936	1864	0	1236	5	12041	30.5
2001	44	64	0	3	0	111	0.3
TOTAL	33321	2759	364	2987	19	39450	100.0

Tables 4 and 5 show the distribution of the individuals by location and number of missions. 68% of the individuals performed a single mission, 23.5% performed two missions, and 8.7% more than two missions.

Table 4. Mission locations by Service

Mission - location	SERVICE					
	Air Force	Carabinieri	Army	Navy	Civilians (Army)	Total
SARAJEVO	227	2243	23185		6	25661
SARAJEVO-PODROMANIJA			1			1
SARAJEVO-MOSTAR			5			5
SARAJEVO-PLOCE			1			1
SARAJEVO-VOGOSCA			1			1
BANJA			3263		1	3264
BANJA ILIDZA			845			845
BANJA LUKA	8		3			11
BANJA LUCA - TUZLA			1			1
BIHAC			1			1
BIJELNA			1			1
BOSNIA (various locations)	18	9	1212	103		142
BRCKO			1			1
BREZOVICA		2	3			5
BRKA			1			1
BUKOVAC			347			347
BUTTIMR			2			2
CAPLJNA			1			1
DAKOVICA	2036	91	5479		1	7607
DAKOVICA-PEC			171			171
DAKOVICA-DECANE			3			3
DECANE			2483			2483
MOSTAR	56	49	598			703

DOBOJ			1			1
DRVAR			1			1
GNJLANE		2				2
GORADZEVAC			1627			1627
GORBAVINCIA			2			2
ISTOK			10			10
JAICE			1			1
KARLOVAC-SZEGED			1			1
KISELJAK			4			4
KLINA			401			401
KNIN			5			5
KNIN-ZENICA			1			1
KOSOVO (various locations)	27		4	310		341
KRAJNA			1			1
LIVNO			1			1

Table 4 - continued

	SERVICE					
Mission - location	Air Force	Carabinieri	Army	Navy	Civilians (Army)	Total
LIVNO-DRVAR			1			1
MITROVIZA		2				2
OGULIN			1			1
OSIEK			1			1
OTTRID			1			1
PEC	26	227	9738		13	10004
PEC-KLINA			3			3
PEC-PRISTINA			5			5

PODGORICA			2			2
POLJE			654			654
PRISTINA	745	945	265			1955
PRISTINA-PEC-DAKOVICA	1					1
PRIZREN		1	3			4
PRIZREN-ORAHOVAC			1			1
RAJLOVAC			603			603
ZENICA			2			2
ROGATICA			132			132
SIROKJ BRIEG MOSTAR			1			1
SISAK-SARAJEVO			1			1
SOKOLAC			1			1
STRMICA			24			24
STRMICA OTOKA			1			1
TUZLA			3			3
TUZLA MOSTAR			1			1
TUZLA SAVA			4			4
USTIPRACA			1			1
VINKOVCI			1			1
VISOKO			1			1
VOGOSKA			67			67
VUKOVAR			3			3
ZENICA			3			3
ZETRA			9			9
ZVORNIK			10			10
ZVORNIK-BIH			1			1
ZVORNIKGRAD			2			2
ZVORNIK-TUZLA			1			1
Total	3144	3571	50015	413	21	57164

Table 5. Distribution of individuals by Service and number of missions

Number of missions	SERVICE										Total	
	Air Force		Carabinieri		Army		Navy		Civilians (Army)			
		%		%		%		%		%		
1	2434	88.2	2500	83.7	21502	64.5	316	86.8	17	89.5	26769	67.9
2	268	9.7	416	13.9	8561	25.7	48	13.2	2	10.5	9295	23.6
3	49	1.8	58	1.9	2227	6.7					2334	5.9
4	6	0.2	8	0.3	690	2.1					704	1.8
5	1	0.04	2	0.07	205	0.6					208	0.5
6	1	0.04	2	0.07	79	0.2					82	0.2
7					41	0.1					41	0.1
8					12	0.04					12	0.03
9					3	0.01					3	0.01
11			1	0.03							1	0.0
13					1	0.0					1	0.0
Total	2759	100.0	2987	100.0	33321	100.0	364	100.0	19	100.0	39450	100.0

Table 6 gives a description of cases: 4 NHL, 9HL, 2 ALL and 13 solid tumours were reported for a total of 28 of which 23 cases in the Army, 2 in the Air Force and 3 in the Carabinieri.

Table 6. Description of confirmed cases until 31/01/2001.

N°	Service	Age of diagnosis	Region of birth	Diagnosis	Date of diagnosis	Date of 1 st mission	Follow-up (months)	Number of Missions	Location of Missions	Length of service (days)	Unit location
1175	Army	25	Puglia	NHL	22/07/99	31/08/98	10.7	1	Sarajevo	183	Firenze
24744	Army	25	Sardinia	NHL	05/11/99	12/10/96	36.8	3	Sarajevo-Dakovica(2)	277	Cagliari
2763	Army	30	Veneto	NHL	27/11/96	03/07/96	4.8	1	Sarajevo	125	Castel Maggiore
31721	Army	22	Campania	NHL	24/02/00	13/05/99	9.4	1	Sarajevo	109	Siena
23732	Army	22	Sardinia	HL	30/11/99	01/04/99	8.0	1	Pec	64	Caserta
19481	Army	22	Puglia	HL	20/10/00	22/05/99	17.0	1	Pec	137	Cosenza
12425	Army	24	Puglia	HL	02/03/99	27/01/97	25.1	1	Sarajevo	388	Pinerolo
25808	Army	24	Campania	HL	27/11/00	07/06/99	17.7	1	Sarajevo	80	Siena
34327	Army	25	Campania	HL	09/05/00	21/10/99	6.6	1	Pec	89	Milano
29920	Army	26	Sardinia	HL	18/12/00	23/09/96	50.8	3	Sarajevo-Dakovica(2)	358	Salerno
24859	Army	28	Lazio	HL	16/09/98	09/05/96	28.3	1	Sarajevo	147	Caserta
24562	Army	32	Puglia	HL	07/04/00	13/01/98	26.8	3	Sarajevo	197	Verona
38311	Army	36	Lombardia	HL	01/03/98	28/04/97	10.1	1	Sarajevo	98	Roma
5649	Army	22	Sicily	ALL	27/05/99	14/10/97	19.4	2	Sarajevo	223	Persano
37516	Army	23	Sardinia	ALL	27/04/99	18/11/98	5.3	1	Sarajevo	102	Cagliari
13297	Army	21	Campania	Thyroid MT	06/10/98	27/11/97	10.3	1	Sarajevo	161	Salemo
18931	Army	26	Basilicata	Thyroid MT	22/03/00	03/03/99	12.6	1	Sarajevo	162	Grosseto
4584	Air Force	33	Lazio	Thyroid MT	13/07/00	05/08/99	11.3	1	Dakovica	60	Ciampino
31984	Army	29	Lazio	Intestine MT	17/04/00	08/06/96	46.3	3	Sarajevo	161	Livorno
7788	Carabinieri	41	Calabria	Intestine MT	09/10/00	30/12/96	45.3	5	Sarajevo(2)-Mostar(3)	419	Not available
37392	Carabinieri	47	Piemonte	Intestine MT	15/08/99	22/10/97	21.7	1	Sarajevo	201	Genova
33360	Army	26	Umbria	Brain MT	21/09/00	26/06/97	38.9	1	Sarajevo	55	Feltre
36398	Army	43	Umbria	Brain MT	04/09/99	05/01/96	44.0	2	Banja-Sarajevo	107	Civitavecchia
31058	Army	26	Lombardia	Testis MT	13/10/99	26/08/97	25.6	1	Sarajevo	167	Pinerolo
36501	Army	39	Campania	Pharynx MT	14/04/00	09/01/96	51.2	3	Sarajevo(2)-Pec	240	Caserta
10167	Army	36	Campania	Larynx MT	12/01/00	19/09/96	38.8	2	Sarajevo-Klina	313	Cremona
16436	Air Force	47	Campania	Lung MT	28/04/00	10/02/00	2.6	1	Sarajevo	132	Roma
8387	Carabinieri	29	Lombardia	Melanoma	18/05/98	09/12/96	17.2	1	Sarajevo	108	Not available

NHL = Non-Hodgkin's Lymphoma; HL = Hodgkin's Lymphoma ; ALL = Acute Lymphatic Leukaemia; MT = Malignant tumour

Shown on Table 7 are the specific incidence rates by age and pathology.

Table 7. Incidence rates (per 100,000 individual/years), with confidence intervals at 95% for the pathologies observed, presented by age group.

Diagnosis	Age Groups						Total 20-49
	20-24	25-29	30-34	35-39	40-44	45-49	
NHL	4.90 (0.10-27.33)	5.27 (0.63-19.06)	12.98 (0.26-72.42)	0	0	0	4.91 (1.33-12.58)
HL	24.49 (7.93-57.15)	5.27 (0.63-19.06)	12.98 (0.26-72.42)	13.49 (0.27-75.26)	0	0	11.05 (5.05-20.98)
ALL	9.80 (1.18-35.41)	0	0	0	0	0	2.46 (0.29-8.88)
NHL+HL+ALL	39.18 (16.90-77.23)	10.54 (2.85-27.02)	25.96 (3.11-93.84)	13.49 (0.27-75.26)	0	0	18.41 (10.30-30.38)
Solid tumours	4.90 (0.10-27.33)	13.18 (4.27-30.76)	12.98 (0.26-72.42)	26.98 (3.24-97.52)	38.34 (4.60-138.59)	72.26 (8.67-261.24)	15.96 (8.50-27.30)
Total	44.98 (20.13-83.70)	23.72 (10.83-45.05)	38.94 (7.92-113.83)	40.46 (8.23-118.29)	38.34 (4.60-138.59)	72.26 (8.67-261.24)	34.37 (22.83-49.68)

Table 8 shows the comparison with the data of the Tumour Registers through the calculation of the SIR.

Table 8. SIR by type of pathology.

Pathology	Cases Observed	Cases Expected	SIR	I.C. 95%	
NHL	4	5.41	0.74	0.01	1.46
HL	9	3.81	2.36	0.82	3.90

ALL	2	0.72	2.79	0.00	6.67
<i>NHL + HL + ALL</i>	<i>15</i>	<i>9.94</i>	<i>1.51</i>	<i>0.75</i>	<i>2.27</i>
Solid tumours	13	41.80	0.31	0.14	0.48
<i>All neoplasia</i>	<i>28</i>	<i>53.29</i>	<i>0.53</i>	<i>0.33</i>	<i>0.72</i>

Table 9 shows the values of the SIR, calculated under the assumption of a minimum period of latency of 12 months for the different pathologies. Therefore, cases diagnosed earlier than 12 months from exposure are not included.

Table 9. SIR by type of pathology, assuming a period of latency of 12 months.

Pathology	Cases Observed	Cases Expected	SIR	C.I. 95%	
<u>Assumption: 12 months of latency</u>					
NHL	1	3.29	0.30	0.00	0.90
HL	6	2.24	2.67	0.53	4.81
ALL	1	0.42	2.38	0.00	7.04
<i>NHL + HL + ALL</i>	8	5.95	1.34	0.41	2.28
Solid tumours	10	25.10	0.40	0.15	0.65
<i>All neoplasia</i>	18	31.98	0.56	0.30	0.82

Table 10 establishes a comparison between the days spent in Bosnia and/or the Kosovo by those who have suffered from malignant pathologies and the time spent by those who did not develop pathologies.

Table 10. Days spent in Bosnia and/or the Kosovo for individuals representing cases and non-cases.

	Cases	Non-cases
Days on Mission		

Number	28	35897
Average	165.9	161.5
Range	55-419	1-995
Mann-Whitney test	P = 0.1624 (not significant)	

EXPOSURE TO RADIATION AND HODGKIN'S LYMPHOMA

From a radiological point of view, depleted uranium, as is the case with all elements emitting radiation with a weak level of penetration, and in particular alpha radiation, has an effect on health in the event of internal exposure through inhalation, ingestion or entry into the body through wounds.

As regards the possibility of a causal connection between Hodgkin's disease and internal exposure, based on the knowledge currently available, it is possible to refer to the following information.

In its chapter on Hodgkin's lymphoma, the recent, far-reaching review of the UNSCEAR 2000 Report (United Nations Scientific Committee on the Effects of Atomic Radiation) (1), whose undisputed prestige makes it an international point of reference, lists three studies on internal exposure to the isotope iodine I^{131} , a radioisotope which, for that matter, does not emit alpha radiation, unlike uranium: two of the studies do not point to any meaningful causal connection (2,3,4). Two works (5,6) regard patients treated with thorotrast, a solution utilised as a contrast medium up through the 1950's, and they are based on the observation of only a few cases (1 in the Danish work; 2 in the German work), while the third work, which regards exposure to radon gas (Rn^{222}) in a mine, does not analyse the number of cases which occurred with relation to the levels of exposure (7).

Two similar cases had been addressed in the previous UNSCEAR Report of 1994 regarding workers assigned to handle uranium ore. In performing their jobs, they were exposed to dust containing isotopes of uranium and thorium (8,9). Within this context the incidence of lung and bone tumours proved lower than expected, though excess cases of other pathologies were recorded during the 20 years of the period of observation, including 3 cases of Hodgkin's lymphoma.

Recently, noteworthy epidemiological indications have emerged from two studies on squads of workers at plants for the production and reprocessing of nuclear fuel (10,11). These studies analysed the connection between accumulated external exposure (meaning that not involving inhalation, ingestion or introduction into the body) and death from cancer. In particular, the first study also examined the relationship between external exposure and illness. Both studies found there to be a statistically significant association between Hodgkin's lymphomas and external exposure when a

delay of 10 years is assumed between exposure and the onset of the illness, but it is concluded that there cannot be a cause and effect relationship, given that it would clash with the results of analyses on survivors of Hiroshima and Nagasaki, as well as with other studies (1, 12, 13). As is stressed by other authors (14), however, these studies do not take into account the role of internal exposure and of other risk factors (such as smoking). The reconstruction of data on internal exposure and other, irrelevant elements is extremely complex, given that use is made of the historical tumour registries. Nevertheless, Mc Georghean and Binks (10) state that their objective is to undertake a renewed analysis of the data on the basis of information that can be obtained on internal exposure. These future results may help clarify the role of internal contamination of uranium in the aetiology of the lymphomas.

Finally, a number of other studies have analysed clusters of cases involving the onset of Hodgkin's lymphoma, but without finding a single, definitive explanation, to the point where it has been hypothesised that there might also be a connection with viral forms.

Having outlined the body of knowledge that has emerged from epidemiological studies, it is thought useful to present a number of considerations dealing strictly with the topic of radiation protection.

Risk estimates based on analyses of the survivors of Hiroshima and Nagasaki, which still provide the fundamental epidemiological data for the calculation of risk estimates involving protection from radiation (12), do not point to a meaningful connection between exposure and the incidence of lymphomas, in particular for Hodgkin's lymphomas, but also for non-Hodgkin's (15). It should be observed, however, that these estimates regard external, uniform, acute exposure, primarily in the form of gamma radiation. The exposure scenario to be formulated in the case of the Italian contingent in the Kosovo and in Bosnia is radically different. Indeed, it can be assumed that, given the prevalence of emissions of depleted uranium (alpha and beta), the external exposure in this case is very limited; the main mode of exposure must be considered internal, consisting of alpha and beta radiation, probably chronic and occurring mainly through inhalation and/or, in part, ingestion. There is good reason to doubt, therefore, that the risk coefficients drawn up from the data on survivors of Hiroshima and Nagasaki can adequately represent an exposure scenario as different as that of the Italian contingent. In addition, it should be noted that, especially in the case of the inhalation of insoluble uranium oxides, the target organs, meaning those

subject to the highest level of exposure, are expected to be the lungs, so that it is legitimate to assume (16) that a significant fraction of the radioactivity deposited in these organs will be concentrated in the lymph nodes of the mediastinum.

In light of what has been presented above, and based on the current body of knowledge, a causal connection between Hodgkin's disease and internal exposure has not yet been demonstrated. What is more, the studies cited refer to chronic exposure for lengthy periods of time under conditions of exposure which differ from those of the military personnel considered herein.

Though due consideration must be given to the statement made above, the excess of cases of Hodgkin's lymphoma – at present not statistically significant - nevertheless deserves to be carefully analysed, so that it is held necessary to monitor the eventual on-going development of the databank over time.

POSSIBLE EXPOSURE OF ITALIAN MILITARY PERSONNEL TO DEPLETED URANIUM

With regard to the exposure of military personnel in the Balkans, it should be remembered that the estimates available in the ANPA Report for the year 2000 (17), widely reviewed in the technical literature produced by military sources in the United States, indicates as the worst case scenario for the inhalation of uranium dust that involving the impact of a penetration dart against the surface of an armoured vehicle, arriving at an estimated effective dose of 22.6 mSv. This dose is regarded as an upper limit, and it refers to individuals present in the immediate vicinity of the target hit by the dart at the moment of impact.

The recent report of the UNEP (United Nations Environmental Program) in the Kosovo (18), regarding visits to 11 sites made last November by a team of experts from a number of different countries - including, for Italy, a technician of the ANPA (Agenzia Nazionale per la Protezione dell'Ambiente)- provided useful indications.

The report concludes that no significant contamination has been registered in the areas which were subject to machine-gun fire using depleted uranium darts, except for the points of contamination where the darts themselves were retrieved. And even these points do not present a significant risk of contamination for the air, water or plants. No contamination has been observed in water, milk, buildings or objects. The UNEP calculates that eventual ingestion of powder accidentally picked up by touching a "point of contamination" does not present a significant radiological risk, while, in such cases, the chemical risk is slightly higher than the applicable health-care standards. The results of the measurement campaign of the UNEP essentially agree with those of the measurement campaign carried out by the CISAM (Centro Interforze Studi ed Applicazioni Militari).

In any event, an evaluation of possible exposure to depleted uranium on the part of Italian military personnel shall be performed through analyses which are still underway and which shall require a number of additional months time. This is due to the need to have a statistically meaningful group of military personnel whose experience with exposure is their first and whose urine is analysed both before and after the mission. In addition, the period of

winter exposure proves to be less meaningful in terms of the re-suspension of the dust, given the specific climactic conditions. It should be remembered, nonetheless, that the screening of a group of German military personnel, an effort which took a year and a half, did not show any exposure to depleted uranium (19). To ensure that the analysis is complete, the sample group of military personnel will also be subjected to the “Whole Body Counter” at low and high energies.

Based on the information available at present, there are no elements which can lead to the conclusion that there has been significant exposure to the components of uranium. The results of the analyses, however, will make possible a more accurate evaluation of the situation.

PRELIMINARY CONCLUSIONS

- 1) Considering the sum total of cases of malignant neoplasia (both haematological and otherwise), their number is lower than expected. This result may be due, in part, to the process of selection on the basis of physical fitness to which the military personnel are subjected, and in part to the fact that the expectations were calculated on the basis of Tumours Registers formulated primarily in northern Italy, where the overall incidence of tumours is higher than in southern Italy (the home area of the majority of the military personnel assigned to operations in Bosnia and/or the Kosovo).
- 2) There does exist an excess of cases of Hodgkin's lymphoma and Acute Lymphatic Leukaemia, though they are not statistically significant; given the current state of the numbers, these results may be due primarily to chance, especially in the case of the ALL. It should also be noted, with regard to HL and ALL, that there are no evident geographic differences of a magnitude able to lead to overestimates of expectations.

It is judged necessary that the results obtained so far be confirmed, and so it is suggested:

- a. To update, with a new report by the end of May, the number of cases of neoplasia through the acquisition of the relevant documentation needed to obtain diagnostic confirmation of cases already known or that could be notified in coming months.
- b. To monitor over time the groups of individuals assigned to operations in Bosnia and/or the Kosovo. To this end, the feasibility of conducting a study designed to monitor the incidence of neoplasia should be considered.
- c. To proposed to the other Nato countries engaged in Bosnia and/or the Kosovo, also taking into account the studies already underway, the definition of uniform methodologies to evaluate the incidence of neoplasia in the military personnel of the respective countries. This would allow a comparison of data and the overall evaluation of the results of the different studies.

BIBLIOGRAPHY

- 1) UNSCEAR. United Nations Scientific Committee on the Effects of Atomic Radiation. Sources and Effects of Ionising Radiation. Report to the General Assembly, with Scientific Annexes. New York, United Nations (2000).
- 2) Holm L-E, P. Hall K. Wiklund et al., Cancer risk after iodine-131 therapy for hyperthyroidism. J. Natl. Cancer Inst. 83:1072-1077 (1991).
- 3) Holm L-E, K. E. Wiklund, G.E. Lundell et al., Cancer risk in population examined with diagnostic doses of I¹³¹ J. Natl. Cancer Inst. 81: 302-306 (1989).
- 4) Ron E., M.M. Doody, D.V. Becker et al., Cancer mortality following treatment for adult hyperthyroidism. J. Am. Med. Assoc. 280: 347-355 (1998).
- 5) Andersson, M., B. Carstensen, H. H. Storm, Mortality and cancer incidence after cerebral arteriography with or without Thorotrast. Radiat. Res. 142: 305-320 (1995).
- 6) Van Kaick G.A., A. Dalheimer, S. Hornik et al., The German Thorotrast study: recent results and assessment of risk. Radiat. Res. 152 S64-S71 (1999).
- 7) Darby S.C., E. Whitley, G.R. Howe et al., Radon and cancers other than lung cancers in underground miners: a collaborative analysis of 11 studies. J. Natl. Cancer Inst. 87: 378-384 (1995).
- 8) Archer, V. E., J. K. Wagoner and F. E. Lundin. Cancer mortality among uranium mill workers. J. Occup. Med. 15: 11-14 (1973).
- 9) Waxweiler, R. J., V. E. Archer, R. J. Roscoe et al. Mortality patterns among a retrospective cohort of uranium mill workers. p. 428 - 435 in: Epidemiology Applied to Health Physics. CONF - 830101 (1983).

- 10) Mc Gheorgean G. and K. Binks, The mortality and cancer morbidity experience of workers at the Springfield uranium production facility, 1946-95 (J. Radiol. Prot. 20: 111-137 (2000).
- 11) Gilbert E.S. et al., Mortality of workers at the Hanford site:1945-1986, Health Phys. 64(6): 577-590; (1993).
- 12) International Commission on Radiological Protection. Recommendation of the International Commission on Radiological Protection ICRP Publication 60; Ann. ICRP 21; 1-201; (1991).
- 13) National Research Council (1990) Committee on the Biological Effects of Ionizing Radiations. Health Effects of Exposure to Low Levels of Ionizing Radiation: BEIR V, Washington DC, National Academic Press.
- 14) Cardis E and Richardson D, Health effects of radiation exposure at uranium processing facilities, J Radiol. Prot. 20, 95-97, (2000).
- 15) Preston et al. Cancer incidence of atomic Bomb Survivors. Part III: leukemia, lymphoma and multiple myeloma, 1950-1987. Radiat. Res. 137, 568-597, (1994).
- 16) National Research Council (1988) Committee on the Biological Effects of Ionizing Radiations. Health Risks of Radon and other Internally Deposited Alpha-emitters: BEIR IV, Washington DC, National Academic Press.
- 17) ANPA, Utilizzo di armamenti ad uranio impoverito nel conflitto dei Balcani (Serbia-Kosovo). Rischi di radioprotezione. Stime preliminari. Rapporto tecnico, Roma febbraio 2000.
- 18) UNEP, Depleted Uranium in Kosovo. Post-conflict environmental assessment. Technical Report. Geneva, March 2001.
- 19) Roth P., E. Werner, H.G. Paretzke Untersuchungen zur Urauscheidung im Urin. Überprüfung von Schutzmaßnahmen beim Deutschen Heereskontingent KFOR. Forschungsbericht im Auftrag des Bundesministeriums der Verteidigung. GSF – Forschungszentrum für Umwelt und Gesundheit, Institut für Strahlenschutz Neuherberg. GSF-Bericht 3/01.

APPENDIX 1

List of the Tumour Registers operating in Italy and from which data have been utilised for comparison

Register	Period of observation
Tumour Register of Turin	1993-1997
Tumour Register of Modena	1993-1997
Tumour Register of Venetia (Padua)	1993-1996
Tumour Register of the Province of Ferrara	1993-1997
Tumour Register of Romagna (Forlì-Ravenna)	1993-1997
Tumour Register of the Province of Macerata	1993-1996
Tumour Register of the Province of Florence	1993-1997
Tumour Register of the Province of Ragusa	1993-1996
Tumour Register of Sassari	1993-1997

Thanks must go to the Tumour Registers and to the AIRT (Italian Association of Tumour Registers) for having made their data fully available.